

ΕΡΓΟΔΟΤΗΣ

ΔΗΜΟΣ ΚΑΛΑΜΑΤΑΣ

ΕΡΓΟ

ΚΑΤΑΣΚΕΥΗ ΑΝΟΙΧΤΟΥ ΘΕΑΤΡΟΥ ΚΑΛΑΜΑΤΑΣ

ΘΕΣΗ ΕΡΓΟΥ

Ο.Τ. 1183 του Ρ.Σ. ΚΑΛΑΜΑΤΑΣ

ΑΡΧΙΤΕΚΤΟΝΙΚΗ ΜΕΛΕΤΗ :

ΝΙΚΟΛΑΟΣ ΓΙΑΝΝΑΚΟΠΟΥΛΟΣ
ΑΡΧΙΤΕΚΤΩΝ ΜΗΧΑΝΙΚΟΣ

ΣΤΑΤΙΚΗ ΜΕΛΕΤΗ :

VASARTIS SA

ΜΕΛΕΤΗ

ΣΤΑΤΙΚΗ

ΣΤΑΔΙΟ ΜΕΛΕΤΗΣ

ΟΡΙΣΤΙΚΗ

ΑΡ. ΑΝΑΘΕΩΡΗΣΗΣ

ΗΜΕΡ.

ΙΑΝΟΥΑΡΙΟΣ 2019

ΤΙΤΛΟΣ ΤΕΥΧΟΥΣ

ΤΕΥΧΟΣ ΣΤΑΤΙΚΩΝ ΥΠΟΛΟΓΙΣΜΩΝ
ΜΕΤΑΛΛΙΚΟΥ ΣΚΕΛΕΤΟΥ

ΑΡ. ΤΕΥΧΟΥΣ

T 01

ΥΠΟΓΡΑΦΗ ΚΑΙ ΣΦΡΑΓΙΔΑ ΜΕΛΕΤΗΤΩΝ

Κωδ. Εντύπου:

Κωδ. Η/Υ:ΞΞΩΦΥΛΛΑ.dwg

Κωδ. Έργου: 191672

VASARTIS ΤΕΧΝΙΚΗ ΕΤΑΙΡΙΑ
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Υπογραφή Φορέα

Ελέγχθηκε:

Ομορρώθηκε:

Εγκρίθηκε:

Αναθεώρηση	Ημερομηνία:	Όνομα:	Περιγραφή:
1			
2			

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Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

1 ΤΕΧΝΙΚΗ ΠΕΡΙΓΡΑΦΗ

Η παρούσα τεχνική έκθεση και τα σχέδια που την συνοδεύουν αφορούν στη στατική μελέτη της νέας κατασκευής του ανοιχτού θεάτρου στην περιοχή της Καλαμάτας καθώς και του κεντρικού κλιμακοστασίου που οδηγεί κατευθείαν στον κύριο διάδρομο κυκλοφορίας.

Σε κάτοψη ο σκελετός είναι μορφή ημικυκλίου με διάμετρο 54m και χωρίζεται σε δύο επίπεδα. Το μεν πρώτο φτάνει στο ύψος του οριζόντιου διαδρόμου (+2,94m) και το δεύτερο από τον διάδρομο στο +6.90m. Ο στατικός φορέας αποτελείται από 7 βαθμιδοφόρους διατομών HEA240 και συνολικού μήκους 16.50m και από 8 βαθμιδοφόρους διατομών HEA240 συνολικού μήκους 10.64m. Το άνοιγμα μεταξύ των βαθμιδοφόρων γεφυρώνεται με δοκίδες διατομών IPE140. Για την δυσκαμψία του φορέα τοποθετούνται κατάλληλα συμμετρικά κατακόρυφοι και οριζόντιοι σύνδεσμοι διατομών SHS70*5 σε θέσεις που φαίνονται στα παραδοτέα σχέδια.

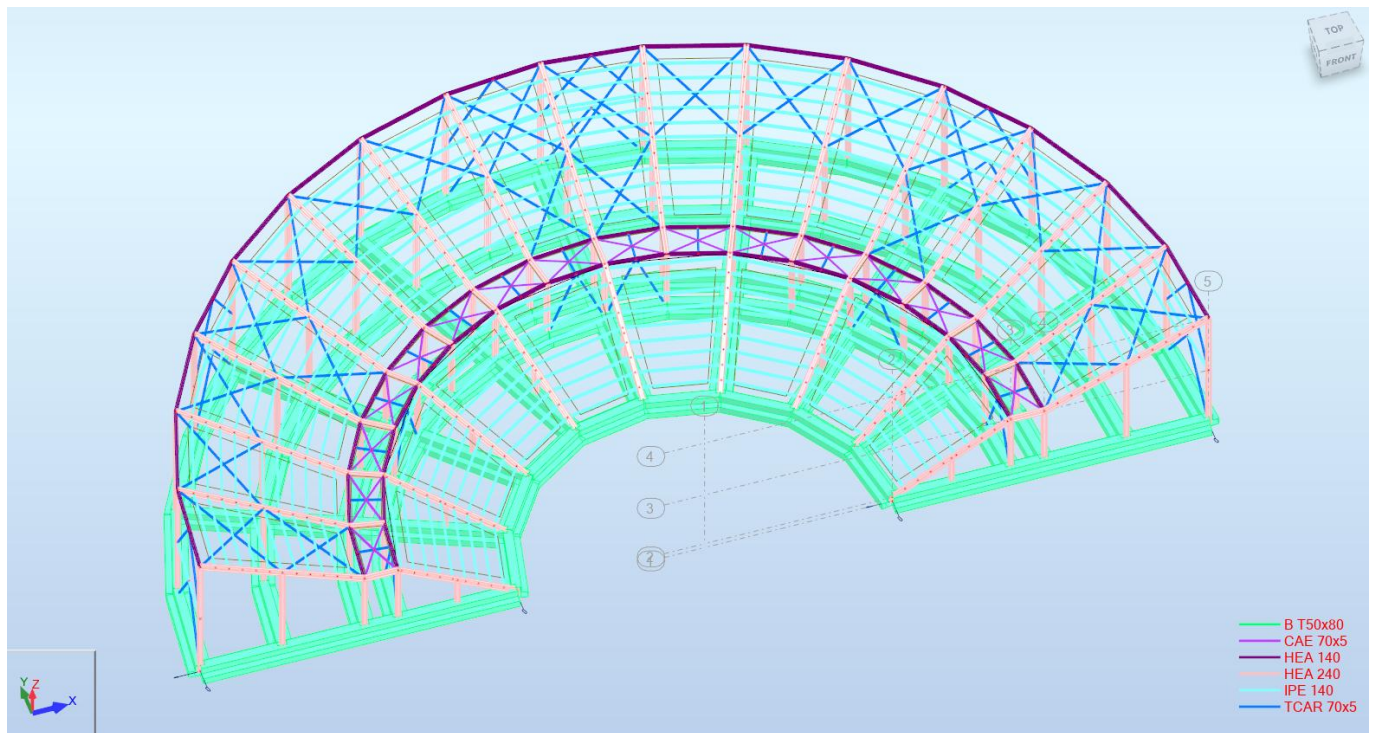
Ο δευτερεύων σκελετός πάνω στον οποίο θα πατήσουν τα καθίσματα αποτελείται από διατομές SHS60*4. Όλα τα πατήματα των κλιμακοστασίων και των διαδρόμων κυκλοφορίας στις κερκίδες θα αποτελούνται από διάτρητη λαμαρίνα πάχους 3mm.

Η θεμελίωση του φορέα θα γίνει με πεδιλοδοκούς διατομής 50/80/120/80 και όπλιση όπως φαίνεται στα σχέδια.

Κύριος έργο: Δήμος Καλαμάτας

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Εικόνα 1: Τρισδιάστατη απεικόνιση φορέα

2 ΠΑΡΑΔΟΧΕΣ ΜΕΛΕΤΗΣ

2.1 ΥΛΙΚΑ

Για την μεταλλική κατασκευή θα γίνει χρήση χάλυβα ποιότητας S275, ενώ οι κοχλίες και τα αγκύρια θα είναι ποιότητας 8.8.

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

2.2 ΦΟΡΤΙΣΕΙΣ

Μόνιμα Φορτία:

- | | |
|--|-------------------------|
| ➤ Ίδιο Βάρος Χάλυβα: | 78.50 kN/m ³ |
| ➤ Ίδιο Βάρος Σκυροδέματος: | 25.00 kN/m ³ |
| ➤ Βάρος μεταλλικού σκελετού κερκίδων και καθισμάτων: | 0.60 kN/m ² |

Κινητά Φορτία:

- | | |
|--------------------------|------------------------|
| ➤ Ωφέλιμο φορτίο δαπέδων | 5.00 kN/m ² |
|--------------------------|------------------------|

Δράσεις Χιονιού/Ανέμου:

- | | |
|--------------------------------|--------------------|
| ➤ Φορτίο Χιονιού κατά τον EC1: | Γεωγραφική ζώνη II |
| ➤ Φορτίο Ανέμου κατά τον EC1: | Vb=27,III |

<u>Θερμοκρασιακή μεταβολή:</u>	±20 ⁰ C
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Σεισμικά φορτία:

Οι σεισμικές παράμετροι, σύμφωνα με τον ΕΑΚ και το ελληνικό κείμενο εφαρμογής, έχουν ως εξής:

Σεισμική οριζόντιος επιτάχυνση	α=	0.24g
Κατηγορία Σπουδαιότητας	Σ3	γ _I = 1.15
Κατηγορία Εδάφους	Γ	T _B = 0.20, T _C = 0.80
Συντελεστής σεισμικής συμπεριφοράς	q	1.50
Συντελεστής θεμελίωσης	θ=	1.00
Ποσοστό απόσβεσης	ζ=	4%

3 ΛΟΓΙΣΜΙΚΟ ΕΠΙΛΥΣΗΣ

Η μελέτη του φορέα έγινε με το Robot Structural Analysis 2019. Το Autodesk Robot Structural Analysis Professional είναι ένα γενικό πρόγραμμα ανάλυσης και διαστασιολόγησης οποιασδήποτε κατασκευής (κτίρια, γέφυρες, ειδικές κατασκευές) από οπλισμένο σκυρόδεμα, χάλυβα, αλουμίνιο, ξύλο κλπ.

Για τον έλεγχο των συνδέσεων των μεταλλικών στοιχείων του φέροντος σκελετού χρησιμοποιήθηκε το πρόγραμμα Robot Structural Analysis 2019 και το IDEA Statica 9.

Κύριος έργου: Δήμος Καλαμάτας
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4 ΚΑΝΟΝΙΣΜΟΙ

Οι κανονισμοί, βάση των οποίων μελετάται συνολικά το έργο, είναι οι ακόλουθοι.

- EN1990: Βάσεις Σχεδιασμού
- EN1991-1: Δράσεις επί των Κατασκευών
- EN1992-1-1: Σχεδιασμός Φορέων από Σκυρόδεμα - Γενικοί Κανόνες και Κανόνες για Κτίρια
- EN1993-1-1: Σχεδιασμός Φορέων από Χάλυβα - Γενικοί Κανόνες και Κανόνες για Κτίρια
- EN1997-1: Γεωτεχνικός Σχεδιασμός – Γενικοί Κανόνες

5 ΑΠΟΤΕΛΕΣΜΑΤΑ

5.1 ΜΕΤΑΛΛΙΚΟΣ ΣΚΕΛΕΤΟΣ ΘΕΑΤΡΟΥ

5.1.1 ΔΙΑΤΟΜΕΣ

Section name	Bar list	AX (cm2)	AY (cm2)	AZ (cm2)	IX (cm4)	IY (cm4)	IZ (cm4)
CAE 70x5	792to855	6.84	3.50	3.50	0.56	31.23	31.23
HEA 140	181to188 599to622 856to871	31.42	22.79	7.75	7.97	1033.1 ₃	389.32
IPE 140	34 47to51 60to62 99to118 124to128 132to166 172to176 178to180 189to207 216to230 234to236 241to269 66 130 876 877 886 891to-995 997to1005	16.43	9.89	6.57	2.54	541.22	44.92
TCAR 70x5	87to98 131 231to233 237to240 735to758 776to791 1006to1041	12.88	5.72	5.72	141.80	90.02	90.02
HEA 240	1to7 13 14 52to58 64 65 69to75 81 82 119to123 129 167to171 177 366to372 378 379 381to387 393 394 396to402 408 409 483to487 493 495to499 505 507to511 517to562By15 519to525 531 534to540 546 549to555 561 564to568 574 576to580 586 588to592 598	76.84	55.44	18.53	38.20	7763.1 ₈	2768.81
B T50x80	1042 1043to1055By2 1057to1129	6800.0 0	4800.0 0	4000.0 0	25839 36.19	31654 90.20	617666 6.67

5.1.2 ΥΛΙΚΑ

	Material	E (MPa)	G (MPa)	NI	LX (1/°C)	RO (kN/m3)	Re (MPa)
1	S275	210000.00	80800.00	0.30	0.00	77.01	275.00
2	C25/30	31000.00	12916.67	0.20	0.00	24.53	25.00

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5.1.3 ΦΟΡΤΙΣΕΙΣ

Case	Label	Case name	Nature	Analysis type
1	DL1	DL1	Structural	Static - Linear
2	LL1	LL1	Category A	Static - Linear
3	TEMP1	TEMP1	temperature	Static - Linear
4	TEMP2	TEMP2	temperature	Static - Linear
5	SN1	SN1	snow	Static - Linear
6	WIND1	WIND1	wind	Static - Linear
7	WIND2	WIND2	wind	Static - Linear
8	SEIS1	Ex+0.3Ey	seismic	Static - Linear
9	SEIS11	0.3Ex+0Ey	seismic	Static - Linear
10		ULS		Static - Linear
11		ULS+		Static - Linear
12		ULS-		Static - Linear
13		SLS		Static - Linear
14		SLS+		Static - Linear
15		SLS-		Static - Linear
16		SLS		Static - Linear
17		SLS+		Static - Linear
18		SLS-		Static - Linear
19		SLS		Static - Linear
20		SLS+		Static - Linear
21		SLS-		Static - Linear
22		SLS		Static - Linear
23		SLS+		Static - Linear
24		SLS-		Static - Linear
25		ACC		Static - Linear
26		ACC+		Static - Linear
27		ACC-		Static - Linear

5.1.4 ΤΙΜΕΣ ΦΟΡΤΙΣΕΩΝ

Case	Load type	List	Load values
1	self-weight	1to7 16to44 46to58 60to62 64to66 69to75 87to269 13 14 81 82 273 274 366to372 381to387 396to402 483to487 495to499 507to511 378 379 393 394 408 409 493 505 517to562By15 519to525 534to540 549to555 564to568 576to580 588to592 598to622 735to758 775to871 531 546 561 574 586 876 877 886 891to995 997to1043 1045to1055By2 1057to1129	PZ Negative Factor=1.00
1	(FE) uniform	208to215 273 274	PZ=-0.60(kN/m2) projected
1	(FE) uniform	16to33 35to44 46 775	PZ=-0.60(kN/m2) projected
2	(FE) uniform	208to215 273 274	PZ=-5.00(kN/m2) projected
2	(FE) uniform	16to33 35to44 46 775	PZ=-5.00(kN/m2) projected
3	thermal load	1to7 13 14 34 52to58 64 65 69to75 81 82 119to123 129 149 167to171 177 181to188 3-66to372 378 379 381to387 393 394 396to402 408 409 483to487 493 495to499 505 50-7to511 517to562By15 519to525 531 534to540 546 549to555 561 564to568 574 576to580 586 588to592 598	TX=-20.00(°C)
4	thermal load	1to7 13 14 34 52to58 64 65 69to75 81 82 119to123 129 149 167to171 177 181to188 3-66to372 378 379 381to387 393 394 396to402 408 409 483to487 493 495to499 505 50-	TX=20.00(°C)

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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Case	Load type	List	Load values
		7to511 517to562By15 519to525 531 534to540 546 549to555 561 564to568 574 576to-580 586 588to592 598	
5	(FE) uniform	208to215 273 274	PZ=-0.39(kN/m2) projected
5	(FE) uniform	16to33 35to44 46 775	PZ=-0.39(kN/m2) projected
6	(FE) uniform	208to215 273 274	PZ=-3.00(kN/m2) local
6	(FE) uniform	16to33 35to44 46 775	PZ=-3.00(kN/m2) local
7	(FE) uniform	208to215 273 274	PZ=3.00(kN/m2) local
7	(FE) uniform	16to33 35to44 46 775	PZ=3.00(kN/m2) local
8	(FE) uniform	208to215 273 274	PX=1.60(kN/m2) PY=0.48(kN/m2)
8	(FE) uniform	16to33 35to44 46 775	PX=1.60(kN/m2) PY=0.48(kN/m2)
9	(FE) uniform	16to33 35to44 46 775	PX=0.48(kN/m2) PY=1.60(kN/m2)
9	(FE) uniform	208to215 273 274	PX=0.48(kN/m2) PY=1.60(kN/m2)

5.1.5 ΣΥΝΔΥΑΣΜΟΙ ΦΟΡΤΙΣΗΣ

ULS/t1	$1*1.35 + 2*1.50 + 3*0.90 + 4*0.90 + 5*0.75$
ULS/t2	$1*1.35 + 2*1.50 + 5*0.75$
ULS/t3	$1*1.35 + 2*1.50 + 3*0.90 + 5*0.75$
ULS/t4	$1*1.35 + 2*1.50 + 4*0.90 + 5*0.75$
ULS/t5	$1*1.35 + 2*1.50 + 3*0.90 + 4*0.90$
ULS/t6	$1*1.35 + 2*1.50$
ULS/t7	$1*1.35 + 2*1.50 + 3*0.90$
ULS/t8	$1*1.35 + 2*1.50 + 4*0.90$
ULS/t9	$1*1.35 + 2*1.50 + 3*0.90 + 4*0.90 + 5*0.75 + 6*0.90$
ULS/t10	$1*1.35 + 2*1.50 + 5*0.75 + 6*0.90$
ULS/t11	$1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$
ULS/t12	$1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$
ULS/t13	$1*1.35 + 2*1.50 + 3*0.90 + 4*0.90 + 6*0.90$
ULS/t14	$1*1.35 + 2*1.50 + 6*0.90$
ULS/t15	$1*1.35 + 2*1.50 + 3*0.90 + 6*0.90$
ULS/t16	$1*1.35 + 2*1.50 + 4*0.90 + 6*0.90$
ULS/t17	$1*1.35 + 2*1.50 + 3*0.90 + 4*0.90 + 5*0.75 + 7*0.90$
ULS/t18	$1*1.35 + 2*1.50 + 5*0.75 + 7*0.90$
ULS/t19	$1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 7*0.90$
ULS/t20	$1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 7*0.90$
ULS/t21	$1*1.35 + 2*1.50 + 3*0.90 + 4*0.90 + 7*0.90$
ULS/t22	$1*1.35 + 2*1.50 + 7*0.90$
ULS/t23	$1*1.35 + 2*1.50 + 3*0.90 + 7*0.90$
ULS/t24	$1*1.35 + 2*1.50 + 4*0.90 + 7*0.90$
ULS/t25	$1*1.35$
ULS/t26	$1*1.00 + 2*1.50 + 3*0.90 + 4*0.90 + 5*0.75$
ULS/t27	$1*1.00 + 2*1.50 + 5*0.75$
ULS/t28	$1*1.00 + 2*1.50 + 3*0.90 + 5*0.75$
ULS/t29	$1*1.00 + 2*1.50 + 4*0.90 + 5*0.75$
ULS/t30	$1*1.00 + 2*1.50 + 3*0.90 + 4*0.90$
ULS/t31	$1*1.00 + 2*1.50$
ULS/t32	$1*1.00 + 2*1.50 + 3*0.90$
ULS/t33	$1*1.00 + 2*1.50 + 4*0.90$
ULS/t34	$1*1.00 + 2*1.50 + 3*0.90 + 4*0.90 + 5*0.75 + 6*0.90$
ULS/t35	$1*1.00 + 2*1.50 + 5*0.75 + 6*0.90$

Κύριος έργου: Δήμος Καλαμάτας

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Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ULS/t36	$1*1.00 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$
ULS/t37	$1*1.00 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$
ULS/t38	$1*1.00 + 2*1.50 + 3*0.90 + 4*0.90 + 6*0.90$
ULS/t39	$1*1.00 + 2*1.50 + 6*0.90$
ULS/t40	$1*1.00 + 2*1.50 + 3*0.90 + 6*0.90$
ULS/t41	$1*1.00 + 2*1.50 + 4*0.90 + 6*0.90$
ULS/t42	$1*1.00 + 2*1.50 + 3*0.90 + 4*0.90 + 5*0.75 + 7*0.90$
ULS/t43	$1*1.00 + 2*1.50 + 5*0.75 + 7*0.90$
ULS/t44	$1*1.00 + 2*1.50 + 3*0.90 + 5*0.75 + 7*0.90$
ULS/t45	$1*1.00 + 2*1.50 + 4*0.90 + 5*0.75 + 7*0.90$
ULS/t46	$1*1.00 + 2*1.50 + 3*0.90 + 4*0.90 + 7*0.90$
ULS/t47	$1*1.00 + 2*1.50 + 7*0.90$
ULS/t48	$1*1.00 + 2*1.50 + 3*0.90 + 7*0.90$
ULS/t49	$1*1.00 + 2*1.50 + 4*0.90 + 7*0.90$
ULS/t50	$1*1.00$
ULS/t51	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t52	$1*1.35 + 2*1.05 + 5*0.75 + 6*1.50$
ULS/t53	$1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50$
ULS/t54	$1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t55	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 6*1.50$
ULS/t56	$1*1.35 + 2*1.05 + 6*1.50$
ULS/t57	$1*1.35 + 2*1.05 + 3*0.90 + 6*1.50$
ULS/t58	$1*1.35 + 2*1.05 + 4*0.90 + 6*1.50$
ULS/t59	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t60	$1*1.35 + 2*1.05 + 5*0.75 + 7*1.50$
ULS/t61	$1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 7*1.50$
ULS/t62	$1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t63	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 7*1.50$
ULS/t64	$1*1.35 + 2*1.05 + 7*1.50$
ULS/t65	$1*1.35 + 2*1.05 + 3*0.90 + 7*1.50$
ULS/t66	$1*1.35 + 2*1.05 + 4*0.90 + 7*1.50$
ULS/t67	$1*1.35 + 3*0.90 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t68	$1*1.35 + 5*0.75 + 6*1.50$
ULS/t69	$1*1.35 + 3*0.90 + 5*0.75 + 6*1.50$
ULS/t70	$1*1.35 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t71	$1*1.35 + 3*0.90 + 4*0.90 + 6*1.50$
ULS/t72	$1*1.35 + 6*1.50$
ULS/t73	$1*1.35 + 3*0.90 + 6*1.50$
ULS/t74	$1*1.35 + 4*0.90 + 6*1.50$
ULS/t75	$1*1.35 + 3*0.90 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t76	$1*1.35 + 5*0.75 + 7*1.50$
ULS/t77	$1*1.35 + 3*0.90 + 5*0.75 + 7*1.50$
ULS/t78	$1*1.35 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t79	$1*1.35 + 3*0.90 + 4*0.90 + 7*1.50$
ULS/t80	$1*1.35 + 7*1.50$
ULS/t81	$1*1.35 + 3*0.90 + 7*1.50$
ULS/t82	$1*1.35 + 4*0.90 + 7*1.50$
ULS/t83	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t84	$1*1.00 + 2*1.05 + 5*0.75 + 6*1.50$
ULS/t85	$1*1.00 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50$
ULS/t86	$1*1.00 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t87	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 6*1.50$
ULS/t88	$1*1.00 + 2*1.05 + 6*1.50$
ULS/t89	$1*1.00 + 2*1.05 + 3*0.90 + 6*1.50$
ULS/t90	$1*1.00 + 2*1.05 + 4*0.90 + 6*1.50$
ULS/t91	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t92	$1*1.00 + 2*1.05 + 5*0.75 + 7*1.50$
ULS/t93	$1*1.00 + 2*1.05 + 3*0.90 + 5*0.75 + 7*1.50$
ULS/t94	$1*1.00 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ULS/t95	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 7*1.50$
ULS/t96	$1*1.00 + 2*1.05 + 7*1.50$
ULS/t97	$1*1.00 + 2*1.05 + 3*0.90 + 7*1.50$
ULS/t98	$1*1.00 + 2*1.05 + 4*0.90 + 7*1.50$
ULS/t99	$1*1.00 + 3*0.90 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t100	$1*1.00 + 5*0.75 + 6*1.50$
ULS/t101	$1*1.00 + 3*0.90 + 5*0.75 + 6*1.50$
ULS/t102	$1*1.00 + 4*0.90 + 5*0.75 + 6*1.50$
ULS/t103	$1*1.00 + 3*0.90 + 4*0.90 + 6*1.50$
ULS/t104	$1*1.00 + 6*1.50$
ULS/t105	$1*1.00 + 3*0.90 + 6*1.50$
ULS/t106	$1*1.00 + 4*0.90 + 6*1.50$
ULS/t107	$1*1.00 + 3*0.90 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t108	$1*1.00 + 5*0.75 + 7*1.50$
ULS/t109	$1*1.00 + 3*0.90 + 5*0.75 + 7*1.50$
ULS/t110	$1*1.00 + 4*0.90 + 5*0.75 + 7*1.50$
ULS/t111	$1*1.00 + 3*0.90 + 4*0.90 + 7*1.50$
ULS/t112	$1*1.00 + 7*1.50$
ULS/t113	$1*1.00 + 3*0.90 + 7*1.50$
ULS/t114	$1*1.00 + 4*0.90 + 7*1.50$
ULS/t115	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 5*1.50$
ULS/t116	$1*1.35 + 2*1.05 + 5*1.50$
ULS/t117	$1*1.35 + 2*1.05 + 3*0.90 + 5*1.50$
ULS/t118	$1*1.35 + 2*1.05 + 4*0.90 + 5*1.50$
ULS/t119	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t120	$1*1.35 + 2*1.05 + 5*1.50 + 6*0.90$
ULS/t121	$1*1.35 + 2*1.05 + 3*0.90 + 5*1.50 + 6*0.90$
ULS/t122	$1*1.35 + 2*1.05 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t123	$1*1.35 + 2*1.05 + 3*0.90 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t124	$1*1.35 + 2*1.05 + 5*1.50 + 7*0.90$
ULS/t125	$1*1.35 + 2*1.05 + 3*0.90 + 5*1.50 + 7*0.90$
ULS/t126	$1*1.35 + 2*1.05 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t127	$1*1.35 + 3*0.90 + 4*0.90 + 5*1.50$
ULS/t128	$1*1.35 + 5*1.50$
ULS/t129	$1*1.35 + 3*0.90 + 5*1.50$
ULS/t130	$1*1.35 + 4*0.90 + 5*1.50$
ULS/t131	$1*1.35 + 3*0.90 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t132	$1*1.35 + 5*1.50 + 6*0.90$
ULS/t133	$1*1.35 + 3*0.90 + 5*1.50 + 6*0.90$
ULS/t134	$1*1.35 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t135	$1*1.35 + 3*0.90 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t136	$1*1.35 + 5*1.50 + 7*0.90$
ULS/t137	$1*1.35 + 3*0.90 + 5*1.50 + 7*0.90$
ULS/t138	$1*1.35 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t139	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 5*1.50$
ULS/t140	$1*1.00 + 2*1.05 + 5*1.50$
ULS/t141	$1*1.00 + 2*1.05 + 3*0.90 + 5*1.50$
ULS/t142	$1*1.00 + 2*1.05 + 4*0.90 + 5*1.50$
ULS/t143	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t144	$1*1.00 + 2*1.05 + 5*1.50 + 6*0.90$
ULS/t145	$1*1.00 + 2*1.05 + 3*0.90 + 5*1.50 + 6*0.90$
ULS/t146	$1*1.00 + 2*1.05 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t147	$1*1.00 + 2*1.05 + 3*0.90 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t148	$1*1.00 + 2*1.05 + 5*1.50 + 7*0.90$
ULS/t149	$1*1.00 + 2*1.05 + 3*0.90 + 5*1.50 + 7*0.90$
ULS/t150	$1*1.00 + 2*1.05 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t151	$1*1.00 + 3*0.90 + 4*0.90 + 5*1.50$
ULS/t152	$1*1.00 + 5*1.50$
ULS/t153	$1*1.00 + 3*0.90 + 5*1.50$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ULS/t154	$1*1.00 + 4*0.90 + 5*1.50$
ULS/t155	$1*1.00 + 3*0.90 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t156	$1*1.00 + 5*1.50 + 6*0.90$
ULS/t157	$1*1.00 + 3*0.90 + 5*1.50 + 6*0.90$
ULS/t158	$1*1.00 + 4*0.90 + 5*1.50 + 6*0.90$
ULS/t159	$1*1.00 + 3*0.90 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t160	$1*1.00 + 5*1.50 + 7*0.90$
ULS/t161	$1*1.00 + 3*0.90 + 5*1.50 + 7*0.90$
ULS/t162	$1*1.00 + 4*0.90 + 5*1.50 + 7*0.90$
ULS/t163	$1*1.35 + 2*1.05 + 3*1.50 + 4*1.50 + 5*0.75$
ULS/t164	$1*1.35 + 2*1.05 + 3*1.50 + 5*0.75$
ULS/t165	$1*1.35 + 2*1.05 + 4*1.50 + 5*0.75$
ULS/t166	$1*1.35 + 2*1.05 + 3*1.50 + 4*1.50$
ULS/t167	$1*1.35 + 2*1.05 + 3*1.50$
ULS/t168	$1*1.35 + 2*1.05 + 4*1.50$
ULS/t169	$1*1.35 + 2*1.05 + 3*1.50 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t170	$1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$
ULS/t171	$1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t172	$1*1.35 + 2*1.05 + 3*1.50 + 4*1.50 + 6*0.90$
ULS/t173	$1*1.35 + 2*1.05 + 3*1.50 + 6*0.90$
ULS/t174	$1*1.35 + 2*1.05 + 4*1.50 + 6*0.90$
ULS/t175	$1*1.35 + 2*1.05 + 3*1.50 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t176	$1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$
ULS/t177	$1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t178	$1*1.35 + 2*1.05 + 3*1.50 + 4*1.50 + 7*0.90$
ULS/t179	$1*1.35 + 2*1.05 + 3*1.50 + 7*0.90$
ULS/t180	$1*1.35 + 2*1.05 + 4*1.50 + 7*0.90$
ULS/t181	$1*1.35 + 3*1.50 + 4*1.50 + 5*0.75$
ULS/t182	$1*1.35 + 3*1.50 + 5*0.75$
ULS/t183	$1*1.35 + 4*1.50 + 5*0.75$
ULS/t184	$1*1.35 + 3*1.50 + 4*1.50$
ULS/t185	$1*1.35 + 3*1.50$
ULS/t186	$1*1.35 + 4*1.50$
ULS/t187	$1*1.35 + 3*1.50 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t188	$1*1.35 + 3*1.50 + 5*0.75 + 6*0.90$
ULS/t189	$1*1.35 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t190	$1*1.35 + 3*1.50 + 4*1.50 + 6*0.90$
ULS/t191	$1*1.35 + 3*1.50 + 6*0.90$
ULS/t192	$1*1.35 + 4*1.50 + 6*0.90$
ULS/t193	$1*1.35 + 3*1.50 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t194	$1*1.35 + 3*1.50 + 5*0.75 + 7*0.90$
ULS/t195	$1*1.35 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t196	$1*1.35 + 3*1.50 + 4*1.50 + 7*0.90$
ULS/t197	$1*1.35 + 3*1.50 + 7*0.90$
ULS/t198	$1*1.35 + 4*1.50 + 7*0.90$
ULS/t199	$1*1.00 + 2*1.05 + 3*1.50 + 4*1.50 + 5*0.75$
ULS/t200	$1*1.00 + 2*1.05 + 3*1.50 + 5*0.75$
ULS/t201	$1*1.00 + 2*1.05 + 4*1.50 + 5*0.75$
ULS/t202	$1*1.00 + 2*1.05 + 3*1.50 + 4*1.50$
ULS/t203	$1*1.00 + 2*1.05 + 3*1.50$
ULS/t204	$1*1.00 + 2*1.05 + 4*1.50$
ULS/t205	$1*1.00 + 2*1.05 + 3*1.50 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t206	$1*1.00 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$
ULS/t207	$1*1.00 + 2*1.05 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t208	$1*1.00 + 2*1.05 + 3*1.50 + 4*1.50 + 6*0.90$
ULS/t209	$1*1.00 + 2*1.05 + 3*1.50 + 6*0.90$
ULS/t210	$1*1.00 + 2*1.05 + 4*1.50 + 6*0.90$
ULS/t211	$1*1.00 + 2*1.05 + 3*1.50 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t212	$1*1.00 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ULS/t213	$1*1.00 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t214	$1*1.00 + 2*1.05 + 3*1.50 + 4*1.50 + 7*0.90$
ULS/t215	$1*1.00 + 2*1.05 + 3*1.50 + 7*0.90$
ULS/t216	$1*1.00 + 2*1.05 + 4*1.50 + 7*0.90$
ULS/t217	$1*1.00 + 3*1.50 + 4*1.50 + 5*0.75$
ULS/t218	$1*1.00 + 3*1.50 + 5*0.75$
ULS/t219	$1*1.00 + 4*1.50 + 5*0.75$
ULS/t220	$1*1.00 + 3*1.50 + 4*1.50$
ULS/t221	$1*1.00 + 3*1.50$
ULS/t222	$1*1.00 + 4*1.50$
ULS/t223	$1*1.00 + 3*1.50 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t224	$1*1.00 + 3*1.50 + 5*0.75 + 6*0.90$
ULS/t225	$1*1.00 + 4*1.50 + 5*0.75 + 6*0.90$
ULS/t226	$1*1.00 + 3*1.50 + 4*1.50 + 6*0.90$
ULS/t227	$1*1.00 + 3*1.50 + 6*0.90$
ULS/t228	$1*1.00 + 4*1.50 + 6*0.90$
ULS/t229	$1*1.00 + 3*1.50 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t230	$1*1.00 + 3*1.50 + 5*0.75 + 7*0.90$
ULS/t231	$1*1.00 + 4*1.50 + 5*0.75 + 7*0.90$
ULS/t232	$1*1.00 + 3*1.50 + 4*1.50 + 7*0.90$
ULS/t233	$1*1.00 + 3*1.50 + 7*0.90$
ULS/t234	$1*1.00 + 4*1.50 + 7*0.90$
SLS:CHR/t1	$1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50$
SLS:CHR/t2	$1*1.00 + 2*1.00 + 5*0.50$
SLS:CHR/t3	$1*1.00 + 2*1.00 + 3*0.60 + 5*0.50$
SLS:CHR/t4	$1*1.00 + 2*1.00 + 4*0.60 + 5*0.50$
SLS:CHR/t5	$1*1.00 + 2*1.00 + 3*0.60 + 4*0.60$
SLS:CHR/t6	$1*1.00 + 2*1.00$
SLS:CHR/t7	$1*1.00 + 2*1.00 + 3*0.60$
SLS:CHR/t8	$1*1.00 + 2*1.00 + 4*0.60$
SLS:CHR/t9	$1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60$
SLS:CHR/t10	$1*1.00 + 2*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t11	$1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$
SLS:CHR/t12	$1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$
SLS:CHR/t13	$1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 6*0.60$
SLS:CHR/t14	$1*1.00 + 2*1.00 + 6*0.60$
SLS:CHR/t15	$1*1.00 + 2*1.00 + 3*0.60 + 6*0.60$
SLS:CHR/t16	$1*1.00 + 2*1.00 + 4*0.60 + 6*0.60$
SLS:CHR/t17	$1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*0.60$
SLS:CHR/t18	$1*1.00 + 2*1.00 + 5*0.50 + 7*0.60$
SLS:CHR/t19	$1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 7*0.60$
SLS:CHR/t20	$1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 7*0.60$
SLS:CHR/t21	$1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 7*0.60$
SLS:CHR/t22	$1*1.00 + 2*1.00 + 7*0.60$
SLS:CHR/t23	$1*1.00 + 2*1.00 + 3*0.60 + 7*0.60$
SLS:CHR/t24	$1*1.00 + 2*1.00 + 4*0.60 + 7*0.60$
SLS:CHR/t25	$1*1.00$
SLS:CHR/t26	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$
SLS:CHR/t27	$1*1.00 + 2*0.70 + 5*0.50 + 6*1.00$
SLS:CHR/t28	$1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$
SLS:CHR/t29	$1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$
SLS:CHR/t30	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00$
SLS:CHR/t31	$1*1.00 + 2*0.70 + 6*1.00$
SLS:CHR/t32	$1*1.00 + 2*0.70 + 3*0.60 + 6*1.00$
SLS:CHR/t33	$1*1.00 + 2*0.70 + 4*0.60 + 6*1.00$
SLS:CHR/t34	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00$
SLS:CHR/t35	$1*1.00 + 2*0.70 + 5*0.50 + 7*1.00$
SLS:CHR/t36	$1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00$
SLS:CHR/t37	$1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

SLS:CHR/t38	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 7*1.00$
SLS:CHR/t39	$1*1.00 + 2*0.70 + 7*1.00$
SLS:CHR/t40	$1*1.00 + 2*0.70 + 3*0.60 + 7*1.00$
SLS:CHR/t41	$1*1.00 + 2*0.70 + 4*0.60 + 7*1.00$
SLS:CHR/t42	$1*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$
SLS:CHR/t43	$1*1.00 + 5*0.50 + 6*1.00$
SLS:CHR/t44	$1*1.00 + 3*0.60 + 5*0.50 + 6*1.00$
SLS:CHR/t45	$1*1.00 + 4*0.60 + 5*0.50 + 6*1.00$
SLS:CHR/t46	$1*1.00 + 3*0.60 + 4*0.60 + 6*1.00$
SLS:CHR/t47	$1*1.00 + 6*1.00$
SLS:CHR/t48	$1*1.00 + 3*0.60 + 6*1.00$
SLS:CHR/t49	$1*1.00 + 4*0.60 + 6*1.00$
SLS:CHR/t50	$1*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00$
SLS:CHR/t51	$1*1.00 + 5*0.50 + 7*1.00$
SLS:CHR/t52	$1*1.00 + 3*0.60 + 5*0.50 + 7*1.00$
SLS:CHR/t53	$1*1.00 + 4*0.60 + 5*0.50 + 7*1.00$
SLS:CHR/t54	$1*1.00 + 3*0.60 + 4*0.60 + 7*1.00$
SLS:CHR/t55	$1*1.00 + 7*1.00$
SLS:CHR/t56	$1*1.00 + 3*0.60 + 7*1.00$
SLS:CHR/t57	$1*1.00 + 4*0.60 + 7*1.00$
SLS:CHR/t58	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00$
SLS:CHR/t59	$1*1.00 + 2*0.70 + 5*1.00$
SLS:CHR/t60	$1*1.00 + 2*0.70 + 3*0.60 + 5*1.00$
SLS:CHR/t61	$1*1.00 + 2*0.70 + 4*0.60 + 5*1.00$
SLS:CHR/t62	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60$
SLS:CHR/t63	$1*1.00 + 2*0.70 + 5*1.00 + 6*0.60$
SLS:CHR/t64	$1*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 6*0.60$
SLS:CHR/t65	$1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60$
SLS:CHR/t66	$1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 7*0.60$
SLS:CHR/t67	$1*1.00 + 2*0.70 + 5*1.00 + 7*0.60$
SLS:CHR/t68	$1*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 7*0.60$
SLS:CHR/t69	$1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 7*0.60$
SLS:CHR/t70	$1*1.00 + 3*0.60 + 4*0.60 + 5*1.00$
SLS:CHR/t71	$1*1.00 + 5*1.00$
SLS:CHR/t72	$1*1.00 + 3*0.60 + 5*1.00$
SLS:CHR/t73	$1*1.00 + 4*0.60 + 5*1.00$
SLS:CHR/t74	$1*1.00 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60$
SLS:CHR/t75	$1*1.00 + 5*1.00 + 6*0.60$
SLS:CHR/t76	$1*1.00 + 3*0.60 + 5*1.00 + 6*0.60$
SLS:CHR/t77	$1*1.00 + 4*0.60 + 5*1.00 + 6*0.60$
SLS:CHR/t78	$1*1.00 + 3*0.60 + 4*0.60 + 5*1.00 + 7*0.60$
SLS:CHR/t79	$1*1.00 + 5*1.00 + 7*0.60$
SLS:CHR/t80	$1*1.00 + 3*0.60 + 5*1.00 + 7*0.60$
SLS:CHR/t81	$1*1.00 + 4*0.60 + 5*1.00 + 7*0.60$
SLS:CHR/t82	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50$
SLS:CHR/t83	$1*1.00 + 2*0.70 + 3*1.00 + 5*0.50$
SLS:CHR/t84	$1*1.00 + 2*0.70 + 4*1.00 + 5*0.50$
SLS:CHR/t85	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00$
SLS:CHR/t86	$1*1.00 + 2*0.70 + 3*1.00$
SLS:CHR/t87	$1*1.00 + 2*0.70 + 4*1.00$
SLS:CHR/t88	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t89	$1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t90	$1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t91	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 6*0.60$
SLS:CHR/t92	$1*1.00 + 2*0.70 + 3*1.00 + 6*0.60$
SLS:CHR/t93	$1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$
SLS:CHR/t94	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 7*0.60$
SLS:CHR/t95	$1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$
SLS:CHR/t96	$1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

SLS:CHR/t97 $1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 7*0.60$
SLS:CHR/t98 $1*1.00 + 2*0.70 + 3*1.00 + 7*0.60$
SLS:CHR/t99 $1*1.00 + 2*0.70 + 4*1.00 + 7*0.60$
SLS:CHR/t100 $1*1.00 + 3*1.00 + 4*1.00 + 5*0.50$
SLS:CHR/t101 $1*1.00 + 3*1.00 + 5*0.50$
SLS:CHR/t102 $1*1.00 + 4*1.00 + 5*0.50$
SLS:CHR/t103 $1*1.00 + 3*1.00 + 4*1.00$
SLS:CHR/t104 $1*1.00 + 3*1.00$
SLS:CHR/t105 $1*1.00 + 4*1.00$
SLS:CHR/t106 $1*1.00 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t107 $1*1.00 + 3*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t108 $1*1.00 + 4*1.00 + 5*0.50 + 6*0.60$
SLS:CHR/t109 $1*1.00 + 3*1.00 + 4*1.00 + 6*0.60$
SLS:CHR/t110 $1*1.00 + 3*1.00 + 6*0.60$
SLS:CHR/t111 $1*1.00 + 4*1.00 + 6*0.60$
SLS:CHR/t112 $1*1.00 + 3*1.00 + 4*1.00 + 5*0.50 + 7*0.60$
SLS:CHR/t113 $1*1.00 + 3*1.00 + 5*0.50 + 7*0.60$
SLS:CHR/t114 $1*1.00 + 4*1.00 + 5*0.50 + 7*0.60$
SLS:CHR/t115 $1*1.00 + 3*1.00 + 4*1.00 + 7*0.60$
SLS:CHR/t116 $1*1.00 + 3*1.00 + 7*0.60$
SLS:CHR/t117 $1*1.00 + 4*1.00 + 7*0.60$
SLS:FRE/t118 $1*1.00 + 2*0.50$
SLS:FRE/t119 $1*1.00$
SLS:FRE/t120 $1*1.00 + 2*0.30 + 6*0.20$
SLS:FRE/t121 $1*1.00 + 2*0.30 + 7*0.20$
SLS:FRE/t122 $1*1.00 + 6*0.20$
SLS:FRE/t123 $1*1.00 + 7*0.20$
SLS:FRE/t124 $1*1.00 + 2*0.30 + 5*0.20$
SLS:FRE/t125 $1*1.00 + 5*0.20$
SLS:FRE/t126 $1*1.00 + 2*0.30 + 3*0.50 + 4*0.50$
SLS:FRE/t127 $1*1.00 + 2*0.30 + 3*0.50$
SLS:FRE/t128 $1*1.00 + 2*0.30 + 4*0.50$
SLS:FRE/t129 $1*1.00 + 3*0.50 + 4*0.50$
SLS:FRE/t130 $1*1.00 + 3*0.50$
SLS:FRE/t131 $1*1.00 + 4*0.50$
SLS:QPR/t132 $1*1.00 + 2*0.30$
SLS:QPR/t133 $1*1.00$
SLS/t1 $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50$
SLS/t2 $1*1.00 + 2*1.00 + 5*0.50$
SLS/t3 $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50$
SLS/t4 $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50$
SLS/t5 $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60$
SLS/t6 $1*1.00 + 2*1.00$
SLS/t7 $1*1.00 + 2*1.00 + 3*0.60$
SLS/t8 $1*1.00 + 2*1.00 + 4*0.60$
SLS/t9 $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60$
SLS/t10 $1*1.00 + 2*1.00 + 5*0.50 + 6*0.60$
SLS/t11 $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$
SLS/t12 $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$
SLS/t13 $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 6*0.60$
SLS/t14 $1*1.00 + 2*1.00 + 6*0.60$
SLS/t15 $1*1.00 + 2*1.00 + 3*0.60 + 6*0.60$
SLS/t16 $1*1.00 + 2*1.00 + 4*0.60 + 6*0.60$
SLS/t17 $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*0.60$
SLS/t18 $1*1.00 + 2*1.00 + 5*0.50 + 7*0.60$
SLS/t19 $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 7*0.60$
SLS/t20 $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 7*0.60$
SLS/t21 $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 7*0.60$
SLS/t22 $1*1.00 + 2*1.00 + 7*0.60$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

SLS/t231*1.00 + 2*1.00 + 3*0.60 + 7*0.60
SLS/t241*1.00 + 2*1.00 + 4*0.60 + 7*0.60
SLS/t251*1.00
SLS/t261*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00
SLS/t271*1.00 + 2*0.70 + 5*0.50 + 6*1.00
SLS/t281*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00
SLS/t291*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00
SLS/t301*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00
SLS/t311*1.00 + 2*0.70 + 6*1.00
SLS/t321*1.00 + 2*0.70 + 3*0.60 + 6*1.00
SLS/t331*1.00 + 2*0.70 + 4*0.60 + 6*1.00
SLS/t341*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00
SLS/t351*1.00 + 2*0.70 + 5*0.50 + 7*1.00
SLS/t361*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00
SLS/t371*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00
SLS/t381*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 7*1.00
SLS/t391*1.00 + 2*0.70 + 7*1.00
SLS/t401*1.00 + 2*0.70 + 3*0.60 + 7*1.00
SLS/t411*1.00 + 2*0.70 + 4*0.60 + 7*1.00
SLS/t421*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00
SLS/t431*1.00 + 5*0.50 + 6*1.00
SLS/t441*1.00 + 3*0.60 + 5*0.50 + 6*1.00
SLS/t451*1.00 + 4*0.60 + 5*0.50 + 6*1.00
SLS/t461*1.00 + 3*0.60 + 4*0.60 + 6*1.00
SLS/t471*1.00 + 6*1.00
SLS/t481*1.00 + 3*0.60 + 6*1.00
SLS/t491*1.00 + 4*0.60 + 6*1.00
SLS/t501*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00
SLS/t511*1.00 + 5*0.50 + 7*1.00
SLS/t521*1.00 + 3*0.60 + 5*0.50 + 7*1.00
SLS/t531*1.00 + 4*0.60 + 5*0.50 + 7*1.00
SLS/t541*1.00 + 3*0.60 + 4*0.60 + 7*1.00
SLS/t551*1.00 + 7*1.00
SLS/t561*1.00 + 3*0.60 + 7*1.00
SLS/t571*1.00 + 4*0.60 + 7*1.00
SLS/t581*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00
SLS/t591*1.00 + 2*0.70 + 5*1.00
SLS/t601*1.00 + 2*0.70 + 3*0.60 + 5*1.00
SLS/t611*1.00 + 2*0.70 + 4*0.60 + 5*1.00
SLS/t621*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60
SLS/t631*1.00 + 2*0.70 + 5*1.00 + 6*0.60
SLS/t641*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 6*0.60
SLS/t651*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60
SLS/t661*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 7*0.60
SLS/t671*1.00 + 2*0.70 + 5*1.00 + 7*0.60
SLS/t681*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 7*0.60
SLS/t691*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 7*0.60
SLS/t701*1.00 + 3*0.60 + 4*0.60 + 5*1.00
SLS/t711*1.00 + 5*1.00
SLS/t721*1.00 + 3*0.60 + 5*1.00
SLS/t731*1.00 + 4*0.60 + 5*1.00
SLS/t741*1.00 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60
SLS/t75 1*1.00 + 5*1.00 + 6*0.60
SLS/t76 1*1.00 + 3*0.60 + 5*1.00 + 6*0.60
SLS/t77 1*1.00 + 4*0.60 + 5*1.00 + 6*0.60
SLS/t78 1*1.00 + 3*0.60 + 4*0.60 + 5*1.00 + 7*0.60
SLS/t79 1*1.00 + 5*1.00 + 7*0.60
SLS/t80 1*1.00 + 3*0.60 + 5*1.00 + 7*0.60
SLS/t81 1*1.00 + 4*0.60 + 5*1.00 + 7*0.60

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

SLS/t82	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50$
SLS/t83	$1*1.00 + 2*0.70 + 3*1.00 + 5*0.50$
SLS/t84	$1*1.00 + 2*0.70 + 4*1.00 + 5*0.50$
SLS/t85	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00$
SLS/t86	$1*1.00 + 2*0.70 + 3*1.00$
SLS/t87	$1*1.00 + 2*0.70 + 4*1.00$
SLS/t88	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60$
SLS/t89	$1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$
SLS/t90	$1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$
SLS/t91	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 6*0.60$
SLS/t92	$1*1.00 + 2*0.70 + 3*1.00 + 6*0.60$
SLS/t93	$1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$
SLS/t94	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 7*0.60$
SLS/t95	$1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$
SLS/t96	$1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$
SLS/t97	$1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 7*0.60$
SLS/t98	$1*1.00 + 2*0.70 + 3*1.00 + 7*0.60$
SLS/t99	$1*1.00 + 2*0.70 + 4*1.00 + 7*0.60$
SLS/t100	$1*1.00 + 3*1.00 + 4*1.00 + 5*0.50$
SLS/t101	$1*1.00 + 3*1.00 + 5*0.50$
SLS/t102	$1*1.00 + 4*1.00 + 5*0.50$
SLS/t103	$1*1.00 + 3*1.00 + 4*1.00$
SLS/t104	$1*1.00 + 3*1.00$
SLS/t105	$1*1.00 + 4*1.00$
SLS/t106	$1*1.00 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60$
SLS/t107	$1*1.00 + 3*1.00 + 5*0.50 + 6*0.60$
SLS/t108	$1*1.00 + 4*1.00 + 5*0.50 + 6*0.60$
SLS/t109	$1*1.00 + 3*1.00 + 4*1.00 + 6*0.60$
SLS/t110	$1*1.00 + 3*1.00 + 6*0.60$
SLS/t111	$1*1.00 + 4*1.00 + 6*0.60$
SLS/t112	$1*1.00 + 3*1.00 + 4*1.00 + 5*0.50 + 7*0.60$
SLS/t113	$1*1.00 + 3*1.00 + 5*0.50 + 7*0.60$
SLS/t114	$1*1.00 + 4*1.00 + 5*0.50 + 7*0.60$
SLS/t115	$1*1.00 + 3*1.00 + 4*1.00 + 7*0.60$
SLS/t116	$1*1.00 + 3*1.00 + 7*0.60$
SLS/t117	$1*1.00 + 4*1.00 + 7*0.60$
SLS/t1	$1*1.00 + 2*0.50$
SLS/t2	$1*1.00$
SLS/t3	$1*1.00 + 2*0.30 + 6*0.20$
SLS/t4	$1*1.00 + 2*0.30 + 7*0.20$
SLS/t5	$1*1.00 + 6*0.20$
SLS/t6	$1*1.00 + 7*0.20$
SLS/t7	$1*1.00 + 2*0.30 + 5*0.20$
SLS/t8	$1*1.00 + 5*0.20$
SLS/t9	$1*1.00 + 2*0.30 + 3*0.50 + 4*0.50$
SLS/t10	$1*1.00 + 2*0.30 + 3*0.50$
SLS/t11	$1*1.00 + 2*0.30 + 4*0.50$
SLS/t12	$1*1.00 + 3*0.50 + 4*0.50$
SLS/t13	$1*1.00 + 3*0.50$
SLS/t14	$1*1.00 + 4*0.50$
SLS/t1	$1*1.00 + 2*0.30$
SLS/t2	$1*1.00$
ACC:SEI/t1	$1*1.00 + 2*0.30 + 8*1.00$
ACC:SEI/t2	$1*1.00 + 8*1.00$
ACC:SEI/t3	$1*1.00$
ACC:SEI/t4	$1*1.00 + 2*0.30 + 9*1.00$
ACC:SEI/t5	$1*1.00 + 9*1.00$
ACC:SEI/t6	$1*1.00 + 2*0.30 + 8*-1.00$
ACC:SEI/t7	$1*1.00 + 8*-1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

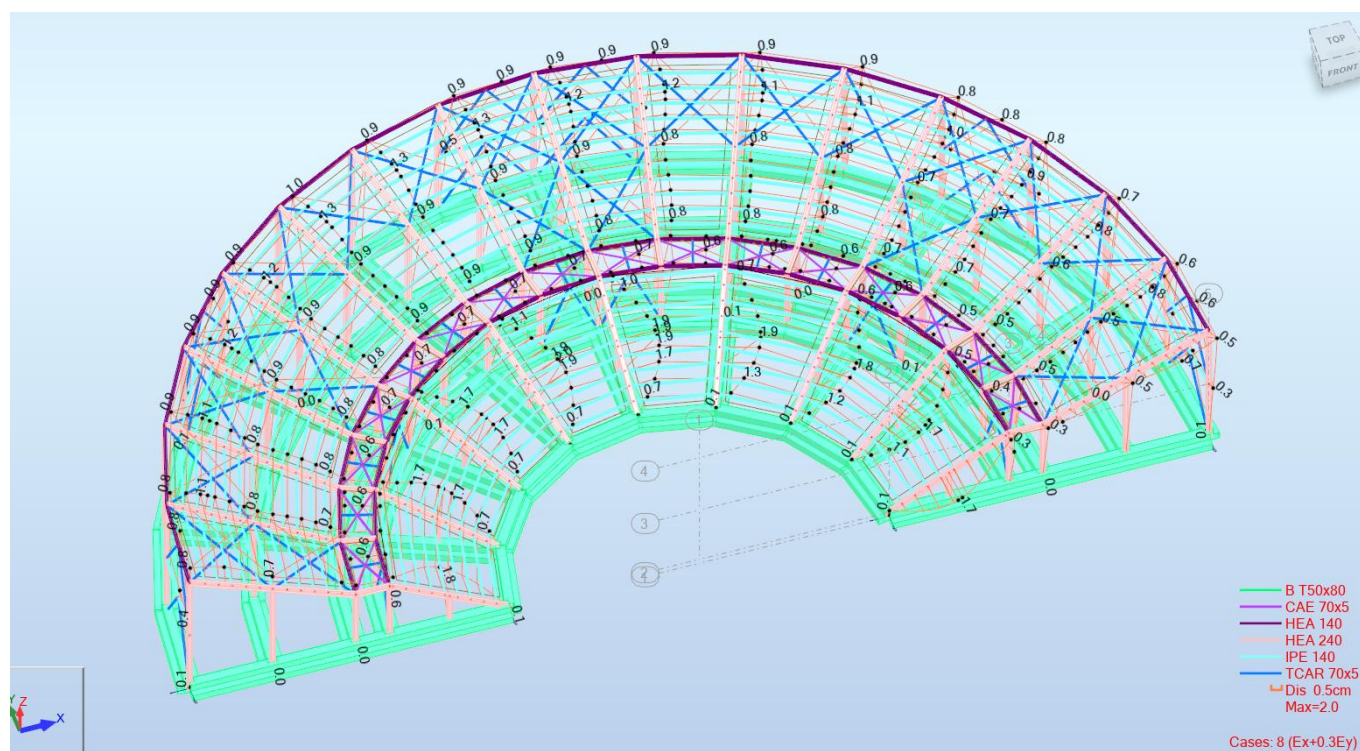
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ACC:SEI/t8 $1*1.00 + 2*0.30 + 9*-1.00$

ACC:SEI/t9 $1*1.00 + 9*-1.00$

5.1.6 ΜΕΓΙΣΤΕΣ ΜΕΤΑΤΟΠΙΣΕΙΣ – SLS

	UX (cm)	UY (cm)	UZ (cm)	RX (Rad)	RY (Rad)	RZ (Rad)
MAX	1.9	1.8	0.3	0.008	0.009	0.007
Node	460	624	734	15	460	76
Case	8	8	7	8	8	8
MIN	-0.5	-1.7	-0.9	-0.008	-0.005	-0.010
Node	12	15	734	624	731	465
Case	SLS/29	8	SLS/11	8	SLS/11	8

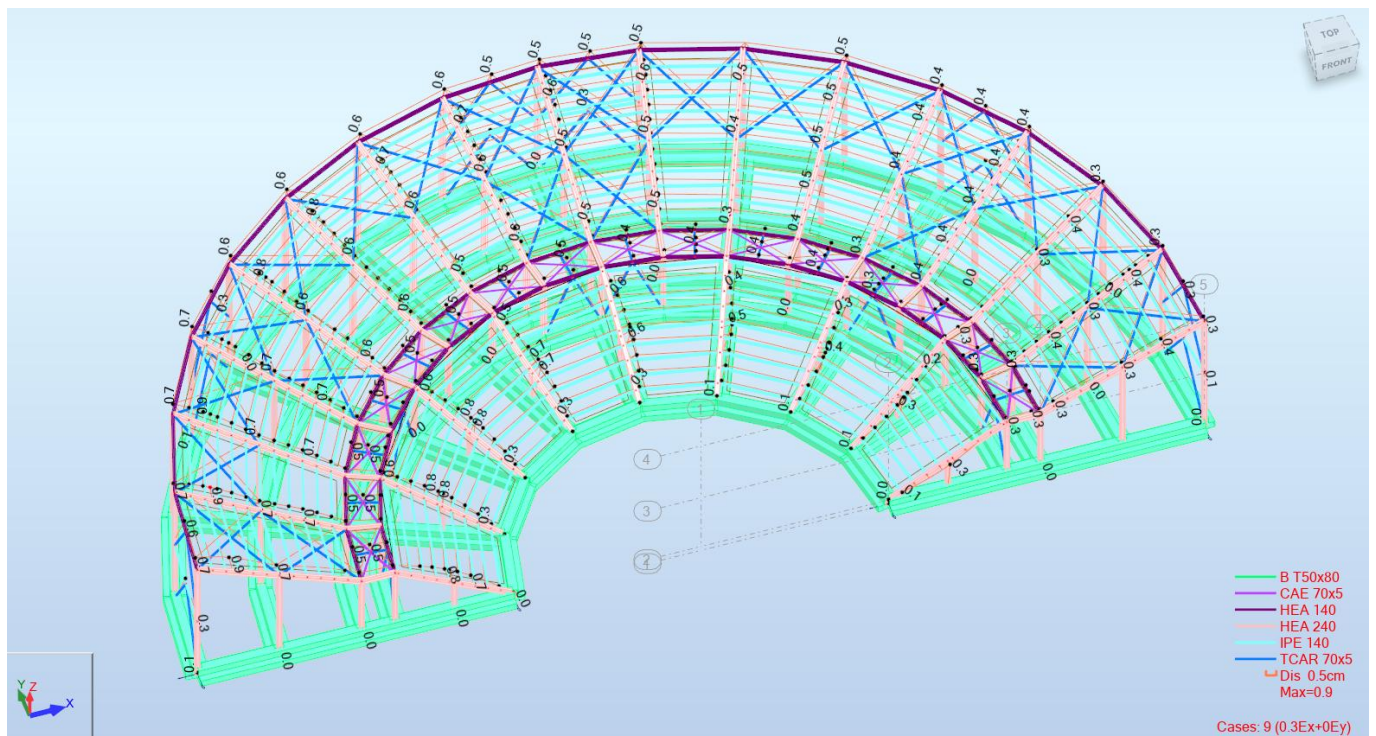


Εικόνα 2: Μετατοπίσεις φορέα για σεισμική διέγερση +X

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Εικόνα 3: Μετατοπίσεις φορέα για σεισμική διέγερση +Y

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

5.1.7 ΕΛΕΓΧΟΣ ΜΕΛΩΝ

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1 Beam_1

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -4.10$ kN	$M_{y,Ed} = -26.91$ kN*m	$M_{z,Ed} = -34.93$ kN*m	$V_{y,Ed} = -116.38$ kN
$N_{t,Rd} = 2112.98$ kN	$M_{y,pl,Rd} = 204.79$ kN*m	$M_{z,pl,Rd} = 96.72$ kN*m	$V_{y,T,Rd} = 1021.74$ kN
	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 42.51$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 399.01$ kN
			$T_{t,Ed} = -0.04$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.38 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.11 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.11 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0$ cm < $v_x \max = L/150.00 = 0.2$ cm Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00
 $v_y = 0.0$ cm < $v_y \max = L/150.00 = 0.2$ cm Verified
Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 2 Beam_main_2

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 154.76$ kN	$M_{y,Ed} = -7.23$ kN*m	$M_{z,Ed} = -1.11$ kN*m	$V_{y,Ed} = -8.92$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -7.23$ kN*m	$M_{z,Ed,max} = -24.52$ kN*m	$V_{y,T,Rd} = 1015.29$ kN
$N_{b,Rd} = 2112.98$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 5.97$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 397.44$ kN
	$M_{b,Rd} = 184.92$ kN*m		$T_{t,Ed} = 0.11$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 435.17$ kN*m	Curve,LT - b	$XLT = 0.88$
$L_{cr,low} = 1.85$ m	$\lambda_{m,LT} = 0.69$	$f_{i,LT} = 0.73$	$XLT_{mod} = 0.90$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.02 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.37 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.37 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.2$ cm < $u_{y,max} = L/200.00 = 3.7$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

$u_z = 0.1$ cm < $u_{z,max} = L/200.00 = 3.7$ cm Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 3 Beam_main_3

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 96.25 kN	My _{Ed} = -10.86 kN*m	Mz _{Ed} = -21.12 kN*m	Vy _{Ed} = -12.13 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = -10.86 kN*m	Mz _{Ed,max} = -21.12 kN*m	Vy _{T,Rd} = 1020.60 kN
N _{b,Rd} = 2112.98 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = 10.92 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 398.73 kN
	Mb _{Rd} = 204.79 kN*m		Tt _{Ed} = 0.05 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	M _{cr} = 2913.56 kN*m	Curve,LT - b	XLT = 1.00
L _{cr,low} = 0.45 m	Lam_LT = 0.27	fi,LT = 0.50	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.22 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$
$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$
$$\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00 \quad (6.2.6)$$
$$\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.32 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.32 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /90/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 4 Beam_main_4

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /11/ \quad 1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tw=0.8 cm
tf=1.2 cm

Iy=7763.18 cm⁴
Wply=744.68 cm³

Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 0.09 kN
N_{c,Rd} = 2112.98 kN
N_{b,Rd} = 2112.98 kN

M_{y,Ed} = -57.39 kN*m
M_{y,Ed,max} = -57.39 kN*m
M_{y,c,Rd} = 204.79 kN*m
M_{N,y,Rd} = 204.79 kN*m
M_{b,Rd} = 176.20 kN*m

M_{z,Ed} = -10.66 kN*m
M_{z,Ed,max} = -10.66 kN*m
M_{z,c,Rd} = 96.72 kN*m
M_{N,z,Rd} = 96.72 kN*m

V_{y,Ed} = -11.42 kN
V_{y,T,Rd} = 1024.19 kN
V_{z,Ed} = 65.59 kN
V_{z,T,Rd} = 399.61 kN
T_{t,Ed} = 0.01 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
L_{cr,low} = 2.43 m

M_{cr} = 347.48 kN*m
Lam_{LT} = 0.77

Curve,LT - b
φ_{i,LT} = 0.78

XLT = 0.83
XLT_{mod} = 0.86

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))
(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.19 < 1.00 (6.2.9.1.(6))
V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 (6.2.6-7)
V_{z,Ed}/V_{z,T,Rd} = 0.16 < 1.00 (6.2.6-7)
Tau_{ty,Ed}/(f_y/(sqrt(3)*g_{M0})) = 0.00 < 1.00 (6.2.6)
Tau_{tz,Ed}/(f_y/(sqrt(3)*g_{M0})) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.33 < 1.00 (6.3.2.1.(1))
N_{Ed}/(X_y*N_{Rk}/g_{M1}) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/g_{M1}) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.44 < 1.00 (6.3.3.(4))
N_{Ed}/(X_z*N_{Rk}/g_{M1}) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/g_{M1}) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.44 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.3 cm < u_y max = L/200.00 = 4.9 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.3 cm < u_z max = L/200.00 = 4.9 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 5 Column_5

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm

g_{M0}=1.00
A_y=64.54 cm²
I_y=7763.18 cm⁴
W_{ply}=744.68 cm³

g_{M1}=1.00
A_z=25.18 cm²
I_z=2768.81 cm⁴
W_{plz}=351.70 cm³

A_x=76.84 cm²
I_x=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 68.86 kN
N_{c,Rd} = 2112.98 kN

M_{y,Ed} = 12.04 kN*m
M_{y,Ed,max} = -13.25 kN*m

M_{z,Ed,max} = -11.62 kN*m

V_{y,Ed} = -2.85 kN
V_{y,T,Rd} = 1023.56 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Nb,Rd = 1421.83 kN

My,c,Rd = 204.79 kN*m
MN,y,Rd = 204.79 kN*m

Mz,c,Rd = 96.72 kN*m

Vz,Ed = 6.20 kN
Vz,T,Rd = 399.45 kN
Tt,Ed = -0.01 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.08 m
Lcr,y = 4.08 m
Lamy = 40.59

Lam_y = 0.47
Xy = 0.90
kyy = 0.60



About z axis:

Lz = 4.08 m
Lcr,z = 4.08 m
Lamz = 67.97

Lam_z = 0.78
Xz = 0.67
kzy = 0.31

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))
My,Ed/My,c,Rd = 0.06 < 1.00 (6.2.5.(1))
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.02 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda,y = 40.59 < Lambda,max = 210.00 Lambda,z = 67.97 < Lambda,max = 210.00 STABLE
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.14 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.16 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

vx = 0.2 cm < vx max = L/150.00 = 2.7 cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
vy = 0.2 cm < vy max = L/150.00 = 2.7 cm Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 6 Column_6

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 43.39 kN	My,Ed = -19.91 kN*m	Mz,Ed,max = 2.32 kN*m	Vy,Ed = 0.57 kN
Nc,Rd = 2112.98 kN	My,Ed,max = 20.18 kN*m	Mz,c,Rd = 96.72 kN*m	Vy,T,Rd = 1023.78 kN
Nb,Rd = 1421.83 kN	My,c,Rd = 204.79 kN*m		Vz,Ed = -9.82 kN
	MN,y,Rd = 204.79 kN*m		Vz,T,Rd = 399.51 kN
			Tt,Ed = 0.01 kN*m
			Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$
 $L_{cr,y} = 4.08 \text{ m}$
 $\lambda_{my} = 40.59$
 $\lambda_{my} = 0.47$
 $X_y = 0.90$
 $k_{yy} = 0.58$



About z axis:

$L_z = 4.08 \text{ m}$
 $L_{cr,z} = 4.08 \text{ m}$
 $\lambda_{mz} = 67.97$
 $\lambda_{mz} = 0.78$
 $X_z = 0.67$
 $k_{zy} = 0.30$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.10 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{my} = 40.59 < \lambda_{my,max} = 210.00$ $\lambda_{mz} = 67.97 < \lambda_{mz,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.09 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.3 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $v_y = 0.3 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 7 Column_7

POINT: 3

COORDINATE: x = 0.50 L = 4.05 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 63.47 \text{ kN}$	$M_{y,Ed} = -4.34 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 0.14 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -0.03 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -26.67 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = 0.14 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1023.74 \text{ kN}$
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 5.51 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 399.50 \text{ kN}$
			$T_{t,Ed} = 0.01 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 8.10 \text{ m}$

$L_{cr,y} = 8.10 \text{ m}$

$\lambda_{my} = 80.58$

$\lambda_{m,y} = 0.93$

$\chi_y = 0.64$

$\kappa_{zy} = 0.33$



About z axis:

$L_z = 8.10 \text{ m}$

$L_{cr,z} = 8.10 \text{ m}$

$\lambda_{mz} = 134.93$

$\lambda_{m,z} = 1.55$

$\chi_z = 0.30$

$\kappa_{zz} = 0.81$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.00 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 80.58 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 134.93 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1}) = 0.13 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1}) = 0.14 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.4 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$v_y = 0.6 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 13 Column_13

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 106.65 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 1873.30 \text{ kN}$

$M_{y,Ed} = 20.15 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 20.15 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.04 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.02 \text{ kN}$

$V_{y,T,Rd} = 1024.59 \text{ kN}$

$V_{z,Ed} = 14.46 \text{ kN}$

$V_{z,T,Rd} = 399.70 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.19 \text{ m}$

$L_{cr,y} = 2.19 \text{ m}$

$\lambda_{my} = 21.79$

$\lambda_{m,y} = 0.25$

$\chi_y = 0.98$

$\kappa_{yy} = 0.67$



About z axis:

$L_z = 2.19 \text{ m}$

$L_{cr,z} = 2.19 \text{ m}$

$\lambda_{mz} = 36.48$

$\lambda_{m,z} = 0.42$

$\chi_z = 0.89$

$\kappa_{yz} = 0.34$

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VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.10 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 21.79 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 36.48 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.12 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 1.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$ Verified

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 1.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 14 Column_14

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 140.34 \text{ kN}$	$M_{y,Ed} = -5.79 \text{ kN} \cdot \text{m}$		$V_{y,Ed} = -0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 8.28 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = -0.01 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.49 \text{ kN}$
$N_{b,Rd} = 948.80 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = -2.31 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,T,Rd} = 399.68 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$ $\lambda_{m,y} = 0.70$
 $L_{cr,y} = 6.09 \text{ m}$ $X_y = 0.78$
 $\lambda_{m,y} = 60.59$ $k_{yy} = 0.65$



About z axis:

$L_z = 6.09 \text{ m}$ $\lambda_{m,z} = 1.17$
 $L_{cr,z} = 6.09 \text{ m}$ $X_z = 0.45$
 $\lambda_{m,z} = 101.45$ $k_{zy} = 0.32$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

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$$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 60.59 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 101.45 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.11 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.16 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.4 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 34 Beam_34

POINT: 2

COORDINATE: x = 0.50 L = 1.96 m

LOADS:

Governing Load Case: 10 ULS /198/ $1 \cdot 1.35 + 4 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$b = 7.3 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.7 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 11.15 \text{ cm}^2$$

$$I_y = 541.22 \text{ cm}^4$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 7.64 \text{ cm}^2$$

$$I_z = 44.92 \text{ cm}^4$$

$$W_{plz} = 19.25 \text{ cm}^3$$

$$A_x = 16.43 \text{ cm}^2$$

$$I_x = 2.54 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 113.55 \text{ kN}$$

$$M_{y,Ed} = 0.33 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.33 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 22.55 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 10.83 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 11.37 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT - b}$$

$$X_{LT} = 0.44$$

$$L_{cr,upp} = 3.93 \text{ m}$$

$$\lambda_{m,LT} = 1.46$$

$$f_{i,LT} = 1.48$$

$$X_{LT,mod} = 0.45$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.25 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.01 < 1.00 \quad (6.2.9.1.(2))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.28 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.28 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /64/ $1*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 47 Beam_47

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.95 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /198/ $1*1.35 + 4*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.97 \text{ kN}$

$M_{y,Ed} = 0.33 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.33 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 10.88 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.43 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.45$

$L_{cr,upp} = 3.91 \text{ m}$

$\lambda_{m_LT} = 1.46$

$\phi_{i,LT} = 1.48$

$X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /7/ $1*1.00 + 2*1.00 + 3*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 48 Beam_48

POINT: 2

COORDINATE: x = 0.50 L = 1.97 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.38$ kN	$M_{y,Ed} = 0.33$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.33$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 10.79$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.32$ kN*m	Curve,LT - b	$XLT = 0.44$
$L_{cr,upp} = 3.95$ m	$\lambda_{m,LT} = 1.47$	$\phi_{i,LT} = 1.49$	$XLT_{mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /32/ 1*1.00 + 2*0.70 + 3*0.60 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /66/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 49 Beam_49

POINT: 2

COORDINATE: x = 0.50 L = 1.96 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 13.73 \text{ kN}$	$M_{y,Ed} = 0.33 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.33 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 10.84 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.38 \text{ kN}\cdot\text{m}$	Curve,LT - b	$XLT = 0.44$
$L_{cr,upp}=3.92 \text{ m}$	$\Lambda_{m_LT} = 1.46$	$f_{i,LT} = 1.48$	$XLT_{mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$ Verified
Governing Load Case: 13 SLS /26/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00
 $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$ Verified
Governing Load Case: 13 SLS /13/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 50 Beam_50

POINT: 2

COORDINATE: x = 0.50 L = 1.97 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 13.75 kN	My,Ed = 0.33 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.33 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 10.81 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 11.35 kN*m	Curve,LT - b	XLT = 0.44
Lcr,upp=3.94 m	Lam_LT = 1.46	fi,LT = 1.48	XLT,mod = 0.45

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /37/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /16/ 1*1.00 + 2*1.00 + 4*0.60 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 51 Beam_51

POINT: 2

COORDINATE: x = 0.50 L = 1.97 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 12.83 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.33 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.33 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 10.81 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.94 \text{ m}$

$M_{cr} = 11.35 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.46$

Curve,LT - b
 $\eta_{LT} = 1.48$

$X_{LT} = 0.44$
 $X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /46/ $1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /80/ $1 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 1.00 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 52 Column_52

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$
 $b = 24.0 \text{ cm}$
 $t_w = 0.8 \text{ cm}$
 $t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 64.54 \text{ cm}^2$
 $I_y = 7763.18 \text{ cm}^4$
 $W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 25.18 \text{ cm}^2$
 $I_z = 2768.81 \text{ cm}^4$
 $W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$
 $I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 135.94 \text{ kN}$
 $N_{c,Rd} = 2112.98 \text{ kN}$
 $N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed} = 51.18 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 51.18 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$
 $M_{y,V,Rd} = 204.62 \text{ kN}\cdot\text{m}$

$M_{z,Ed} = -2.76 \text{ kN}\cdot\text{m}$
 $M_{z,Ed,max} = -2.76 \text{ kN}\cdot\text{m}$
 $M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$
 $M_{N,z,Rd} = 96.72 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = -6.95 \text{ kN}$
 $V_{y,T,Rd} = 947.72 \text{ kN}$
 $V_{z,Ed} = -207.33 \text{ kN}$
 $V_{z,T,Rd} = 381.24 \text{ kN}$
 $T_{t,Ed} = -0.91 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:

$L_y = 0.30 \text{ m}$
 $L_{cr,y} = 0.30 \text{ m}$
 $\lambda_{my} = 2.98$
 $\lambda_{my} = 0.03$
 $\chi_y = 1.00$
 $\eta_{yy} = 0.74$



About z axis:

$L_z = 0.30 \text{ m}$
 $L_{cr,z} = 0.30 \text{ m}$
 $\lambda_{mz} = 5.00$
 $\lambda_{mz} = 0.06$
 $\chi_z = 1.00$
 $\eta_{yz} = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,V,Rd} + M_{z,Ed}/M_{z,c,Rd} = 0.28 < 1.00$ (6.2.8)
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.09 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.54 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.18 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.11 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 2.98 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 5.00 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.26 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{yz} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.18 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 0.2 \text{ cm}$ Verified
Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$
 $v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 0.2 \text{ cm}$ Verified
Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 53 Beam_main_53

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 249.22 \text{ kN}$	$M_{y,Ed} = -11.02 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = -1.13 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -10.22 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -11.02 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = -23.78 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1015.15 \text{ kN}$
$N_{b,Rd} = 2112.98 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 9.40 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 397.41 \text{ kN}$
	$M_{b,Rd} = 184.92 \text{ kN} \cdot \text{m}$		$T_{t,Ed} = 0.12 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 435.17 \text{ kN} \cdot \text{m}$	Curve,LT - b	$XLT = 0.88$
$L_{cr,low} = 1.85 \text{ m}$	$\lambda_{LT} = 0.69$	$\eta_{LT} = 0.73$	$XLT_{mod} = 0.90$

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.12 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.42 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.42 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 3.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /28/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 54 Beam_main_54

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 24.0 \text{ cm}$

$A_y = 64.54 \text{ cm}^2$

$A_z = 25.18 \text{ cm}^2$

$A_x = 76.84 \text{ cm}^2$

$t_w = 0.8 \text{ cm}$

$I_y = 7763.18 \text{ cm}^4$

$I_z = 2768.81 \text{ cm}^4$

$I_x = 38.20 \text{ cm}^4$

$t_f = 1.2 \text{ cm}$

$W_{ply} = 744.68 \text{ cm}^3$

$W_{plz} = 351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 123.46 \text{ kN}$

$M_{y,Ed} = -12.87 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = -20.48 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = -12.13 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = -12.87 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = -20.48 \text{ kN} \cdot \text{m}$

$V_{y,T,Rd} = 1020.78 \text{ kN}$

$N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{z,Ed} = 12.30 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{z,T,Rd} = 398.78 \text{ kN}$

$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$T_{t,Ed} = 0.05 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 1.00$

$L_{cr,low} = 0.45 \text{ m}$

$\lambda_{m,LT} = 0.27$

$\phi_{i,LT} = 0.50$

$XLT_{mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/N_{c,Rd} = 0.06 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd}) = 0.22 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.33 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.33 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 55 Beam_main_55

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

$g_{M0}=1.00$

$g_{M1}=1.00$

b=24.0 cm

$A_y=64.54 \text{ cm}^2$

$A_z=25.18 \text{ cm}^2$

$A_x=76.84 \text{ cm}^2$

tw=0.8 cm

$I_y=7763.18 \text{ cm}^4$

$I_z=2768.81 \text{ cm}^4$

$I_x=38.20 \text{ cm}^4$

tf=1.2 cm

$W_{ply}=744.68 \text{ cm}^3$

$W_{plz}=351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 90.81 \text{ kN}$

$M_{y,Ed} = -105.24 \text{ kN}\cdot\text{m}$

$M_{z,Ed} = -7.65 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = -7.39 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = -105.24 \text{ kN}\cdot\text{m}$

$M_{z,Ed,max} = -7.65 \text{ kN}\cdot\text{m}$

$V_{y,T,Rd} = 1024.21 \text{ kN}$

$N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$

$V_{z,Ed} = 126.53 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN}\cdot\text{m}$

$M_{N,z,Rd} = 96.72 \text{ kN}\cdot\text{m}$

$V_{z,T,Rd} = 399.61 \text{ kN}$

$M_{b,Rd} = 176.20 \text{ kN}\cdot\text{m}$

$T_{t,Ed} = 0.01 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 347.48 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.83$

$L_{cr,low} = 2.43 \text{ m}$

$\lambda_{m,LT} = 0.77$

$\phi_{i,LT} = 0.78$

$X_{LT,mod} = 0.86$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd}) = 0.34 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.60 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.72 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.72 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$$u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 56 Column_56

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /53/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 24.0 \text{ cm}$$

$$A_y = 64.54 \text{ cm}^2$$

$$A_z = 25.18 \text{ cm}^2$$

$$A_x = 76.84 \text{ cm}^2$$

$$t_w = 0.8 \text{ cm}$$

$$I_y = 7763.18 \text{ cm}^4$$

$$I_z = 2768.81 \text{ cm}^4$$

$$I_x = 38.20 \text{ cm}^4$$

$$t_f = 1.2 \text{ cm}$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$W_{plz} = 351.70 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 209.95 \text{ kN}$$

$$M_{y,Ed} = 18.54 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 0.43 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$M_{y,Ed,max} = -29.18 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 1.76 \text{ kN} \cdot \text{m}$$

$$V_{y,T,Rd} = 1024.46 \text{ kN}$$

$$N_{b,Rd} = 1421.83 \text{ kN}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 11.70 \text{ kN}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$V_{z,T,Rd} = 399.67 \text{ kN}$$

$$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$$

$$\text{Class of section} = 1$$



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 4.08 \text{ m}$$

$$\text{Lam}_y = 0.47$$

$$L_{cr,y} = 4.08 \text{ m}$$

$$X_y = 0.90$$

$$\text{Lam}_y = 40.59$$

$$k_{yy} = 0.65$$



About z axis:

$$L_z = 4.08 \text{ m}$$

$$\text{Lam}_z = 0.78$$

$$L_{cr,z} = 4.08 \text{ m}$$

$$X_z = 0.67$$

$$\text{Lam}_z = 67.97$$

$$k_{zy} = 0.33$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00 \quad (6.2.5.(1))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$

$$\tau_{u,ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{u,tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\text{Lambda}_{y} = 40.59 < \text{Lambda}_{max} = 210.00 \quad \text{Lambda}_{z} = 67.97 < \text{Lambda}_{max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.21 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.21 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_x \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$v_y = 0.3 \text{ cm} < v_y \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 57 Column_57

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$

$b=24.0 \text{ cm}$

$tw=0.8 \text{ cm}$

$tf=1.2 \text{ cm}$

$gM0=1.00$

$A_y=64.54 \text{ cm}^2$

$I_y=7763.18 \text{ cm}^4$

$W_{ply}=744.68 \text{ cm}^3$

$gM1=1.00$

$A_z=25.18 \text{ cm}^2$

$I_z=2768.81 \text{ cm}^4$

$W_{plz}=351.70 \text{ cm}^3$

$A_x=76.84 \text{ cm}^2$

$I_x=38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{,Ed} = 112.66 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,Ed} = -9.90 \text{ kN*m}$

$M_{y,Ed,max} = 21.40 \text{ kN*m}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$MN_{y,Rd} = 204.79 \text{ kN*m}$

$M_{z,Ed,max} = -0.10 \text{ kN*m}$

$M_{z,c,Rd} = 96.72 \text{ kN*m}$

$V_{y,Ed} = -0.02 \text{ kN}$

$V_{y,T,Rd} = 1024.55 \text{ kN}$

$V_{z,Ed} = -7.67 \text{ kN}$

$V_{z,T,Rd} = 399.69 \text{ kN}$

$T_{t,Ed} = -0.00 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{my} = 0.47$

$\chi_y = 0.90$

$\kappa_{yy} = 0.69$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{mz} = 0.78$

$\chi_z = 0.67$

$\kappa_{zy} = 0.36$

VERIFICATION FORMULAS:

Section strength check:

$N_{,Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{bda,y} = 40.59 < \lambda_{bda,max} = 210.00$ $\lambda_{bz} = 67.97 < \lambda_{bda,max} = 210.00$ STABLE

$N_{,Ed}/(\chi_y*N_{c,Rd}/gM1) + \kappa_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + \kappa_{yz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.13 < 1.00$ (6.3.3.(4))

$N_{,Ed}/(\chi_z*N_{c,Rd}/gM1) + \kappa_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + \kappa_{zz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_x \text{ max} = L/150.00 = 2.7 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$
 $v_y = 0.3 \text{ cm} < v_y \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 58 Column_58

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /12/ $1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$tw=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$tf=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 122.93 \text{ kN}$	$M_{y,Ed} = 25.77 \text{ kN}^*\text{m}$		$V_{y,Ed} = 0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -44.86 \text{ kN}^*\text{m}$	$M_{z,Ed,max} = 0.01 \text{ kN}^*\text{m}$	$V_{y,T,Rd} = 1024.04 \text{ kN}$
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN}^*\text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN}^*\text{m}$	$V_{z,Ed} = 8.72 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN}^*\text{m}$		$V_{z,T,Rd} = 399.57 \text{ kN}$
			$T_{t,Ed} = 0.01 \text{ kN}^*\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10 \text{ m}$	$\text{Lam}_y = 0.93$
$L_{cr,y} = 8.10 \text{ m}$	$X_y = 0.64$
$\text{Lam}_y = 80.58$	$k_{yy} = 0.68$



About z axis:

$L_z = 8.10 \text{ m}$	$\text{Lam}_z = 1.55$
$L_{cr,z} = 8.10 \text{ m}$	$X_z = 0.30$
$\text{Lam}_z = 134.93$	$k_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.13 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_{y} = 80.58 < \text{Lambda}_{max} = 210.00$ $\text{Lambda}_{z} = 134.93 < \text{Lambda}_{max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_x \text{ max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.6 \text{ cm} < v_y \text{ max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 60 Beam_60

POINT: 1

COORDINATE: $x = 0.50 L = 2.67 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 35.96 \text{ kN}$	$M_{y,Ed} = -0.84 \text{ kN*m}$		
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = -0.84 \text{ kN*m}$		
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$	$V_{z,Ed} = 0.54 \text{ kN}$	
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$	$V_{z,c,Rd} = 121.34 \text{ kN}$	
	$M_{b,Rd} = 8.48 \text{ kN*m}$		
		Class of section = 1	



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.48 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.35$
$L_{cr,low} = 5.33 \text{ m}$	$\lambda_{m,LT} = 1.69$	$\phi_{i,LT} = 1.79$	$X_{LT,mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.08 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$
$$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.10 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.18 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.18 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 61 Beam_61

POINT: 3

COORDINATE: $x = 0.50 L = 2.66 \text{ m}$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



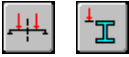
SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.32 \text{ kN}$	$M_{y,Ed} = -0.90 \text{ kN*m}$	
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = -0.90 \text{ kN*m}$	
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$	$V_{z,Ed} = -0.57 \text{ kN}$
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$	$V_{z,c,Rd} = 121.34 \text{ kN}$
	$M_{b,Rd} = 8.52 \text{ kN*m}$	

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.52 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.35$
$L_{cr,low} = 5.31 \text{ m}$	$\Lambda_{m_LT} = 1.69$	$\phi_{i,LT} = 1.79$	$X_{LT,mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.15 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.15 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$
 $u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 62 Beam_62

POINT: 1

COORDINATE: $x = 0.50 \text{ L} = 2.65 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=20.28$ kN	$M_{y,Ed}=-0.90$ kN*m		
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=-0.90$ kN*m		
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m	$V_{z,Ed}=0.57$ kN	
	$MN_{y,Rd}=24.30$ kN*m	$V_{z,c,Rd}=121.34$ kN	
	$M_{b,Rd}=8.53$ kN*m		
		Class of section = 1	



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=8.53$ kN*m	Curve,LT - b	$XLT=0.35$
$L_{cr,low}=5.30$ m	$\lambda_{m,LT}=1.69$	$f_{i,LT}=1.79$	$XLT_{mod}=0.35$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.04 < 1.00 \quad (6.2.5.(1))$$

$$V_{z,Ed}/V_{z,c,Rd}=0.00 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.11 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.15 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.15 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y=0.0 \text{ cm} < u_{y,max}=L/200.00=2.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$$u_z=0.1 \text{ cm} < u_{z,max}=L/200.00=2.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 64 Column_64

POINT: 3

COORDINATE: $x=1.00$ L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 215.12 \text{ kN}$	$M_{y,Ed} = 24.04 \text{ kN*m}$		$V_{y,Ed} = 0.01 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 24.04 \text{ kN*m}$	$M_{z,Ed,max} = 0.02 \text{ kN*m}$	$V_{y,T,Rd} = 1024.58 \text{ kN}$
$N_{b,Rd} = 1873.30 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{z,Ed} = 16.38 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN*m}$		$V_{z,T,Rd} = 399.70 \text{ kN}$
			$T_{t,Ed} = 0.00 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.19 \text{ m}$	$\lambda_{m,y} = 0.25$
$L_{cr,y} = 2.19 \text{ m}$	$\chi_y = 0.98$
$\lambda_{m,y} = 21.79$	$\chi_{yy} = 0.68$



About z axis:

$L_z = 2.19 \text{ m}$	$\lambda_{m,z} = 0.42$
$L_{cr,z} = 2.19 \text{ m}$	$\chi_z = 0.89$
$\lambda_{m,z} = 36.48$	$\chi_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.12 < 1.00$ (6.2.5.(1))
$M_{y,Ed}/M_{N,y,Rd} = 0.12 < 1.00$ (6.2.9.1.(2))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)
$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 21.79 < \lambda_{m,max} = 210.00$	$\lambda_{m,z} = 36.48 < \lambda_{m,max} = 210.00$	STABLE
$N_{Ed}/(\chi_y \cdot N_{c,Rd}/g_{M1}) + \chi_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/g_{M1}) + \chi_{yz} \cdot M_{z,Ed,max}/(M_{z,Rd}/g_{M1}) = 0.18 < 1.00$ (6.3.3.(4))		
$N_{Ed}/(\chi_z \cdot N_{c,Rd}/g_{M1}) + \chi_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/g_{M1}) + \chi_{zz} \cdot M_{z,Ed,max}/(M_{z,Rd}/g_{M1}) = 0.16 < 1.00$ (6.3.3.(4))		

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 1.5 \text{ cm}$	Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00	
$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 1.5 \text{ cm}$	Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 65 Column_65

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 272.72 \text{ kN}$	$M_{y,Ed} = -5.46 \text{ kN*m}$		$V_{y,Ed} = -0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 11.12 \text{ kN*m}$	$M_{z,Ed,max} = -0.01 \text{ kN*m}$	$V_{y,T,Rd} = 1024.54 \text{ kN}$
$N_{b,Rd} = 948.80 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{z,Ed} = -2.72 \text{ kN}$
	$M_{N,y,Rd} = 203.88 \text{ kN*m}$		$V_{z,T,Rd} = 399.69 \text{ kN}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$T_t, Ed = -0.00 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$
 $L_{cr,y} = 6.09 \text{ m}$
 $\lambda_{my} = 60.59$
 $\lambda_{m,y} = 0.70$
 $\chi_y = 0.78$
 $\chi_{yy} = 0.70$



About z axis:

$L_z = 6.09 \text{ m}$
 $L_{cr,z} = 6.09 \text{ m}$
 $\lambda_{mz} = 101.45$
 $\lambda_{m,z} = 1.17$
 $\chi_z = 0.45$
 $\chi_{zy} = 0.34$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3})\cdot g_{M0}) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3})\cdot g_{M0}) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 60.59 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 101.45 < \lambda_{m,max} = 210.00$ STABLE
 $N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \chi_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \chi_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \chi_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \chi_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.31 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 66 Beam_66

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.98 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.3 \text{ cm}$	$A_y = 11.15 \text{ cm}^2$	$A_z = 7.64 \text{ cm}^2$	$A_x = 16.43 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 541.22 \text{ cm}^4$	$I_z = 44.92 \text{ cm}^4$	$I_x = 2.54 \text{ cm}^4$
$t_f = 0.7 \text{ cm}$	$W_{ply} = 88.35 \text{ cm}^3$	$W_{plz} = 19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.29 \text{ kN}$	$M_{y,Ed} = 0.33 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.33 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 10.77 \text{ kN}\cdot\text{m}$

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.96 \text{ m}$

$M_{cr} = 11.30 \text{ kN}^*\text{m}$
 $\Lambda_{m_LT} = 1.47$

Curve,LT - b
 $\eta_{LT} = 1.49$

$X_{LT} = 0.44$
 $X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /37/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /53/ $1 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 69 Column_69

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /8/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$
 $b = 24.0 \text{ cm}$
 $t_w = 0.8 \text{ cm}$
 $t_f = 1.2 \text{ cm}$

$gM0 = 1.00$
 $A_y = 64.54 \text{ cm}^2$
 $I_y = 7763.18 \text{ cm}^4$
 $W_{ply} = 744.68 \text{ cm}^3$

$gM1 = 1.00$
 $A_z = 25.18 \text{ cm}^2$
 $I_z = 2768.81 \text{ cm}^4$
 $W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$
 $I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 161.08 \text{ kN}$
 $N_{c,Rd} = 2112.98 \text{ kN}$
 $N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed} = 61.86 \text{ kN}^*\text{m}$
 $M_{y,Ed,max} = 61.86 \text{ kN}^*\text{m}$
 $M_{y,c,Rd} = 204.79 \text{ kN}^*\text{m}$
 $M_{y,V,Rd} = 203.48 \text{ kN}^*\text{m}$

$M_{z,Ed} = 0.52 \text{ kN}^*\text{m}$
 $M_{z,Ed,max} = 0.52 \text{ kN}^*\text{m}$
 $M_{z,c,Rd} = 96.72 \text{ kN}^*\text{m}$
 $M_{N,z,Rd} = 96.72 \text{ kN}^*\text{m}$

$V_{y,Ed} = 2.23 \text{ kN}$
 $V_{y,T,Rd} = 1008.61 \text{ kN}$
 $V_{z,Ed} = -246.37 \text{ kN}$
 $V_{z,T,Rd} = 395.82 \text{ kN}$
 $T_{t,Ed} = -0.20 \text{ kN}^*\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 0.30 \text{ m}$
 $L_{cr,y} = 0.30 \text{ m}$
 $\Lambda_{my} = 2.98$

$\Lambda_{m_y} = 0.03$
 $X_y = 1.00$
 $k_{yy} = 0.74$



About z axis:

$L_z = 0.30 \text{ m}$
 $L_{cr,z} = 0.30 \text{ m}$
 $\Lambda_{mz} = 5.00$

$\Lambda_{m_z} = 0.06$
 $X_z = 1.00$
 $k_{yz} = 0.47$

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VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,V,Rd} + M_{z,Ed}/M_{z,c,Rd} = 0.31 < 1.00$ (6.2.8)
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.10 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.62 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.04 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 2.98 < \lambda_{y,max} = 210.00$ $\lambda_{z,Ed} = 5.00 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.30 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.19 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 70 Beam_main_70

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 275.03 \text{ kN}$	$M_{y,Ed} = -11.76 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = -1.18 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -12.08 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -11.76 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = -24.38 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1014.85 \text{ kN}$
$N_{b,Rd} = 2112.98 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 9.93 \text{ kN}$
	$M_{N,y,Rd} = 203.62 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 397.33 \text{ kN}$
	$M_{b,Rd} = 184.92 \text{ kN} \cdot \text{m}$		$T_{t,Ed} = 0.12 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 435.17 \text{ kN} \cdot \text{m}$	Curve,LT - b	$X_{LT} = 0.88$
$L_{cr,low} = 1.85 \text{ m}$	$\lambda_{m,LT} = 0.69$	$f_{i,LT} = 0.73$	$X_{LT,mod} = 0.90$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.02 < 1.00$ (6.2.9.1.(6))

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$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.45 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.45 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 3.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$ Verified

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 71 Beam_main_71

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$b = 24.0 \text{ cm}$$

$$t_w = 0.8 \text{ cm}$$

$$t_f = 1.2 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 64.54 \text{ cm}^2$$

$$I_y = 7763.18 \text{ cm}^4$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 25.18 \text{ cm}^2$$

$$I_z = 2768.81 \text{ cm}^4$$

$$W_{plz} = 351.70 \text{ cm}^3$$

$$A_x = 76.84 \text{ cm}^2$$

$$I_x = 38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 143.66 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 2112.98 \text{ kN}$$

$$M_{y,Ed} = -13.81 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = -13.81 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = -21.00 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = -21.00 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -12.84 \text{ kN}$$

$$V_{y,T,Rd} = 1020.74 \text{ kN}$$

$$V_{z,Ed} = 13.37 \text{ kN}$$

$$V_{z,T,Rd} = 398.77 \text{ kN}$$

$$T_{t,Ed} = 0.05 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,low} = 0.45 \text{ m}$$

$$M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$$

$$\lambda_{m,LT} = 0.27$$

$$\text{Curve}_{LT-b}$$

$$f_{i,LT} = 0.50$$

$$X_{LT} = 1.00$$

$$X_{LT,mod} = 1.00$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.07 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.22 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00 \quad (6.3.2.1.(1))$$

Κύριος έργο: Δήμος Καλαμάτας

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$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.35 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.35 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 72 Beam_main_72

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

gM0=1.00

gM1=1.00

b=24.0 cm

Ay=64.54 cm²

Az=25.18 cm²

Ax=76.84 cm²

tw=0.8 cm

Iy=7763.18 cm⁴

Iz=2768.81 cm⁴

Ix=38.20 cm⁴

tf=1.2 cm

Wply=744.68 cm³

Wplz=351.70 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 88.35 kN

M_{y,Ed} = -104.75 kN*m

M_{z,Ed} = -6.26 kN*m

V_{y,Ed} = -7.77 kN

N_{c,Rd} = 2112.98 kN

M_{y,Ed,max} = -104.75 kN*m

M_{z,Ed,max} = -6.26 kN*m

V_{y,T,Rd} = 1024.25 kN

N_{b,Rd} = 2112.98 kN

M_{y,c,Rd} = 204.79 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{z,Ed} = 125.63 kN

MN_{y,Rd} = 204.79 kN*m

MN_{z,Rd} = 96.72 kN*m

V_{z,T,Rd} = 399.62 kN

M_{b,Rd} = 176.20 kN*m

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 347.48 kN*m

Curve,LT - b

XLT = 0.83

L_{cr,low} = 2.43 m

Lam_LT = 0.77

fi,LT = 0.78

XLT,mod = 0.86

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.33 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00 \quad (6.2.6-7)$$

$$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.59 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.70 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.70 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$u_y = 0.1 \text{ cm} < u_{y \text{ max}} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.6 \text{ cm} < u_{z \text{ max}} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 73 Column_73

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /53/ $1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$

$b=24.0 \text{ cm}$

$tw=0.8 \text{ cm}$

$tf=1.2 \text{ cm}$

$gM0=1.00$

$A_y=64.54 \text{ cm}^2$

$I_y=7763.18 \text{ cm}^4$

$W_{ply}=744.68 \text{ cm}^3$

$gM1=1.00$

$A_z=25.18 \text{ cm}^2$

$I_z=2768.81 \text{ cm}^4$

$W_{plz}=351.70 \text{ cm}^3$

$A_x=76.84 \text{ cm}^2$

$I_x=38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 197.82 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,Ed} = 18.27 \text{ kN*m}$

$M_{y,Ed,max} = -28.37 \text{ kN*m}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$MN_{y,Rd} = 204.79 \text{ kN*m}$

$M_{z,Ed,max} = 2.91 \text{ kN*m}$

$M_{z,c,Rd} = 96.72 \text{ kN*m}$

$V_{y,Ed} = 0.71 \text{ kN}$

$V_{y,T,Rd} = 1024.20 \text{ kN}$

$V_{z,Ed} = 11.43 \text{ kN}$

$V_{z,T,Rd} = 399.61 \text{ kN}$

$T_{t,Ed} = 0.01 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$L_{amy} = 40.59$

$\lambda_{m,y} = 0.47$

$\chi_y = 0.90$

$\chi_{yy} = 0.65$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$L_{amz} = 67.97$

$\lambda_{m,z} = 0.78$

$\chi_z = 0.67$

$\chi_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.09 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 40.59 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 67.97 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y*N_{c,Rd}/gM1) + \chi_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + \chi_{yz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.21 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z*N_{c,Rd}/gM1) + \chi_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + \chi_{zz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.21 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /37/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$

$v_y = 0.3 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 74 Column_74

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 112.23$ kN	$M_{y,Ed} = -9.87$ kN*m	$M_{z,Ed,max} = -1.56$ kN*m	$V_{y,Ed} = -0.38$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = 21.24$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{y,T,Rd} = 1024.30$ kN
$N_{b,Rd} = 1421.83$ kN	$M_{y,c,Rd} = 204.79$ kN*m		$V_{z,Ed} = -7.63$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.63$ kN
			$T_{t,Ed} = -0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08$ m	$Lam_y = 0.47$
$L_{cr,y} = 4.08$ m	$X_y = 0.90$
$L_{amy} = 40.59$	$k_{yy} = 0.69$



About z axis:

$L_z = 4.08$ m	$Lam_z = 0.78$
$L_{cr,z} = 4.08$ m	$X_z = 0.67$
$L_{amz} = 67.97$	$k_{zy} = 0.36$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{bda,y} = 40.59 < \lambda_{bda,max} = 210.00$	$\lambda_{bda,z} = 67.97 < \lambda_{bda,max} = 210.00$	STABLE
$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.14 < 1.00$	(6.3.3.(4))	
$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.13 < 1.00$	(6.3.3.(4))	

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0$ cm < $v_{x,max} = L/150.00 = 2.7$ cm Verified

Governing Load Case: 13 SLS /37/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$

$v_y = 0.3$ cm < $v_{y,max} = L/150.00 = 2.7$ cm Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 75 Column_75

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 161.23 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 628.77 kN

M_{y,Ed} = 25.77 kN*m

M_{y,Ed,max} = -44.40 kN*m

M_{y,c,Rd} = 204.79 kN*m

M_{N,y,Rd} = 204.79 kN*m

M_{z,Ed,max} = -0.53 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{y,Ed} = -0.13 kN

V_{y,T,Rd} = 1024.20 kN

V_{z,Ed} = 8.65 kN

V_{z,T,Rd} = 399.61 kN

T_{t,Ed} = 0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 8.10 m

L_{cr,y} = 8.10 m

L_{am,y} = 80.58

L_{am,y} = 0.93

X_y = 0.64

k_{yy} = 0.68



About z axis:

L_z = 8.10 m

L_{cr,z} = 8.10 m

L_{am,z} = 134.93

L_{am,z} = 1.55

X_z = 0.30

k_{zy} = 0.32

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.08 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.13 < 1.00 (6.2.5.(1))

V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 (6.2.6-7)

V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda_y = 80.58 < Lambda_{max} = 210.00 Lambda_z = 134.93 < Lambda_{max} = 210.00 STABLE

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.33 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.1 cm < v_{x,max} = L/150.00 = 5.4 cm Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

v_y = 0.5 cm < v_{y,max} = L/150.00 = 5.4 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 81 Column_81

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 208.66 \text{ kN}$	$M_{y,Ed} = 24.41 \text{ kN*m}$	$M_{z,Ed,max} = 0.01 \text{ kN*m}$	$V_{y,Ed} = 0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 24.41 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{y,T,Rd} = 1024.62 \text{ kN}$
$N_{b,Rd} = 1873.30 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$		$V_{z,Ed} = 16.83 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN*m}$		$V_{z,T,Rd} = 399.71 \text{ kN}$
			$T_{t,Ed} = 0.00 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.19 \text{ m}$	$\text{Lam}_y = 0.25$
$L_{cr,y} = 2.19 \text{ m}$	$X_y = 0.98$
$\text{Lam}_y = 21.79$	$k_{yy} = 0.67$



About z axis:

$L_z = 2.19 \text{ m}$	$\text{Lam}_z = 0.42$
$L_{cr,z} = 2.19 \text{ m}$	$X_z = 0.89$
$\text{Lam}_z = 36.48$	$k_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.12 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lam}_{b,y} = 21.79 < \text{Lam}_{b,max} = 210.00$ $\text{Lam}_{b,z} = 36.48 < \text{Lam}_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{c,Rd}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.18 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{c,Rd}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.15 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 1.5 \text{ cm}$ Verified
Governing Load Case: 13 SLS /36/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00$
 $v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 1.5 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 82 Column_82

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 6.09 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 271.53 kN	My _{Ed} = -5.38 kN*m	Mz _{Ed,max} = -0.00 kN*m	Vy _{Ed} = -0.00 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = 11.02 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vy _{T,Rd} = 1024.58 kN
N _{b,Rd} = 948.80 kN	My _{c,Rd} = 204.79 kN*m		Vz _{Ed} = -2.69 kN
	MN _{y,Rd} = 204.01 kN*m		Vz _{T,Rd} = 399.70 kN
			Tt _{Ed} = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.09 m	Lam _y = 0.70
Lcr,y = 6.09 m	Xy = 0.78
Lamy = 60.59	kyy = 0.70



About z axis:

Lz = 6.09 m	Lam _z = 1.17
Lcr,z = 6.09 m	Xz = 0.45
Lamz = 101.45	kzy = 0.34

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{fy}/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{fy}/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 60.59 < \lambda_{y,max} = 210.00$ $\lambda_{z,Ed} = 101.45 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y N_{Rk}/gM1) + k_{yy} M_{y,Ed,max}/(X_{LT} M_{y,Rk}/gM1) + k_{yz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z N_{Rk}/gM1) + k_{zy} M_{y,Ed,max}/(X_{LT} M_{y,Rk}/gM1) + k_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$
 $v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 87 Simple bar_0.5_87

POINT: 3

COORDINATE: x = 1.00 L = 6.29 m

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$Ay=6.44$ cm ²	$Az=6.44$ cm ²	$Ax=12.88$ cm ²
$tw=0.5$ cm	$Iy=90.02$ cm ⁴	$Iz=90.02$ cm ⁴	$Ix=141.80$ cm ⁴
$tf=0.5$ cm	$Wply=31.75$ cm ³	$Wplz=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 44.47$ kN
 $Nc,Rd = 354.20$ kN
 $Nb,Rd = 153.20$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.29$ m
 $L_{cr,y} = 3.15$ m
 $L_{amy} = 118.99$
 $Lam_y = 1.37$
 $X_y = 0.43$



About z axis:

$L_z = 6.29$ m
 $L_{cr,z} = 3.15$ m
 $L_{amz} = 118.99$
 $Lam_z = 1.37$
 $X_z = 0.43$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.13 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_y = 118.99 < Lambda_{max} = 210.00$ STABLE
 $N,Ed/Nb,Rd = 0.29 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 88 Simple bar_0.5_88

POINT: 3

COORDINATE: x = 1.00 L = 6.29 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$Ay=6.44$ cm ²	$Az=6.44$ cm ²	$Ax=12.88$ cm ²
$tw=0.5$ cm	$Iy=90.02$ cm ⁴	$Iz=90.02$ cm ⁴	$Ix=141.80$ cm ⁴
$tf=0.5$ cm	$Wply=31.75$ cm ³	$Wplz=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 68.18$ kN
 $Nc,Rd = 354.20$ kN
 $Nb,Rd = 153.20$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.29$ m
 $L_{cr,y} = 3.15$ m
 $L_{amy} = 118.99$
 $Lam_y = 1.37$
 $X_y = 0.43$



About z axis:

$L_z = 6.29$ m
 $L_{cr,z} = 3.15$ m
 $L_{amz} = 118.99$
 $Lam_z = 1.37$
 $X_z = 0.43$

VERIFICATION FORMULAS:

Section strength check:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed}/N_{c,Rd} = 0.19 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{b,y} = 118.99 < \Lambda_{b,max} = 210.00$

$\Lambda_{b,z} = 118.99 < \Lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.45 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 89 Simple bar_0.5_89

POINT: 3

COORDINATE: x = 1.00 L = 6.28 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

$g_{M0}=1.00$

$g_{M1}=1.00$

b=7.0 cm

$A_y=6.44$ cm²

$A_z=6.44$ cm²

$A_x=12.88$ cm²

tw=0.5 cm

$I_y=90.02$ cm⁴

$I_z=90.02$ cm⁴

$I_x=141.80$ cm⁴

tf=0.5 cm

$W_{ply}=31.75$ cm³

$W_{plz}=31.75$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 46.60$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 153.65$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.28$ m

$\Lambda_{m,y} = 1.37$

$L_{cr,y} = 3.14$ m

$\chi_y = 0.43$

$\Lambda_{m,y} = 118.78$



About z axis:

$L_z = 6.28$ m

$\Lambda_{m,z} = 1.37$

$L_{cr,z} = 3.14$ m

$\chi_z = 0.43$

$\Lambda_{m,z} = 118.78$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{b,y} = 118.78 < \Lambda_{b,max} = 210.00$

$\Lambda_{b,z} = 118.78 < \Lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.30 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 90 Simple bar_0.5_90

POINT: 3

COORDINATE: x = 1.00 L = 6.28 m

LOADS:

Governing Load Case: 10 ULS /191/ 1*1.35 + 3*1.50 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$Ay=6.44$ cm ²	$Az=6.44$ cm ²	$Ax=12.88$ cm ²
$tw=0.5$ cm	$Iy=90.02$ cm ⁴	$Iz=90.02$ cm ⁴	$Ix=141.80$ cm ⁴
$tf=0.5$ cm	$Wply=31.75$ cm ³	$Wplz=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 67.85$ kN
 $Nc,Rd = 354.20$ kN
 $Nb,Rd = 153.65$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.28$ m
 $L_{cr,y} = 3.14$ m
 $L_{my} = 118.78$
 $Lam_y = 1.37$
 $X_y = 0.43$



About z axis:

$L_z = 6.28$ m
 $L_{cr,z} = 3.14$ m
 $L_{mz} = 118.78$
 $Lam_z = 1.37$
 $X_z = 0.43$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.19 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_y = 118.78 < Lambda_{max} = 210.00$ $Lambda_z = 118.78 < Lambda_{max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.44 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 91 Simple bar_0.5_91

POINT: 3

COORDINATE: $x = 1.00$ L = 6.28 m

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$Ay=6.44$ cm ²	$Az=6.44$ cm ²	$Ax=12.88$ cm ²
$tw=0.5$ cm	$Iy=90.02$ cm ⁴	$Iz=90.02$ cm ⁴	$Ix=141.80$ cm ⁴
$tf=0.5$ cm	$Wply=31.75$ cm ³	$Wplz=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 46.56$ kN
 $Nc,Rd = 354.20$ kN
 $Nb,Rd = 153.82$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.28$ m
 $L_{cr,y} = 3.14$ m
 $L_{my} = 118.70$
 $Lam_y = 1.37$
 $X_y = 0.43$



About z axis:

$L_z = 6.28$ m
 $L_{cr,z} = 3.14$ m
 $L_{mz} = 118.70$
 $Lam_z = 1.37$
 $X_z = 0.43$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.13 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 118.70 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 118.70 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.30 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 92 Simple bar_0.5_92

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 62.03 kN

N_{c,Rd} = 354.20 kN

N_{b,Rd} = 153.82 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 6.28 m

Lam_y = 1.37

L_{cr,y} = 3.14 m

X_y = 0.43

Lam_y = 118.70



About z axis:

L_z = 6.28 m

Lam_z = 1.37

L_{cr,z} = 3.14 m

X_z = 0.43

Lam_z = 118.70

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.18 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 118.70 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 118.70 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.40 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 93 Simple bar_0.5_93

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 58.48 kN
Nc,Rd = 354.20 kN
Nb,Rd = 153.47 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.28 m
Lcr,y = 3.14 m
Lamy = 118.87
Lam_y = 1.37
Xy = 0.43



About z axis:

Lz = 6.28 m
Lcr,z = 3.14 m
Lamz = 118.87
Lam_z = 1.37
Xz = 0.43

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.17 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 118.87 < Lambda,max = 210.00

Lambda,z = 118.87 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.38 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 94 Simple bar_0.5_94

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 49.45 kN
Nc,Rd = 354.20 kN
Nb,Rd = 153.47 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.28 m
Lcr,y = 3.14 m
Lam_y = 1.37
Xy = 0.43



About z axis:

Lz = 6.28 m
Lcr,z = 3.14 m
Lam_z = 1.37
Xz = 0.43

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lamy = 118.87

Lamz = 118.87

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{y} = 118.87 < \lambda_{max} = 210.00$

$\lambda_{z} = 118.87 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.32 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 95 Simple bar_0.5_95

POINT: 3

COORDINATE: x = 1.00 L = 6.28 m

LOADS:

Governing Load Case: 10 ULS /191/ 1*1.35 + 3*1.50 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 63.62$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 153.82$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.28$ m

$\lambda_{y} = 1.37$

$L_{cr,y} = 3.14$ m

$\chi_y = 0.43$

$L_{my} = 118.70$



About z axis:

$L_z = 6.28$ m

$\lambda_{z} = 1.37$

$L_{cr,z} = 3.14$ m

$\chi_z = 0.43$

$L_{mz} = 118.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.18 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{y} = 118.70 < \lambda_{max} = 210.00$

$\lambda_{z} = 118.70 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 96 Simple bar_0.5_96

POINT: 3

COORDINATE: x = 1.00 L = 6.28 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ply}=31.75 \text{ cm}^3$	$W_{plz}=31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 72.54 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 153.82 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.28 \text{ m}$
 $L_{cr,y} = 3.14 \text{ m}$
 $\lambda_{my} = 118.70$
 $\lambda_{my} = 1.37$
 $X_y = 0.43$



About z axis:

$L_z = 6.28 \text{ m}$
 $L_{cr,z} = 3.14 \text{ m}$
 $\lambda_{mz} = 118.70$
 $\lambda_{mz} = 1.37$
 $X_z = 0.43$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.20 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 118.70 < \lambda_{max} = 210.00$

$\lambda_{mz} = 118.70 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.47 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 97 Simple bar_0.5_97

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 6.27 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /233/ $1*1.00 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ply}=31.75 \text{ cm}^3$	$W_{plz}=31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 108.53 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 154.09 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.27 \text{ m}$
 $\lambda_{my} = 1.37$



About z axis:

$L_z = 6.27 \text{ m}$
 $\lambda_{mz} = 1.37$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,y = 3.13 m
Lamy = 118.57

Xy = 0.44

Lcr,z = 3.13 m
Lamz = 118.57

Xz = 0.44

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.31 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 118.57 < Lambda,max = 210.00 Lambda,z = 118.57 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.70 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 98 Simple bar_0.5_98

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 30.45 kN

Nc,Rd = 354.20 kN

Nb,Rd = 154.09 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.27 m
Lcr,y = 3.13 m
Lamy = 118.57

Lam_y = 1.37
Xy = 0.44



About z axis:

Lz = 6.27 m
Lcr,z = 3.13 m
Lamz = 118.57

Lam_z = 1.37
Xz = 0.44

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.09 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 118.57 < Lambda,max = 210.00 Lambda,z = 118.57 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.20 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 99 Beam_99

POINT: 2

COORDINATE: x = 0.50 L = 2.10 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.29$ kN	$M_{y,Ed} = 0.38$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.38$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 10.29$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 10.67$ kN*m	Curve,LT - b	$X_{LT} = 0.42$
$L_{cr,upp}=4.20$ m	$\Lambda_{m_LT} = 1.51$	$f_{i,LT} = 1.54$	$X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /40/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 7 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /3/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 100 Beam_100

POINT: 2

COORDINATE: $x = 0.50$ L = 2.23 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /82/ \quad 1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$t_f=0.7$ cm

$W_{ply}=88.35$ cm³

$W_{plz}=19.25$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=2.99$ kN

$M_{y,Ed}=0.43$ kN*m

$N_{c,Rd}=451.71$ kN

$M_{y,Ed,max}=0.43$ kN*m

$N_{b,Rd}=451.71$ kN

$M_{y,c,Rd}=24.30$ kN*m

$M_{N,y,Rd}=24.30$ kN*m

$M_{b,Rd}=9.83$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$

$M_{cr}=10.05$ kN*m

Curve,LT - b

$X_{LT}=0.40$

$L_{cr,upp}=4.46$ m

$\lambda_{m,LT}=1.55$

$\phi_{i,LT}=1.60$

$X_{LT,mod}=0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy}=1.00$



About z axis:

$k_{zy}=1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd}=0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd}=0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y=0.0$ cm < $u_{y,max}=L/200.00=2.2$ cm

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z=0.1$ cm < $u_{z,max}=L/200.00=2.2$ cm

Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 101 Beam_101

POINT: 2

COORDINATE: x = 0.50 L = 2.37 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm

$g_{M0}=1.00$

$g_{M1}=1.00$

$b=7.3$ cm

$A_y=11.15$ cm²

$A_z=7.64$ cm²

$A_x=16.43$ cm²

$t_w=0.5$ cm

$I_y=541.22$ cm⁴

$I_z=44.92$ cm⁴

$I_x=2.54$ cm⁴

$t_f=0.7$ cm

$W_{ply}=88.35$ cm³

$W_{plz}=19.25$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=11.26$ kN

$M_{y,Ed}=0.35$ kN*m

$N_{c,Rd}=451.71$ kN

$M_{y,Ed,max}=0.35$ kN*m

$N_{b,Rd}=451.71$ kN

$M_{y,c,Rd}=24.30$ kN*m

$M_{N,y,Rd}=24.30$ kN*m

$M_{b,Rd}=9.41$ kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.73 \text{ m}$

$M_{cr} = 9.51 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.60$

Curve,LT - b
 $\eta_{LT} = 1.66$

$X_{LT} = 0.39$
 $X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /17/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 102 Beam_102

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.50 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.76 \text{ kN}$

$M_{y,Ed} = 0.53 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.53 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.02 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.00 \text{ m}$

$M_{cr} = 9.02 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.64$

Curve,LT - b
 $\eta_{LT} = 1.72$

$X_{LT} = 0.37$
 $X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /16/ } 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /50/ } 1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 103 Beam_103

POINT: 2

COORDINATE: x = 0.50 L = 2.63 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS /54/ } 1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 8.88 \text{ kN}$$

$$M_{y,Ed} = 0.59 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.59 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 8.58 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 8.58 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.35$$

$$L_{cr,upp} = 5.27 \text{ m}$$

$$\lambda_{m,LT} = 1.68$$

$$f_{i,LT} = 1.78$$

$$XLT_{mod} = 0.35$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /36/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 104 Beam_104

POINT: 2

COORDINATE: $x = 0.50 L = 2.77 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /198/ $1*1.35 + 4*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.00 \text{ kN}$

$M_{y,Ed} = 0.65 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.65 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 8.19 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 8.19 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 0.34$

$L_{cr,upp} = 5.54 \text{ m}$

$\lambda_{m_LT} = 1.72$

$\phi_{i,LT} = 1.84$

$X_{LT,mod} = 0.34$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.08 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 105 Beam_105

POINT: 2

COORDINATE: x = 0.50 L = 2.90 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.40 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.72 kN*m

M_{y,Ed,max} = 0.72 kN*m

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 7.83 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 5.80 m

M_{cr} = 7.83 kN*m

Lam_{LT} = 1.76

Curve,LT - b

f_{i,LT} = 1.90

XLT = 0.32

XLT_{mod} = 0.32

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.10 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.10 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.9 cm

Verified

Governing Load Case: 13 SLS /93/ 1*1.00 + 2*0.70 + 4*1.00 + 6*0.60

u_z = 0.2 cm < u_{z,max} = L/200.00 = 2.9 cm

Verified

Governing Load Case: 13 SLS /44/ 1*1.00 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 106 Beam_106

POINT: 2

COORDINATE: x = 0.50 L = 3.04 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 13.94 kN	My,Ed = 0.79 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.79 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 7.50 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 7.50 kN*m	Curve,LT - b	XLT = 0.31
Lcr,upp=6.07 m	Lam_LT = 1.80	fi,LT = 1.95	XLT,mod = 0.31

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))
My,Ed/My,c,Rd = 0.03 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.10 < 1.00 (6.3.2.1.(1))
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.14 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.14 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 3.0 cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
uz = 0.2 cm < uz max = L/200.00 = 3.0 cm Verified
Governing Load Case: 13 SLS /110/ 1*1.00 + 3*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 107 Beam_107

POINT: 2

COORDINATE: x = 0.50 L = 3.17 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 55.62$ kN	$My,Ed = 0.86$ kN*m
$Nc,Rd = 451.71$ kN	$My,Ed,max = 0.86$ kN*m
$Nb,Rd = 451.71$ kN	$My,c,Rd = 24.30$ kN*m
	$MN,y,Rd = 24.30$ kN*m
	$Mb,Rd = 7.20$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$Mcr = 7.20$ kN*m	Curve,LT - b	$XLT = 0.30$
$Lcr,upp=6.34$ m	$Lam_LT = 1.84$	$fi,LT = 2.01$	$XLT,mod = 0.30$

BUCKLING PARAMETERS:



About y axis:

$$kyy = 1.00$$



About z axis:

$$kzy = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N,Ed/Nc,Rd = 0.12 < 1.00 \quad (6.2.4.(1))$$

$$My,Ed/My,c,Rd = 0.04 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$My,Ed,max/Mb,Rd = 0.12 < 1.00 \quad (6.3.2.1.(1))$$

$$N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.24 < 1.00 \quad (6.3.3.(4))$$

$$N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.24 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /12/ \quad 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$$

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /4/ \quad 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 108 Beam_108

POINT: 2

COORDINATE: x = 0.50 L = 2.09 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /82/ \quad 1*1.35 + 4*0.90 + 7*1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 8.35 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.37 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.37 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.33 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.17 \text{ m}$

$M_{cr} = 10.72 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.51$

Curve,LT - b

$\eta_{LT} = 1.54$

$X_{LT} = 0.43$

$X_{LT,mod} = 0.43$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 109 Beam_109

POINT: 2

COORDINATE: $x = 0.50 L = 2.22 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.64 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.31 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.31 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.87 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.10 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.41$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=4.44 m

Lam_LT = 1.55

fi,LT = 1.60

XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 110 Beam_110

POINT: 2

COORDINATE: x = 0.50 L = 2.35 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 15.65 kN

My,Ed = 0.35 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.35 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.45 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 9.55 kN*m

Curve,LT - b

XLT = 0.39

Lcr,upp=4.71 m

Lam_LT = 1.59

fi,LT = 1.66

XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /32/ 1*1.00 + 2*0.70 + 3*0.60 + 6*1.00

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /91/ 1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 111 Beam_111

POINT: 2

COORDINATE: x = 0.50 L = 2.49 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.46 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.39 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.06 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.06 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.37$

$L_{cr,upp} = 4.97 \text{ m}$

$\lambda_{m,LT} = 1.64$

$f_{i,LT} = 1.72$

$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /20/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 7*0.60$
 $uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /64/ $1*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 112 Beam_112

POINT: 2

COORDINATE: x = 0.50 L = 2.62 m

LOADS:

Governing Load Case: 25 ACC /4/ $1*1.00 + 2*0.30 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 19.40 kN

M_{y,Ed} = 0.43 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.43 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb,Rd = 8.63 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 8.63 kN*m

Curve,LT - b

XLT = 0.36

L_{cr,upp} = 5.24 m

Lam_LT = 1.68

f_{i,LT} = 1.77

XLT,mod = 0.36

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.04 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

u_z = 0.1 cm < u_z max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /3/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 113 Beam_113

POINT: 2

COORDINATE: x = 0.50 L = 2.75 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.90$ kN	$M_{y,Ed} = 0.48$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.48$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb_{Rd} = 8.23$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.23$ kN*m	Curve,LT - b	$XLT = 0.34$
$L_{cr,upp}=5.51$ m	$\lambda_{m_LT} = 1.72$	$\phi_{LT} = 1.83$	$XLT_{mod} = 0.34$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.8 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /49/ 1*1.00 + 4*0.60 + 6*1.00

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.8 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /3/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 114 Beam_114

POINT: 2

COORDINATE: x = 0.50 L = 2.89 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.56 \text{ kN}$	$M_{y,Ed} = 0.71 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.71 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 7.87 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 7.87 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.32$
$L_{cr,upp}=5.77 \text{ m}$	$\Lambda_{m_LT} = 1.76$	$f_{i,LT} = 1.89$	$X_{LT,mod} = 0.32$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.9 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 2.9 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /44/ $1 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 115 Beam_115

POINT: 2

COORDINATE: $x = 0.50 L = 3.02 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 9.68 kN

My_{Ed} = 0.78 kN*m

N_{c,Rd} = 451.71 kN

My_{Ed,max} = 0.78 kN*m

Nb_{Rd} = 451.71 kN

My_{c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 7.54 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 7.54 kN*m

Curve,LT - b

XLT = 0.31

L_{cr,upp} = 6.04 m

Lam_{LT} = 1.80

fi,LT = 1.95

XLT,mod = 0.31

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

My_{Ed}/My_{c,Rd} = 0.03 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.10 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.12 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.12 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 3.0 cm

Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00

uz = 0.2 cm < uz max = L/200.00 = 3.0 cm

Verified

Governing Load Case: 13 SLS /62/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 116 Beam_116

POINT: 2

COORDINATE: x = 0.50 L = 3.15 m

LOADS:

Governing Load Case: 10 ULS /177/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.80 kN

My_{Ed} = 0.85 kN*m

N_{c,Rd} = 451.71 kN

My_{Ed,max} = 0.85 kN*m

Nb_{Rd} = 451.71 kN

My_{c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 7.23 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 6.31 \text{ m}$

$M_{cr} = 7.23 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.83$

Curve,LT - b
 $\eta_{LT} = 2.00$

$X_{LT} = 0.30$
 $X_{LT,mod} = 0.30$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.13 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.13 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /45/ $1 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 117 Beam_117

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.11 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.90 \text{ kN}$

$M_{y,Ed} = 0.38 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.38 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.25 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.22 \text{ m}$

$M_{cr} = 10.62 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.51$

Curve,LT - b
 $\eta_{LT} = 1.55$

$X_{LT} = 0.42$
 $X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /16/ } 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /11/ } 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 118 Beam_118

POINT: 2

COORDINATE: x = 0.50 L = 2.24 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC /5/ } 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 10.87 \text{ kN}$$

$$M_{y,Ed} = 0.32 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.32 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.79 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.00 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT - b}$$

$$XLT = 0.40$$

$$L_{cr,upp} = 4.49 \text{ m}$$

$$\lambda_{m,LT} = 1.56$$

$$f_{i,LT} = 1.61$$

$$XLT_{mod} = 0.40$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /121/ $1*1.00 + 2*0.30 + 7*0.20$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 119 Beam_main_119

POINT: 3

COORDINATE: x = 1.00 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=24.0 \text{ cm}$

$A_y=64.54 \text{ cm}^2$

$A_z=25.18 \text{ cm}^2$

$A_x=76.84 \text{ cm}^2$

$tw=0.8 \text{ cm}$

$I_y=7763.18 \text{ cm}^4$

$I_z=2768.81 \text{ cm}^4$

$I_x=38.20 \text{ cm}^4$

$tf=1.2 \text{ cm}$

$W_{ply}=744.68 \text{ cm}^3$

$W_{plz}=351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 12.89 \text{ kN}$

$M_{y,Ed} = -44.20 \text{ kN}^*\text{m}$

$M_{z,Ed} = -0.18 \text{ kN}^*\text{m}$

$V_{y,Ed} = 0.10 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = -44.20 \text{ kN}^*\text{m}$

$M_{z,Ed,max} = -0.18 \text{ kN}^*\text{m}$

$V_{y,T,Rd} = 1024.43 \text{ kN}$

$N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN}^*\text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN}^*\text{m}$

$V_{z,Ed} = -35.44 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN}^*\text{m}$

$M_{N,z,Rd} = 96.72 \text{ kN}^*\text{m}$

$V_{z,T,Rd} = 399.67 \text{ kN}$

$M_{b,Rd} = 204.79 \text{ kN}^*\text{m}$

$T_{t,Ed} = 0.00 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 2913.56 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 1.00$

$L_{cr,low}=0.45 \text{ m}$

$\lambda_{m_LT} = 0.27$

$\phi_{i,LT} = 0.50$

$X_{LT,mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.05 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.09 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.22 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y N_{Rk}/gM1) + k_{yy} M_{y,Ed,max}/(X_{LT} M_{y,Rk}/gM1) + k_{yz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.22 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z N_{Rk}/gM1) + k_{zy} M_{y,Ed,max}/(X_{LT} M_{y,Rk}/gM1) + k_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.22 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 120 Beam_main_120

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 5.27 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 2112.98 kN

M_{y,Ed} = -109.01 kN*m

M_{y,Ed,max} = -109.01 kN*m

M_{y,c,Rd} = 204.79 kN*m

MN_{y,Rd} = 204.79 kN*m

M_{b,Rd} = 176.20 kN*m

M_{z,Ed} = -5.93 kN*m

M_{z,Ed,max} = -5.93 kN*m

M_{z,c,Rd} = 96.72 kN*m

MN_{z,Rd} = 96.72 kN*m

V_{y,Ed} = -6.97 kN

V_{y,T,Rd} = 1024.51 kN

V_{z,Ed} = 128.52 kN

V_{z,T,Rd} = 399.68 kN

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,low} = 2.43 m

M_{cr} = 347.48 kN*m

Lam_{LT} = 0.77

Curve,LT - b

fi,LT = 0.78

XLT = 0.83

XLT_{mod} = 0.86

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))

(M_{y,Ed}/MN_{y,Rd})^{2.00} + (M_{z,Ed}/MN_{z,Rd})^{1.00} = 0.34 < 1.00 (6.2.9.1.(6))

V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 (6.2.6-7)

V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.62 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.68 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.68 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.1 cm < u_{y,max} = L/200.00 = 4.9 cm

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

u_z = 0.6 cm < u_{z,max} = L/200.00 = 4.9 cm

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 121 Column_121

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -5.17$ kN	$M_{y,Ed} = 19.49$ kN*m	$V_{y,Ed} = -0.00$ kN
$N_{t,Rd} = 2112.98$ kN	$M_{y,pl,Rd} = 204.79$ kN*m	$V_{y,T,Rd} = 1024.47$ kN
	$M_{y,c,Rd} = 204.79$ kN*m	$V_{z,Ed} = 9.01$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$V_{z,T,Rd} = 399.67$ kN
		$T_{t,Ed} = -0.00$ kN*m
		Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.10 < 1.00$ (6.2.5.(1))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1$ cm < $v_{x,max} = L/150.00 = 2.7$ cm	Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00	
$v_y = 0.3$ cm < $v_{y,max} = L/150.00 = 2.7$ cm	Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 122 Column_122

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 148.17$ kN	$M_{y,Ed} = -7.96$ kN*m	$M_{z,Ed,max} = -1.26$ kN*m	$V_{y,Ed} = -0.31$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = 19.53$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{y,T,Rd} = 1024.49$ kN
$N_{b,Rd} = 1421.83$ kN	$M_{y,c,Rd} = 204.79$ kN*m		$V_{z,Ed} = -6.74$ kN
	$MN_{y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.68$ kN
			$T_{t,Ed} = -0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08$ m	$\Lambda_{m,y} = 0.47$
$L_{cr,y} = 4.08$ m	$X_y = 0.90$
$\Lambda_{m,y} = 40.59$	$k_{yy} = 0.71$



About z axis:

$L_z = 4.08$ m	$\Lambda_{m,z} = 0.78$
$L_{cr,z} = 4.08$ m	$X_z = 0.67$
$\Lambda_{m,z} = 67.97$	$k_{zy} = 0.36$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\Lambda_{m,y} = 40.59 < \Lambda_{m,y,max} = 210.00$	$\Lambda_{m,z} = 67.97 < \Lambda_{m,z,max} = 210.00$	STABLE
$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(Mz,Rd/gM1) = 0.15 < 1.00$	(6.3.3.(4))	
$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(Mz,Rd/gM1) = 0.15 < 1.00$	(6.3.3.(4))	

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1$ cm $< v_{x,max} = L/150.00 = 2.7$ cm	Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$	
$v_y = 0.3$ cm $< v_{y,max} = L/150.00 = 2.7$ cm	Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 123 Column_123

POINT: 3

COORDINATE: x = 0.50 L = 4.05 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 120.42 kN	My _{Ed} = -10.18 kN*m	Mz _{Ed} = 0.51 kN*m	Vy _{Ed} = -0.13 kN
Nc _{Rd} = 2112.98 kN	My _{Ed,max} = -45.33 kN*m	Mz _{Ed,max} = 0.51 kN*m	Vy _{T,Rd} = 1024.16 kN
Nb _{Rd} = 628.77 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = 8.68 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 399.60 kN
			Tt _{Ed} = 0.01 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 8.10 m	Lam _y = 0.93
Lcr,y = 8.10 m	Xy = 0.64
Lamy = 80.58	kzy = 0.33



About z axis:

Lz = 8.10 m	Lam _z = 1.55
Lcr,z = 8.10 m	Xz = 0.30
Lamz = 134.93	kzz = 0.82

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 80.58 < \lambda_{y,max} = 210.00$ $\lambda_{z,Ed} = 134.93 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$ Verified

$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 124 Beam_124

POINT: 2

COORDINATE: x = 0.50 L = 2.38 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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tw=0.5 cm
tf=0.7 cm

Iy=541.22 cm⁴
Wply=88.35 cm³

Iz=44.92 cm⁴
Wplz=19.25 cm³

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 17.54 kN
N_{c,Rd} = 451.71 kN
N_{b,Rd} = 451.71 kN
M_{y,Ed} = 0.36 kN*m
M_{y,Ed,max} = 0.36 kN*m
M_{y,c,Rd} = 24.30 kN*m
M_{N,y,Rd} = 24.30 kN*m
M_{b,Rd} = 9.37 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
L_{cr,upp} = 4.76 m

M_{cr} = 9.46 kN*m
Lam_{LT} = 1.60

Curve,LT - b
f_{i,LT} = 1.67

XLT = 0.39
XLT_{mod} = 0.39

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.04 < 1.00 (6.2.4.(1))
M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))
N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))
N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.4 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.4 cm Verified

Governing Load Case: 13 SLS /9/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 125 Beam_125

POINT: 2

COORDINATE: x = 0.50 L = 2.51 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm
b=7.3 cm
tw=0.5 cm
tf=0.7 cm

gM0=1.00
A_y=11.15 cm²
I_y=541.22 cm⁴
Wply=88.35 cm³

gM1=1.00
A_z=7.64 cm²
I_z=44.92 cm⁴
Wplz=19.25 cm³

A_x=16.43 cm²
I_x=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 22.86 kN
N_{c,Rd} = 451.71 kN
N_{b,Rd} = 451.71 kN
M_{y,Ed} = 0.40 kN*m
M_{y,Ed,max} = 0.40 kN*m
M_{y,c,Rd} = 24.30 kN*m
M_{N,y,Rd} = 24.30 kN*m
M_{b,Rd} = 8.97 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.03 \text{ m}$

$M_{cr} = 8.97 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.65$

Curve,LT - b
 $\eta_{i,LT} = 1.73$

$X_{LT} = 0.37$
 $X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /94/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 126 Beam_126

POINT: 2

COORDINATE: $x = 0.50 L = 2.65 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$gM0 = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.67 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.44 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.44 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 8.54 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.30 \text{ m}$

$M_{cr} = 8.54 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.69$

Curve,LT - b
 $\eta_{i,LT} = 1.79$

$X_{LT} = 0.35$
 $X_{LT,mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:



About z axis:

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$k_{yy} = 1.00$

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /90/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /46/ \quad 1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 127 Beam_127

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.78 \text{ m}$

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /5/ \quad 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 16.79 \text{ kN}$$

$$M_{y,Ed} = 0.49 \text{ kN}\cdot\text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.49 \text{ kN}\cdot\text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$$

$$M_{b,Rd} = 8.15 \text{ kN}\cdot\text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 8.15 \text{ kN}\cdot\text{m}$$

$$\text{Curve,LT - b}$$

$$XLT = 0.34$$

$$L_{cr,upp} = 5.56 \text{ m}$$

$$\lambda_{m,LT} = 1.73$$

$$f_{i,LT} = 1.84$$

$$XLT_{mod} = 0.34$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

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LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_z \text{ max} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /42/ $1*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 128 Beam_128

POINT: 2

COORDINATE: $x = 0.50 L = 2.92 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 7.13 \text{ kN}$

$M_{y,Ed} = 0.73 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.73 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 7.79 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 7.79 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 0.32$

$L_{cr,upp} = 5.83 \text{ m}$

$\lambda_{m,LT} = 1.77$

$\phi_{LT} = 1.90$

$X_{LT,mod} = 0.32$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.11 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.11 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.2 \text{ cm} < u_z \text{ max} = L/200.00 = 2.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 129 Column_129

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 272.46 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 948.80 kN

M_{y,Ed} = -6.04 kN*m

M_{y,Ed,max} = 10.69 kN*m

M_{y,c,Rd} = 204.79 kN*m

MN_{y,Rd} = 203.90 kN*m

M_{z,Ed,max} = -0.00 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{y,Ed} = -0.00 kN

V_{y,T,Rd} = 1024.56 kN

V_{z,Ed} = -2.75 kN

V_{z,T,Rd} = 399.70 kN

T_{t,Ed} = -0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 6.09 m

L_{cr,y} = 6.09 m

L_{amy} = 60.59

Lam_y = 0.70

X_y = 0.78

k_{yy} = 0.68



About z axis:

L_z = 6.09 m

L_{cr,z} = 6.09 m

Lam_z = 101.45

Lam_z = 1.17

X_z = 0.45

k_{zy} = 0.33

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.13 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 (6.2.5.(1))

M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00 (6.2.9.1.(2))

V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 (6.2.6-7)

V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lam_{b,y} = 60.59 < Lam_{b,max} = 210.00 Lam_{b,z} = 101.45 < Lam_{b,max} = 210.00 STABLE

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.1 cm < v_{x,max} = L/150.00 = 4.1 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

v_y = 0.5 cm < v_{y,max} = L/150.00 = 4.1 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 130 Beam_130

POINT: 2

COORDINATE: x = 0.50 L = 3.05 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 6.37 kN	M _{y,Ed} = 0.80 kN*m
N _{c,Rd} = 451.71 kN	M _{y,Ed,max} = 0.80 kN*m
N _{b,Rd} = 451.71 kN	M _{y,c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	M _{b,Rd} = 7.46 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	M _{cr} = 7.46 kN*m	Curve,LT - b	XLT = 0.31
L _{cr,upp} = 6.10 m	Lam_LT = 1.80	fi,LT = 1.96	XLT,mod = 0.31

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.12 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.12 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.1 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /93/ 1*1.00 + 2*0.70 + 4*1.00 + 6*0.60

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.1 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 131 Simple bar_0.5_131

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 52.27$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 132.76$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.86$ m
 $L_{cr,y} = 3.43$ m
 $L_{amy} = 129.74$

$Lam_y = 1.49$
 $X_y = 0.37$



About z axis:

$L_z = 6.86$ m
 $L_{cr,z} = 3.43$ m
 $L_{amz} = 129.74$

$Lam_z = 1.49$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_{y} = 129.74 < Lambda_{max} = 210.00$

$Lambda_{z} = 129.74 < Lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.39 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 132 Beam_132

POINT: 2

COORDINATE: $x = 0.50$ L = 3.19 m

LOADS:

Governing Load Case: 10 ULS /177/ $1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$tw=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$tf=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 10.22$ kN

$M_{y,Ed} = 0.87$ kN*m

$N_{c,Rd} = 451.71$ kN

$M_{y,Ed,max} = 0.87$ kN*m

$N_{b,Rd} = 451.71$ kN

$M_{y,c,Rd} = 24.30$ kN*m

$MN_{y,Rd} = 24.30$ kN*m

$Mb,Rd = 7.16$ kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 6.37 \text{ m}$

$M_{cr} = 7.16 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.84$

Curve,LT - b
 $\eta_{LT} = 2.02$

$X_{LT} = 0.29$
 $X_{LT,mod} = 0.29$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.14 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.14 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 133 Beam_133

POINT: 2

COORDINATE: $x = 0.50 L = 2.10 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.82 \text{ kN}$

$M_{y,Ed} = 0.38 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.38 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.29 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.19 \text{ m}$

$M_{cr} = 10.68 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.51$

Curve,LT - b
 $\eta_{LT} = 1.54$

$X_{LT} = 0.42$
 $X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /62/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /4/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 134 Beam_134

POINT: 2

COORDINATE: x = 0.50 L = 2.23 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /5/ \quad 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 10.22 \text{ kN}$$

$$M_{y,Ed} = 0.31 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,\max} = 0.31 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.83 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.06 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} - b$$

$$X_{LT} = 0.40$$

$$L_{cr,upp} = 4.46 \text{ m}$$

$$\lambda_{m,LT} = 1.55$$

$$f_{i,LT} = 1.60$$

$$X_{LT,mod} = 0.40$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /30/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /20/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 135 Beam_135

POINT: 2

COORDINATE: $x = 0.50 L = 2.36 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 16.68 \text{ kN}$

$M_{y,Ed} = 0.35 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.35 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 9.42 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.51 \text{ kN*m}$

Curve,LT - b

$XLT = 0.39$

$L_{cr,upp} = 4.73 \text{ m}$

$\lambda_{m_LT} = 1.60$

$\phi_{i,LT} = 1.66$

$XLT_{mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /24/ $1*1.00 + 2*1.00 + 4*0.60 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 136 Beam_136

POINT: 2

COORDINATE: x = 0.50 L = 2.50 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 21.87 kN

My,Ed = 0.39 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.39 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.03 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=5.00 m

Mcr = 9.03 kN*m

Lam_LT = 1.64

Curve,LT - b

fi,LT = 1.72

XLT = 0.37

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.05 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 137 Beam_137

POINT: 2

COORDINATE: x = 0.50 L = 2.63 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 20.80 kN	My,Ed = 0.44 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.44 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 8.59 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 8.59 kN*m	Curve,LT - b	XLT = 0.35
Lcr,upp=5.26 m	Lam_LT = 1.68	fi,LT = 1.78	XLT,mod = 0.35

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.05 < 1.00 (6.2.4.(1))
My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.10 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.10 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.6 cm Verified
Governing Load Case: 13 SLS /65/ 1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60
uz = 0.1 cm < uz max = L/200.00 = 2.6 cm Verified
Governing Load Case: 13 SLS /126/ 1*1.00 + 2*0.30 + 3*0.50 + 4*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 138 Beam_138

POINT: 2

COORDINATE: x = 0.50 L = 2.77 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.99$ kN	$M_{y,Ed} = 0.48$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.48$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 8.19$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.19$ kN*m	Curve,LT - b	$XLT = 0.34$
$L_{cr,upp}=5.53$ m	$Lam_{LT} = 1.72$	$fi,LT = 1.84$	$XLT_{mod} = 0.34$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.8 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /9/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.8 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /39/ 1*1.00 + 2*0.70 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 139 Beam_139

POINT: 2

COORDINATE: x = 0.50 L = 2.90 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$N_{Ed} = 6.64 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.72 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.72 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 7.83 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 5.80 \text{ m}$

$M_{cr} = 7.83 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.76$

Curve,LT - b

$\eta_{LT} = 1.89$

$X_{LT} = 0.32$

$X_{LT,mod} = 0.32$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.11 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.11 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 2.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /9/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 140 Beam_140

POINT: 2

COORDINATE: $x = 0.50 L = 3.03 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.62 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.79 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.79 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 7.51 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 7.51 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.31$

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=6.07 m

Lam_LT = 1.80

fi,LT = 1.95

XLT,mod = 0.31

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.10 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.12 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /16/ 1*1.00 + 2*1.00 + 4*0.60 + 6*0.60

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /36/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 141 Beam_141

POINT: 2

COORDINATE: x = 0.50 L = 3.17 m

LOADS:

Governing Load Case: 10 ULS /177/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.52 \text{ kN}$

$M_{y,Ed} = 0.86 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.86 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 7.20 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

$M_{cr} = 7.20 \text{ kN*m}$

Curve,LT - b

XLT = 0.30

Lcr,upp=6.33 m

Lam_LT = 1.84

fi,LT = 2.01

XLT,mod = 0.30

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.14 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.14 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /80/ 1*1.00 + 3*0.60 + 5*1.00 + 7*0.60

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /62/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 142 Beam_142

POINT: 2

COORDINATE: x = 0.50 L = 2.10 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 8.12 \text{ kN}$$

$$M_{y,Ed} = 0.38 \text{ kN}\cdot\text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.38 \text{ kN}\cdot\text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$$

$$M_{b,Rd} = 10.27 \text{ kN}\cdot\text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.65 \text{ kN}\cdot\text{m}$$

$$\text{Curve,LT} - b$$

$$XLT = 0.42$$

$$L_{cr,upp} = 4.21 \text{ m}$$

$$\lambda_{m,LT} = 1.51$$

$$f_{i,LT} = 1.54$$

$$XLT_{mod} = 0.42$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /32/ $1*1.00 + 2*0.70 + 3*0.60 + 6*1.00$
 $uz = 0.0 \text{ cm} < uz \text{ max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /24/ $1*1.00 + 2*1.00 + 4*0.60 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 143 Beam_143

POINT: 2

COORDINATE: $x = 0.50 L = 2.24 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.94 \text{ kN}$

$M_{y,Ed} = 0.43 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.43 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$Mb,Rd = 9.81 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.03 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.40$

$L_{cr,upp} = 4.47 \text{ m}$

$\lambda_{m,LT} = 1.56$

$f_{i,LT} = 1.60$

$XLT_{mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /15/ $1*1.00 + 2*1.00 + 3*0.60 + 6*0.60$

$uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /21/ $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 144 Beam_144

POINT: 2

COORDINATE: x = 0.50 L = 2.37 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 13.39$ kN	$M_{y,Ed} = 0.36$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.36$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb_{Rd} = 9.39$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.49$ kN*m	Curve,LT - b	$XLT = 0.39$
$L_{cr,upp}=4.74$ m	$\lambda_{m_LT} = 1.60$	$\phi_{LT} = 1.66$	$XLT_{mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /30/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /75/ 1*1.00 + 5*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 145 Beam_145

POINT: 2

COORDINATE: x = 0.50 L = 2.51 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 11.54$ kN	$M_{y,Ed} = 0.54$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.54$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 9.00$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.00$ kN*m	Curve,LT - b	$X_{LT} = 0.37$
$L_{cr,upp}=5.01$ m	$\Lambda_{m_LT} = 1.64$	$\phi_{i,LT} = 1.72$	$X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /93/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /127/ } 1 \cdot 1.00 + 2 \cdot 0.30 + 3 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 146 Beam_146

POINT: 2

COORDINATE: x = 0.50 L = 2.64 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS /53/ } 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 10.99 kN

M_{y,Ed} = 0.59 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.59 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 8.56 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 8.56 kN*m

Curve,LT - b

XLT = 0.35

L_{cr,upp} = 5.28 m

Lam_LT = 1.68

fi,LT = 1.78

XLT,mod = 0.35

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.1 cm < u_z max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /19/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 147 Beam_147

POINT: 2

COORDINATE: x = 0.50 L = 2.77 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

A_y=11.15 cm²

A_z=7.64 cm²

A_x=16.43 cm²

tw=0.5 cm

I_y=541.22 cm⁴

I_z=44.92 cm⁴

I_x=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 12.92 kN

M_{y,Ed} = 0.49 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.49 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 8.17 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.55 \text{ m}$

$M_{cr} = 8.17 \text{ kN}\cdot\text{m}$
 $\lambda_{LT} = 1.72$

Curve, LT - b
 $\eta_{LT} = 1.84$

$X_{LT} = 0.34$
 $X_{LT,mod} = 0.34$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /30/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 148 Beam_148

POINT: 2

COORDINATE: $x = 0.50 L = 2.91 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.67 \text{ kN}$

$M_{y,Ed} = 0.72 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.72 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 7.81 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.82 \text{ m}$

$M_{cr} = 7.81 \text{ kN}\cdot\text{m}$
 $\lambda_{LT} = 1.76$

Curve, LT - b
 $\eta_{LT} = 1.90$

$X_{LT} = 0.32$
 $X_{LT,mod} = 0.32$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.09 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /16/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 0.60$$

$$u_z = 0.2 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /3/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 149 Beam_149

POINT: 2

COORDINATE: x = 0.50 L = 1.96 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /198/ \quad 1 \cdot 1.35 + 4 \cdot 1.50 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 118.55 \text{ kN}$$

$$M_{y,Ed} = 0.33 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.33 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 22.21 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 10.83 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 11.37 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} - b$$

$$X_{LT} = 0.44$$

$$L_{cr,upp} = 3.93 \text{ m}$$

$$\lambda_{m,LT} = 1.46$$

$$f_{i,LT} = 1.48$$

$$X_{LT,mod} = 0.45$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.26 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.01 < 1.00 \quad (6.2.9.1.(2))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.29 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.29 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /37/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /7/ $1*1.00 + 2*1.00 + 3*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 150 Beam_150

POINT: 2

COORDINATE: $x = 0.50 L = 3.04 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.91 \text{ kN}$

$M_{y,Ed} = 0.79 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.79 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 7.48 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 7.48 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 0.31$

$L_{cr,upp} = 6.08 \text{ m}$

$\lambda_{m_LT} = 1.80$

$\phi_{i,LT} = 1.96$

$X_{LT,mod} = 0.31$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.12 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 3.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.2 \text{ cm} < u_{z \text{ max}} = L/200.00 = 3.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /19/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 7*0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 151 Beam_151

POINT: 2

COORDINATE: $x = 0.50 L = 3.18 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /62/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.18 \text{ kN}$	$M_{y,Ed} = 0.86 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.86 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$MN_{y,Rd} = 24.30 \text{ kN*m}$
	$M_{b,Rd} = 7.18 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 7.18 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.30$
$L_{cr,upp}=6.35 \text{ m}$	$\lambda_{m_LT} = 1.84$	$\phi_{LT} = 2.01$	$X_{LT,mod} = 0.30$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 152 Beam_152

POINT: 2

COORDINATE: x = 0.50 L = 2.10 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



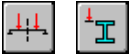
SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.46$ kN	$M_{y,Ed} = 0.38$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.38$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 10.27$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 10.65$ kN*m	Curve,LT - b	$XLT = 0.42$
$L_{cr,upp}=4.21$ m	$\lambda_{m_LT} = 1.51$	$\phi_{i,LT} = 1.54$	$XLT_{mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 2.1$ cm Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 2.1$ cm Verified

Governing Load Case: 13 SLS /62/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 153 Beam_153

POINT: 2

COORDINATE: x = 0.50 L = 2.24 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=2.86$ kN	$M_{y,Ed}=0.43$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.43$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=9.81$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=10.03$ kN*m	Curve,LT - b	$XLT=0.40$
$L_{cr,upp}=4.47$ m	$\Lambda_{m,LT}=1.56$	$\phi_{i,LT}=1.60$	$XLT_{mod}=0.40$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y=0.0 \text{ cm} < u_{y,max}=L/200.00=2.2 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /90/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z=0.1 \text{ cm} < u_{z,max}=L/200.00=2.2 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /30/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 154 Beam_154

POINT: 2

COORDINATE: $x=0.50$ L = 2.37 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 8.39 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.36 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.36 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 9.39 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.74 \text{ m}$

$M_{cr} = 9.49 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.60$

Curve,LT - b
 $\eta_{LT} = 1.66$

$X_{LT} = 0.39$
 $X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /32/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /83/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 155 Beam_155

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.51 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.62 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.54 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.54 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 9.00 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.00 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.37$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=5.01 m

Lam_LT = 1.64

fi,LT = 1.72

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ 1*1.00 + 2*0.70 + 4*1.00 + 6*0.60

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /80/ 1*1.00 + 3*0.60 + 5*1.00 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 156 Beam_156

POINT: 2

COORDINATE: x = 0.50 L = 2.64 m

LOADS:

Governing Load Case: 10 ULS /53/ 1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.39 \text{ kN}$

$M_{y,Ed} = 0.59 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.59 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 8.56 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 8.56 kN*m

Curve,LT - b

XLT = 0.35

Lcr,upp=5.28 m

Lam_LT = 1.68

fi,LT = 1.78

XLT,mod = 0.35

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /19/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 157 Beam_157

POINT: 2

COORDINATE: x = 0.50 L = 2.77 m

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 1.78 \text{ kN}$$

$$M_{y,Ed} = 0.66 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.66 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 8.17 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 8.17 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.34$$

$$L_{cr,upp} = 5.55 \text{ m}$$

$$\lambda_{m,LT} = 1.72$$

$$f_{i,LT} = 1.84$$

$$XLT_{mod} = 0.34$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.08 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.8 \text{ cm}$$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /16/ $1*1.00 + 2*1.00 + 4*0.60 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_z \text{ max} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /30/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 158 Beam_158

POINT: 2

COORDINATE: $x = 0.50 L = 1.85 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /191/ $1*1.35 + 3*1.50 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 19.12 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.29 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.29 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 11.33 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 3.71 \text{ m}$

$M_{cr} = 12.04 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.42$

Curve,LT - b

$\eta_{LT} = 1.43$

$X_{LT} = 0.46$

$X_{LT,mod} = 0.47$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /56/ $1*1.00 + 3*0.60 + 7*1.00$

$u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 159 Beam_159

POINT: 2

COORDINATE: x = 0.50 L = 1.92 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.73$ kN	$M_{y,Ed} = 0.32$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.32$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb_{Rd} = 11.01$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.60$ kN*m	Curve,LT - b	$XLT = 0.45$
$L_{cr,upp}=3.85$ m	$\lambda_{m_LT} = 1.45$	$\phi_{i,LT} = 1.46$	$XLT_{mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.9$ cm Verified

Governing Load Case: 13 SLS /114/ 1*1.00 + 4*1.00 + 5*0.50 + 7*0.60

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.9$ cm Verified

Governing Load Case: 13 SLS /32/ 1*1.00 + 2*0.70 + 3*0.60 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 160 Beam_160

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.21$ kN	$M_{y,Ed} = 0.34$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.34$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 10.70$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.20$ kN*m	Curve,LT - b	$XLT = 0.44$
$L_{cr,upp}=3.99$ m	$\Lambda_{m_LT} = 1.47$	$f_{i,LT} = 1.50$	$XLT_{mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 2.0$ cm Verified
Governing Load Case: 13 SLS /108/ $1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 2.0$ cm Verified
Governing Load Case: 13 SLS /1/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 161 Beam_161

POINT: 2

COORDINATE: x = 0.50 L = 2.91 m

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 4.58 kN

My,Ed = 0.72 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.72 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 7.81 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 7.81 kN*m

Curve,LT - b

XLT = 0.32

Lcr,upp=5.82 m

Lam_LT = 1.76

fi,LT = 1.90

XLT,mod = 0.32

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.03 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.09 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.10 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.10 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.9 cm

Verified

Governing Load Case: 13 SLS /16/ 1*1.00 + 2*1.00 + 4*0.60 + 6*0.60

uz = 0.2 cm < uz max = L/200.00 = 2.9 cm

Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 162 Beam_162

POINT: 2

COORDINATE: x = 0.50 L = 3.04 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 3.13 kN

My,Ed = 0.79 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.79 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 7.48 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 6.08 \text{ m}$

$M_{cr} = 7.48 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.80$

Curve,LT - b
 $\eta_{LT} = 1.96$

$X_{LT} = 0.31$
 $X_{LT,mod} = 0.31$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.11 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.11 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.0 \text{ cm}$ Verified

Governing Load Case: 13 SLS /30/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.0 \text{ cm}$ Verified

Governing Load Case: 13 SLS /62/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 163 Beam_163

POINT: 2

COORDINATE: $x = 0.50 L = 3.18 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /171/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$gM0 = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.24 \text{ kN}$

$M_{y,Ed} = 0.86 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.86 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 7.18 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 6.35 \text{ m}$

$M_{cr} = 7.18 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.84$

Curve,LT - b
 $\eta_{LT} = 2.01$

$X_{LT} = 0.30$
 $X_{LT,mod} = 0.30$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.13 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.13 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /36/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /1/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 164 Beam_164

POINT: 2

COORDINATE: x = 0.50 L = 2.11 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 3.39 \text{ kN}$$

$$M_{y,Ed} = 0.38 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.38 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 10.23 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.60 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} - b$$

$$XLT = 0.42$$

$$L_{cr,upp} = 4.23 \text{ m}$$

$$\lambda_{m_LT} = 1.51$$

$$f_{i,LT} = 1.55$$

$$XLT_{mod} = 0.42$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /32/ $1*1.00 + 2*0.70 + 3*0.60 + 6*1.00$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /34/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 165 Beam_165

POINT: 2

COORDINATE: $x = 0.50 L = 2.25 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.23 \text{ kN}$

$M_{y,Ed} = 0.43 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.43 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 9.78 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.98 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 0.40$

$L_{cr,upp} = 4.50 \text{ m}$

$\lambda_{m_LT} = 1.56$

$\phi_{i,LT} = 1.61$

$X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /15/ $1*1.00 + 2*1.00 + 3*0.60 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /80/ $1*1.00 + 3*0.60 + 5*1.00 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 166 Beam_166

POINT: 2

COORDINATE: x = 0.50 L = 2.38 m

LOADS:

Governing Load Case: 10 ULS /74/ 1*1.35 + 4*0.90 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 0.83 kN

My,Ed = 0.48 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.48 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.36 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.77 m

Mcr = 9.44 kN*m

Lam_LT = 1.60

Curve,LT - b

fi,LT = 1.67

XLT = 0.39

XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /9/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 167 Beam_main_167

POINT: 3

COORDINATE: x = 1.00 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 12.09 kN	My _{Ed} = -43.59 kN*m	Mz _{Ed} = -5.11 kN*m	Vy _{Ed} = 2.84 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = -43.59 kN*m	Mz _{Ed,max} = -5.11 kN*m	Vy _{T,Rd} = 1023.67 kN
N _{b,Rd} = 2112.98 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = -34.03 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 399.48 kN
	Mb _{Rd} = 204.79 kN*m		Tt _{Ed} = 0.01 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2913.56 kN*m	Curve,LT - b	XLT = 1.00
Lcr,low=0.45 m	Lam_LT = 0.27	fi,LT = 0.50	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))
(My_{Ed}/MN_{y,Rd})^{2.00} + (Mz_{Ed}/MN_{z,Rd})^{1.00} = 0.10 < 1.00 (6.2.9.1.(6))
Vy_{Ed}/Vy_{T,Rd} = 0.00 < 1.00 (6.2.6-7)
Vz_{Ed}/Vz_{T,Rd} = 0.09 < 1.00 (6.2.6-7)
Tau_{ty,Ed}/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau_{tz,Ed}/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Global stability check of member:
My_{Ed,max}/Mb_{Rd} = 0.21 < 1.00 (6.3.2.1.(1))
N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) + kyz*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.27 < 1.00 (6.3.3.(4))
N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) + kzz*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.27 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 0.9 cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
uz = 0.0 cm < uz max = L/200.00 = 0.9 cm Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 168 Beam_main_168

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 72.48$ kN	$M_{y,Ed} = -106.82$ kN*m	$M_{z,Ed} = -12.99$ kN*m	$V_{y,Ed} = -15.92$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -106.82$ kN*m	$M_{z,Ed,max} = -12.99$ kN*m	$V_{y,T,Rd} = 1023.97$ kN
$N_{b,Rd} = 2112.98$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 127.73$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 399.55$ kN
	$M_{b,Rd} = 176.20$ kN*m		$T_{t,Ed} = 0.01$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 347.48$ kN*m	Curve,LT - b	$XLT = 0.83$
$L_{cr,low} = 2.43$ m	$\lambda_{m,LT} = 0.77$	$\phi_{i,LT} = 0.78$	$XLT_{mod} = 0.86$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.41 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
Global stability check of member:
 $M_{y,Ed,max}/M_{b,Rd} = 0.61 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.77 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.77 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.2$ cm < $u_{y,max} = L/200.00 = 4.9$ cm Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.6$ cm < $u_{z,max} = L/200.00 = 4.9$ cm Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 169 Column_169

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = -3.60 kN	My,Ed = 15.37 kN*m	Vy,Ed = -0.00 kN
Nt,Rd = 2112.98 kN	My,pl,Rd = 204.79 kN*m	Vy,T,Rd = 1024.58 kN
	My,c,Rd = 204.79 kN*m	Vz,Ed = 7.52 kN
	MN,y,Rd = 204.79 kN*m	Vz,T,Rd = 399.70 kN
		Tt,Ed = -0.00 kN*m
		Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nt,Rd = 0.00 < 1.00 (6.2.3.(1))
My,Ed/My,c,Rd = 0.08 < 1.00 (6.2.5.(1))
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.02 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

vx = 0.2 cm < vx max = L/150.00 = 2.7 cm	Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00	
vy = 0.3 cm < vy max = L/150.00 = 2.7 cm	Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 170 Column_170

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 165.69 kN	My,Ed = 0.42 kN*m	Mz,Ed,max = -2.38 kN*m	Vy,Ed = -0.58 kN
Nc,Rd = 2112.98 kN	My,Ed,max = 11.31 kN*m	Mz,c,Rd = 96.72 kN*m	Vy,T,Rd = 1024.12 kN
Nb,Rd = 1421.83 kN	My,c,Rd = 204.79 kN*m		Vz,Ed = -2.67 kN
	MN,y,Rd = 204.79 kN*m		Vz,T,Rd = 399.59 kN
			Tt,Ed = -0.01 kN*m
			Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{m,y} = 0.47$

$\chi_y = 0.90$

$\kappa_{yy} = 0.80$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{m,z} = 0.78$

$\chi_z = 0.67$

$\kappa_{zy} = 0.41$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.00 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 40.59 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 67.97 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y N_{Rk}/gM1) + \kappa_{yy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM1) + \kappa_{yz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z N_{Rk}/gM1) + \kappa_{zy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM1) + \kappa_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$v_y = 0.3 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 171 Column_171

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 8.10 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$gM0 = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 176.43 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 628.77 \text{ kN}$

$M_{y,Ed} = 23.69 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = -44.31 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = -0.64 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = -0.16 \text{ kN}$

$V_{y,T,Rd} = 1023.80 \text{ kN}$

$V_{z,Ed} = 8.38 \text{ kN}$

$V_{z,T,Rd} = 399.51 \text{ kN}$

$T_{t,Ed} = 0.01 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 8.10 \text{ m}$

$L_{cr,y} = 8.10 \text{ m}$

$\lambda_{my} = 80.58$

$\lambda_{m,y} = 0.93$

$\chi_y = 0.64$

$\kappa_{yy} = 0.69$



About z axis:

$L_z = 8.10 \text{ m}$

$L_{cr,z} = 8.10 \text{ m}$

$\lambda_{mz} = 134.93$

$\lambda_{m,z} = 1.55$

$\chi_z = 0.30$

$\kappa_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.12 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 80.58 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 134.93 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1}) = 0.28 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1}) = 0.36 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.3 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$v_y = 0.6 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 172 Beam_172

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.52 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.15 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.54 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 0.54 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$Mb_{Rd} = 8.96 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 5.03 \text{ m}$

$M_{cr} = 8.96 \text{ kN} \cdot \text{m}$

$\lambda_{m,LT} = 1.65$

Curve,LT - b

$\phi_{LT} = 1.73$

$XLT = 0.37$

$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$\kappa_{yy} = 1.00$



About z axis:

$\kappa_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /98/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 7 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 173 Beam_173

POINT: 2

COORDINATE: x = 0.50 L = 2.65 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /53/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 6.15 \text{ kN}$$

$$M_{y,Ed} = 0.60 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.60 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 8.52 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 8.52 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.35$$

$$L_{cr,upp} = 5.30 \text{ m}$$

$$\lambda_{m,LT} = 1.69$$

$$f_{i,LT} = 1.79$$

$$XLT_{mod} = 0.35$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /9/ $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 174 Beam_174

POINT: 2

COORDINATE: $x = 0.50 L = 2.79 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.74 \text{ kN}$

$M_{y,Ed} = 0.66 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.66 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 8.13 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 8.13 \text{ kN}^*\text{m}$

Curve,LT - b

$XLT = 0.33$

$L_{cr,upp} = 5.57 \text{ m}$

$\lambda_{m_LT} = 1.73$

$\phi_{i,LT} = 1.85$

$XLT_{mod} = 0.33$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.08 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /44/ $1*1.00 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 175 Beam_175

POINT: 2

COORDINATE: x = 0.50 L = 2.92 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.10$ kN	$M_{y,Ed} = 0.73$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.73$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 7.78$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 7.78$ kN*m	Curve,LT - b	$X_{LT} = 0.32$
$L_{cr,upp} = 5.84$ m	$\lambda_{m,LT} = 1.77$	$f_{i,LT} = 1.90$	$X_{LT,mod} = 0.32$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 2.9$ cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$u_z = 0.2$ cm < $u_{z,max} = L/200.00 = 2.9$ cm Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 176 Beam_176

POINT: 2

COORDINATE: x = 0.50 L = 3.06 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 1.61 kN	My _{Ed} = 0.80 kN*m
N _{c,Rd} = 451.71 kN	My _{Ed,max} = 0.80 kN*m
Nb _{Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 7.45 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 7.45 kN*m	Curve,LT - b	XLT = 0.31
Lcr,upp=6.11 m	Lam_LT = 1.81	fi,LT = 1.96	XLT,mod = 0.31

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))

My_{Ed}/My_{c,Rd} = 0.03 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.11 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.11 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.11 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 3.1 cm Verified

Governing Load Case: 13 SLS /116/ 1*1.00 + 3*1.00 + 7*0.60

uz = 0.2 cm < uz max = L/200.00 = 3.1 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 177 Column_177

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 274.71 kN	My _{Ed} = -6.69 kN*m	Mz _{Ed,max} = -0.01 kN*m	Vy _{Ed} = -0.00 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = 11.14 kN*m		Vy _{T,Rd} = 1024.52 kN
N _{b,Rd} = 948.80 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = -2.93 kN
	MN _{y,Rd} = 203.66 kN*m		Vz _{T,Rd} = 399.69 kN
			Tt _{Ed} = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.09 m	Lam _y = 0.70
Lcr,y = 6.09 m	Xy = 0.78
Lamy = 60.59	kyy = 0.67



About z axis:

Lz = 6.09 m	Lam _z = 1.17
Lcr,z = 6.09 m	Xz = 0.45
Lamz = 101.45	kzy = 0.33

VERIFICATION FORMULAS:

Section strength check:

N _{Ed} /N _{c,Rd} = 0.13 < 1.00 (6.2.4.(1))
My _{Ed} /My _{c,Rd} = 0.03 < 1.00 (6.2.5.(1))
My _{Ed} /MN _{y,Rd} = 0.03 < 1.00 (6.2.9.1.(2))
Vy _{Ed} /Vy _{T,Rd} = 0.00 < 1.00 (6.2.6-7)
Vz _{Ed} /Vz _{T,Rd} = 0.01 < 1.00 (6.2.6-7)
Tau _{ty,Ed} /(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau _{tz,Ed} /(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda _y = 60.59 < Lambda _{max} = 210.00	Lambda _z = 101.45 < Lambda _{max} = 210.00	STABLE
N _{Ed} /(Xy*N _{Rk} /gM1) + kyy*My _{Ed,max} /(XLT*My _{Rk} /gM1) + kyz*Mz _{Ed,max} /(Mz _{Rk} /gM1) = 0.20 < 1.00 (6.3.3.(4))		
N _{Ed} /(Xz*N _{Rk} /gM1) + kzy*My _{Ed,max} /(XLT*My _{Rk} /gM1) + kzz*Mz _{Ed,max} /(Mz _{Rk} /gM1) = 0.31 < 1.00 (6.3.3.(4))		

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

vx = 0.2 cm < vx max = L/150.00 = 4.1 cm	Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60	
vy = 0.5 cm < vy max = L/150.00 = 4.1 cm	Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 178 Beam_178

POINT: 2

COORDINATE: x = 0.50 L = 3.19 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00
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Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

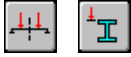
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 5.48 kN	My,Ed = 0.87 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.87 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 7.15 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 7.15 kN*m	Curve,LT - b	XLT = 0.29
Lcr,upp=6.38 m	Lam_LT = 1.84	fi,LT = 2.02	XLT,mod = 0.29

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.04 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.12 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.13 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.13 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 3.2 cm Verified

Governing Load Case: 13 SLS /30/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00

uz = 0.2 cm < uz max = L/200.00 = 3.2 cm Verified

Governing Load Case: 13 SLS /1/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 179 Beam_179

POINT: 2

COORDINATE: x = 0.50 L = 2.07 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 1.66 kN	My,Ed = 0.36 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.36 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 10.41 kN*m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.13 \text{ m}$

$M_{cr} = 10.83 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.50$

Curve,LT - b

$f_{i,LT} = 1.53$

$X_{LT} = 0.43$

$X_{LT,mod} = 0.43$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /113/ $1 \cdot 1.00 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 180 Beam_180

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.14 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /192/ $1 \cdot 1.35 + 4 \cdot 1.50 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.72 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.15 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.27 \text{ m}$

$M_{cr} = 10.48 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.52$

Curve,LT - b

$f_{i,LT} = 1.56$

$X_{LT} = 0.42$

$X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /113/ $1 \cdot 1.00 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 181 Beam_181

POINT: 1

COORDINATE: $x = 0.50 \text{ L} = 1.61 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$b = 14.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.9 \text{ cm}$

$gM0 = 1.00$

$A_y = 26.36 \text{ cm}^2$

$I_y = 1033.13 \text{ cm}^4$

$W_{ply} = 173.51 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 10.12 \text{ cm}^2$

$I_z = 389.32 \text{ cm}^4$

$W_{plz} = 84.85 \text{ cm}^3$

$A_x = 31.42 \text{ cm}^2$

$I_x = 7.97 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 53.01 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,Ed} = 13.82 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 13.82 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 40.07 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = 0.15 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.15 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$MN_{z,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.09 \text{ kN}$

$V_{y,T,Rd} = 417.41 \text{ kN}$

$V_{z,Ed} = -0.13 \text{ kN}$

$V_{z,T,Rd} = 160.47 \text{ kN}$

$T_{t,Ed} = -0.01 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 3.23 \text{ m}$

$M_{cr} = 73.68 \text{ kN} \cdot \text{m}$

$\Lambda_{m_LT} = 0.80$

Curve,LT - b

$\phi_{i,LT} = 0.81$

$XLT = 0.81$

$XLT_{mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/MN_{y,Rd})^{2.00} + (M_{z,Ed}/MN_{z,Rd})^{1.00} = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.41 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.41 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.5 \text{ cm} < u_{z,max} = L/200.00 = 1.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 182 Beam_182

POINT: 3

COORDINATE: x = 0.50 L = 1.61 m

LOADS:

Governing Load Case: 10 ULS /234/ $1 \cdot 1.00 + 4 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$$h = 13.3 \text{ cm}$$

$$b = 14.0 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.9 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 26.36 \text{ cm}^2$$

$$I_y = 1033.13 \text{ cm}^4$$

$$W_{ply} = 173.51 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 10.12 \text{ cm}^2$$

$$I_z = 389.32 \text{ cm}^4$$

$$W_{plz} = 84.85 \text{ cm}^3$$

$$A_x = 31.42 \text{ cm}^2$$

$$I_x = 7.97 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 98.67 \text{ kN}$$

$$N_{c,Rd} = 863.94 \text{ kN}$$

$$N_{b,Rd} = 863.94 \text{ kN}$$

$$M_{y,Ed} = 4.14 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = 4.14 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 47.71 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 40.12 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 0.24 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 0.24 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 23.33 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.15 \text{ kN}$$

$$V_{y,c,Rd} = 418.46 \text{ kN}$$

$$V_{z,Ed} = 3.89 \text{ kN}$$

$$V_{z,c,Rd} = 160.73 \text{ kN}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,upp} = 3.21 \text{ m}$$

$$M_{cr} = 74.06 \text{ kN} \cdot \text{m}$$

$$\lambda_{m,LT} = 0.80$$

$$\text{Curve,LT - b}$$

$$\phi_{LT} = 0.81$$

$$X_{LT} = 0.82$$

$$X_{LT,mod} = 0.84$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.11 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.02 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.02 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.10 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.23 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.23 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 183 Beam_183

POINT: 1

COORDINATE: $x = 0.50 L = 1.79 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 14.0 \text{ cm}$

$A_y = 26.36 \text{ cm}^2$

$A_z = 10.12 \text{ cm}^2$

$A_x = 31.42 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 1033.13 \text{ cm}^4$

$I_z = 389.32 \text{ cm}^4$

$I_x = 7.97 \text{ cm}^4$

$t_f = 0.9 \text{ cm}$

$W_{ply} = 173.51 \text{ cm}^3$

$W_{plz} = 84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 71.19 \text{ kN}$

$M_{y,Ed} = 16.69 \text{ kN}^*\text{m}$

$M_{z,Ed} = -0.16 \text{ kN}^*\text{m}$

$V_{y,Ed} = -0.09 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$M_{y,Ed,max} = 16.70 \text{ kN}^*\text{m}$

$M_{z,Ed,max} = -0.24 \text{ kN}^*\text{m}$

$V_{y,T,Rd} = 418.41 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN}^*\text{m}$

$M_{z,c,Rd} = 23.33 \text{ kN}^*\text{m}$

$V_{z,Ed} = -0.27 \text{ kN}$

$M_{N,y,Rd} = 47.71 \text{ kN}^*\text{m}$

$M_{N,z,Rd} = 23.33 \text{ kN}^*\text{m}$

$V_{z,T,Rd} = 160.72 \text{ kN}$

$M_{b,Rd} = 38.73 \text{ kN}^*\text{m}$

$T_{t,Ed} = 0.00 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 65.63 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 0.79$

$L_{cr,upp} = 3.58 \text{ m}$

$\lambda_{m_LT} = 0.85$

$\phi_{i,LT} = 0.85$

$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.13 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.7 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 184 Beam_184

POINT: 3

COORDINATE: x = 0.50 L = 1.78 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 72.82 kN	M _{y,Ed} = 16.53 kN*m	M _{z,Ed} = -0.25 kN*m	V _{y,Ed} = 0.14 kN
N _{c,Rd} = 863.94 kN	M _{y,Ed,max} = 16.54 kN*m	M _{z,Ed,max} = -0.25 kN*m	V _{y,c,Rd} = 418.46 kN
N _{b,Rd} = 863.94 kN	M _{y,c,Rd} = 47.71 kN*m	M _{z,c,Rd} = 23.33 kN*m	V _{z,Ed} = -0.04 kN
	MN _{y,Rd} = 47.71 kN*m	MN _{z,Rd} = 23.33 kN*m	V _{z,c,Rd} = 160.73 kN
	Mb,Rd = 38.79 kN*m		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	M _{cr} = 65.95 kN*m	Curve,LT - b	XLT = 0.79
L _{cr,upp} = 3.56 m	Lam_LT = 0.85	fi,LT = 0.85	XLT,mod = 0.81

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 1.8 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

u_z = 0.7 cm < u_z max = L/200.00 = 1.8 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 185 Beam_185

POINT: 1

COORDINATE: x = 0.50 L = 1.61 m

LOADS:

Governing Load Case: 10 ULS /234/ 1*1.00 + 4*1.50 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm

gM0=1.00

gM1=1.00

b=14.0 cm

Ay=26.36 cm²

Az=10.12 cm²

Ax=31.42 cm²

tw=0.5 cm

Iy=1033.13 cm⁴

Iz=389.32 cm⁴

Ix=7.97 cm⁴

tf=0.9 cm

Wply=173.51 cm³

Wplz=84.85 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 125.52 kN

My,Ed = 4.31 kN*m

Mz,Ed = 0.30 kN*m

Vy,Ed = 0.18 kN

Nc,Rd = 863.94 kN

My,Ed,max = 4.31 kN*m

Mz,Ed,max = 0.30 kN*m

Vy,T,Rd = 417.87 kN

Nb,Rd = 863.94 kN

My,c,Rd = 47.71 kN*m

Mz,c,Rd = 23.33 kN*m

Vz,Ed = -3.99 kN

MN,y,Rd = 46.41 kN*m

MN,z,Rd = 23.33 kN*m

Vz,T,Rd = 160.59 kN

Mb,Rd = 40.09 kN*m

Tt,Ed = 0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 73.83 kN*m

Curve,LT - b

XLT = 0.82

Lcr,upp=3.22 m

Lam_LT = 0.80

fi,LT = 0.81

XLT,mod = 0.84

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.15 < 1.00 (6.2.4.(1))

(My,Ed/MN,y,Rd)^2.00 + (Mz,Ed/MN,z,Rd)^1.00 = 0.02 < 1.00 (6.2.9.1.(6))

Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)

Vz,Ed/Vz,T,Rd = 0.02 < 1.00 (6.2.6-7)

Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

My,Ed,max/Mb,Rd = 0.11 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.27 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.27 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

uz = 0.1 cm < uz max = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 186 Beam_186

POINT: 1

COORDINATE: x = 0.50 L = 1.61 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²
$t_w=0.5$ cm	$I_y=1033.13$ cm ⁴	$I_z=389.32$ cm ⁴	$I_x=7.97$ cm ⁴
$t_f=0.9$ cm	$W_{ply}=173.51$ cm ³	$W_{plz}=84.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=71.20$ kN	$M_{y,Ed}=13.73$ kN*m	$M_{z,Ed}=0.23$ kN*m	$V_{y,Ed}=0.14$ kN
$N_{c,Rd}=863.94$ kN	$M_{y,Ed,max}=13.75$ kN*m	$M_{z,Ed,max}=0.23$ kN*m	$V_{y,T,Rd}=416.84$ kN
$N_{b,Rd}=863.94$ kN	$M_{y,c,Rd}=47.71$ kN*m	$M_{z,c,Rd}=23.33$ kN*m	$V_{z,Ed}=-0.13$ kN
	$MN_{y,Rd}=47.71$ kN*m	$MN_{z,Rd}=23.33$ kN*m	$V_{z,T,Rd}=160.33$ kN
	$M_{b,Rd}=40.10$ kN*m		$T_{t,Ed}=-0.01$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=73.91$ kN*m	Curve,LT - b	$XLT=0.82$
$L_{cr,upp}=3.22$ m	$\lambda_{m,LT}=0.80$	$\phi_{LT}=0.81$	$XLT_{mod}=0.84$

BUCKLING PARAMETERS:



About y axis:

$k_{yy}=1.00$



About z axis:

$k_{zz}=1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd}=0.08 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.09 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd}=0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd}=0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
Global stability check of member:
 $M_{y,Ed,max}/M_{b,Rd}=0.34 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.44 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.44 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y=0.0$ cm < $u_{y,max}=L/200.00=1.6$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

$u_z=0.5$ cm < $u_{z,max}=L/200.00=1.6$ cm Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 187 Beam_187

POINT: 3

COORDINATE: x = 0.50 L = 1.79 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 71.84 kN	My _{Ed} = 16.63 kN*m	Mz _{Ed} = -0.18 kN*m	Vy _{Ed} = 0.10 kN
N _{c,Rd} = 863.94 kN	My _{Ed,max} = 16.63 kN*m	Mz _{Ed,max} = -0.19 kN*m	Vy _{c,Rd} = 418.46 kN
N _{b,Rd} = 863.94 kN	My _{c,Rd} = 47.71 kN*m	Mz _{c,Rd} = 23.33 kN*m	Vz _{Ed} = -0.03 kN
	MN _{y,Rd} = 47.71 kN*m	MN _{z,Rd} = 23.33 kN*m	Vz _{c,Rd} = 160.73 kN
	Mb _{Rd} = 38.76 kN*m		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 65.76 kN*m	Curve,LT - b	XLT = 0.79
Lcr,upp=3.57 m	Lam_LT = 0.85	fi,LT = 0.85	XLT,mod = 0.81

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 1.8 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.7 cm < uz max = L/200.00 = 1.8 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 188 Beam_188

POINT: 1

COORDINATE: x = 0.50 L = 1.79 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 58.75 \text{ kN}$	$M_{y,Ed} = 16.62 \text{ kN*m}$	$M_{z,Ed} = -0.09 \text{ kN*m}$	$V_{y,Ed} = -0.05 \text{ kN}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 16.62 \text{ kN*m}$	$M_{z,Ed,max} = -0.20 \text{ kN*m}$	$V_{y,T,Rd} = 418.40 \text{ kN}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN*m}$	$M_{z,c,Rd} = 23.33 \text{ kN*m}$	$V_{z,Ed} = -0.28 \text{ kN}$
	$MN_{y,Rd} = 47.71 \text{ kN*m}$	$MN_{z,Rd} = 23.33 \text{ kN*m}$	$V_{z,T,Rd} = 160.72 \text{ kN}$
	$M_{b,Rd} = 38.77 \text{ kN*m}$		$T_{t,Ed} = 0.00 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 65.82 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.79$
$L_{cr,upp} = 3.57 \text{ m}$	$\lambda_{m,LT} = 0.85$	$\phi_{LT} = 0.85$	$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
Global stability check of member:
 $M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.51 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.51 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$ Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$ Verified
Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 189 Beam_189

POINT: 2

COORDINATE: x = 0.50 L = 1.86 m

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.3 \text{ cm}$	$A_y = 11.15 \text{ cm}^2$	$A_z = 7.64 \text{ cm}^2$	$A_x = 16.43 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 541.22 \text{ cm}^4$	$I_z = 44.92 \text{ cm}^4$	$I_x = 2.54 \text{ cm}^4$
$t_f = 0.7 \text{ cm}$	$W_{ply} = 88.35 \text{ cm}^3$	$W_{plz} = 19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 29.72 \text{ kN}$	$M_{y,Ed} = 0.30 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.30 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$MN_{y,Rd} = 24.30 \text{ kN*m}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{b,Rd} = 11.29 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.72 \text{ m}$

$M_{cr} = 11.99 \text{ kN*m}$
 $\lambda_{m,LT} = 1.42$

Curve,LT - b
 $\eta_{LT} = 1.43$

$X_{LT} = 0.46$
 $X_{LT,mod} = 0.46$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /32/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 190 Beam_190

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.93 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.18 \text{ kN}$

$M_{y,Ed} = 0.32 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.32 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 10.97 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.87 \text{ m}$

$M_{cr} = 11.55 \text{ kN*m}$
 $\lambda_{m,LT} = 1.45$

Curve,LT - b
 $\eta_{LT} = 1.47$

$X_{LT} = 0.45$
 $X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /45/ } 1 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /92/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 191 Beam_191

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.00 \text{ m}$

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS /82/ } 1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.27 \text{ kN}$

$M_{y,Ed} = 0.34 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.34 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 10.66 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.15 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.44$

$L_{cr,upp} = 4.01 \text{ m}$

$\Lambda_{m_LT} = 1.48$

$f_{i,LT} = 1.50$

$XLT_{mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /15/ 1*1.00 + 2*1.00 + 3*0.60 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 192 Beam_192

POINT: 2

COORDINATE: x = 0.50 L = 2.08 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 3.83 kN

My_{Ed} = 0.37 kN*m

N_{c,Rd} = 451.71 kN

My_{Ed,max} = 0.37 kN*m

N_{b,Rd} = 451.71 kN

My_{c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 10.37 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 10.78 kN*m

Curve,LT - b

XLT = 0.43

L_{cr,upp} = 4.15 m

Lam_LT = 1.50

fi,LT = 1.53

XLT_{mod} = 0.43

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$My_{Ed}/My_{c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$My_{Ed,max}/Mb_{Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /16/ 1*1.00 + 2*1.00 + 4*0.60 + 6*0.60

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /44/ 1*1.00 + 3*0.60 + 5*0.50 + 6*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 193 Beam_193

POINT: 2

COORDINATE: $x = 0.50 L = 2.15 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.63 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.12 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.29 \text{ m}$

$M_{cr} = 10.44 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.53$

Curve,LT - b

$\phi_{LT} = 1.56$

$X_{LT} = 0.42$

$X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /108/ $1*1.00 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /126/ $1*1.00 + 2*0.30 + 3*0.50 + 4*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 194 Beam_194

POINT: 2

COORDINATE: x = 0.50 L = 2.22 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 18.94 kN	My _{Ed} = 0.42 kN*m
N _{c,Rd} = 451.71 kN	My _{Ed,max} = 0.42 kN*m
N _{b,Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 9.86 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 10.09 kN*m	Curve,LT - b	XLT = 0.41
Lcr,upp=4.45 m	Lam_LT = 1.55	fi,LT = 1.60	XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.04 < 1.00 (6.2.4.(1))

My_{Ed}/My_{c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 195 Beam_195

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 7.36$ kN	$M_{y,Ed} = 0.45$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.45$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 9.64$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.81$ kN*m	Curve,LT - b	$XLT = 0.40$
$L_{cr,upp}=4.58$ m	$\Lambda_{m_LT} = 1.57$	$f_{i,LT} = 1.63$	$XLT_{mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /93/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /92/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 196 Beam_196

POINT: 2

COORDINATE: x = 0.50 L = 2.36 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS /81/ } 1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 3.63 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.48 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.48 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 9.43 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.72 \text{ m}$

$M_{cr} = 9.53 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.60$

Curve,LT - b
 $\eta_{LT} = 1.66$

$X_{LT} = 0.39$
 $X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /34/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 197 Beam_197

POINT: 2

COORDINATE: $x = 0.50 L = 2.43 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.76 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.51 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.51 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 9.22 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.26 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.38$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=4.86 m

Lam_LT = 1.62

fi,LT = 1.69

XLT,mod = 0.38

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 198 Beam_198

POINT: 2

COORDINATE: x = 0.50 L = 2.50 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.51 \text{ kN}$

$M_{y,Ed} = 0.54 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.54 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 9.01 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

$M_{cr} = 9.01 \text{ kN*m}$

Curve,LT - b

XLT = 0.37

Lcr,upp=5.01 m

Lam_LT = 1.64

fi,LT = 1.72

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /99/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 7 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 199 Beam_199

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 3.87 \text{ kN}$$

$$M_{y,Ed} = 0.57 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.57 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 8.77 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 8.77 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.36$$

$$L_{cr,upp} = 5.15 \text{ m}$$

$$\lambda_{m,LT} = 1.66$$

$$f_{i,LT} = 1.75$$

$$XLT_{mod} = 0.36$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_z \text{ max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /88/ $1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 200 Beam_200

POINT: 2

COORDINATE: $x = 0.50 L = 1.86 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 32.91 \text{ kN}$

$M_{y,Ed} = 0.29 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.29 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$Mb_{Rd} = 11.31 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 12.02 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.46$

$L_{cr,upp} = 3.71 \text{ m}$

$\lambda_{m,LT} = 1.42$

$\phi_{i,LT} = 1.43$

$XLT_{mod} = 0.47$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /17/ $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 201 Beam_201

POINT: 2

COORDINATE: x = 0.50 L = 1.93 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 6.71 kN

My,Ed = 0.32 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.32 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.99 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 11.58 kN*m

Curve,LT - b

XLT = 0.45

Lcr,upp=3.85 m

Lam_LT = 1.45

fi,LT = 1.46

XLT,mod = 0.45

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.04 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.0 cm < uz max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 202 Beam_202

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.44 \text{ kN}$	$M_{y,Ed} = 0.25 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.25 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 10.69 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.18 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.44$
$L_{cr,upp}=4.00 \text{ m}$	$\Lambda_{m_LT} = 1.47$	$f_{i,LT} = 1.50$	$X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$ Verified
Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$ Verified
Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 203 Beam_203

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.07 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.47 kN

M_{y,Ed} = 0.37 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.37 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.40 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 10.81 kN*m

Curve,LT - b

XLT = 0.43

L_{cr,upp} = 4.14 m

Lam_LT = 1.50

fi,LT = 1.53

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.05 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.05 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

u_z = 0.0 cm < u_z max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /32/ 1*1.00 + 2*0.70 + 3*0.60 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 204 Beam_204

POINT: 2

COORDINATE: x = 0.50 L = 2.14 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

A_y=11.15 cm²

A_z=7.64 cm²

A_x=16.43 cm²

t_w=0.5 cm

I_y=541.22 cm⁴

I_z=44.92 cm⁴

I_x=2.54 cm⁴

tf=0.7 cm

W_{ply}=88.35 cm³

W_{plz}=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 6.22 kN

M_{y,Ed} = 0.39 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.39 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.14 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.28 \text{ m}$

$M_{cr} = 10.46 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.52$

Curve,LT - b
 $\eta_{LT} = 1.56$

$X_{LT} = 0.42$
 $X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /92/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 205 Beam_205

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.22 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.27 \text{ kN}$

$M_{y,Ed} = 0.42 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.42 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.88 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.43 \text{ m}$

$M_{cr} = 10.12 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.55$

Curve,LT - b
 $\eta_{LT} = 1.60$

$X_{LT} = 0.41$
 $X_{LT,mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /84/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /107/ $1 \cdot 1.00 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 206 Beam_206

POINT: 2

COORDINATE: x = 0.50 L = 2.28 m

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 7.80 \text{ kN}$$

$$M_{y,Ed} = 0.45 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.45 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.66 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 9.84 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.40$$

$$L_{cr,upp} = 4.57 \text{ m}$$

$$\lambda_{m,LT} = 1.57$$

$$f_{i,LT} = 1.63$$

$$XLT_{mod} = 0.40$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /92/ $1*1.00 + 2*0.70 + 3*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 207 Beam_207

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.35 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.55 \text{ kN}$

$M_{y,Ed} = 0.47 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.47 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 9.44 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.55 \text{ kN*m}$

Curve,LT - b

$XLT = 0.39$

$L_{cr,upp} = 4.71 \text{ m}$

$\lambda_{m_LT} = 1.59$

$\phi_{i,LT} = 1.66$

$XLT_{mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 216 Beam_216

POINT: 2

COORDINATE: x = 0.50 L = 2.43 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 12.10 kN

My,Ed = 0.37 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.37 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.23 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.85 m

Mcr = 9.28 kN*m

Lam_LT = 1.62

Curve,LT - b

fi,LT = 1.69

XLT = 0.38

XLT,mod = 0.38

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /17/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 217 Beam_217

POINT: 2

COORDINATE: x = 0.50 L = 2.50 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$tw=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$tf=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.39$ kN	$M_{y,Ed} = 0.53$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.53$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 9.03$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.03$ kN*m	Curve,LT - b	$XLT = 0.37$
$L_{cr,upp}=4.99$ m	$\lambda_{m_LT} = 1.64$	$\phi_{i,LT} = 1.72$	$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_y \max = L/200.00 = 2.5$ cm Verified
Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60
 $u_z = 0.1$ cm < $u_z \max = L/200.00 = 2.5$ cm Verified
Governing Load Case: 13 SLS /113/ 1*1.00 + 3*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 218 Beam_218

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=5.02$ kN	$M_{y,Ed}=0.56$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.56$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=8.79$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=8.79$ kN*m	Curve,LT - b	$XLT=0.36$
$L_{cr,upp}=5.14$ m	$\lambda_{m,LT}=1.66$	$\phi_{i,LT}=1.75$	$XLT_{mod}=0.36$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /16/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /89/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 219 Beam_219

POINT: 2

COORDINATE: x = 0.50 L = 1.86 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /82/ \quad 1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 4.77 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.30 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.30 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 11.29 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 3.72 \text{ m}$

$M_{cr} = 11.99 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.42$

Curve,LT - b

$\eta_{LT} = 1.43$

$X_{LT} = 0.46$

$X_{LT,mod} = 0.46$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 220 Beam_220

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.93 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.69 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.24 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.24 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.97 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.55 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.45$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=3.87 m

Lam_LT = 1.45

fi,LT = 1.47

XLT,mod = 0.45

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.02 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.04 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

uz = 0.0 cm < uz max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /36/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 221 Beam_221

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 5.46 kN

My,Ed = 0.34 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.34 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.66 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 11.15 kN*m

Curve,LT - b

XLT = 0.44

Lcr,upp=4.01 m

Lam_LT = 1.48

fi,LT = 1.50

XLT,mod = 0.44

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /15/ 1*1.00 + 2*1.00 + 3*0.60 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 222 Beam_222

POINT: 2

COORDINATE: x = 0.50 L = 2.08 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 5.48 kN

M_{y,Ed} = 0.37 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.37 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.37 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 10.78 kN*m

Curve,LT - b

XLT = 0.43

L_{cr,upp} = 4.15 m

Lam_LT = 1.50

fi,LT = 1.53

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$
 $u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /3/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 223 Beam_223

POINT: 2

COORDINATE: $x = 0.50 L = 2.15 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=7.3 \text{ cm}$

$A_y=11.15 \text{ cm}^2$

$A_z=7.64 \text{ cm}^2$

$A_x=16.43 \text{ cm}^2$

$t_w=0.5 \text{ cm}$

$I_y=541.22 \text{ cm}^4$

$I_z=44.92 \text{ cm}^4$

$I_x=2.54 \text{ cm}^4$

$t_f=0.7 \text{ cm}$

$W_{ply}=88.35 \text{ cm}^3$

$W_{plz}=19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.71 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.39 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.12 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.44 \text{ kN}\cdot\text{m}$

Curve,LT - b

$XLT = 0.42$

$L_{cr,upp}=4.29 \text{ m}$

$\lambda_{m_LT} = 1.53$

$\phi_{i,LT} = 1.56$

$XLT_{mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /108/ $1*1.00 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 224 Beam_224

POINT: 2

COORDINATE: x = 0.50 L = 2.22 m

LOADS:

Governing Load Case: 10 ULS /177/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 15.55 kN

M_{y,Ed} = 0.42 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.42 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 9.86 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 10.09 kN*m

Curve,LT - b

XLT = 0.41

L_{cr,upp} = 4.45 m

Lam_LT = 1.55

fi,LT = 1.60

XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.03 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.2 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.2 cm

Verified

Governing Load Case: 13 SLS /60/ 1*1.00 + 2*0.70 + 3*0.60 + 5*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 225 Beam_225

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.46 \text{ kN}$	$M_{y,Ed} = 0.45 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.45 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 9.64 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.81 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.40$
$L_{cr,upp}=4.58 \text{ m}$	$\Lambda_{m_LT} = 1.57$	$f_{i,LT} = 1.63$	$X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$ Verified

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 226 Beam_226

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.36 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$t_f=0.7$ cm

$W_{ply}=88.35$ cm³

$W_{plz}=19.25$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=6.54$ kN

$M_{y,Ed}=0.48$ kN*m

$N_{c,Rd}=451.71$ kN

$M_{y,Ed,max}=0.48$ kN*m

$N_{b,Rd}=451.71$ kN

$M_{y,c,Rd}=24.30$ kN*m

$M_{N,y,Rd}=24.30$ kN*m

$M_{b,Rd}=9.43$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$

$M_{cr}=9.53$ kN*m

Curve,LT - b

$X_{LT}=0.39$

$L_{cr,upp}=4.72$ m

$\lambda_{m,LT}=1.60$

$\phi_{i,LT}=1.66$

$X_{LT,mod}=0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy}=1.00$



About z axis:

$k_{zy}=1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd}=0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd}=0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y=0.0$ cm < $u_{y,max}=L/200.00=2.4$ cm

Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z=0.1$ cm < $u_{z,max}=L/200.00=2.4$ cm

Verified

Governing Load Case: 13 SLS /32/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 227 Beam_227

POINT: 2

COORDINATE: x = 0.50 L = 2.43 m

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm

$g_{M0}=1.00$

$g_{M1}=1.00$

$b=7.3$ cm

$A_y=11.15$ cm²

$A_z=7.64$ cm²

$A_x=16.43$ cm²

$t_w=0.5$ cm

$I_y=541.22$ cm⁴

$I_z=44.92$ cm⁴

$I_x=2.54$ cm⁴

$t_f=0.7$ cm

$W_{ply}=88.35$ cm³

$W_{plz}=19.25$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=6.86$ kN

$M_{y,Ed}=0.51$ kN*m

$N_{c,Rd}=451.71$ kN

$M_{y,Ed,max}=0.51$ kN*m

$N_{b,Rd}=451.71$ kN

$M_{y,c,Rd}=24.30$ kN*m

$M_{N,y,Rd}=24.30$ kN*m

$M_{b,Rd}=9.22$ kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.86 \text{ m}$

$M_{cr} = 9.26 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.62$

Curve,LT - b
 $\eta_{LT} = 1.69$

$X_{LT} = 0.38$
 $X_{LT,mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 228 Beam_228

POINT: 2

COORDINATE: $x = 0.50 L = 2.50 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.60 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.54 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.54 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.01 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.01 \text{ m}$

$M_{cr} = 9.01 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.64$

Curve,LT - b
 $\eta_{LT} = 1.72$

$X_{LT} = 0.37$
 $X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /84/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /93/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 229 Beam_229

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /197/ \quad 1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 6.91 \text{ kN}$$

$$M_{y,Ed} = 0.57 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.57 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 8.77 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 8.77 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.36$$

$$L_{cr,upp} = 5.15 \text{ m}$$

$$\lambda_{m,LT} = 1.66$$

$$f_{i,LT} = 1.75$$

$$XLT_{mod} = 0.36$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /34/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 230 Beam_230

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.86 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.08 \text{ kN}$

$M_{y,Ed} = 0.22 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.22 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 11.29 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.99 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.46$

$L_{cr,upp} = 3.72 \text{ m}$

$\lambda_{m_LT} = 1.42$

$\phi_{i,LT} = 1.43$

$X_{LT,mod} = 0.46$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.03 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.03 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /3/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 231 Simple bar_0.5_231 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 52.99 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.76 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 6.86 m
L_{cr,y} = 3.43 m
L_{amy} = 129.74

L_{am,y} = 1.49
X_y = 0.37



About z axis:

L_z = 6.86 m
L_{cr,z} = 3.43 m
L_{amz} = 129.74

L_{am,z} = 1.49
X_z = 0.37

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.15 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda_y = 129.74 < Lambda_{max} = 210.00

Lambda_z = 129.74 < Lambda_{max} = 210.00 STABLE

N,Ed/Nb,Rd = 0.40 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 232 Simple bar_0.5_232 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴

Ax=12.88 cm²
Ix=141.80 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 51.27 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.86 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.86 m

Lam_y = 1.49

Lcr,y = 3.43 m

Xy = 0.38

Lamy = 129.68



About z axis:

Lz = 6.86 m

Lam_z = 1.49

Lcr,z = 3.43 m

Xz = 0.38

Lamz = 129.68

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.14 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 129.68 < Lambda,max = 210.00

Lambda,z = 129.68 < Lambda,max = 210.00

STABLE

N,Ed/Nb,Rd = 0.39 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 233 Simple bar_0.5_233

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 45.63 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.86 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.86 m

Lam_y = 1.49

Lcr,y = 3.43 m

Xy = 0.38

Lamy = 129.68



About z axis:

Lz = 6.86 m

Lam_z = 1.49

Lcr,z = 3.43 m

Xz = 0.38

Lamz = 129.68

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.13 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 129.68 < Lambda,max = 210.00

Lambda,z = 129.68 < Lambda,max = 210.00

STABLE

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed}/N_{b,Rd} = 0.34 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 234 Beam_234

POINT: 2

COORDINATE: $x = 0.50$ $L = 1.93$ m

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.72$ kN	$M_{y,Ed} = 0.32$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.32$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 10.97$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$ cm	$M_{cr} = 11.55$ kN*m	Curve,LT - b	$XLT = 0.45$
$L_{cr,upp} = 3.87$ m	$\Lambda_{m,LT} = 1.45$	$\phi_{i,LT} = 1.47$	$XLT_{mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm $< u_{y,max} = L/200.00 = 1.9$ cm Verified

Governing Load Case: 13 SLS /20/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 7*0.60$

$u_z = 0.0$ cm $< u_{z,max} = L/200.00 = 1.9$ cm Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 235 Beam_235

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.34 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.34 kN*m

M_{y,Ed,max} = 0.34 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.66 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.01 m

M_{cr} = 11.15 kN*m

Lam_{LT} = 1.48

Curve,LT - b

fi,LT = 1.50

XLT = 0.44

XLT_{mod} = 0.44

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00

u_z = 0.0 cm < u_{z,max} = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /1/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 236 Beam_236

POINT: 2

COORDINATE: x = 0.50 L = 2.08 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=4.00$ kN	$M_{y,Ed}=0.37$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.37$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=10.37$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=10.78$ kN*m	Curve,LT - b	$XLT=0.43$
$L_{cr,upp}=4.15$ m	$\lambda_{m,LT}=1.50$	$f_{i,LT}=1.53$	$XLT_{mod}=0.43$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /11/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 237 Simple bar_0.5_237 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /197/ \quad 1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$Ay=6.44$ cm ²	$Az=6.44$ cm ²	$Ax=12.88$ cm ²
$tw=0.5$ cm	$Iy=90.02$ cm ⁴	$Iz=90.02$ cm ⁴	$Ix=141.80$ cm ⁴
$tf=0.5$ cm	$Wply=31.75$ cm ³	$Wplz=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 43.55 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 132.56 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$

$L_{cr,y} = 3.43 \text{ m}$

$\lambda_{my} = 129.85$

$\lambda_{m,y} = 1.50$

$\chi_y = 0.37$



About z axis:

$L_z = 6.87 \text{ m}$

$L_{cr,z} = 3.43 \text{ m}$

$\lambda_{mz} = 129.85$

$\lambda_{m,z} = 1.50$

$\chi_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 129.85 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 129.85 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.33 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 238 Simple bar_0.5_238

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 70.49 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 132.56 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$

$L_{cr,y} = 3.43 \text{ m}$

$\lambda_{my} = 129.85$

$\lambda_{m,y} = 1.50$

$\chi_y = 0.37$



About z axis:

$L_z = 6.87 \text{ m}$

$L_{cr,z} = 3.43 \text{ m}$

$\lambda_{mz} = 129.85$

$\lambda_{m,z} = 1.50$

$\chi_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.20 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 129.85 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 129.85 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.53 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 239 Simple bar_0.5_239

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 60.36 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 133.06 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.85 m
L_{cr,y} = 3.43 m
L_{amy} = 129.56

Lam_y = 1.49
Xy = 0.38



About z axis:

Lz = 6.85 m
L_{cr,z} = 3.43 m
Lam_z = 129.56

Lam_z = 1.49
Xz = 0.38

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.17 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{da,y} = 129.56 < Lam_{da,max} = 210.00 Lam_{da,z} = 129.56 < Lam_{da,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.45 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 240 Simple bar_0.5_240

POINT: 3

COORDINATE: x = 1.00 L = 6.85 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 28.38 \text{ kN}$

$Nc, Rd = 354.20 \text{ kN}$

$Nb, Rd = 133.06 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.85 \text{ m}$

$L_{cr,y} = 3.43 \text{ m}$

$\lambda_{my} = 129.56$

$\lambda_{my} = 1.49$

$\chi_y = 0.38$



About z axis:

$L_z = 6.85 \text{ m}$

$L_{cr,z} = 3.43 \text{ m}$

$\lambda_{mz} = 129.56$

$\lambda_{mz} = 1.49$

$\chi_z = 0.38$

VERIFICATION FORMULAS:

Section strength check:

$N, Ed / Nc, Rd = 0.08 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{my} = 129.56 < \lambda_{max} = 210.00$

$\lambda_{mz} = 129.56 < \lambda_{max} = 210.00 \quad \text{STABLE}$

$N, Ed / Nb, Rd = 0.21 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 241 Beam_241

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.15 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 5.52 \text{ kN}$

$Nc, Rd = 451.71 \text{ kN}$

$Nb, Rd = 451.71 \text{ kN}$

$M_y, Ed = 0.39 \text{ kN} \cdot \text{m}$

$M_y, Ed, max = 0.39 \text{ kN} \cdot \text{m}$

$M_y, c, Rd = 24.30 \text{ kN} \cdot \text{m}$

$MN_y, Rd = 24.30 \text{ kN} \cdot \text{m}$

$Mb, Rd = 10.12 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr, upp} = 4.29 \text{ m}$

$M_{cr} = 10.44 \text{ kN} \cdot \text{m}$

$\lambda_{m, LT} = 1.53$

Curve, LT - b

$\phi_{LT} = 1.56$

$\chi_{LT} = 0.42$

$\chi_{LT, mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$\chi_y = 1.00$



About z axis:

$\chi_z = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N, Ed / Nc, Rd = 0.01 < 1.00 \quad (6.2.4.(1))$

$M_y, Ed / M_y, c, Rd = 0.02 < 1.00 \quad (6.2.5.(1))$

Global stability check of member:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{y,Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{z,Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /37/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 242 Beam_242

POINT: 2

COORDINATE: x = 0.50 L = 2.22 m

LOADS:

Governing Load Case: 10 ULS /62/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{y,Ed} = 9.44 \text{ kN}$

$M_{y,Ed} = 0.42 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.42 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.86 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.09 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.41$

$L_{cr,upp} = 4.45 \text{ m}$

$\Lambda_{m_LT} = 1.55$

$\phi_{i,LT} = 1.60$

$XLT_{mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{y,Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{y,Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{z,Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /108/ $1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /53/ $1*1.00 + 4*0.60 + 5*0.50 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 243 Beam_243

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 6.03 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.45 kN*m

M_{y,Ed,max} = 0.45 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 9.64 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.58 m

M_{cr} = 9.81 kN*m

Lam_{LT} = 1.57

Curve,LT - b

fi,LT = 1.63

XLT = 0.40

XLT,mod = 0.40

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /9/ $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 244 Beam_244

POINT: 2

COORDINATE: x = 0.50 L = 2.36 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 4.93 kN	My _{Ed} = 0.48 kN*m
N _{c,Rd} = 451.71 kN	My _{Ed,max} = 0.48 kN*m
N _{b,Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 9.43 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 9.53 kN*m	Curve,LT - b	XLT = 0.39
Lcr,upp=4.72 m	Lam_LT = 1.60	fi,LT = 1.66	XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))
My_{Ed}/My_{c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.05 < 1.00 (6.3.2.1.(1))
N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))
N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.4 cm Verified

Governing Load Case: 13 SLS /45/ 1*1.00 + 4*0.60 + 5*0.50 + 6*1.00

uz = 0.1 cm < uz max = L/200.00 = 2.4 cm Verified

Governing Load Case: 13 SLS /37/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 245 Beam_245

POINT: 2

COORDINATE: x = 0.50 L = 2.43 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.37$ kN	$M_{y,Ed} = 0.51$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.51$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 9.22$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.26$ kN*m	Curve,LT - b	$XLT = 0.38$
$L_{cr,upp} = 4.86$ m	$Lam_{LT} = 1.62$	$f_{i,LT} = 1.69$	$XLT_{mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(Xy \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(Xz \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 2.4$ cm

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1$ cm < $u_{z,max} = L/200.00 = 2.4$ cm

Verified

Governing Load Case: 13 SLS /92/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 246 Beam_246

POINT: 2

COORDINATE: $x = 0.50$ L = 2.50 m

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

Κύριος έργο: Δήμος Καλαμάτας

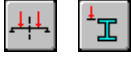
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.50 \text{ kN}$	$M_{y,Ed} = 0.54 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.54 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$
	$M_{b,Rd} = 9.01 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.01 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.37$
$L_{cr,upp} = 5.01 \text{ m}$	$\lambda_{m,LT} = 1.64$	$\phi_{i,LT} = 1.72$	$X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$ Verified
Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$ Verified
Governing Load Case: 13 SLS /91/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 4 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 247 Beam_247

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.57 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$	$gM0 = 1.00$	$gM1 = 1.00$	
$b = 7.3 \text{ cm}$	$A_y = 11.15 \text{ cm}^2$	$A_z = 7.64 \text{ cm}^2$	$A_x = 16.43 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 541.22 \text{ cm}^4$	$I_z = 44.92 \text{ cm}^4$	$I_x = 2.54 \text{ cm}^4$
$t_f = 0.7 \text{ cm}$	$W_{ply} = 88.35 \text{ cm}^3$	$W_{plz} = 19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.98 \text{ kN}$	$M_{y,Ed} = 0.57 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.57 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$
	$M_{b,Rd} = 8.77 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$z = 1.00$
 $L_{cr,upp} = 5.15 \text{ m}$

$M_{cr} = 8.77 \text{ kN}\cdot\text{m}$
 $\text{Lam}_{LT} = 1.66$

Curve,LT - b
 $\phi_{LT} = 1.75$

$X_{LT} = 0.36$
 $X_{LT,mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /44/ $1 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 248 Beam_248

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.87 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /198/ $1 \cdot 1.35 + 4 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.77 \text{ kN}$

$M_{y,Ed} = 0.30 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.30 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 11.24 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.92 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.46$

$L_{cr,upp} = 3.74 \text{ m}$

$\text{Lam}_{LT} = 1.43$

$\phi_{LT} = 1.44$

$X_{LT,mod} = 0.46$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /36/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 249 Beam_249

POINT: 2

COORDINATE: x = 0.50 L = 1.94 m

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$b = 7.3 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.7 \text{ cm}$$

$$gM0 = 1.00$$

$$A_y = 11.15 \text{ cm}^2$$

$$I_y = 541.22 \text{ cm}^4$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$gM1 = 1.00$$

$$A_z = 7.64 \text{ cm}^2$$

$$I_z = 44.92 \text{ cm}^4$$

$$W_{plz} = 19.25 \text{ cm}^3$$

$$A_x = 16.43 \text{ cm}^2$$

$$I_x = 2.54 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 2.44 \text{ kN}$$

$$M_{y,Ed} = 0.32 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.32 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 10.92 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,upp} = 3.89 \text{ m}$$

$$M_{cr} = 11.49 \text{ kN} \cdot \text{m}$$

$$\Lambda_{m,LT} = 1.45$$

$$\text{Curve}_{LT-b}$$

$$f_{i,LT} = 1.47$$

$$XLT = 0.45$$

$$XLT_{mod} = 0.45$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /88/ $1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 250 Beam_250

POINT: 2

COORDINATE: $x = 0.50 L = 2.01 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.29 \text{ kN}$

$M_{y,Ed} = 0.35 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.35 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$Mb_{Rd} = 10.62 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.10 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.44$

$L_{cr,upp} = 4.03 \text{ m}$

$\lambda_{m,LT} = 1.48$

$\eta_{LT} = 1.50$

$X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /16/ $1*1.00 + 2*1.00 + 4*0.60 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 251 Beam_251

POINT: 2

COORDINATE: x = 0.50 L = 2.09 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 3.28 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.37 kN*m

M_{y,Ed,max} = 0.37 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.33 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.17 m

M_{cr} = 10.73 kN*m

Lam_{LT} = 1.50

Curve,LT - b

fi,LT = 1.54

XLT = 0.43

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /114/ 1*1.00 + 4*1.00 + 5*0.50 + 7*0.60

u_z = 0.0 cm < u_{z,max} = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /20/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 252 Beam_252

POINT: 2

COORDINATE: x = 0.50 L = 2.16 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.99$ kN	$M_{y,Ed} = 0.40$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.40$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 10.08$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 10.38$ kN*m	Curve,LT - b	$XLT = 0.41$
$L_{cr,upp}=4.32$ m	$\lambda_{m_LT} = 1.53$	$\phi_{i,LT} = 1.57$	$XLT_{mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_y \max = L/200.00 = 2.2$ cm

Verified

Governing Load Case: 13 SLS /108/ $1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1$ cm < $u_z \max = L/200.00 = 2.2$ cm

Verified

Governing Load Case: 13 SLS /60/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 253 Beam_253

POINT: 2

COORDINATE: x = 0.50 L = 2.23 m

LOADS:

Governing Load Case: 10 ULS /61/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tw=0.5 cm
tf=0.7 cm

Iy=541.22 cm⁴
Wply=88.35 cm³

Iz=44.92 cm⁴
Wplz=19.25 cm³

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 5.66 kN
N_{c,Rd} = 451.71 kN
N_{b,Rd} = 451.71 kN
M_{y,Ed} = 0.43 kN*m
M_{y,Ed,max} = 0.43 kN*m
M_{y,c,Rd} = 24.30 kN*m
M_{N,y,Rd} = 24.30 kN*m
M_{b,Rd} = 9.82 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
L_{cr,upp} = 4.47 m

M_{cr} = 10.04 kN*m
Lam_LT = 1.56

Curve,LT - b
f_{i,LT} = 1.60

XLT = 0.40
XLT_{mod} = 0.40

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))
M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))
N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))
N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /19/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 254 Beam_254

POINT: 2

COORDINATE: x = 0.50 L = 2.30 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm
b=7.3 cm
tw=0.5 cm
tf=0.7 cm

gM0=1.00
A_y=11.15 cm²
I_y=541.22 cm⁴
Wply=88.35 cm³

gM1=1.00
A_z=7.64 cm²
I_z=44.92 cm⁴
Wplz=19.25 cm³

A_x=16.43 cm²
I_x=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.23 kN
N_{c,Rd} = 451.71 kN
N_{b,Rd} = 451.71 kN
M_{y,Ed} = 0.45 kN*m
M_{y,Ed,max} = 0.45 kN*m
M_{y,c,Rd} = 24.30 kN*m
M_{N,y,Rd} = 24.30 kN*m
M_{b,Rd} = 9.61 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.60 \text{ m}$

$M_{cr} = 9.76 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.58$

Curve,LT - b
 $\eta_{i,LT} = 1.63$

$X_{LT} = 0.40$
 $X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 255 Beam_255

POINT: 2

COORDINATE: $x = 0.50 L = 2.37 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1 \cdot 1.35 + 4 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$gM0 = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.88 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.48 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.48 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.39 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.75 \text{ m}$

$M_{cr} = 9.48 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.60$

Curve,LT - b
 $\eta_{i,LT} = 1.67$

$X_{LT} = 0.39$
 $X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:



About z axis:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$k_{yy} = 1.00$

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /108/ $1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /116/ $1 \cdot 1.00 + 3 \cdot 1.00 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 256 Beam_256

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.45 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.78 \text{ kN}$

$M_{y,Ed} = 0.51 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.51 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.18 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.21 \text{ kN}\cdot\text{m}$

Curve,LT - b

$XLT = 0.38$

$L_{cr,upp} = 4.89 \text{ m}$

$\Lambda_{m_LT} = 1.62$

$\phi_{i,LT} = 1.70$

$XLT_{mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 257 Beam_257

POINT: 2

COORDINATE: $x = 0.50 L = 2.52 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.59 \text{ kN}$

$M_{y,Ed} = 0.54 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.54 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 8.96 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 8.96 \text{ kN}^*\text{m}$

Curve,LT - b

$X_{LT} = 0.37$

$L_{cr,upp} = 5.03 \text{ m}$

$\lambda_{m,LT} = 1.65$

$\phi_{i,LT} = 1.73$

$X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 258 Beam_258

POINT: 2

COORDINATE: $x = 0.50 L = 2.59 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.12 \text{ kN}$	$M_{y,Ed} = 0.57 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.57 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 8.72 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.72 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.36$
$L_{cr,upp} = 5.18 \text{ m}$	$\lambda_{m,LT} = 1.67$	$\phi_{LT} = 1.76$	$X_{LT,mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /45/ $1 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /116/ $1 \cdot 1.00 + 3 \cdot 1.00 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 259 Beam_259

POINT: 2

COORDINATE: x = 0.50 L = 1.87 m

LOADS:

Governing Load Case: 10 ULS /192/ 1*1.35 + 4*1.50 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 5.26 kN	My _{Ed} = 0.30 kN*m
Nc _{Rd} = 451.71 kN	My _{Ed,max} = 0.30 kN*m
Nb _{Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 11.25 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 11.93 kN*m	Curve,LT - b	XLT = 0.46
Lcr,upp=3.74 m	Lam_LT = 1.43	fi,LT = 1.44	XLT,mod = 0.46

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

My_{Ed}/My_{c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.03 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /114/ 1*1.00 + 4*1.00 + 5*0.50 + 7*0.60

uz = 0.0 cm < uz max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /85/ 1*1.00 + 2*0.70 + 3*1.00 + 4*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 260 Beam_260

POINT: 2

COORDINATE: x = 0.50 L = 1.94 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=1.35$ kN	$M_{y,Ed}=0.32$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.32$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=10.93$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=11.50$ kN*m	Curve,LT - b	$XLT=0.45$
$L_{cr,upp}=3.88$ m	$\lambda_{m,LT}=1.45$	$f_{i,LT}=1.47$	$XLT_{mod}=0.45$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.00 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y=0.0 \text{ cm} < u_{y,max}=L/200.00=1.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /102/ \quad 1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50$$

$$u_z=0.0 \text{ cm} < u_{z,max}=L/200.00=1.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /4/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 261 Beam_261

POINT: 2

COORDINATE: x = 0.50 L = 2.01 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /81/ \quad 1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 2.18 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.35 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.35 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 10.63 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.03 \text{ m}$

$M_{cr} = 11.11 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.48$

Curve,LT - b
 $\eta_{LT} = 1.50$

$X_{LT} = 0.44$
 $X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.04 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /111/ $1 \cdot 1.00 + 4 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /65/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 262 Beam_262

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.82 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.37 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.37 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 10.34 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.74 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.43$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=4.17 m

Lam_LT = 1.50

fi,LT = 1.54

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.04 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60

uz = 0.0 cm < uz max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /15/ 1*1.00 + 2*1.00 + 3*0.60 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 263 Beam_263

POINT: 2

COORDINATE: x = 0.50 L = 2.16 m

LOADS:

Governing Load Case: 10 ULS /192/ 1*1.35 + 4*1.50 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 8.17 kN

My,Ed = 0.40 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.40 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.08 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 10.39 kN*m

Curve,LT - b

XLT = 0.41

Lcr,upp=4.31 m

Lam_LT = 1.53

fi,LT = 1.57

XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{y,Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{y,Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /93/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 264 Beam_264

POINT: 2

COORDINATE: x = 0.50 L = 2.23 m

LOADS:

Governing Load Case: 10 ULS /171/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{y,Ed} = 27.05 \text{ kN}$$

$$M_{y,Ed} = 0.43 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.43 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.83 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.05 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} - b$$

$$XLT = 0.40$$

$$L_{cr,upp} = 4.46 \text{ m}$$

$$\lambda_{m,LT} = 1.55$$

$$f_{i,LT} = 1.60$$

$$XLT_{mod} = 0.40$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{y,Ed}/N_{c,Rd} = 0.06 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{y,Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

$$N_{y,Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.10 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /23/ $1*1.00 + 2*1.00 + 3*0.60 + 7*0.60$
 $uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /80/ $1*1.00 + 3*0.60 + 5*1.00 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 265 Beam_265

POINT: 2

COORDINATE: x = 0.50 L = 2.30 m

LOADS:

Governing Load Case: 10 ULS /192/ $1*1.35 + 4*1.50 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=7.3 \text{ cm}$

$A_y=11.15 \text{ cm}^2$

$A_z=7.64 \text{ cm}^2$

$A_x=16.43 \text{ cm}^2$

$tw=0.5 \text{ cm}$

$I_y=541.22 \text{ cm}^4$

$I_z=44.92 \text{ cm}^4$

$I_x=2.54 \text{ cm}^4$

$tf=0.7 \text{ cm}$

$W_{ply}=88.35 \text{ cm}^3$

$W_{plz}=19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.46 \text{ kN}$

$M_{y,Ed} = 0.45 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.45 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$Mb,Rd = 9.61 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.77 \text{ kN*m}$

Curve,LT - b

$XLT = 0.40$

$L_{cr,upp}=4.60 \text{ m}$

$\lambda_{m,LT} = 1.58$

$f_{i,LT} = 1.63$

$XLT_{mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 266 Beam_266

POINT: 2

COORDINATE: x = 0.50 L = 2.37 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.91$ kN	$M_{y,Ed} = 0.48$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.48$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 9.39$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.49$ kN*m	Curve,LT - b	$XLT = 0.39$
$L_{cr,upp}=4.74$ m	$\lambda_{m_LT} = 1.60$	$\phi_{i,LT} = 1.66$	$XLT_{mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 2.4$ cm Verified

Governing Load Case: 13 SLS /108/ 1*1.00 + 4*1.00 + 5*0.50 + 6*0.60

$u_z = 0.1$ cm < $u_{z,max} = L/200.00 = 2.4$ cm Verified

Governing Load Case: 13 SLS /106/ 1*1.00 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 267 Beam_267

POINT: 2

COORDINATE: x = 0.50 L = 2.44 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.23$ kN	$M_{y,Ed} = 0.51$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.51$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 9.19$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.22$ kN*m	Curve,LT - b	$X_{LT} = 0.38$
$L_{cr,upp}=4.89$ m	$\Lambda_{m_LT} = 1.62$	$\phi_{i,LT} = 1.70$	$X_{LT,mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 2.4$ cm Verified

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$ Verified

$u_z = 0.1$ cm < $u_{z,max} = L/200.00 = 2.4$ cm

Governing Load Case: 13 SLS /20/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 268 Beam_268

POINT: 2

COORDINATE: $x = 0.50$ L = 2.51 m

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 1.80 kN

M_{y,Ed} = 0.54 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.54 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 8.97 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 8.97 kN*m

Curve,LT - b

XLT = 0.37

L_{cr,upp} = 5.03 m

Lam_LT = 1.65

fi,LT = 1.73

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

u_z = 0.1 cm < u_z max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 269 Beam_269

POINT: 2

COORDINATE: x = 0.50 L = 2.59 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

A_y=11.15 cm²

A_z=7.64 cm²

A_x=16.43 cm²

t_w=0.5 cm

I_y=541.22 cm⁴

I_z=44.92 cm⁴

I_x=2.54 cm⁴

tf=0.7 cm

W_{ply}=88.35 cm³

W_{plz}=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 1.82 kN

M_{y,Ed} = 0.57 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.57 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 8.73 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.17 \text{ m}$

$M_{cr} = 8.73 \text{ kN}\cdot\text{m}$
 $\text{Lam}_{LT} = 1.67$

Curve,LT - b
 $\text{fi}_{LT} = 1.76$

$\text{XLT} = 0.36$
 $\text{XLT}_{mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /19/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 366 Column_366

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$
 $b = 24.0 \text{ cm}$
 $tw = 0.8 \text{ cm}$
 $tf = 1.2 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 64.54 \text{ cm}^2$
 $I_y = 7763.18 \text{ cm}^4$
 $W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 25.18 \text{ cm}^2$
 $I_z = 2768.81 \text{ cm}^4$
 $W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$
 $I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 182.25 \text{ kN}$
 $N_{c,Rd} = 2112.98 \text{ kN}$
 $N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed} = 71.87 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 71.87 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$
 $M_{y,V,Rd} = 200.74 \text{ kN}\cdot\text{m}$

$M_{z,Ed} = -0.57 \text{ kN}\cdot\text{m}$
 $M_{z,Ed,max} = -0.57 \text{ kN}\cdot\text{m}$
 $M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$
 $M_{N,z,Rd} = 96.72 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = -1.28 \text{ kN}$
 $V_{y,T,Rd} = 1004.09 \text{ kN}$
 $V_{z,Ed} = -282.21 \text{ kN}$
 $V_{z,T,Rd} = 394.72 \text{ kN}$
 $T_{t,Ed} = -0.25 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 0.30 \text{ m}$
 $L_{cr,y} = 0.30 \text{ m}$
 $\text{Lam}_y = 2.98$

$\text{Lam}_y = 0.03$
 $X_y = 1.00$
 $k_{yy} = 0.74$



About z axis:

$L_z = 0.30 \text{ m}$
 $L_{cr,z} = 0.30 \text{ m}$
 $\text{Lam}_z = 5.00$

$\text{Lam}_z = 0.06$
 $X_z = 1.00$
 $k_{yz} = 0.55$

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VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.09 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,V,Rd} + M_{z,Ed}/M_{z,c,Rd} = 0.36 < 1.00$ (6.2.8)
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.71 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.05 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.03 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 2.98 < \lambda_{y,max} = 210.00$ $\lambda_{z,Ed} = 5.00 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.35 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.22 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 367 Beam_main_367

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 186.74 \text{ kN}$	$M_{y,Ed} = -9.63 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = -1.23 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -13.74 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -9.63 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = -22.75 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1014.55 \text{ kN}$
$N_{b,Rd} = 2112.98 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 10.22 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 397.26 \text{ kN}$
	$M_{b,Rd} = 184.92 \text{ kN} \cdot \text{m}$		$T_{t,Ed} = 0.12 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 435.17 \text{ kN} \cdot \text{m}$	Curve,LT - b	$X_{LT} = 0.88$
$L_{cr,low} = 1.85 \text{ m}$	$\lambda_{m,LT} = 0.69$	$f_{i,LT} = 0.73$	$X_{LT,mod} = 0.90$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.09 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00$ (6.2.9.1.(6))

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$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.38 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.38 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 368 Beam_main_368

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$b = 24.0 \text{ cm}$$

$$t_w = 0.8 \text{ cm}$$

$$t_f = 1.2 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 64.54 \text{ cm}^2$$

$$I_y = 7763.18 \text{ cm}^4$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 25.18 \text{ cm}^2$$

$$I_z = 2768.81 \text{ cm}^4$$

$$W_{plz} = 351.70 \text{ cm}^3$$

$$A_x = 76.84 \text{ cm}^2$$

$$I_x = 38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 92.45 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 2112.98 \text{ kN}$$

$$M_{y,Ed} = -11.19 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = -11.19 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = -19.60 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = -19.60 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -11.31 \text{ kN}$$

$$V_{y,T,Rd} = 1020.83 \text{ kN}$$

$$V_{z,Ed} = 9.62 \text{ kN}$$

$$V_{z,T,Rd} = 398.79 \text{ kN}$$

$$T_{t,Ed} = 0.05 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,low} = 0.45 \text{ m}$$

$$M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$$

$$\lambda_{m,LT} = 0.27$$

$$\text{Curve}_{LT-b}$$

$$f_{i,LT} = 0.50$$

$$X_{LT} = 1.00$$

$$X_{LT,mod} = 1.00$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.21 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

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$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 369 Beam_main_369

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

gM0=1.00

gM1=1.00

b=24.0 cm

Ay=64.54 cm²

Az=25.18 cm²

Ax=76.84 cm²

tw=0.8 cm

Iy=7763.18 cm⁴

Iz=2768.81 cm⁴

Ix=38.20 cm⁴

tf=1.2 cm

Wply=744.68 cm³

Wplz=351.70 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 94.27 kN

M_{y,Ed} = -103.80 kN*m

M_{z,Ed} = -2.08 kN*m

V_{y,Ed} = -2.26 kN

N_{c,Rd} = 2112.98 kN

M_{y,Ed,max} = -103.80 kN*m

M_{z,Ed,max} = -2.08 kN*m

V_{y,T,Rd} = 1024.53 kN

N_{b,Rd} = 2112.98 kN

M_{y,c,Rd} = 204.79 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{z,Ed} = 125.00 kN

M_{N,y,Rd} = 204.79 kN*m

M_{N,z,Rd} = 96.72 kN*m

V_{z,T,Rd} = 399.69 kN

M_{b,Rd} = 176.20 kN*m

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 347.48 kN*m

Curve,LT - b

XLT = 0.83

L_{cr,low} = 2.43 m

Lam_LT = 0.77

fi,LT = 0.78

XLT,mod = 0.86

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.28 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00 \quad (6.2.6-7)$$

$$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.59 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.66 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.66 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.6 \text{ cm} < u_{z \text{ max}} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 370 Column_370

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /53/ $1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 24.0 \text{ cm}$

$A_y = 64.54 \text{ cm}^2$

$A_z = 25.18 \text{ cm}^2$

$A_x = 76.84 \text{ cm}^2$

$t_w = 0.8 \text{ cm}$

$I_y = 7763.18 \text{ cm}^4$

$I_z = 2768.81 \text{ cm}^4$

$I_x = 38.20 \text{ cm}^4$

$t_f = 1.2 \text{ cm}$

$W_{ply} = 744.68 \text{ cm}^3$

$W_{plz} = 351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 205.52 \text{ kN}$

$M_{y,Ed} = 18.62 \text{ kN}^*\text{m}$

$V_{y,Ed} = 0.28 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = -29.14 \text{ kN}^*\text{m}$

$M_{z,Ed,max} = 1.14 \text{ kN}^*\text{m}$

$V_{y,T,Rd} = 1024.46 \text{ kN}$

$N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN}^*\text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN}^*\text{m}$

$V_{z,Ed} = 11.71 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN}^*\text{m}$

$V_{z,T,Rd} = 399.67 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$\lambda_{m,y} = 0.47$

$L_{cr,y} = 4.08 \text{ m}$

$\chi_y = 0.90$

$\lambda_{m,y} = 40.59$

$\chi_{y,y} = 0.65$



About z axis:

$L_z = 4.08 \text{ m}$

$\lambda_{m,z} = 0.78$

$L_{cr,z} = 4.08 \text{ m}$

$\chi_z = 0.67$

$\lambda_{m,z} = 67.97$

$\chi_{z,y} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 40.59 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 67.97 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y*N_{c,Rd}/gM1) + \chi_{y,y}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + \chi_{y,z}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.21 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z*N_{c,Rd}/gM1) + \chi_{z,y}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + \chi_{z,z}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.2 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 371 Column_371

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 111.46$ kN	$M_{y,Ed} = -9.72$ kN*m	$M_{z,Ed,max} = -0.68$ kN*m	$V_{y,Ed} = -0.17$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = 21.03$ kN*m		$V_{y,T,Rd} = 1024.50$ kN
$N_{b,Rd} = 1421.83$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = -7.54$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.68$ kN
			$T_{t,Ed} = -0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08$ m	$Lam_y = 0.47$
$L_{cr,y} = 4.08$ m	$X_y = 0.90$
$L_{amy} = 40.59$	$k_{yy} = 0.69$



About z axis:

$L_z = 4.08$ m	$Lam_z = 0.78$
$L_{cr,z} = 4.08$ m	$X_z = 0.67$
$L_{amz} = 67.97$	$k_{zy} = 0.36$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{bda,y} = 40.59 < \lambda_{bda,max} = 210.00$ $\lambda_{bda,z} = 67.97 < \lambda_{bda,max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0$ cm $< v_{x,max} = L/150.00 = 2.7$ cm Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.3$ cm $< v_{y,max} = L/150.00 = 2.7$ cm Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 372 Column_372

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 127.72$ kN	$M_{y,Ed} = 18.56$ kN*m	$M_{z,Ed,max} = 0.00$ kN*m	$V_{y,Ed} = 0.00$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -38.71$ kN*m		$V_{y,T,Rd} = 1024.54$ kN
$N_{b,Rd} = 628.77$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 7.07$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.69$ kN
			$T_{t,Ed} = 0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10$ m	$\text{Lam}_y = 0.93$
$L_{cr,y} = 8.10$ m	$X_y = 0.64$
$\text{Lam}_y = 80.58$	$k_{yy} = 0.70$



About z axis:

$L_z = 8.10$ m	$\text{Lam}_z = 1.55$
$L_{cr,z} = 8.10$ m	$X_z = 0.30$
$\text{Lam}_z = 134.93$	$k_{zy} = 0.34$

VERIFICATION FORMULAS:

Section strength check:

$$\begin{aligned} N_{Ed}/N_{c,Rd} &= 0.06 < 1.00 \quad (6.2.4.(1)) \\ M_{y,Ed}/M_{y,c,Rd} &= 0.09 < 1.00 \quad (6.2.5.(1)) \\ V_{y,Ed}/V_{y,T,Rd} &= 0.00 < 1.00 \quad (6.2.6-7) \\ V_{z,Ed}/V_{z,T,Rd} &= 0.02 < 1.00 \quad (6.2.6-7) \\ \tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) &= 0.00 < 1.00 \quad (6.2.6) \\ \tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) &= 0.00 < 1.00 \quad (6.2.6) \end{aligned}$$

Global stability check of member:

$$\begin{aligned} \text{Lambda}_{y,y} &= 80.58 < \text{Lambda}_{y,max} = 210.00 \quad \text{Lambda}_{z,z} = 134.93 < \text{Lambda}_{z,max} = 210.00 \quad \text{STABLE} \\ N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) &= 0.23 < 1.00 \quad (6.3.3.(4)) \\ N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) &= 0.27 < 1.00 \quad (6.3.3.(4)) \end{aligned}$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /89/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /90/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 378 Column_378

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 216.64$ kN	$M_{y,Ed} = 23.16$ kN*m	$M_{z,Ed,max} = 0.00$ kN*m	$V_{y,Ed} = 0.00$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = 23.16$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{y,T,Rd} = 1024.60$ kN
$N_{b,Rd} = 1873.30$ kN	$M_{y,c,Rd} = 204.79$ kN*m		$V_{z,Ed} = 15.61$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.71$ kN
			$T_{t,Ed} = -0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.19$ m	$\lambda_{m,y} = 0.25$
$L_{cr,y} = 2.19$ m	$\chi_y = 0.98$
$\lambda_{m,y} = 21.79$	$\chi_{yy} = 0.68$



About z axis:

$L_z = 2.19$ m	$\lambda_{m,z} = 0.42$
$L_{cr,z} = 2.19$ m	$\chi_z = 0.89$
$\lambda_{m,z} = 36.48$	$\chi_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.11 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.11 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 21.79 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 36.48 < \lambda_{m,max} = 210.00$ STABLE
 $N_{Ed}/(\chi_y \cdot N_{Rk}/gM1) + \chi_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + \chi_{zy} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.18 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z \cdot N_{Rk}/gM1) + \chi_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + \chi_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0$ cm < $v_{x,max} = L/150.00 = 1.5$ cm Verified

Governing Load Case: 13 SLS /36/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00

$v_y = 0.1$ cm < $v_{y,max} = L/150.00 = 1.5$ cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 379 Column_379

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$tw=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$tf=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 270.77 \text{ kN}$	$M_{y,Ed} = -5.48 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = -0.00 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = -0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 11.08 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$	$V_{y,T,Rd} = 1024.61 \text{ kN}$
$N_{b,Rd} = 948.80 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$		$V_{z,Ed} = -2.72 \text{ kN}$
	$MN_{y,Rd} = 204.09 \text{ kN}\cdot\text{m}$		$V_{z,T,Rd} = 399.71 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN}\cdot\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$	$\text{Lam}_y = 0.70$
$L_{cr,y} = 6.09 \text{ m}$	$X_y = 0.78$
$\text{Lam}_y = 60.59$	$k_{yy} = 0.70$



About z axis:

$L_z = 6.09 \text{ m}$	$\text{Lam}_z = 1.17$
$L_{cr,z} = 6.09 \text{ m}$	$X_z = 0.45$
$\text{Lam}_z = 101.45$	$k_{zy} = 0.34$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
$M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3}\cdot gM0)) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3}\cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lam}_{b,y} = 60.59 < \text{Lam}_{b,max} = 210.00$	$\text{Lam}_{b,z} = 101.45 < \text{Lam}_{b,max} = 210.00$	STABLE
$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))		
$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00$ (6.3.3.(4))		

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$	Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$	
$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$	Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 381 Column_381

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 198.35 kN	My _{Ed} = 78.57 kN*m	Mz _{Ed} = -1.73 kN*m	Vy _{Ed} = -5.00 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = 78.57 kN*m	Mz _{Ed,max} = -1.73 kN*m	Vy _{T,Rd} = 998.90 kN
N _{b,Rd} = 2112.98 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = -307.98 kN
	My _{V,Rd} = 197.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 393.47 kN
			Tt _{Ed} = -0.31 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 0.30 m	Lam _y = 0.03
Lcr,y = 0.30 m	Xy = 1.00
Lamy = 2.98	ky _y = 0.74



About z axis:

Lz = 0.30 m	Lam _z = 0.06
Lcr,z = 0.30 m	Xz = 1.00
Lamz = 5.00	kyz = 0.52

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.09 < 1.00$ (6.2.4.(1))
 $My_{Ed}/My_{V,Rd} + Mz_{Ed}/Mz_{c,Rd} = 0.42 < 1.00$ (6.2.8)
 $(My_{Ed}/MN_{y,Rd})^{2.00} + (Mz_{Ed}/MN_{z,Rd})^{1.00} = 0.17 < 1.00$ (6.2.9.1.(6))
 $Vy_{Ed}/Vy_{T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $Vz_{Ed}/Vz_{T,Rd} = 0.78 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(fy/(\sqrt{3}*gM0)) = 0.06 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(fy/(\sqrt{3}*gM0)) = 0.04 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y} = 2.98 < \lambda_{y,max} = 210.00$ $\lambda_{z} = 5.00 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) + kyz*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.39 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) + kzz*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.25 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 0.2 \text{ cm}$ Verified
Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60
 $v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 0.2 \text{ cm}$ Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 382 Beam_main_382

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00
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Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

b=24.0 cm
tw=0.8 cm
tf=1.2 cm

Ay=64.54 cm²
Iy=7763.18 cm⁴
Wply=744.68 cm³

Az=25.18 cm²
Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ax=76.84 cm²
Ix=38.20 cm⁴

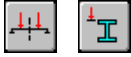
INTERNAL FORCES AND CAPACITIES:

N,Ed = 122.34 kN
Nc,Rd = 2112.98 kN
Nb,Rd = 2112.98 kN

My,Ed = -8.84 kN*m
My,Ed,max = -9.91 kN*m
My,c,Rd = 204.79 kN*m
MN,y,Rd = 204.79 kN*m
Mb,Rd = 184.92 kN*m

Mz,Ed = -1.25 kN*m
Mz,Ed,max = -26.83 kN*m
Mz,c,Rd = 96.72 kN*m
MN,z,Rd = 96.72 kN*m

Vy,Ed = -14.63 kN
Vy,T,Rd = 1014.37 kN
Vz,Ed = 11.78 kN
Vz,T,Rd = 397.22 kN
Tt,Ed = 0.13 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
Lcr,low=1.85 m

Mcr = 435.17 kN*m
Lam_LT = 0.69

Curve,LT - b
fi,LT = 0.73

XLT = 0.88
XLT,mod = 0.90

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.06 < 1.00 (6.2.4.(1))
(My,Ed/MN,y,Rd)^{2.00} + (Mz,Ed/MN,z,Rd)^{1.00} = 0.01 < 1.00 (6.2.9.1.(6))
Vy,Ed/Vy,T,Rd = 0.01 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.03 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.02 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.02 < 1.00 (6.2.6)

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.39 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.39 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 3.7 cm Verified
Governing Load Case: 13 SLS /36/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00
uz = 0.2 cm < uz max = L/200.00 = 3.7 cm Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 383 Beam_main_383

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm

gM0=1.00
Ay=64.54 cm²
Iy=7763.18 cm⁴
Wply=744.68 cm³

gM1=1.00
Az=25.18 cm²
Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ax=76.84 cm²
Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 62.83 kN

My,Ed = -8.66 kN*m

Mz,Ed = -23.10 kN*m

Vy,Ed = -14.17 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Nc,Rd = 2112.98 kN	My,Ed,max = -8.66 kN*m	Mz,Ed,max = -23.10 kN*m	Vy,T,Rd = 1020.30 kN
Nb,Rd = 2112.98 kN	My,c,Rd = 204.79 kN*m	Mz,c,Rd = 96.72 kN*m	Vz,Ed = 5.79 kN
	MN,y,Rd = 204.79 kN*m	MN,z,Rd = 96.72 kN*m	Vz,T,Rd = 398.66 kN
	Mb,Rd = 204.79 kN*m		Tt,Ed = 0.05 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2913.56 kN*m	Curve,LT - b	XLT = 1.00
Lcr,low=0.45 m	Lam_LT = 0.27	fi,LT = 0.50	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.24 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00$ (6.2.6)
Global stability check of member:
 $M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.31 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.31 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 384 Beam_main_384

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 86.80 kN	My _{Ed} = -103.71 kN*m	Mz _{Ed} = 0.74 kN*m	Vy _{Ed} = 1.10 kN
Nc,Rd = 2112.98 kN	My _{Ed,max} = -103.71 kN*m	Mz _{Ed,max} = 0.74 kN*m	Vy,T,Rd = 1024.63 kN
Nb,Rd = 2112.98 kN	My,c,Rd = 204.79 kN*m	Mz,c,Rd = 96.72 kN*m	Vz,Ed = 124.94 kN
	MN,y,Rd = 204.79 kN*m	MN,z,Rd = 96.72 kN*m	Vz,T,Rd = 399.71 kN
	Mb,Rd = 176.20 kN*m		Tt,Ed = -0.00 kN*m
			Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,low} = 2.43 \text{ m}$

$M_{cr} = 347.48 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 0.77$

Curve,LT - b
 $\eta_{LT} = 0.78$

$X_{LT} = 0.83$
 $X_{LT,mod} = 0.86$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.26 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.59 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.64 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.64 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 385 Column_385

POINT: 3

COORDINATE: $x = 1.00$ $L = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$
 $b = 24.0 \text{ cm}$
 $t_w = 0.8 \text{ cm}$
 $t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 64.54 \text{ cm}^2$
 $I_y = 7763.18 \text{ cm}^4$
 $W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 25.18 \text{ cm}^2$
 $I_z = 2768.81 \text{ cm}^4$
 $W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$
 $I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 145.20 \text{ kN}$
 $N_{c,Rd} = 2112.98 \text{ kN}$
 $N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,Ed} = 27.27 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = -36.88 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 204.79 \text{ kN}\cdot\text{m}$

$M_{z,Ed,max} = -0.55 \text{ kN}\cdot\text{m}$
 $M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = -0.14 \text{ kN}$
 $V_{y,T,Rd} = 1024.57 \text{ kN}$
 $V_{z,Ed} = 15.72 \text{ kN}$
 $V_{z,T,Rd} = 399.70 \text{ kN}$
 $T_{t,Ed} = -0.00 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{m,y} = 0.47$

$\chi_y = 0.90$

$\kappa_{yy} = 0.63$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{m,z} = 0.78$

$\chi_z = 0.67$

$\kappa_{zy} = 0.32$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.13 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 40.59 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 67.97 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.19 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 386 Column_386

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 108.45 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,Ed} = -9.75 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 21.24 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = -0.18 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = -0.04 \text{ kN}$

$V_{y,T,Rd} = 1024.61 \text{ kN}$

$V_{z,Ed} = -7.60 \text{ kN}$

$V_{z,T,Rd} = 399.71 \text{ kN}$

$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{m,y} = 0.47$

$\chi_y = 0.90$

$\kappa_{yy} = 0.69$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{m,z} = 0.78$

$\chi_z = 0.67$

$\kappa_{zy} = 0.36$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 40.59 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 67.97 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.13 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.11 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$ Verified

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 387 Column_387

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 120.61 \text{ kN}$	$M_{y,Ed} = 21.68 \text{ kN} \cdot \text{m}$		$V_{y,Ed} = 0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -46.63 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = 0.00 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.63 \text{ kN}$
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 6.66 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,T,Rd} = 399.72 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10 \text{ m}$ $\lambda_{m,y} = 0.93$
 $L_{cr,y} = 8.10 \text{ m}$ $X_y = 0.64$
 $\lambda_{m,y} = 80.58$ $k_{yy} = 0.70$



About z axis:

$L_z = 8.10 \text{ m}$ $\lambda_{m,z} = 1.55$
 $L_{cr,z} = 8.10 \text{ m}$ $X_z = 0.30$
 $\lambda_{m,z} = 134.93$ $k_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.11 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

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$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 80.58 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 134.93 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.25 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.27 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 393 Column_393

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$b = 24.0 \text{ cm}$$

$$t_w = 0.8 \text{ cm}$$

$$t_f = 1.2 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 64.54 \text{ cm}^2$$

$$I_y = 7763.18 \text{ cm}^4$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 25.18 \text{ cm}^2$$

$$I_z = 2768.81 \text{ cm}^4$$

$$W_{plz} = 351.70 \text{ cm}^3$$

$$A_x = 76.84 \text{ cm}^2$$

$$I_x = 38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 217.10 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 1873.30 \text{ kN}$$

$$M_{y,Ed} = 23.64 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = 23.64 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = -0.01 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.00 \text{ kN}$$

$$V_{y,T,Rd} = 1024.53 \text{ kN}$$

$$V_{z,Ed} = 16.00 \text{ kN}$$

$$V_{z,T,Rd} = 399.69 \text{ kN}$$

$$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 2.19 \text{ m}$$

$$L_{cr,y} = 2.19 \text{ m}$$

$$\lambda_{my} = 21.79$$

$$\lambda_{m,y} = 0.25$$

$$X_y = 0.98$$

$$k_{yy} = 0.68$$



About z axis:

$$L_z = 2.19 \text{ m}$$

$$L_{cr,z} = 2.19 \text{ m}$$

$$\lambda_{mz} = 36.48$$

$$\lambda_{m,z} = 0.42$$

$$X_z = 0.89$$

$$k_{zy} = 0.35$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.12 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.12 < 1.00 \quad (6.2.9.1.(2))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 21.79 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 36.48 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

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$$N_{Ed}/(Xy \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{yz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.18 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(Xz \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{zz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.16 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 1.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /36/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$

$$v_y = 0.1 \text{ cm} < v_{y \text{ max}} = L/150.00 = 1.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 394 Column_394

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h=23.0 \text{ cm}$$

$$b=24.0 \text{ cm}$$

$$t_w=0.8 \text{ cm}$$

$$t_f=1.2 \text{ cm}$$

$$gM0=1.00$$

$$A_y=64.54 \text{ cm}^2$$

$$I_y=7763.18 \text{ cm}^4$$

$$W_{ply}=744.68 \text{ cm}^3$$

$$gM1=1.00$$

$$A_z=25.18 \text{ cm}^2$$

$$I_z=2768.81 \text{ cm}^4$$

$$W_{plz}=351.70 \text{ cm}^3$$

$$A_x=76.84 \text{ cm}^2$$

$$I_x=38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 272.40 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 948.80 \text{ kN}$$

$$M_{y,Ed} = -5.06 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = 10.55 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 203.91 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 0.00 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 0.00 \text{ kN}$$

$$V_{y,T,Rd} = 1024.64 \text{ kN}$$

$$V_{z,Ed} = -2.56 \text{ kN}$$

$$V_{z,T,Rd} = 399.72 \text{ kN}$$

$$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$$

$$\text{Class of section} = 1$$



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 6.09 \text{ m}$$

$$L_{cr,y} = 6.09 \text{ m}$$

$$L_{amy} = 60.59$$

$$\lambda_{m,y} = 0.70$$

$$X_y = 0.78$$

$$k_{yy} = 0.70$$



About z axis:

$$L_z = 6.09 \text{ m}$$

$$L_{cr,z} = 6.09 \text{ m}$$

$$L_{amz} = 101.45$$

$$\lambda_{m,z} = 1.17$$

$$X_z = 0.45$$

$$k_{zy} = 0.34$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.13 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.02 < 1.00 \quad (6.2.9.1.(2))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{m,y} = 60.59 < \lambda_{m,max} = 210.00 \quad \lambda_{m,z} = 101.45 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(Xy \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{yz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.20 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(Xz \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{zz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.30 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.3 \text{ cm} < v_{y \text{ max}} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 396 Column_396

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ $1*1.00 + 2*0.30 + 9*-1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=24.0 \text{ cm}$

$A_y=64.54 \text{ cm}^2$

$A_z=25.18 \text{ cm}^2$

$A_x=76.84 \text{ cm}^2$

$t_w=0.8 \text{ cm}$

$I_y=7763.18 \text{ cm}^4$

$I_z=2768.81 \text{ cm}^4$

$I_x=38.20 \text{ cm}^4$

$t_f=1.2 \text{ cm}$

$W_{ply}=744.68 \text{ cm}^3$

$W_{plz}=351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 158.91 \text{ kN}$

$M_{y,Ed} = 60.46 \text{ kN*m}$

$M_{z,Ed} = -3.11 \text{ kN*m}$

$V_{y,Ed} = -9.45 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = 60.46 \text{ kN*m}$

$M_{z,Ed,max} = -3.11 \text{ kN*m}$

$V_{y,T,Rd} = 994.01 \text{ kN}$

$N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$M_{z,c,Rd} = 96.72 \text{ kN*m}$

$V_{z,Ed} = -241.77 \text{ kN}$

$M_{y,V,Rd} = 203.60 \text{ kN*m}$

$MN_{z,Rd} = 96.72 \text{ kN*m}$

$V_{z,T,Rd} = 392.29 \text{ kN}$

$T_{t,Ed} = -0.37 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 0.30 \text{ m}$

$\text{Lam}_y = 0.03$

$L_{cr,y} = 0.30 \text{ m}$

$X_y = 1.00$

$\text{Lam}_y = 2.98$

$k_{yy} = 0.74$



About z axis:

$L_z = 0.30 \text{ m}$

$\text{Lam}_z = 0.06$

$L_{cr,z} = 0.30 \text{ m}$

$X_z = 1.00$

$\text{Lam}_z = 5.00$

$k_{yz} = 0.53$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,V,Rd} + M_{z,Ed}/M_{z,c,Rd} = 0.33 < 1.00$ (6.2.8)

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.12 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.62 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.07 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.05 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_y = 2.98 < \text{Lambda}_{max} = 210.00$ $\text{Lambda}_z = 5.00 < \text{Lambda}_{max} = 210.00$ STABLE

$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.31 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.21 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$

$v_y = 0.0 \text{ cm} < v_{y \text{ max}} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 397 Beam_main_397

POINT: 3

COORDINATE: $x = 0.50 \text{ L} = 3.70 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$

$b=24.0 \text{ cm}$

$tw=0.8 \text{ cm}$

$tf=1.2 \text{ cm}$

$gM0=1.00$

$A_y=64.54 \text{ cm}^2$

$I_y=7763.18 \text{ cm}^4$

$W_{ply}=744.68 \text{ cm}^3$

$gM1=1.00$

$A_z=25.18 \text{ cm}^2$

$I_z=2768.81 \text{ cm}^4$

$W_{plz}=351.70 \text{ cm}^3$

$A_x=76.84 \text{ cm}^2$

$I_x=38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -131.69 \text{ kN}$

$N_{t,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed} = -66.07 \text{ kN}^*\text{m}$

$M_{y,pl,Rd} = 204.79 \text{ kN}^*\text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN}^*\text{m}$

$MN_{y,Rd} = 204.79 \text{ kN}^*\text{m}$

$Mb,Rd = 184.92 \text{ kN}^*\text{m}$

$M_{z,Ed} = -0.41 \text{ kN}^*\text{m}$

$M_{z,pl,Rd} = 96.72 \text{ kN}^*\text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN}^*\text{m}$

$MN_{z,Rd} = 96.72 \text{ kN}^*\text{m}$

$V_{y,Ed} = 0.26 \text{ kN}$

$V_{y,T,Rd} = 1024.00 \text{ kN}$

$V_{z,Ed} = -93.93 \text{ kN}$

$V_{z,T,Rd} = 399.56 \text{ kN}$

$T_{t,Ed} = -0.01 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,low} = 1.85 \text{ m}$

$M_{cr} = 435.17 \text{ kN}^*\text{m}$

$\lambda_{m,LT} = 0.69$

Curve,LT - b

$\phi_{LT} = 0.73$

$X_{LT} = 0.88$

$X_{LT,mod} = 0.90$

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.06 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/MN_{y,Rd})^2 + (M_{z,Ed}/MN_{z,Rd})^2 = 0.11 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.24 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed}/M_{b,Rd} = 0.36 < 1.00$ (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y \text{ max}} = L/200.00 = 3.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.2 \text{ cm} < u_{z \text{ max}} = L/200.00 = 3.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 398 Beam_main_398

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 7.66$ kN	$M_{y,Ed} = -3.99$ kN*m	$M_{z,Ed} = -19.59$ kN*m	$V_{y,Ed} = -11.14$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -6.32$ kN*m	$M_{z,Ed,max} = -19.59$ kN*m	$V_{y,T,Rd} = 1020.78$ kN
$N_{b,Rd} = 2112.98$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = -0.54$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 398.78$ kN
	$Mb,Rd = 204.79$ kN*m		$Tt,Ed = 0.05$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2913.56$ kN*m	Curve,LT - b	$XLT = 1.00$
$L_{cr,low} = 0.45$ m	$\Lambda_{m_LT} = 0.27$	$f_{i,LT} = 0.50$	$XLT_{mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.20 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 0.9$ cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 0.9$ cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 399 Beam_main_399

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 92.21 kN	My _{Ed} = -103.87 kN*m	Mz _{Ed} = 2.10 kN*m	Vy _{Ed} = 1.92 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = -103.87 kN*m	Mz _{Ed,max} = 2.10 kN*m	Vy _{T,Rd} = 1024.52 kN
N _{b,Rd} = 2112.98 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = 125.10 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 399.69 kN
	Mb _{Rd} = 176.20 kN*m		Tt _{Ed} = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 347.48 kN*m	Curve,LT - b	XLT = 0.83
L _{cr,low} = 2.43 m	Lam_LT = 0.77	fi,LT = 0.78	XLT _{mod} = 0.86

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.28 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.59 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y N_{Rk}/gM1) + k_{yy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM1) + k_{yz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.65 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z N_{Rk}/gM1) + k_{zy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM1) + k_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.65 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
 $u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 400 Column_400

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /53/ 1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 205.35 \text{ kN}$	$M_{y,Ed} = 18.51 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = -1.04 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = -0.26 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -28.98 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$	$V_{y,T,Rd} = 1024.55 \text{ kN}$
$N_{b,Rd} = 1421.83 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$		$V_{z,Ed} = 11.64 \text{ kN}$
	$MN_{y,Rd} = 204.79 \text{ kN}\cdot\text{m}$		$V_{z,T,Rd} = 399.69 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN}\cdot\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$	$\text{Lam}_y = 0.47$
$L_{cr,y} = 4.08 \text{ m}$	$X_y = 0.90$
$\text{Lam}_y = 40.59$	$k_{yy} = 0.65$



About z axis:

$L_z = 4.08 \text{ m}$	$\text{Lam}_z = 0.78$
$L_{cr,z} = 4.08 \text{ m}$	$X_z = 0.67$
$\text{Lam}_z = 67.97$	$k_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_y = 40.59 < \text{Lambda}_{max} = 210.00$	$\text{Lambda}_z = 67.97 < \text{Lambda}_{max} = 210.00$	STABLE
$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.21 < 1.00$	(6.3.3.(4))	
$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$	(6.3.3.(4))	

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$	Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$	
$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$	Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 401 Column_401

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 112.61 kN	My _{Ed} = -9.76 kN*m	Mz _{Ed,max} = -0.04 kN*m	Vy _{Ed} = -0.01 kN
Nc _{Rd} = 2112.98 kN	My _{Ed,max} = 21.02 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vy _{T,Rd} = 1024.60 kN
Nb _{Rd} = 1421.83 kN	My _{c,Rd} = 204.79 kN*m		Vz _{Ed} = -7.54 kN
	MN _{y,Rd} = 204.79 kN*m		Vz _{T,Rd} = 399.71 kN
			Tt _{Ed} = 0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.08 m	Lam _y = 0.47
Lcr,y = 4.08 m	Xy = 0.90
Lamy = 40.59	kyy = 0.69



About z axis:

Lz = 4.08 m	Lam _z = 0.78
Lcr,z = 4.08 m	Xz = 0.67
Lamz = 67.97	kzy = 0.36

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 40.59 < \lambda_{b,z} = 67.97 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(Mz_{Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(Mz_{Rk}/gM1) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$ Verified

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 402 Column_402

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 127.55 \text{ kN}$	$M_{y,Ed} = 18.52 \text{ kN*m}$	$M_{z,Ed,max} = -0.00 \text{ kN*m}$	$V_{y,Ed} = -0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -38.66 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{y,T,Rd} = 1024.56 \text{ kN}$
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$		$V_{z,Ed} = 7.06 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN*m}$		$V_{z,T,Rd} = 399.70 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10 \text{ m}$	$\text{Lam}_y = 0.93$
$L_{cr,y} = 8.10 \text{ m}$	$X_y = 0.64$
$\text{Lam}_y = 80.58$	$k_{yy} = 0.70$



About z axis:

$L_z = 8.10 \text{ m}$	$\text{Lam}_z = 1.55$
$L_{cr,z} = 8.10 \text{ m}$	$X_z = 0.30$
$\text{Lam}_z = 134.93$	$k_{zy} = 0.34$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_y = 80.58 < \text{Lambda}_{y,max} = 210.00$	$\text{Lambda}_z = 134.93 < \text{Lambda}_{z,max} = 210.00$	STABLE
$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.23 < 1.00$ (6.3.3.(4))		
$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.27 < 1.00$ (6.3.3.(4))		

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm}$	Verified
Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$	
$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm}$	Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$	

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 408 Column_408 **POINT:** 3 **COORDINATE:** x = 1.00 L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 216.93 \text{ kN}$	$M_{y,Ed} = 23.13 \text{ kN*m}$	$M_{z,Ed,max} = -0.02 \text{ kN*m}$	$V_{y,Ed} = -0.01 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 23.13 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{y,T,Rd} = 1024.45 \text{ kN}$
$N_{b,Rd} = 1873.30 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$		$V_{z,Ed} = 15.55 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN*m}$		$V_{z,T,Rd} = 399.67 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN*m}$
			Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.19 \text{ m}$

$L_{cr,y} = 2.19 \text{ m}$

$\lambda_{my} = 21.79$

$\lambda_{m,y} = 0.25$

$\chi_y = 0.98$

$\eta_{yy} = 0.68$



About z axis:

$L_z = 2.19 \text{ m}$

$L_{cr,z} = 2.19 \text{ m}$

$\lambda_{mz} = 36.48$

$\lambda_{m,z} = 0.42$

$\chi_z = 0.89$

$\eta_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.11 < 1.00$ (6.2.5.(1))

$M_{y,Ed}/M_{N,y,Rd} = 0.11 < 1.00$ (6.2.9.1.(2))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3})\cdot gM_0) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3})\cdot gM_0) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 21.79 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 36.48 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/gM_1) + \eta_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM_1) + \eta_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM_1) = 0.18 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/gM_1) + \eta_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM_1) + \eta_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM_1) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 1.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 1.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 409 Column_409

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$gM_0 = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$gM_1 = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 270.19 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 948.80 \text{ kN}$

$M_{y,Ed} = -5.53 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 11.13 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 204.16 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.00 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.00 \text{ kN}$

$V_{y,T,Rd} = 1024.61 \text{ kN}$

$V_{z,Ed} = -2.74 \text{ kN}$

$V_{z,T,Rd} = 399.71 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$
 $L_{cr,y} = 6.09 \text{ m}$
 $\lambda_{my} = 60.59$
 $\lambda_{my} = 0.70$
 $\chi_y = 0.78$
 $\eta_{yy} = 0.70$



About z axis:

$L_z = 6.09 \text{ m}$
 $L_{cr,z} = 6.09 \text{ m}$
 $\lambda_{mz} = 101.45$
 $\lambda_{mz} = 1.17$
 $\chi_z = 0.45$
 $\eta_{zy} = 0.34$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{my} = 60.59 < \lambda_{my,max} = 210.00$ $\lambda_{mz} = 101.45 < \lambda_{mz,max} = 210.00$ STABLE
 $N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{zy} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.30 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 483 Beam_main_483

POINT: 3

COORDINATE: x = 1.00 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -8.62 \text{ kN}$	$M_{y,Ed} = -44.87 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 1.23 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -0.69 \text{ kN}$
$N_{t,Rd} = 2112.98 \text{ kN}$	$M_{y,pl,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,pl,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.56 \text{ kN}$
	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = -35.82 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 399.70 \text{ kN}$
	$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,low} = 0.45 \text{ m}$
 $M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$
 $\lambda_{LT} = 0.27$
Curve,LT - b
 $\eta_{LT} = 0.50$
 $XLT = 1.00$
 $XLT_{mod} = 1.00$

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.00 < 1.00 \quad (6.2.3.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.06 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.09 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.22 < 1.00 \quad (6.3.2.1.(1))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /89/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: **484 Beam_main_484**

POINT: **1**

COORDINATE: **x = 0.50 L = 4.85 m**

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /12/ \quad 1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

gM0=1.00

gM1=1.00

b=24.0 cm

Ay=64.54 cm²

Az=25.18 cm²

Ax=76.84 cm²

tw=0.8 cm

Iy=7763.18 cm⁴

Iz=2768.81 cm⁴

Ix=38.20 cm⁴

tf=1.2 cm

Wply=744.68 cm³

Wplz=351.70 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 95.21 kN

M_{y,Ed} = -102.86 kN*m

M_{z,Ed} = -3.74 kN*m

V_{y,Ed} = -4.10 kN

N_{c,Rd} = 2112.98 kN

M_{y,Ed,max} = -102.86 kN*m

M_{z,Ed,max} = -3.74 kN*m

V_{y,T,Rd} = 1024.45 kN

N_{b,Rd} = 2112.98 kN

M_{y,c,Rd} = 204.79 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{z,Ed} = 124.48 kN

M_{N,y,Rd} = 204.79 kN*m

M_{N,z,Rd} = 96.72 kN*m

V_{z,T,Rd} = 399.67 kN

M_{b,Rd} = 176.20 kN*m

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 347.48 kN*m

Curve,LT - b

XLT = 0.83

L_{cr,low}=2.43 m

Lam_LT = 0.77

f_{i,LT} = 0.78

XLT,mod = 0.86

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.29 < 1.00 \quad (6.2.9.1.(6))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.58 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.67 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.67 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 485 Column_485

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$g_{M0} = 1.00$$

$$g_{M1} = 1.00$$

$$b = 24.0 \text{ cm}$$

$$A_y = 64.54 \text{ cm}^2$$

$$A_z = 25.18 \text{ cm}^2$$

$$A_x = 76.84 \text{ cm}^2$$

$$t_w = 0.8 \text{ cm}$$

$$I_y = 7763.18 \text{ cm}^4$$

$$I_z = 2768.81 \text{ cm}^4$$

$$I_x = 38.20 \text{ cm}^4$$

$$t_f = 1.2 \text{ cm}$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$W_{plz} = 351.70 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = -14.77 \text{ kN}$$

$$M_{y,Ed} = 21.28 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 0.00 \text{ kN}$$

$$N_{t,Rd} = 2112.98 \text{ kN}$$

$$M_{y,pl,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$V_{y,T,Rd} = 1024.63 \text{ kN}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 9.92 \text{ kN}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$V_{z,T,Rd} = 399.71 \text{ kN}$$

$$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.01 < 1.00 \quad (6.2.3.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.10 < 1.00 \quad (6.2.5.(1))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_x \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.3 \text{ cm} < v_y \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 486 Column_486

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 146.73 \text{ kN}$	$M_{y,Ed} = -6.69 \text{ kN*m}$		$V_{y,Ed} = -0.31 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 18.04 \text{ kN*m}$	$M_{z,Ed,max} = -1.25 \text{ kN*m}$	$V_{y,T,Rd} = 1024.48 \text{ kN}$
$N_{b,Rd} = 1421.83 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{z,Ed} = -6.06 \text{ kN}$
	$MN_{y,Rd} = 204.79 \text{ kN*m}$		$V_{z,T,Rd} = 399.68 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$	$\text{Lam}_y = 0.47$
$L_{cr,y} = 4.08 \text{ m}$	$X_y = 0.90$
$\text{Lam}_y = 40.59$	$k_{yy} = 0.71$



About z axis:

$L_z = 4.08 \text{ m}$	$\text{Lam}_z = 0.78$
$L_{cr,z} = 4.08 \text{ m}$	$X_z = 0.67$
$\text{Lam}_z = 67.97$	$k_{zy} = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_y = 40.59 < \text{Lambda}_{max} = 210.00$ $\text{Lambda}_z = 67.97 < \text{Lambda}_{max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_x \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.3 \text{ cm} < v_y \text{ max} = L/150.00 = 2.7 \text{ cm}$ Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 487 Column_487

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 126.20$ kN	$M_{y,Ed} = 17.59$ kN*m	$M_{z,Ed,max} = 0.00$ kN*m	$V_{y,Ed} = 0.00$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -38.94$ kN*m		$V_{y,T,Rd} = 1024.49$ kN
$N_{b,Rd} = 628.77$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 6.98$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.68$ kN
			$T_{t,Ed} = 0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10$ m	$\Lambda_{m,y} = 0.93$
$L_{cr,y} = 8.10$ m	$X_y = 0.64$
$\Lambda_{m,y} = 80.58$	$k_{y,y} = 0.71$



About z axis:

$L_z = 8.10$ m	$\Lambda_{m,z} = 1.55$
$L_{cr,z} = 8.10$ m	$X_z = 0.30$
$\Lambda_{m,z} = 134.93$	$k_{z,y} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))
$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\Lambda_{m,y} = 80.58 < \Lambda_{m,max} = 210.00$	$\Lambda_{m,z} = 134.93 < \Lambda_{m,max} = 210.00$	STABLE
$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.23 < 1.00$ (6.3.3.(4))		
$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00$ (6.3.3.(4))		

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1$ cm $< v_{x,max} = L/150.00 = 5.4$ cm	Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$	
$v_y = 0.5$ cm $< v_{y,max} = L/150.00 = 5.4$ cm	Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$	

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 493 Column_493

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 270.33 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 948.80 kN

M_{y,Ed} = -5.78 kN*m

M_{y,Ed,max} = 10.43 kN*m

M_{y,c,Rd} = 204.79 kN*m

MN_{y,Rd} = 204.14 kN*m

M_{z,Ed,max} = -0.00 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{y,Ed} = -0.00 kN

V_{y,T,Rd} = 1024.60 kN

V_{z,Ed} = -2.66 kN

V_{z,T,Rd} = 399.71 kN

T_{t,Ed} = -0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 6.09 m

L_{cr,y} = 6.09 m

L_{am,y} = 60.59

L_{am,y} = 0.70

X_y = 0.78

k_{yy} = 0.68



About z axis:

L_z = 6.09 m

L_{cr,z} = 6.09 m

L_{am,z} = 101.45

L_{am,z} = 1.17

X_z = 0.45

k_{zy} = 0.33

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.13 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 (6.2.5.(1))

M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00 (6.2.9.1.(2))

V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 (6.2.6-7)

V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda_y = 60.59 < Lambda_{max} = 210.00 Lambda_z = 101.45 < Lambda_{max} = 210.00 STABLE

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.1 cm < v_{x,max} = L/150.00 = 4.1 cm

Verified

Governing Load Case: 13 SLS /36/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 7*1.00

v_y = 0.4 cm < v_{y,max} = L/150.00 = 4.1 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 495 Beam_main_495

POINT: 3

COORDINATE: x = 1.00 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm

gM0=1.00
Ay=64.54 cm²
Iy=7763.18 cm⁴
Wply=744.68 cm³

gM1=1.00
Az=25.18 cm²
Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ax=76.84 cm²
Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = -6.19 kN
Nt,Rd = 2112.98 kN

My,Ed = -43.70 kN*m
My,pl,Rd = 204.79 kN*m
My,c,Rd = 204.79 kN*m
MN,y,Rd = 204.79 kN*m
Mb,Rd = 204.79 kN*m

Mz,Ed = 1.06 kN*m
Mz,pl,Rd = 96.72 kN*m
Mz,c,Rd = 96.72 kN*m
MN,z,Rd = 96.72 kN*m

Vy,Ed = -0.59 kN
Vy,T,Rd = 1024.53 kN
Vz,Ed = -34.43 kN
Vz,T,Rd = 399.69 kN
Tt,Ed = -0.00 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
Lcr,low=0.45 m

Mcr = 2913.56 kN*m
Lam_LT = 0.27

Curve,LT - b
fi,LT = 0.50

XLT = 1.00
XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nt,Rd = 0.00 < 1.00 (6.2.3.(1))
(My,Ed/MN,y,Rd)^2.00 + (Mz,Ed/MN,z,Rd)^1.00 = 0.06 < 1.00 (6.2.9.1.(6))
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.09 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

My,Ed/Mb,Rd = 0.21 < 1.00 (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 0.9 cm Verified

Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60

uz = 0.0 cm < uz max = L/200.00 = 0.9 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 496 Beam_main_496

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 89.42 kN	M _{y,Ed} = -103.79 kN*m	M _{z,Ed} = 0.72 kN*m	V _{y,Ed} = 1.99 kN
N _{c,Rd} = 2112.98 kN	M _{y,Ed,max} = -103.79 kN*m	M _{z,Ed,max} = 1.19 kN*m	V _{y,T,Rd} = 1024.53 kN
N _{b,Rd} = 2112.98 kN	M _{y,c,Rd} = 204.79 kN*m	M _{z,c,Rd} = 96.72 kN*m	V _{z,Ed} = 125.58 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	V _{z,T,Rd} = 399.69 kN
	M _{b,Rd} = 176.20 kN*m		T _{t,Ed} = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	M _{cr} = 347.48 kN*m	Curve,LT - b	XLT = 0.83
L _{cr,low} = 2.43 m	Lam _{LT} = 0.77	fi,LT = 0.78	XLT,mod = 0.86

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.26 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$
$$V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00 \quad (6.2.6-7)$$
$$\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$
$$\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.59 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.64 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.64 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /89/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /11/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 497 Column_497

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /4/ \quad 1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tw=0.8 cm
tf=1.2 cm

Iy=7763.18 cm⁴
Wply=744.68 cm³

Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_i,Ed = -18.37 kN
N_t,Rd = 2112.98 kN

M_y,Ed = 21.89 kN*m
M_y,pl,Rd = 204.79 kN*m
M_y,c,Rd = 204.79 kN*m
M_N,y,Rd = 204.79 kN*m

V_y,Ed = 0.00 kN
V_y,T,Rd = 1024.59 kN
V_z,Ed = 10.31 kN
V_z,T,Rd = 399.70 kN
T_t,Ed = 0.00 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

N_i,Ed/N_t,Rd = 0.01 < 1.00 (6.2.3.(1))
M_y,Ed/M_y,c,Rd = 0.11 < 1.00 (6.2.5.(1))
V_y,Ed/V_y,T,Rd = 0.00 < 1.00 (6.2.6-7)
V_z,Ed/V_z,T,Rd = 0.03 < 1.00 (6.2.6-7)
Tau_{ty},Ed/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau_{tz},Ed/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.0 cm < v_x max = L/150.00 = 2.7 cm Verified
Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60
v_y = 0.2 cm < v_y max = L/150.00 = 2.7 cm Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 498 Column_498

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm

gM0=1.00
A_y=64.54 cm²
I_y=7763.18 cm⁴
W_{ply}=744.68 cm³

gM1=1.00
A_z=25.18 cm²
I_z=2768.81 cm⁴
W_{plz}=351.70 cm³

A_x=76.84 cm²
I_x=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_i,Ed = 150.20 kN
N_c,Rd = 2112.98 kN
N_b,Rd = 1421.83 kN

M_y,Ed = -7.17 kN*m
M_y,Ed,max = 18.58 kN*m
M_y,c,Rd = 204.79 kN*m
M_N,y,Rd = 204.79 kN*m

M_z,Ed,max = -0.73 kN*m
M_z,c,Rd = 96.72 kN*m

V_y,Ed = -0.18 kN
V_y,T,Rd = 1024.56 kN
V_z,Ed = -6.31 kN
V_z,T,Rd = 399.70 kN
T_t,Ed = -0.00 kN*m
Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$
 $L_{cr,y} = 4.08 \text{ m}$
 $\lambda_{my} = 40.59$
 $\lambda_{my} = 0.47$
 $\chi_y = 0.90$
 $\eta_{ky} = 0.71$



About z axis:

$L_z = 4.08 \text{ m}$
 $L_{cr,z} = 4.08 \text{ m}$
 $\lambda_{mz} = 67.97$
 $\lambda_{mz} = 0.78$
 $\chi_z = 0.67$
 $\eta_{kz} = 0.36$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{my} = 40.59 < \lambda_{mz} = 67.97 < \lambda_{max} = 210.00$ STABLE
 $N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{ky} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{kz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.15 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{ky} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{kz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.14 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 499 Column_499

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 133.36 \text{ kN}$	$M_{y,Ed} = 17.69 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = 0.71 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = 0.18 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -39.29 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.63 \text{ kN}$
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,Ed} = 7.02 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,T,Rd} = 399.71 \text{ kN}$
			$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 8.10 \text{ m}$

$L_{cr,y} = 8.10 \text{ m}$

$\lambda_{my} = 80.58$

$\lambda_{my} = 0.93$

$\chi_y = 0.64$

$\eta_{yy} = 0.71$



About z axis:

$L_z = 8.10 \text{ m}$

$L_{cr,z} = 8.10 \text{ m}$

$\lambda_{mz} = 134.93$

$\lambda_{mz} = 1.55$

$\chi_z = 0.30$

$\eta_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 80.58 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 134.93 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{yy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1} + \eta_{yz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1})) = 0.24 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{zy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1} + \eta_{zz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1})) = 0.28 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 505 Column_505

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 6.09 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 273.27 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 948.80 \text{ kN}$

$M_{y,Ed} = -5.92 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 10.58 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 203.81 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.00 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.00 \text{ kN}$

$V_{y,T,Rd} = 1024.63 \text{ kN}$

$V_{z,Ed} = -2.71 \text{ kN}$

$V_{z,T,Rd} = 399.71 \text{ kN}$

$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$

$L_{cr,y} = 6.09 \text{ m}$

$\lambda_{my} = 60.59$

$\lambda_{my} = 0.70$

$\chi_y = 0.78$

$\eta_{yy} = 0.68$



About z axis:

$L_z = 6.09 \text{ m}$

$L_{cr,z} = 6.09 \text{ m}$

$\lambda_{mz} = 101.45$

$\lambda_{mz} = 1.17$

$\chi_z = 0.45$

$\eta_{zy} = 0.33$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y} = 60.59 < \lambda_{y,max} = 210.00$ $\lambda_{z} = 101.45 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.31 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$v_y = 0.3 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 507 Beam_main_507

POINT: 3

COORDINATE: x = 1.00 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -7.88 \text{ kN}$	$M_{y,Ed} = -44.33 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 0.22 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -0.12 \text{ kN}$
$N_{t,Rd} = 2112.98 \text{ kN}$	$M_{y,pl,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,pl,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.57 \text{ kN}$
	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = -35.15 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 399.70 \text{ kN}$
	$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$	Curve,LT - b	$X_{LT} = 1.00$
$L_{cr,low}=0.45 \text{ m}$	$\lambda_{m_LT} = 0.27$	$\phi_{LT} = 0.50$	$X_{LT,mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 \cdot 2.00 + (M_{z,Ed}/M_{N,z,Rd})^2 \cdot 1.00 = 0.05 < 1.00$ (6.2.9.1.(6))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.09 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.22 < 1.00 \quad (6.3.2.1.(1))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 508 Beam_main_508

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

gM0=1.00

gM1=1.00

b=24.0 cm

Ay=64.54 cm²

Az=25.18 cm²

Ax=76.84 cm²

tw=0.8 cm

Iy=7763.18 cm⁴

Iz=2768.81 cm⁴

Ix=38.20 cm⁴

tf=1.2 cm

Wply=744.68 cm³

Wplz=351.70 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 91.50 kN

M_{y,Ed} = -103.07 kN*m

M_{z,Ed} = 0.06 kN*m

V_{y,Ed} = -1.04 kN

N_{c,Rd} = 2112.98 kN

M_{y,Ed,max} = -103.07 kN*m

M_{z,Ed,max} = -1.03 kN*m

V_{y,T,Rd} = 1024.55 kN

N_{b,Rd} = 2112.98 kN

M_{y,c,Rd} = 204.79 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{z,Ed} = 124.88 kN

M_{N,y,Rd} = 204.79 kN*m

M_{N,z,Rd} = 96.72 kN*m

V_{z,T,Rd} = 399.69 kN

M_{b,Rd} = 176.20 kN*m

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 347.48 kN*m

Curve,LT - b

XLT = 0.83

L_{cr,low} = 2.43 m

Lam_LT = 0.77

fi,LT = 0.78

XLT,mod = 0.86

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.25 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.31 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.58 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.64 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.64 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 4.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.6 \text{ cm} < u_{z \text{ max}} = L/200.00 = 4.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 509 Column_509

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1*1.00 + 2*0.30 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 24.0 \text{ cm}$

$A_y = 64.54 \text{ cm}^2$

$A_z = 25.18 \text{ cm}^2$

$A_x = 76.84 \text{ cm}^2$

$t_w = 0.8 \text{ cm}$

$I_y = 7763.18 \text{ cm}^4$

$I_z = 2768.81 \text{ cm}^4$

$I_x = 38.20 \text{ cm}^4$

$t_f = 1.2 \text{ cm}$

$W_{ply} = 744.68 \text{ cm}^3$

$W_{plz} = 351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{,Ed} = -16.08 \text{ kN}$

$M_{y,Ed} = 21.36 \text{ kN*m}$

$V_{y,Ed} = 0.00 \text{ kN}$

$N_{t,Rd} = 2112.98 \text{ kN}$

$M_{y,pl,Rd} = 204.79 \text{ kN*m}$

$V_{y,T,Rd} = 1024.62 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$V_{z,Ed} = 9.76 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN*m}$

$V_{z,T,Rd} = 399.71 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{,Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.10 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.2 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 510 Column_510

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 151.64$ kN	$M_{y,Ed} = -7.77$ kN*m		$V_{y,Ed} = 0.05$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = 19.13$ kN*m	$M_{z,Ed,max} = 0.19$ kN*m	$V_{y,T,Rd} = 1024.63$ kN
$N_{b,Rd} = 1421.83$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = -6.59$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.71$ kN
			$T_{t,Ed} = 0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08$ m	$\text{Lam}_y = 0.47$
$L_{cr,y} = 4.08$ m	$X_y = 0.90$
$\text{Lam}_y = 40.59$	$k_{yy} = 0.71$



About z axis:

$L_z = 4.08$ m	$\text{Lam}_z = 0.78$
$L_{cr,z} = 4.08$ m	$X_z = 0.67$
$\text{Lam}_z = 67.97$	$k_{zy} = 0.36$

VERIFICATION FORMULAS:

Section strength check:

$$\begin{aligned} N_{Ed}/N_{c,Rd} &= 0.07 < 1.00 \quad (6.2.4.(1)) \\ M_{y,Ed}/M_{y,c,Rd} &= 0.04 < 1.00 \quad (6.2.5.(1)) \\ V_{y,Ed}/V_{y,T,Rd} &= 0.00 < 1.00 \quad (6.2.6-7) \\ V_{z,Ed}/V_{z,T,Rd} &= 0.02 < 1.00 \quad (6.2.6-7) \\ \tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) &= 0.00 < 1.00 \quad (6.2.6) \\ \tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) &= 0.00 < 1.00 \quad (6.2.6) \end{aligned}$$

Global stability check of member:

$$\begin{aligned} \text{Lambda}_y &= 40.59 < \text{Lambda}_{max} = 210.00 \quad \text{Lambda}_z = 67.97 < \text{Lambda}_{max} = 210.00 \quad \text{STABLE} \\ N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) &= 0.15 < 1.00 \quad (6.3.3.(4)) \\ N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) &= 0.14 < 1.00 \quad (6.3.3.(4)) \end{aligned}$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /95/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$$

$$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /29/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 511 Column_511

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{,Ed} = 132.12$ kN	$M_{y,Ed} = 17.44$ kN*m	$M_{z,Ed,max} = -0.71$ kN*m	$V_{y,Ed} = -0.17$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -38.90$ kN*m		$V_{y,T,Rd} = 1024.64$ kN
$N_{b,Rd} = 628.77$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 6.94$ kN
	$MN_{,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.72$ kN
			$T_{t,Ed} = -0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10$ m	$Lam_y = 0.93$
$L_{cr,y} = 8.10$ m	$X_y = 0.64$
$Lam_y = 80.58$	$k_{yy} = 0.71$



About z axis:

$L_z = 8.10$ m	$Lam_z = 1.55$
$L_{cr,z} = 8.10$ m	$X_z = 0.30$
$Lam_z = 134.93$	$k_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{,Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$Lambda_{y} = 80.58 < Lambda_{max} = 210.00$ $Lambda_{z} = 134.93 < Lambda_{max} = 210.00$ STABLE
 $N_{,Ed}/(X_y*N_{c,Rd}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*My,Rk/gM1) + k_{yz}*M_{z,Ed,max}/(Mz,Rk/gM1) = 0.24 < 1.00$ (6.3.3.(4))
 $N_{,Ed}/(X_z*N_{c,Rd}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*My,Rk/gM1) + k_{zz}*M_{z,Ed,max}/(Mz,Rk/gM1) = 0.28 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0$ cm < $v_x max = L/150.00 = 5.4$ cm Verified
Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60
 $v_y = 0.4$ cm < $v_y max = L/150.00 = 5.4$ cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 517 Column_517

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 270.86$ kN	$M_{y,Ed} = -6.13$ kN*m	$M_{z,Ed,max} = -0.00$ kN*m	$V_{y,Ed} = -0.00$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = 10.75$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{y,T,Rd} = 1024.63$ kN
$N_{b,Rd} = 948.80$ kN	$M_{y,c,Rd} = 204.79$ kN*m		$V_{z,Ed} = -2.77$ kN
	$MN_{y,Rd} = 204.08$ kN*m		$V_{z,T,Rd} = 399.71$ kN
			$T_{t,Ed} = 0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09$ m	$\text{Lam}_y = 0.70$
$L_{cr,y} = 6.09$ m	$X_y = 0.78$
$\text{Lam}_y = 60.59$	$k_{yy} = 0.68$



About z axis:

$L_z = 6.09$ m	$\text{Lam}_z = 1.17$
$L_{cr,z} = 6.09$ m	$X_z = 0.45$
$\text{Lam}_z = 101.45$	$k_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_y = 60.59 < \text{Lambda}_{max} = 210.00$ $\text{Lambda}_z = 101.45 < \text{Lambda}_{max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0$ cm < $v_{x,max} = L/150.00 = 4.1$ cm Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

$v_y = 0.4$ cm < $v_{y,max} = L/150.00 = 4.1$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 519 Column_519

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /62/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 149.59 kN	My _{Ed} = 59.20 kN*m	Mz _{Ed} = -0.67 kN*m	Vy _{Ed} = -2.08 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = 59.20 kN*m	Mz _{Ed,max} = -0.67 kN*m	Vy _{T,Rd} = 1019.67 kN
N _{b,Rd} = 2112.98 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = -231.39 kN
	My _{V,Rd} = 204.22 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 398.51 kN
			Tt _{Ed} = -0.06 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 0.30 m	Lam _y = 0.03
Lcr,y = 0.30 m	Xy = 1.00
Lamy = 2.98	ky _y = 0.74



About z axis:

Lz = 0.30 m	Lam _z = 0.06
Lcr,z = 0.30 m	Xz = 1.00
Lamz = 5.00	kyz = 0.53

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,Rd} + M_{z,Ed}/M_{z,Rd} = 0.30 < 1.00$ (6.2.8)
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.09 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.58 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y} = 2.98 < \lambda_{y,max} = 210.00$ $\lambda_{z} = 5.00 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.29 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.19 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 0.2 \text{ cm}$ Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00
 $v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 0.2 \text{ cm}$ Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 520 Beam_main_520

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00
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Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

b=24.0 cm
tw=0.8 cm
tf=1.2 cm

Ay=64.54 cm²
Iy=7763.18 cm⁴
Wply=744.68 cm³

Az=25.18 cm²
Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ax=76.84 cm²
Ix=38.20 cm⁴

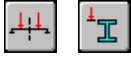
INTERNAL FORCES AND CAPACITIES:

N,Ed = 138.39 kN
Nc,Rd = 2112.98 kN
Nb,Rd = 2112.98 kN

My,Ed = -9.29 kN*m
My,Ed,max = -10.13 kN*m
My,c,Rd = 204.79 kN*m
MN,y,Rd = 204.79 kN*m
Mb,Rd = 184.92 kN*m

Mz,Ed = 1.27 kN*m
Mz,Ed,max = 25.38 kN*m
Mz,c,Rd = 96.72 kN*m
MN,z,Rd = 96.72 kN*m

Vy,Ed = 14.63 kN
Vy,T,Rd = 1014.24 kN
Vz,Ed = 11.44 kN
Vz,T,Rd = 397.19 kN
Tt,Ed = -0.13 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
Lcr,low=1.85 m

Mcr = 435.17 kN*m
Lam_LT = 0.69

Curve,LT - b
fi,LT = 0.73

XLT = 0.88
XLT,mod = 0.90

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.07 < 1.00 (6.2.4.(1))
(My,Ed/MN,y,Rd)^{2.00} + (Mz,Ed/MN,z,Rd)^{1.00} = 0.02 < 1.00 (6.2.9.1.(6))
Vy,Ed/Vy,T,Rd = 0.01 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.03 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.03 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.02 < 1.00 (6.2.6)

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.38 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.38 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.1 cm < uy max = L/200.00 = 3.7 cm Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00
uz = 0.2 cm < uz max = L/200.00 = 3.7 cm Verified
Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 521 Beam_main_521

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm

gM0=1.00
Ay=64.54 cm²
Iy=7763.18 cm⁴
Wply=744.68 cm³

gM1=1.00
Az=25.18 cm²
Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ax=76.84 cm²
Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 69.77 kN

My,Ed = -8.61 kN*m

Mz,Ed = 21.86 kN*m

Vy,Ed = 13.02 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Nc,Rd = 2112.98 kN	My,Ed,max = -8.61 kN*m	Mz,Ed,max = 21.86 kN*m	Vy,T,Rd = 1020.45 kN
Nb,Rd = 2112.98 kN	My,c,Rd = 204.79 kN*m	Mz,c,Rd = 96.72 kN*m	Vz,Ed = 5.91 kN
	MN,y,Rd = 204.79 kN*m	MN,z,Rd = 96.72 kN*m	Vz,T,Rd = 398.70 kN
	Mb,Rd = 204.79 kN*m		Tt,Ed = -0.05 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2913.56 kN*m	Curve,LT - b	XLT = 1.00
Lcr,low=0.45 m	Lam_LT = 0.27	fi,LT = 0.50	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.23 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00$ (6.2.6)
Global stability check of member:
 $M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.30 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.30 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$
 $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 522 Beam_main_522

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 85.38 kN	My,Ed = -105.50 kN*m	Mz,Ed = 6.81 kN*m	Vy,Ed = 8.62 kN
Nc,Rd = 2112.98 kN	My,Ed,max = -105.50 kN*m	Mz,Ed,max = 6.81 kN*m	Vy,T,Rd = 1024.25 kN
Nb,Rd = 2112.98 kN	My,c,Rd = 204.79 kN*m	Mz,c,Rd = 96.72 kN*m	Vz,Ed = 126.35 kN
	MN,y,Rd = 204.79 kN*m	MN,z,Rd = 96.72 kN*m	Vz,T,Rd = 399.62 kN
	Mb,Rd = 176.20 kN*m		Tt,Ed = -0.00 kN*m
			Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,low} = 2.43 \text{ m}$

$M_{cr} = 347.48 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 0.77$

Curve,LT - b
 $\eta_{LT} = 0.78$

$X_{LT} = 0.83$
 $X_{LT,mod} = 0.86$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.34 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.60 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.71 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.71 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 523 Column_523

POINT: 3

COORDINATE: $x = 1.00$ $L = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /53/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$
 $b = 24.0 \text{ cm}$
 $t_w = 0.8 \text{ cm}$
 $t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 64.54 \text{ cm}^2$
 $I_y = 7763.18 \text{ cm}^4$
 $W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 25.18 \text{ cm}^2$
 $I_z = 2768.81 \text{ cm}^4$
 $W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$
 $I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 203.02 \text{ kN}$
 $N_{c,Rd} = 2112.98 \text{ kN}$
 $N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,Ed} = 19.42 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = -29.95 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 204.79 \text{ kN}\cdot\text{m}$

$M_{z,Ed,max} = -1.71 \text{ kN}\cdot\text{m}$
 $M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = -0.42 \text{ kN}$
 $V_{y,T,Rd} = 1024.46 \text{ kN}$
 $V_{z,Ed} = 12.10 \text{ kN}$
 $V_{z,T,Rd} = 399.67 \text{ kN}$
 $T_{t,Ed} = -0.00 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{my} = 0.47$

$\chi_y = 0.90$

$\eta_{yy} = 0.65$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{mz} = 0.78$

$\chi_z = 0.67$

$\eta_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 40.59 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 67.97 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{yy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1} + \eta_{yz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1})) = 0.21 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{zy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1} + \eta_{zz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1})) = 0.21 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 524 Column_524

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 108.42 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,Ed} = -9.24 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 20.66 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.12 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.03 \text{ kN}$

$V_{y,T,Rd} = 1024.54 \text{ kN}$

$V_{z,Ed} = -7.33 \text{ kN}$

$V_{z,T,Rd} = 399.69 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{my} = 0.47$

$\chi_y = 0.90$

$\eta_{yy} = 0.70$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{mz} = 0.78$

$\chi_z = 0.67$

$\eta_{zy} = 0.36$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 40.59 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 67.97 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.13 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.11 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$ Verified

$v_y = 0.3 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 525 Column_525

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 162.06 \text{ kN}$	$M_{y,Ed} = 25.78 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 0.13 \text{ kN}$	
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -44.49 \text{ kN} \cdot \text{m}$	$M_{y,T,Rd} = 1024.19 \text{ kN}$	
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 8.66 \text{ kN}$	
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 399.61 \text{ kN}$	
		$T_{t,Ed} = -0.01 \text{ kN} \cdot \text{m}$	
		Class of section = 1	



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10 \text{ m}$ $\lambda_{m,y} = 0.93$
 $L_{cr,y} = 8.10 \text{ m}$ $X_y = 0.64$
 $\lambda_{m,y} = 80.58$ $k_{yy} = 0.68$



About z axis:

$L_z = 8.10 \text{ m}$ $\lambda_{m,z} = 1.55$
 $L_{cr,z} = 8.10 \text{ m}$ $X_z = 0.30$
 $\lambda_{m,z} = 134.93$ $k_{zy} = 0.32$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.13 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

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$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 80.58 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 134.93 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.27 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.33 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 531 Column_531

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$b = 24.0 \text{ cm}$$

$$t_w = 0.8 \text{ cm}$$

$$t_f = 1.2 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 64.54 \text{ cm}^2$$

$$I_y = 7763.18 \text{ cm}^4$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 25.18 \text{ cm}^2$$

$$I_z = 2768.81 \text{ cm}^4$$

$$W_{plz} = 351.70 \text{ cm}^3$$

$$A_x = 76.84 \text{ cm}^2$$

$$I_x = 38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 217.31 \text{ kN}$$

$$M_{y,Ed} = 23.84 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = 23.84 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 1873.30 \text{ kN}$$

$$M_{z,Ed,max} = -0.03 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.01 \text{ kN}$$

$$V_{y,T,Rd} = 1024.38 \text{ kN}$$

$$V_{z,Ed} = 16.06 \text{ kN}$$

$$V_{z,T,Rd} = 399.65 \text{ kN}$$

$$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 2.19 \text{ m}$$

$$L_{cr,y} = 2.19 \text{ m}$$

$$\lambda_{my} = 21.79$$

$$\lambda_{m,y} = 0.25$$

$$X_y = 0.98$$

$$k_{yy} = 0.68$$



About z axis:

$$L_z = 2.19 \text{ m}$$

$$L_{cr,z} = 2.19 \text{ m}$$

$$\lambda_{mz} = 36.48$$

$$\lambda_{m,z} = 0.42$$

$$X_z = 0.89$$

$$k_{zy} = 0.35$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.12 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.12 < 1.00 \quad (6.2.9.1.(2))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 21.79 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 36.48 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

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$$N_{Ed}/(Xy \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{yz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.18 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(Xz \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{zz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.16 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 1.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$$v_y = 0.2 \text{ cm} < v_{y \text{ max}} = L/150.00 = 1.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 532 Column_532

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h=23.0 \text{ cm}$$

$$b=24.0 \text{ cm}$$

$$t_w=0.8 \text{ cm}$$

$$t_f=1.2 \text{ cm}$$

$$gM0=1.00$$

$$A_y=64.54 \text{ cm}^2$$

$$I_y=7763.18 \text{ cm}^4$$

$$W_{ply}=744.68 \text{ cm}^3$$

$$gM1=1.00$$

$$A_z=25.18 \text{ cm}^2$$

$$I_z=2768.81 \text{ cm}^4$$

$$W_{plz}=351.70 \text{ cm}^3$$

$$A_x=76.84 \text{ cm}^2$$

$$I_x=38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 272.41 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 948.80 \text{ kN}$$

$$M_{y,Ed} = -5.24 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = 10.94 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 203.91 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 0.00 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 0.00 \text{ kN}$$

$$V_{y,T,Rd} = 1024.59 \text{ kN}$$

$$V_{z,Ed} = -2.66 \text{ kN}$$

$$V_{z,T,Rd} = 399.70 \text{ kN}$$

$$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 6.09 \text{ m}$$

$$L_{cr,y} = 6.09 \text{ m}$$

$$L_{amy} = 60.59$$

$$\lambda_{m,y} = 0.70$$

$$X_y = 0.78$$

$$k_{yy} = 0.70$$



About z axis:

$$L_z = 6.09 \text{ m}$$

$$L_{cr,z} = 6.09 \text{ m}$$

$$\lambda_{m,z} = 101.45$$

$$\lambda_{m,z} = 1.17$$

$$X_z = 0.45$$

$$k_{zy} = 0.34$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.13 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00 \quad (6.2.9.1.(2))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{m,y} = 60.59 < \lambda_{m,max} = 210.00 \quad \lambda_{m,z} = 101.45 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(Xy \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{yz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.20 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(Xz \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) + k_{zz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.31 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x \text{ max}} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$

$v_y = 0.4 \text{ cm} < v_{y \text{ max}} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 534 Column_534

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /62/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

gM0=1.00

gM1=1.00

b=24.0 cm

Ay=64.54 cm²

Az=25.18 cm²

Ax=76.84 cm²

tw=0.8 cm

Iy=7763.18 cm⁴

Iz=2768.81 cm⁴

Ix=38.20 cm⁴

tf=1.2 cm

Wply=744.68 cm³

Wplz=351.70 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 136.23 kN

M_{y,Ed} = 53.95 kN*m

M_{z,Ed} = -1.96 kN*m

V_{y,Ed} = -6.34 kN

N_{c,Rd} = 2112.98 kN

M_{y,Ed,max} = 53.95 kN*m

M_{z,Ed,max} = -1.96 kN*m

V_{y,T,Rd} = 1017.74 kN

N_{b,Rd} = 2112.98 kN

M_{y,c,Rd} = 204.79 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{z,Ed} = -211.12 kN

M_{y,V,Rd} = 204.71 kN*m

MN_{z,Rd} = 96.72 kN*m

V_{z,T,Rd} = 398.04 kN

T_{t,Ed} = -0.08 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 0.30 m

Lam_y = 0.03

L_{cr,y} = 0.30 m

X_y = 1.00

Lam_y = 2.98

k_{yy} = 0.74



About z axis:

L_z = 0.30 m

Lam_z = 0.06

L_{cr,z} = 0.30 m

X_z = 1.00

Lam_z = 5.00

k_{yz} = 0.52

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,V,Rd} + M_{z,Ed}/M_{z,c,Rd} = 0.28 < 1.00$ (6.2.8)

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.53 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.02 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 2.98 < \lambda_{y,max} = 210.00$ $\lambda_{z,Ed} = 5.00 < \lambda_{z,max} = 210.00$ STABLE

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.18 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$v_x = 0.0 \text{ cm} < v_{x \text{ max}} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$

$v_y = 0.0 \text{ cm} < v_{y \text{ max}} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 535 Beam_main_535

POINT: 1

COORDINATE: x = 0.50 L = 3.70 m

LOADS:

Governing Load Case: 10 ULS /12/ $1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$

$b=24.0 \text{ cm}$

$tw=0.8 \text{ cm}$

$tf=1.2 \text{ cm}$

$gM0=1.00$

$A_y=64.54 \text{ cm}^2$

$I_y=7763.18 \text{ cm}^4$

$W_{ply}=744.68 \text{ cm}^3$

$gM1=1.00$

$A_z=25.18 \text{ cm}^2$

$I_z=2768.81 \text{ cm}^4$

$W_{plz}=351.70 \text{ cm}^3$

$A_x=76.84 \text{ cm}^2$

$I_x=38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{,Ed} = 15.87 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed} = -56.38 \text{ kN*m}$

$M_{y,Ed,max} = -64.24 \text{ kN*m}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$MN_{y,Rd} = 204.79 \text{ kN*m}$

$M_{b,Rd} = 184.92 \text{ kN*m}$

$M_{z,Ed} = 0.46 \text{ kN*m}$

$M_{z,Ed,max} = 4.00 \text{ kN*m}$

$M_{z,c,Rd} = 96.72 \text{ kN*m}$

$MN_{z,Rd} = 96.72 \text{ kN*m}$

$V_{y,Ed} = 0.72 \text{ kN}$

$V_{y,T,Rd} = 1024.07 \text{ kN}$

$V_{z,Ed} = 98.73 \text{ kN}$

$V_{z,T,Rd} = 399.58 \text{ kN}$

$T_{t,Ed} = 0.01 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,low} = 1.85 \text{ m}$

$M_{cr} = 435.17 \text{ kN*m}$

$\lambda_{m,LT} = 0.69$

Curve,LT - b

$\phi_{i,LT} = 0.73$

$XLT = 0.88$

$XLT_{mod} = 0.90$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{,Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/MN_{y,Rd})^2 + (M_{z,Ed}/MN_{z,Rd}) = 0.08 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.25 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.35 < 1.00$ (6.3.2.1.(1))

$N_{,Ed}/(X_y*N_{c,Rd}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.40 < 1.00$ (6.3.3.(4))

$N_{,Ed}/(X_z*N_{c,Rd}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.40 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y \text{ max}} = L/200.00 = 3.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.2 \text{ cm} < u_{z \text{ max}} = L/200.00 = 3.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 536 Beam_main_536

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$tw=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$tf=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 86.58$ kN	$M_{y,Ed} = -10.30$ kN*m	$M_{z,Ed} = 21.29$ kN*m	$V_{y,Ed} = 12.19$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -10.30$ kN*m	$M_{z,Ed,max} = 21.29$ kN*m	$V_{y,T,Rd} = 1020.46$ kN
$N_{b,Rd} = 2112.98$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 8.56$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 398.70$ kN
	$M_{b,Rd} = 204.79$ kN*m		$T_{t,Ed} = -0.05$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2913.56$ kN*m	Curve,LT - b	$XLT = 1.00$
$L_{cr,low} = 0.45$ m	$\lambda_{m,LT} = 0.27$	$\phi_{i,LT} = 0.50$	$XLT_{mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.22 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.31 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.31 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 0.9$ cm Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00
 $u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 0.9$ cm Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 537 Beam_main_537

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 85.68$ kN	$M_{y,Ed} = -105.83$ kN*m	$M_{z,Ed} = 7.70$ kN*m	$V_{y,Ed} = 7.85$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -105.83$ kN*m	$M_{z,Ed,max} = 7.70$ kN*m	$V_{y,T,Rd} = 1024.21$ kN
$N_{b,Rd} = 2112.98$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 127.33$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 399.61$ kN
	$Mb,Rd = 176.20$ kN*m		$Tt,Ed = -0.01$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 347.48$ kN*m	Curve,LT - b	$XLT = 0.83$
$L_{cr,low} = 2.43$ m	$\lambda_{m,LT} = 0.77$	$\phi_{i,LT} = 0.78$	$XLT_{mod} = 0.86$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.35 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.60 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.72 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.72 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.2$ cm $< u_{y,max} = L/200.00 = 4.9$ cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$u_z = 0.6$ cm $< u_{z,max} = L/200.00 = 4.9$ cm Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 538 Column_538

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$tw=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$tf=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 164.95$ kN	$M_{y,Ed} = 28.02$ kN*m		$V_{y,Ed} = -0.60$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -37.92$ kN*m	$M_{z,Ed,max} = -2.46$ kN*m	$V_{y,T,Rd} = 1024.51$ kN
$N_{b,Rd} = 1421.83$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 16.16$ kN
	$M_{N,y,Rd} = 204.79$ kN*m		$V_{z,T,Rd} = 399.68$ kN
			$T_{t,Ed} = -0.00$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08$ m	$Lam_y = 0.47$
$L_{cr,y} = 4.08$ m	$X_y = 0.90$
$Lam_y = 40.59$	$k_{yy} = 0.63$



About z axis:

$L_z = 4.08$ m	$Lam_z = 0.78$
$L_{cr,z} = 4.08$ m	$X_z = 0.67$
$Lam_z = 67.97$	$k_{zy} = 0.32$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.14 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 40.59 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 67.97 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.22 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1$ cm < $v_{x,max} = L/150.00 = 2.7$ cm Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$v_y = 0.3$ cm < $v_{y,max} = L/150.00 = 2.7$ cm Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 539 Column_539

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 115.09 kN	My _{Ed} = -10.23 kN*m	Mz _{Ed,max} = 0.44 kN*m	Vy _{Ed} = 0.11 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = 21.67 kN*m		Vy _{T,Rd} = 1024.47 kN
N _{b,Rd} = 1421.83 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = -7.82 kN
	MN _{y,Rd} = 204.79 kN*m		Vz _{T,Rd} = 399.68 kN
			Tt _{Ed} = 0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.08 m	Lam _y = 0.47
Lcr,y = 4.08 m	Xy = 0.90
Lamy = 40.59	kyy = 0.69



About z axis:

Lz = 4.08 m	Lam _z = 0.78
Lcr,z = 4.08 m	Xz = 0.67
Lamz = 67.97	kzy = 0.35

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.05 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 40.59 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 67.97 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.14 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$v_y = 0.3 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 540 Column_540

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tw=0.8 cm
tf=1.2 cm

Iy=7763.18 cm⁴
Wply=744.68 cm³

Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 123.47 kN
N_{c,Rd} = 2112.98 kN
N_{b,Rd} = 628.77 kN

M_{y,Ed} = 25.96 kN*m
M_{y,Ed,max} = -45.10 kN*m
M_{y,c,Rd} = 204.79 kN*m
M_{N,y,Rd} = 204.79 kN*m

M_{z,Ed,max} = -0.01 kN*m
M_{z,c,Rd} = 96.72 kN*m

V_{y,Ed} = -0.00 kN
V_{y,T,Rd} = 1024.04 kN
V_{z,Ed} = 8.77 kN
V_{z,T,Rd} = 399.57 kN
T_{t,Ed} = -0.01 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 8.10 m
L_{cr,y} = 8.10 m
L_{amy} = 80.58
L_{am,y} = 0.93
X_y = 0.64
k_{yy} = 0.68



About z axis:

L_z = 8.10 m
L_{cr,z} = 8.10 m
L_{amz} = 134.93
L_{am,z} = 1.55
X_z = 0.30
k_{zy} = 0.33

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.06 < 1.00 (6.2.4.(1))
M_{y,Ed}/M_{y,c,Rd} = 0.13 < 1.00 (6.2.5.(1))
V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 (6.2.6-7)
V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 (6.2.6-7)
Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda_y = 80.58 < Lambda_{max} = 210.00 Lambda_z = 134.93 < Lambda_{max} = 210.00 STABLE
N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00 (6.3.3.(4))
N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.2 cm < v_{x,max} = L/150.00 = 5.4 cm Verified
Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60
v_y = 0.6 cm < v_{y,max} = L/150.00 = 5.4 cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 546 Column_546

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm
gM0=1.00
A_y=64.54 cm²
I_y=7763.18 cm⁴
W_{ply}=744.68 cm³

gM1=1.00
A_z=25.18 cm²
I_z=2768.81 cm⁴
W_{plz}=351.70 cm³
A_x=76.84 cm²
I_x=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 218.11 kN
N_{c,Rd} = 2112.98 kN

M_{y,Ed} = 23.85 kN*m
M_{y,Ed,max} = 23.85 kN*m

M_{z,Ed,max} = -0.03 kN*m

V_{y,Ed} = -0.02 kN
V_{y,T,Rd} = 1024.34 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Nb,Rd = 1873.30 kN

My,c,Rd = 204.79 kN*m
MN,y,Rd = 204.79 kN*m

Mz,c,Rd = 96.72 kN*m

Vz,Ed = 15.96 kN
Vz,T,Rd = 399.64 kN
Tt,Ed = -0.00 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 2.19 m
Lcr,y = 2.19 m
Lamy = 21.79

Lam_y = 0.25
Xy = 0.98
kyy = 0.68



About z axis:

Lz = 2.19 m
Lcr,z = 2.19 m
Lamz = 36.48

Lam_z = 0.42
Xz = 0.89
kzy = 0.35

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.10 < 1.00 (6.2.4.(1))
My,Ed/My,c,Rd = 0.12 < 1.00 (6.2.5.(1))
My,Ed/MN,y,Rd = 0.12 < 1.00 (6.2.9.1.(2))
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.04 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda,y = 21.79 < Lambda,max = 210.00 Lambda,z = 36.48 < Lambda,max = 210.00 STABLE
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) + kyz*Mz,Ed,max/(Mz,Rk/gM1) = 0.18 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) + kzz*Mz,Ed,max/(Mz,Rk/gM1) = 0.16 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

vx = 0.0 cm < vx max = L/150.00 = 1.5 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

vy = 0.3 cm < vy max = L/150.00 = 1.5 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 547 Column_547

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm
b=24.0 cm
tw=0.8 cm
tf=1.2 cm

gM0=1.00
Ay=64.54 cm²
Iy=7763.18 cm⁴
Wply=744.68 cm³

gM1=1.00
Az=25.18 cm²
Iz=2768.81 cm⁴
Wplz=351.70 cm³

Ax=76.84 cm²
Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 272.30 kN
Nc,Rd = 2112.98 kN
Nb,Rd = 948.80 kN

My,Ed = -5.65 kN*m
My,Ed,max = 11.32 kN*m
My,c,Rd = 204.79 kN*m
MN,y,Rd = 203.92 kN*m

Mz,Ed,max = 0.01 kN*m
Mz,c,Rd = 96.72 kN*m

Vy,Ed = 0.00 kN
Vy,T,Rd = 1024.55 kN
Vz,Ed = -2.79 kN
Vz,T,Rd = 399.69 kN
Tt,Ed = 0.00 kN*m
Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$
 $L_{cr,y} = 6.09 \text{ m}$
 $\lambda_{my} = 60.59$
 $\lambda_{my} = 0.70$
 $X_y = 0.78$
 $k_{yy} = 0.70$



About z axis:

$L_z = 6.09 \text{ m}$
 $L_{cr,z} = 6.09 \text{ m}$
 $\lambda_{mz} = 101.45$
 $\lambda_{mz} = 1.17$
 $X_z = 0.45$
 $k_{zy} = 0.34$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{my} = 60.59 < \lambda_{max} = 210.00$ $\lambda_{mz} = 101.45 < \lambda_{max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rd}/g_{M1}) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rd}/g_{M1}) = 0.31 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 549 Column_549

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /1/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 84.10 \text{ kN}$	$M_{y,Ed} = 31.55 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 4.29 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = 11.86 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 31.55 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = 4.29 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 941.00 \text{ kN}$
$N_{b,Rd} = 2112.98 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = -129.02 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 379.65 \text{ kN}$
			$T_{t,Ed} = 0.99 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 0.30 \text{ m}$

$L_{cr,y} = 0.30 \text{ m}$

$\lambda_{my} = 2.98$

$\lambda_{m,y} = 0.03$

$\chi_y = 1.00$

$\kappa_{yy} = 0.74$



About z axis:

$L_z = 0.30 \text{ m}$

$L_{cr,z} = 0.30 \text{ m}$

$\lambda_{mz} = 5.00$

$\lambda_{m,z} = 0.06$

$\chi_z = 1.00$

$\kappa_{yz} = 0.56$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.07 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.34 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.20 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.12 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 2.98 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 5.00 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.18 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.13 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 0.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 550 Beam_main_550

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 153.68 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed} = -7.16 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = -7.16 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 184.92 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = 1.22 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 26.78 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 12.02 \text{ kN}$

$V_{y,T,Rd} = 1014.46 \text{ kN}$

$V_{z,Ed} = 6.10 \text{ kN}$

$V_{z,T,Rd} = 397.24 \text{ kN}$

$T_{t,Ed} = -0.12 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,low} = 1.85 \text{ m}$

$M_{cr} = 435.17 \text{ kN} \cdot \text{m}$

$\lambda_{m,LT} = 0.69$

Curve,LT - b

$\phi_{LT} = 0.73$

$XLT = 0.88$

$XLT_{mod} = 0.90$

BUCKLING PARAMETERS:



About y axis:

$\kappa_{yy} = 1.00$



About z axis:

$\kappa_{zz} = 1.00$

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VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.07 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.39 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.39 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y,max} = L/200.00 = 3.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /28/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 3.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /28/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 551 Beam_main_551

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /1/ \quad 1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$g_{M0} = 1.00$$

$$g_{M1} = 1.00$$

$$b = 24.0 \text{ cm}$$

$$A_y = 64.54 \text{ cm}^2$$

$$A_z = 25.18 \text{ cm}^2$$

$$A_x = 76.84 \text{ cm}^2$$

$$t_w = 0.8 \text{ cm}$$

$$I_y = 7763.18 \text{ cm}^4$$

$$I_z = 2768.81 \text{ cm}^4$$

$$I_x = 38.20 \text{ cm}^4$$

$$t_f = 1.2 \text{ cm}$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$W_{plz} = 351.70 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 97.81 \text{ kN}$$

$$M_{y,Ed} = -11.40 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 23.06 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 13.20 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$M_{y,Ed,max} = -11.40 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 23.06 \text{ kN} \cdot \text{m}$$

$$V_{y,T,Rd} = 1020.13 \text{ kN}$$

$$N_{b,Rd} = 2112.98 \text{ kN}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 11.11 \text{ kN}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{z,T,Rd} = 398.62 \text{ kN}$$

$$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$T_{t,Ed} = -0.06 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT - b}$$

$$X_{LT} = 1.00$$

$$L_{cr,low} = 0.45 \text{ m}$$

$$\lambda_{m_LT} = 0.27$$

$$f_{i,LT} = 0.50$$

$$X_{LT,mod} = 1.00$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.24 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

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$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.34 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.34 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 552 Beam_main_552

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$g_{M0} = 1.00$$

$$g_{M1} = 1.00$$

$$b = 24.0 \text{ cm}$$

$$A_y = 64.54 \text{ cm}^2$$

$$A_z = 25.18 \text{ cm}^2$$

$$A_x = 76.84 \text{ cm}^2$$

$$t_w = 0.8 \text{ cm}$$

$$I_y = 7763.18 \text{ cm}^4$$

$$I_z = 2768.81 \text{ cm}^4$$

$$I_x = 38.20 \text{ cm}^4$$

$$t_f = 1.2 \text{ cm}$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$W_{plz} = 351.70 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 3.17 \text{ kN}$$

$$M_{y,Ed} = -59.35 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 12.57 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 13.82 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$M_{y,Ed,max} = -59.35 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 12.57 \text{ kN} \cdot \text{m}$$

$$V_{y,T,Rd} = 1024.18 \text{ kN}$$

$$N_{b,Rd} = 2112.98 \text{ kN}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 68.00 \text{ kN}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{z,T,Rd} = 399.60 \text{ kN}$$

$$M_{b,Rd} = 176.20 \text{ kN} \cdot \text{m}$$

$$T_{t,Ed} = -0.01 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 347.48 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT - b}$$

$$X_{LT} = 0.83$$

$$L_{cr,low} = 2.43 \text{ m}$$

$$\lambda_{m,LT} = 0.77$$

$$f_{i,LT} = 0.78$$

$$X_{LT,mod} = 0.86$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.21 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.17 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.47 < 1.00 \quad (6.3.3.(4))$$

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$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(X_{LT} \cdot My_{Rk}/gM1) + k_{zz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.47 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.3 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 553 Column_553

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 67.89 \text{ kN}$	$My_{Ed} = 12.26 \text{ kN} \cdot \text{m}$		$Vy_{Ed} = 3.12 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$My_{Ed,max} = -13.63 \text{ kN} \cdot \text{m}$	$Mz_{Ed,max} = 12.73 \text{ kN} \cdot \text{m}$	$Vy_{T,Rd} = 1023.51 \text{ kN}$
$N_{b,Rd} = 1421.83 \text{ kN}$	$My_{c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$Mz_{c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$Vz_{Ed} = 6.35 \text{ kN}$
	$MN_{y,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$Vz_{T,Rd} = 399.44 \text{ kN}$
			$Tt_{Ed} = 0.01 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$	$\lambda_{m,y} = 0.47$
$L_{cr,y} = 4.08 \text{ m}$	$\chi_y = 0.90$
$\lambda_{m,y} = 40.59$	$\chi_y = 0.60$



About z axis:

$L_z = 4.08 \text{ m}$	$\lambda_{m,z} = 0.78$
$L_{cr,z} = 4.08 \text{ m}$	$\chi_z = 0.67$
$\lambda_{m,z} = 67.97$	$k_{zy} = 0.31$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$My_{Ed}/My_{c,Rd} = 0.06 < 1.00 \quad (6.2.5.(1))$$

$$Vy_{Ed}/Vy_{T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$Vz_{Ed}/Vz_{T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{m,y} = 40.59 < \lambda_{m,max} = 210.00 \quad \lambda_{m,z} = 67.97 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(X_{LT} \cdot My_{Rk}/gM1) + k_{yz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.15 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(X_{LT} \cdot My_{Rk}/gM1) + k_{zz} \cdot Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.17 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$v_y = 0.3 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 554 Column_554

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 31.57 \text{ kN}$	$M_{y,Ed} = -17.92 \text{ kN*m}$		$V_{y,Ed} = 0.40 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 18.21 \text{ kN*m}$	$M_{z,Ed,max} = 1.65 \text{ kN*m}$	$V_{y,T,Rd} = 1024.47 \text{ kN}$
$N_{b,Rd} = 1421.83 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{z,Ed} = -8.85 \text{ kN}$
	$MN_{y,Rd} = 204.79 \text{ kN*m}$		$V_{z,T,Rd} = 399.67 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$	$\Lambda_{m,y} = 0.47$
$L_{cr,y} = 4.08 \text{ m}$	$X_y = 0.90$
$\Lambda_{m,y} = 40.59$	$k_{y,y} = 0.58$



About z axis:

$L_z = 4.08 \text{ m}$	$\Lambda_{m,z} = 0.78$
$L_{cr,z} = 4.08 \text{ m}$	$X_z = 0.67$
$\Lambda_{m,z} = 67.97$	$k_{z,y} = 0.30$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\Lambda_{m,y} = 40.59 < \Lambda_{m,max} = 210.00$ $\Lambda_{m,z} = 67.97 < \Lambda_{m,max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{c,Rd}/gM1) + k_{y,y}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + k_{y,z}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.08 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{c,Rd}/gM1) + k_{z,y}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) + k_{z,z}*M_{z,Ed,max}/(M_{z,Rd}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$v_y = 0.4 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$ Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 555 Column_555

POINT: 3

COORDINATE: $x = 0.50$ L = 4.05 m

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

$h=23.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=24.0$ cm	$A_y=64.54$ cm ²	$A_z=25.18$ cm ²	$A_x=76.84$ cm ²
$t_w=0.8$ cm	$I_y=7763.18$ cm ⁴	$I_z=2768.81$ cm ⁴	$I_x=38.20$ cm ⁴
$t_f=1.2$ cm	$W_{ply}=744.68$ cm ³	$W_{plz}=351.70$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 65.57$ kN	$M_{y,Ed} = -4.54$ kN*m	$M_{z,Ed} = -0.16$ kN*m	$V_{y,Ed} = 0.04$ kN
$N_{c,Rd} = 2112.98$ kN	$M_{y,Ed,max} = -27.32$ kN*m	$M_{z,Ed,max} = -0.16$ kN*m	$V_{y,T,Rd} = 1023.72$ kN
$N_{b,Rd} = 628.77$ kN	$M_{y,c,Rd} = 204.79$ kN*m	$M_{z,c,Rd} = 96.72$ kN*m	$V_{z,Ed} = 5.63$ kN
	$MN_{y,Rd} = 204.79$ kN*m	$MN_{z,Rd} = 96.72$ kN*m	$V_{z,T,Rd} = 399.49$ kN
			$T_{t,Ed} = -0.01$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10$ m	$Lam_y = 0.93$
$L_{cr,y} = 8.10$ m	$X_y = 0.64$
$L_{amy} = 80.58$	$kzy = 0.33$



About z axis:

$L_z = 8.10$ m	$Lam_z = 1.55$
$L_{cr,z} = 8.10$ m	$X_z = 0.30$
$L_{amz} = 134.93$	$kzz = 0.81$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$Lambda_y = 80.58 < Lambda_{max} = 210.00$ $Lambda_z = 134.93 < Lambda_{max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.14 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.4$ cm $< v_{x,max} = L/150.00 = 5.4$ cm Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$v_y = 0.6$ cm $< v_{y,max} = L/150.00 = 5.4$ cm Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 561 Column_561

POINT: 3

COORDINATE: x = 1.00 L = 2.19 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 115.35 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 1873.30 kN

M_{y,Ed} = 19.34 kN*m

M_{y,Ed,max} = 19.34 kN*m

M_{y,c,Rd} = 204.79 kN*m

M_{N,y,Rd} = 204.79 kN*m

M_{z,Ed,max} = -0.04 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{y,Ed} = -0.02 kN

V_{y,T,Rd} = 1024.35 kN

V_{z,Ed} = 13.52 kN

V_{z,T,Rd} = 399.65 kN

T_{t,Ed} = -0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 2.19 m

L_{cr,y} = 2.19 m

L_{am,y} = 21.79

L_{am,y} = 0.25

X_y = 0.98

k_{yy} = 0.67



About z axis:

L_z = 2.19 m

L_{cr,z} = 2.19 m

L_{am,z} = 36.48

L_{am,z} = 0.42

X_z = 0.89

k_{zy} = 0.35

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.05 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00 (6.2.5.(1))

V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 (6.2.6-7)

V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda_y = 21.79 < Lambda_{max} = 210.00 Lambda_z = 36.48 < Lambda_{max} = 210.00 STABLE

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.12 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.1 cm < v_{x,max} = L/150.00 = 1.5 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

v_y = 0.3 cm < v_{y,max} = L/150.00 = 1.5 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 562 Column_562

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 145.59 \text{ kN}$	$M_{y,Ed} = -5.45 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = 0.01 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = 0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 8.12 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.50 \text{ kN}$
$N_{b,Rd} = 948.80 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,Ed} = -2.23 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,T,Rd} = 399.68 \text{ kN}$
			$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$	$\text{Lam}_y = 0.70$
$L_{cr,y} = 6.09 \text{ m}$	$X_y = 0.78$
$\text{Lam}_y = 60.59$	$k_{yy} = 0.65$



About z axis:

$L_z = 6.09 \text{ m}$	$\text{Lam}_z = 1.17$
$L_{cr,z} = 6.09 \text{ m}$	$X_z = 0.45$
$\text{Lam}_z = 101.45$	$k_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lam}_{b,y} = 60.59 < \text{Lam}_{b,max} = 210.00$ $\text{Lam}_{b,z} = 101.45 < \text{Lam}_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.11 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.17 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.3 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $v_y = 0.6 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 564 Beam_main_564

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 1.80 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = -8.47 kN	My,Ed = -45.14 kN*m	Mz,Ed = 1.22 kN*m	Vy,Ed = -0.68 kN
Nt,Rd = 2112.98 kN	My,pl,Rd = 204.79 kN*m	Mz,pl,Rd = 96.72 kN*m	Vy,T,Rd = 1024.38 kN
	My,c,Rd = 204.79 kN*m	Mz,c,Rd = 96.72 kN*m	Vz,Ed = -35.89 kN
	MN,y,Rd = 204.79 kN*m	MN,z,Rd = 96.72 kN*m	Vz,T,Rd = 399.65 kN
	Mb,Rd = 204.79 kN*m		Tt,Ed = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2913.56 kN*m	Curve,LT - b	XLT = 1.00
Lcr,low=0.45 m	Lam_LT = 0.27	fi,LT = 0.50	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.06 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.09 < 1.00$ (6.2.6-7)
 $\tau_{u,y,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{u,z,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed}/M_{b,Rd} = 0.22 < 1.00$ (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 565 Beam_main_565

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=1.2 cm

Wply=744.68 cm³

Wplz=351.70 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 93.58 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 2112.98 kN

My_{Ed} = -103.83 kN*m

My_{Ed,max} = -103.83 kN*m

My_{c,Rd} = 204.79 kN*m

MN_{y,Rd} = 204.79 kN*m

Mb_{Rd} = 176.20 kN*m

Mz_{Ed} = 3.83 kN*m

Mz_{Ed,max} = 3.83 kN*m

Mz_{c,Rd} = 96.72 kN*m

MN_{z,Rd} = 96.72 kN*m

Vy_{Ed} = 4.00 kN

Vy_{T,Rd} = 1024.44 kN

Vz_{Ed} = 125.56 kN

Vz_{T,Rd} = 399.67 kN

Tt_{Ed} = -0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,low} = 2.43 m

M_{cr} = 347.48 kN*m

Lam_{LT} = 0.77

Curve,LT - b

fi_{LT} = 0.78

XLT = 0.83

XLT_{mod} = 0.86

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.04 < 1.00 (6.2.4.(1))

(My_{Ed}/MN_{y,Rd})^{2.00} + (Mz_{Ed}/MN_{z,Rd})^{1.00} = 0.30 < 1.00 (6.2.9.1.(6))

Vy_{Ed}/Vy_{T,Rd} = 0.00 < 1.00 (6.2.6-7)

Vz_{Ed}/Vz_{T,Rd} = 0.31 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.59 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) + kyz*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.67 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) + kzz*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.67 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.1 cm < uy max = L/200.00 = 4.9 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.6 cm < uz max = L/200.00 = 4.9 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 566 Column_566

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 3.34 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 1421.83 kN

My_{Ed} = 18.01 kN*m

My_{Ed,max} = 18.01 kN*m

My_{c,Rd} = 204.79 kN*m

Mz_{Ed,max} = 0.00 kN*m

Mz_{c,Rd} = 96.72 kN*m

Vy_{Ed} = 0.00 kN

Vy_{T,Rd} = 1024.60 kN

Vz_{Ed} = 8.61 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$MN,y,Rd = 204.79 \text{ kN*m}$

$Vz,T,Rd = 399.71 \text{ kN}$

$Tt,Ed = 0.00 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$

$L_{cr,y} = 4.08 \text{ m}$

$\lambda_{my} = 40.59$

$\lambda_{m,y} = 0.47$

$\chi_y = 0.90$

$\kappa_{yy} = 0.59$



About z axis:

$L_z = 4.08 \text{ m}$

$L_{cr,z} = 4.08 \text{ m}$

$\lambda_{mz} = 67.97$

$\lambda_{m,z} = 0.78$

$\chi_z = 0.67$

$\kappa_{zy} = 0.30$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 40.59 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 67.97 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{c,Rd}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed,max}/(M_{z,Rd}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{c,Rd}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed,max}/(M_{z,Rd}/g_{M1}) = 0.03 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /37/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$

$v_y = 0.2 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 567 Column_567

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 149.09 \text{ kN}$

$M_{y,Ed} = -6.30 \text{ kN*m}$

$M_{z,Ed,max} = 0.17 \text{ kN*m}$

$V_{y,Ed} = 0.04 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = 17.67 \text{ kN*m}$

$M_{z,c,Rd} = 96.72 \text{ kN*m}$

$V_{y,T,Rd} = 1024.61 \text{ kN}$

$N_{b,Rd} = 1421.83 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$MN_{y,Rd} = 204.79 \text{ kN*m}$

$V_{z,Ed} = -5.87 \text{ kN}$

$V_{z,T,Rd} = 399.71 \text{ kN}$

$Tt_{Ed} = 0.00 \text{ kN*m}$

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$
 $L_{cr,y} = 4.08 \text{ m}$
 $\lambda_{my} = 40.59$
 $\lambda_{my} = 0.47$
 $\chi_y = 0.90$
 $\eta_{ky} = 0.72$



About z axis:

$L_z = 4.08 \text{ m}$
 $L_{cr,z} = 4.08 \text{ m}$
 $\lambda_{mz} = 67.97$
 $\lambda_{mz} = 0.78$
 $\chi_z = 0.67$
 $\eta_{kz} = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{my} = 40.59 < \lambda_{my,max} = 210.00$ $\lambda_{mz} = 67.97 < \lambda_{mz,max} = 210.00$ STABLE
 $N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{ky} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{kz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.14 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{ky} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{kz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.14 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /36/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$
 $v_y = 0.3 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 568 Column_568

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 126.77 \text{ kN}$	$M_{y,Ed} = 17.77 \text{ kN} \cdot \text{m}$		$V_{y,Ed} = -0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -39.28 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = -0.00 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.50 \text{ kN}$
$N_{b,Rd} = 628.77 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 7.04 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$V_{z,T,Rd} = 399.68 \text{ kN}$
			$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 8.10 \text{ m}$

$L_{cr,y} = 8.10 \text{ m}$

$\lambda_{my} = 80.58$

$\lambda_{m,y} = 0.93$

$\chi_y = 0.64$

$\kappa_{yy} = 0.71$



About z axis:

$L_z = 8.10 \text{ m}$

$L_{cr,z} = 8.10 \text{ m}$

$\lambda_{mz} = 134.93$

$\lambda_{m,z} = 1.55$

$\chi_z = 0.30$

$\kappa_{zy} = 0.35$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.09 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 80.58 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 134.93 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1}) = 0.23 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed}/\max(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed}/\max(M_{z,Rk}/g_{M1}) = 0.27 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 574 Column_574

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$b = 24.0 \text{ cm}$

$t_w = 0.8 \text{ cm}$

$t_f = 1.2 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 64.54 \text{ cm}^2$

$I_y = 7763.18 \text{ cm}^4$

$W_{ply} = 744.68 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 25.18 \text{ cm}^2$

$I_z = 2768.81 \text{ cm}^4$

$W_{plz} = 351.70 \text{ cm}^3$

$A_x = 76.84 \text{ cm}^2$

$I_x = 38.20 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 271.96 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$N_{b,Rd} = 948.80 \text{ kN}$

$M_{y,Ed} = -5.72 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 10.41 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 203.96 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.00 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.00 \text{ kN}$

$V_{y,T,Rd} = 1024.60 \text{ kN}$

$V_{z,Ed} = -2.65 \text{ kN}$

$V_{z,T,Rd} = 399.71 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$

$L_{cr,y} = 6.09 \text{ m}$

$\lambda_{my} = 60.59$

$\lambda_{m,y} = 0.70$

$\chi_y = 0.78$

$\kappa_{yy} = 0.68$



About z axis:

$L_z = 6.09 \text{ m}$

$L_{cr,z} = 6.09 \text{ m}$

$\lambda_{mz} = 101.45$

$\lambda_{m,z} = 1.17$

$\chi_z = 0.45$

$\kappa_{zy} = 0.34$

Κύριος έργου: Δήμος Καλαμάτας

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Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y} = 60.59 < \lambda_{y,max} = 210.00$ $\lambda_{z} = 101.45 < \lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.30 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /36/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$

$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 576 Beam_main_576

POINT: 3

COORDINATE: x = 1.00 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -9.73 \text{ kN}$	$M_{y,Ed} = -45.25 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 1.31 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -0.73 \text{ kN}$
$N_{t,Rd} = 2112.98 \text{ kN}$	$M_{y,pl,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,pl,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 1024.28 \text{ kN}$
	$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = -36.20 \text{ kN}$
	$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 399.63 \text{ kN}$
	$M_{b,Rd} = 204.79 \text{ kN} \cdot \text{m}$		$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2913.56 \text{ kN} \cdot \text{m}$	Curve,LT - b	$X_{LT} = 1.00$
$L_{cr,low} = 0.45 \text{ m}$	$\lambda_{m_LT} = 0.27$	$f_{i,LT} = 0.50$	$X_{LT,mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 \cdot 2.00 + (M_{z,Ed}/M_{N,z,Rd})^2 \cdot 1.00 = 0.06 < 1.00$ (6.2.9.1.(6))

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Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.09 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.22 < 1.00 \quad (6.3.2.1.(1))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 577 Beam_main_577

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$b = 24.0 \text{ cm}$$

$$t_w = 0.8 \text{ cm}$$

$$t_f = 1.2 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 64.54 \text{ cm}^2$$

$$I_y = 7763.18 \text{ cm}^4$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 25.18 \text{ cm}^2$$

$$I_z = 2768.81 \text{ cm}^4$$

$$W_{plz} = 351.70 \text{ cm}^3$$

$$A_x = 76.84 \text{ cm}^2$$

$$I_x = 38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{y,Ed} = 87.33 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 2112.98 \text{ kN}$$

$$M_{y,Ed} = -103.43 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = -103.43 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 176.20 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 5.57 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 5.57 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 4.99 \text{ kN}$$

$$V_{y,T,Rd} = 1024.38 \text{ kN}$$

$$V_{z,Ed} = 126.06 \text{ kN}$$

$$V_{z,T,Rd} = 399.65 \text{ kN}$$

$$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,low} = 2.43 \text{ m}$$

$$M_{cr} = 347.48 \text{ kN} \cdot \text{m}$$

$$\lambda_{m,LT} = 0.77$$

$$\text{Curve}_{LT-b}$$

$$\phi_{LT} = 0.78$$

$$X_{LT} = 0.83$$

$$X_{LT,mod} = 0.86$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{y,Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.31 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.59 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{y,Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.69 < 1.00 \quad (6.3.3.(4))$$

$$N_{y,Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.69 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y \text{ max}} = L/200.00 = 4.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.6 \text{ cm} < u_{z \text{ max}} = L/200.00 = 4.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 578 Column_578

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 24.0 \text{ cm}$

$A_y = 64.54 \text{ cm}^2$

$A_z = 25.18 \text{ cm}^2$

$A_x = 76.84 \text{ cm}^2$

$t_w = 0.8 \text{ cm}$

$I_y = 7763.18 \text{ cm}^4$

$I_z = 2768.81 \text{ cm}^4$

$I_x = 38.20 \text{ cm}^4$

$t_f = 1.2 \text{ cm}$

$W_{ply} = 744.68 \text{ cm}^3$

$W_{plz} = 351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -5.88 \text{ kN}$

$M_{y,Ed} = 19.59 \text{ kN*m}$

$V_{y,Ed} = 0.00 \text{ kN}$

$N_{t,Rd} = 2112.98 \text{ kN}$

$M_{y,pl,Rd} = 204.79 \text{ kN*m}$

$V_{y,T,Rd} = 1024.51 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN*m}$

$V_{z,Ed} = 9.11 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN*m}$

$V_{z,T,Rd} = 399.69 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.10 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$v_y = 0.3 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 579 Column_579

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /11/ 1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm

b=24.0 cm

tw=0.8 cm

tf=1.2 cm

gM0=1.00

Ay=64.54 cm²

Iy=7763.18 cm⁴

Wply=744.68 cm³

gM1=1.00

Az=25.18 cm²

Iz=2768.81 cm⁴

Wplz=351.70 cm³

Ax=76.84 cm²

Ix=38.20 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 154.47 kN

N_{c,Rd} = 2112.98 kN

N_{b,Rd} = 1421.83 kN

M_{y,Ed} = -7.87 kN*m

M_{y,Ed,max} = 19.35 kN*m

M_{y,c,Rd} = 204.79 kN*m

MN_{y,Rd} = 204.79 kN*m

M_{z,Ed,max} = 0.81 kN*m

M_{z,c,Rd} = 96.72 kN*m

V_{y,Ed} = 0.20 kN

V_{y,T,Rd} = 1024.54 kN

V_{z,Ed} = -6.67 kN

V_{z,T,Rd} = 399.69 kN

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.08 m

L_{cr,y} = 4.08 m

L_{amy} = 40.59

L_{am,y} = 0.47

X_y = 0.90

k_{yy} = 0.71



About z axis:

L_z = 4.08 m

L_{cr,z} = 4.08 m

L_{amz} = 67.97

L_{am,z} = 0.78

X_z = 0.67

k_{zy} = 0.36

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.07 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00 (6.2.5.(1))

V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 (6.2.6-7)

V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 (6.2.6-7)

Tau_{ty,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau_{tz,Ed}/(f_y/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Global stability check of member:

Lambda_y = 40.59 < Lambda_{max} = 210.00 Lambda_z = 67.97 < Lambda_{max} = 210.00 STABLE

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.15 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

v_x = 0.1 cm < v_{x,max} = L/150.00 = 2.7 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

v_y = 0.3 cm < v_{y,max} = L/150.00 = 2.7 cm Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 580 Column_580

POINT: 3

COORDINATE: x = 0.50 L = 4.05 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 120.87 kN	My _{Ed} = -10.21 kN*m	Mz _{Ed} = -0.51 kN*m	Vy _{Ed} = 0.12 kN
N _{c,Rd} = 2112.98 kN	My _{Ed,max} = -45.50 kN*m	Mz _{Ed,max} = -0.51 kN*m	Vy _{T,Rd} = 1024.16 kN
N _{b,Rd} = 628.77 kN	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = 8.71 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 399.60 kN
			Tt _{Ed} = -0.01 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 8.10 m	Lam _y = 0.93
Lcr,y = 8.10 m	Xy = 0.64
Lamy = 80.58	kzy = 0.33



About z axis:

Lz = 8.10 m	Lam _z = 1.55
Lcr,z = 8.10 m	Xz = 0.30
Lamz = 134.93	kzz = 0.82

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.01 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{b,y} = 80.58 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 134.93 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.27 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2$ cm < $v_{x,max} = L/150.00 = 5.4$ cm Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60
 $v_y = 0.5$ cm < $v_{y,max} = L/150.00 = 5.4$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 586 Column_586

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$tw=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$tf=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 271.76 \text{ kN}$	$M_{y,Ed} = -6.13 \text{ kN}\cdot\text{m}$		$V_{y,Ed} = 0.00 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = 10.77 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = 0.00 \text{ kN}\cdot\text{m}$	$V_{y,T,Rd} = 1024.57 \text{ kN}$
$N_{b,Rd} = 948.80 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 96.72 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = -2.78 \text{ kN}$
	$MN_{y,Rd} = 203.98 \text{ kN}\cdot\text{m}$		$V_{z,T,Rd} = 399.70 \text{ kN}$
			$T_{t,Ed} = 0.00 \text{ kN}\cdot\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.09 \text{ m}$	$\text{Lam}_y = 0.70$
$L_{cr,y} = 6.09 \text{ m}$	$X_y = 0.78$
$\text{Lam}_y = 60.59$	$k_{yy} = 0.68$



About z axis:

$L_z = 6.09 \text{ m}$	$\text{Lam}_z = 1.17$
$L_{cr,z} = 6.09 \text{ m}$	$X_z = 0.45$
$\text{Lam}_z = 101.45$	$k_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00$ (6.2.9.1.(2))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\text{Lambda}_y = 60.59 < \text{Lambda}_{max} = 210.00$ $\text{Lambda}_z = 101.45 < \text{Lambda}_{max} = 210.00$ STABLE
 $N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.30 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 588 Beam_main_588

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 1.80 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = -12.72 kN	My _{Ed} = -45.34 kN*m	Mz _{Ed} = 2.24 kN*m	Vy _{Ed} = -1.24 kN
Nt _{Rd} = 2112.98 kN	My _{pl,Rd} = 204.79 kN*m	Mz _{pl,Rd} = 96.72 kN*m	Vy _{T,Rd} = 1024.08 kN
	My _{c,Rd} = 204.79 kN*m	Mz _{c,Rd} = 96.72 kN*m	Vz _{Ed} = -35.47 kN
	MN _{y,Rd} = 204.79 kN*m	MN _{z,Rd} = 96.72 kN*m	Vz _{T,Rd} = 399.58 kN
	Mb _{Rd} = 204.79 kN*m		Tt _{Ed} = -0.01 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 2913.56 kN*m	Curve _{LT} - b	XLT = 1.00
Lcr,low = 0.45 m	Lam _{LT} = 0.27	fi _{LT} = 0.50	XLT _{mod} = 1.00

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.01 < 1.00 \quad (6.2.3.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.07 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$
$$V_{z,Ed}/V_{z,T,Rd} = 0.09 < 1.00 \quad (6.2.6-7)$$
$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$
$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.22 < 1.00 \quad (6.3.2.1.(1))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

$$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 589 Beam_main_589

POINT: 1

COORDINATE: x = 0.50 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm	gM0=1.00	gM1=1.00	
b=24.0 cm	Ay=64.54 cm ²	Az=25.18 cm ²	Ax=76.84 cm ²
tw=0.8 cm	Iy=7763.18 cm ⁴	Iz=2768.81 cm ⁴	Ix=38.20 cm ⁴
tf=1.2 cm	Wply=744.68 cm ³	Wplz=351.70 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 75.79 \text{ kN}$	$M_{y,Ed} = -107.48 \text{ kN*m}$	$M_{z,Ed} = 11.29 \text{ kN*m}$	$V_{y,Ed} = 13.40 \text{ kN}$
$N_{c,Rd} = 2112.98 \text{ kN}$	$M_{y,Ed,max} = -107.48 \text{ kN*m}$	$M_{z,Ed,max} = 11.29 \text{ kN*m}$	$V_{y,T,Rd} = 1023.97 \text{ kN}$
$N_{b,Rd} = 2112.98 \text{ kN}$	$M_{y,c,Rd} = 204.79 \text{ kN*m}$	$M_{z,c,Rd} = 96.72 \text{ kN*m}$	$V_{z,Ed} = 128.81 \text{ kN}$
	$MN_{y,Rd} = 204.79 \text{ kN*m}$	$MN_{z,Rd} = 96.72 \text{ kN*m}$	$V_{z,T,Rd} = 399.55 \text{ kN}$
	$M_{b,Rd} = 176.20 \text{ kN*m}$		$T_{t,Ed} = -0.01 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 347.48 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.83$
$L_{cr,low} = 2.43 \text{ m}$	$\lambda_{LT} = 0.77$	$\phi_{LT} = 0.78$	$X_{LT,mod} = 0.86$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.39 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.32 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
Global stability check of member:
 $M_{y,Ed,max}/M_{b,Rd} = 0.61 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.76 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.76 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.2 \text{ cm} < u_{y,max} = L/200.00 = 4.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$
 $u_z = 0.6 \text{ cm} < u_{z,max} = L/200.00 = 4.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 590 Column_590

POINT: 3

COORDINATE: x = 1.00 L = 4.08 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h = 23.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 24.0 \text{ cm}$	$A_y = 64.54 \text{ cm}^2$	$A_z = 25.18 \text{ cm}^2$	$A_x = 76.84 \text{ cm}^2$
$t_w = 0.8 \text{ cm}$	$I_y = 7763.18 \text{ cm}^4$	$I_z = 2768.81 \text{ cm}^4$	$I_x = 38.20 \text{ cm}^4$
$t_f = 1.2 \text{ cm}$	$W_{ply} = 744.68 \text{ cm}^3$	$W_{plz} = 351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -4.93 \text{ kN}$	$M_{y,Ed} = 15.78 \text{ kN*m}$	$V_{y,Ed} = 0.00 \text{ kN}$
$N_{t,Rd} = 2112.98 \text{ kN}$	$M_{y,pl,Rd} = 204.79 \text{ kN*m}$	$V_{y,T,Rd} = 1024.47 \text{ kN}$
	$M_{y,c,Rd} = 204.79 \text{ kN*m}$	$V_{z,Ed} = 7.83 \text{ kN}$
	$MN_{y,Rd} = 204.79 \text{ kN*m}$	$V_{z,T,Rd} = 399.68 \text{ kN}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$T_t, E_d = 0.00 \text{ kN}^*\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_t, R_d = 0.00 < 1.00$ (6.2.3.(1))
 $M_y, E_d / M_{y,c}, R_d = 0.08 < 1.00$ (6.2.5.(1))
 $V_y, E_d / V_{y,T}, R_d = 0.00 < 1.00$ (6.2.6-7)
 $V_z, E_d / V_{z,T}, R_d = 0.02 < 1.00$ (6.2.6-7)
 $\tau_{xy}, E_d / (f_y / (\sqrt{3}) * g_{M0}) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz}, E_d / (f_y / (\sqrt{3}) * g_{M0}) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x \text{ max}} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$v_y = 0.3 \text{ cm} < v_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 591 Column_591

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 4.08 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 152.53 \text{ kN}$	$M_y, E_d = -9.00 \text{ kN}^*\text{m}$		$V_y, E_d = 0.24 \text{ kN}$
$N_c, R_d = 2112.98 \text{ kN}$	$M_y, E_d, \text{max} = 20.68 \text{ kN}^*\text{m}$	$M_z, E_d, \text{max} = 1.00 \text{ kN}^*\text{m}$	$V_y, T, R_d = 1024.51 \text{ kN}$
$N_b, R_d = 1421.83 \text{ kN}$	$M_{y,c}, R_d = 204.79 \text{ kN}^*\text{m}$	$M_{z,c}, R_d = 96.72 \text{ kN}^*\text{m}$	$V_z, E_d = -7.27 \text{ kN}$
	$M_{N,y}, R_d = 204.79 \text{ kN}^*\text{m}$		$V_z, T, R_d = 399.68 \text{ kN}$
			$T_t, E_d = 0.00 \text{ kN}^*\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.08 \text{ m}$
 $L_{cr,y} = 4.08 \text{ m}$
 $\lambda_{m,y} = 0.47$
 $\chi_y = 0.90$



About z axis:

$L_z = 4.08 \text{ m}$
 $L_{cr,z} = 4.08 \text{ m}$
 $\lambda_{m,z} = 0.78$
 $\chi_z = 0.67$

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Lamy = 40.59

kyy = 0.70

Lamz = 67.97

kzy = 0.36

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 40.59 < \lambda_{y,max} = 210.00$ $\lambda_{z,Ed} = 67.97 < \lambda_{z,max} = 210.00$ STABLE

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.16 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.15 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.2 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$v_y = 0.4 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 592 Column_592

POINT: 3

COORDINATE: x = 1.00 L = 8.10 m

LOADS:

Governing Load Case: 10 ULS /54/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

h=23.0 cm

$g_{M0}=1.00$

$g_{M1}=1.00$

b=24.0 cm

$A_y=64.54 \text{ cm}^2$

$A_z=25.18 \text{ cm}^2$

$A_x=76.84 \text{ cm}^2$

tw=0.8 cm

$I_y=7763.18 \text{ cm}^4$

$I_z=2768.81 \text{ cm}^4$

$I_x=38.20 \text{ cm}^4$

tf=1.2 cm

$W_{ply}=744.68 \text{ cm}^3$

$W_{plz}=351.70 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 177.82 \text{ kN}$

$M_{y,Ed} = 23.99 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 0.65 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.16 \text{ kN}$

$N_{c,Rd} = 2112.98 \text{ kN}$

$M_{y,Ed,max} = -44.78 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{y,T,Rd} = 1023.80 \text{ kN}$

$N_{b,Rd} = 628.77 \text{ kN}$

$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$

$V_{z,Ed} = 8.47 \text{ kN}$

$M_{N,y,Rd} = 204.79 \text{ kN} \cdot \text{m}$

$V_{z,T,Rd} = 399.51 \text{ kN}$

$T_{t,Ed} = -0.01 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 8.10 \text{ m}$

$\lambda_{m,y} = 0.93$

$L_{cr,y} = 8.10 \text{ m}$

$X_y = 0.64$

$L_{amy} = 80.58$

$k_{yy} = 0.69$



About z axis:

$L_z = 8.10 \text{ m}$

$\lambda_{m,z} = 1.55$

$L_{cr,z} = 8.10 \text{ m}$

$X_z = 0.30$

$L_{amz} = 134.93$

$k_{zy} = 0.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.12 < 1.00$ (6.2.5.(1))

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$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{bda,y} = 80.58 < \lambda_{bda,max} = 210.00 \quad \lambda_{bda,z} = 134.93 < \lambda_{bda,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.29 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.36 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.3 \text{ cm} < v_{x,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /11/ \quad 1 \cdot 1.00 + 4 \cdot 1.00 + 6 \cdot 0.60$$

$$v_y = 0.6 \text{ cm} < v_{y,max} = L/150.00 = 5.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /90/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 598 Column_598

POINT: 3

COORDINATE: x = 1.00 L = 6.09 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /11/ \quad 1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 240

$$h = 23.0 \text{ cm}$$

$$b = 24.0 \text{ cm}$$

$$t_w = 0.8 \text{ cm}$$

$$t_f = 1.2 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 64.54 \text{ cm}^2$$

$$I_y = 7763.18 \text{ cm}^4$$

$$W_{ply} = 744.68 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 25.18 \text{ cm}^2$$

$$I_z = 2768.81 \text{ cm}^4$$

$$W_{plz} = 351.70 \text{ cm}^3$$

$$A_x = 76.84 \text{ cm}^2$$

$$I_x = 38.20 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 274.87 \text{ kN}$$

$$N_{c,Rd} = 2112.98 \text{ kN}$$

$$N_{b,Rd} = 948.80 \text{ kN}$$

$$M_{y,Ed} = -6.96 \text{ kN} \cdot \text{m}$$

$$M_{y,Ed,max} = 11.38 \text{ kN} \cdot \text{m}$$

$$M_{y,c,Rd} = 204.79 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 203.64 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 0.01 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 96.72 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = 0.00 \text{ kN}$$

$$V_{y,T,Rd} = 1024.53 \text{ kN}$$

$$V_{z,Ed} = -3.01 \text{ kN}$$

$$V_{z,T,Rd} = 399.69 \text{ kN}$$

$$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$$

$$\text{Class of section} = 1$$



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 6.09 \text{ m}$$

$$L_{cr,y} = 6.09 \text{ m}$$

$$\lambda_{my} = 60.59$$

$$\lambda_{m,y} = 0.70$$

$$X_y = 0.78$$

$$k_{yy} = 0.67$$



About z axis:

$$L_z = 6.09 \text{ m}$$

$$L_{cr,z} = 6.09 \text{ m}$$

$$\lambda_{mz} = 101.45$$

$$\lambda_{m,z} = 1.17$$

$$X_z = 0.45$$

$$k_{zy} = 0.33$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.13 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

$$M_{y,Ed}/M_{N,y,Rd} = 0.03 < 1.00 \quad (6.2.9.1.(2))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

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$\Lambda_{y,y} = 60.59 < \Lambda_{y,max} = 210.00$ $\Lambda_{z,z} = 101.45 < \Lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.20 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.31 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.3 \text{ cm} < v_{x,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$v_y = 0.5 \text{ cm} < v_{y,max} = L/150.00 = 4.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 599 Beam_599

POINT: 3

COORDINATE: $x = 0.50 L = 1.60 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$t_f=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 11.98 \text{ kN}$	$M_{y,Ed} = 13.61 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = -0.17 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = 0.11 \text{ kN}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 13.63 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = -0.17 \text{ kN} \cdot \text{m}$	$V_{y,c,Rd} = 418.46 \text{ kN}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 0.13 \text{ kN}$
	$MN_{y,Rd} = 47.71 \text{ kN} \cdot \text{m}$	$MN_{z,Rd} = 23.33 \text{ kN} \cdot \text{m}$	$V_{z,c,Rd} = 160.73 \text{ kN}$
	$M_{b,Rd} = 40.16 \text{ kN} \cdot \text{m}$		
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 74.28 \text{ kN} \cdot \text{m}$	Curve,LT - b	$X_{LT} = 0.82$
$L_{cr,upp}=3.20 \text{ m}$	$\Lambda_{m_LT} = 0.80$	$\phi_{i,LT} = 0.81$	$X_{LT,mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/MN_{y,Rd})^2 \cdot 2.00 + (M_{z,Ed}/MN_{z,Rd})^2 \cdot 1.00 = 0.09 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.36 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.36 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.6 \text{ cm}$

Verified

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$
 $uz = 0.5 \text{ cm} < uz \text{ max} = L/200.00 = 1.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 600 Beam_600

POINT: 1

COORDINATE: x = 0.50 L = 1.60 m

LOADS:

Governing Load Case: 10 ULS /12/ $1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

h=13.3 cm

gM0=1.00

gM1=1.00

b=14.0 cm

Ay=26.36 cm²

Az=10.12 cm²

Ax=31.42 cm²

tw=0.5 cm

Iy=1033.13 cm⁴

Iz=389.32 cm⁴

Ix=7.97 cm⁴

tf=0.9 cm

Wply=173.51 cm³

Wplz=84.85 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 15.41 kN

M_{y,Ed} = 13.59 kN*m

M_{z,Ed} = -0.18 kN*m

V_{y,Ed} = -0.11 kN

N_{c,Rd} = 863.94 kN

M_{y,Ed,max} = 13.60 kN*m

M_{z,Ed,max} = -0.18 kN*m

V_{y,T,Rd} = 416.82 kN

N_{b,Rd} = 863.94 kN

M_{y,c,Rd} = 47.71 kN*m

M_{z,c,Rd} = 23.33 kN*m

V_{z,Ed} = -0.13 kN

M_{N,y,Rd} = 47.71 kN*m

M_{N,z,Rd} = 23.33 kN*m

V_{z,T,Rd} = 160.33 kN

M_{b,Rd} = 40.17 kN*m

T_{t,Ed} = 0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 74.36 kN*m

Curve,LT - b

XLT = 0.82

L_{cr,upp} = 3.20 m

Lam_LT = 0.80

f_{i,LT} = 0.81

XLT,mod = 0.84

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.01 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.36 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.36 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 1.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.5 \text{ cm} < u_z \text{ max} = L/200.00 = 1.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 601 Beam_601

POINT: 3

COORDINATE: x = 0.50 L = 1.62 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm

b=14.0 cm

tw=0.5 cm

tf=0.9 cm

gM0=1.00

Ay=26.36 cm²

Iy=1033.13 cm⁴

Wply=173.51 cm³

gM1=1.00

Az=10.12 cm²

Iz=389.32 cm⁴

Wplz=84.85 cm³

Ax=31.42 cm²

Ix=7.97 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 14.83 kN

N_{c,Rd} = 863.94 kN

N_{b,Rd} = 863.94 kN

M_{y,Ed} = 13.93 kN*m

M_{y,Ed,max} = 13.94 kN*m

M_{y,c,Rd} = 47.71 kN*m

MN_{y,Rd} = 47.71 kN*m

M_{b,Rd} = 40.01 kN*m

M_{z,Ed} = -0.18 kN*m

M_{z,Ed,max} = -0.18 kN*m

M_{z,c,Rd} = 23.33 kN*m

MN_{z,Rd} = 23.33 kN*m

V_{y,Ed} = 0.11 kN

V_{y,c,Rd} = 418.46 kN

V_{z,Ed} = 0.13 kN

V_{z,c,Rd} = 160.73 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 3.24 m

M_{cr} = 73.31 kN*m

Lam_{LT} = 0.81

Curve,LT - b

fi,LT = 0.81

XLT = 0.81

XLT,mod = 0.84

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.09 < 1.00 (6.2.9.1.(6))

V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 (6.2.6.(1))

V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 (6.2.6.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.35 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.37 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.37 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

u_z = 0.5 cm < u_{z,max} = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 602 Beam_602

POINT: 3

COORDINATE: x = 0.50 L = 1.62 m

LOADS:

Governing Load Case: 10 ULS /234/ 1*1.00 + 4*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm

gM0=1.00

gM1=1.00

b=14.0 cm

Ay=26.36 cm²

Az=10.12 cm²

Ax=31.42 cm²

tw=0.5 cm

Iy=1033.13 cm⁴

Iz=389.32 cm⁴

Ix=7.97 cm⁴

tf=0.9 cm

Wply=173.51 cm³

Wplz=84.85 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 42.60 kN

M_{y,Ed} = 4.28 kN*m

M_{z,Ed} = -0.29 kN*m

V_{y,Ed} = 0.18 kN

N_{c,Rd} = 863.94 kN

M_{y,Ed,max} = 4.28 kN*m

M_{z,Ed,max} = -0.29 kN*m

V_{y,c,Rd} = 418.46 kN

N_{b,Rd} = 863.94 kN

M_{y,c,Rd} = 47.71 kN*m

M_{z,c,Rd} = 23.33 kN*m

V_{z,Ed} = 3.97 kN

MN_{y,Rd} = 47.71 kN*m

MN_{z,Rd} = 23.33 kN*m

V_{z,c,Rd} = 160.73 kN

Mb,Rd = 40.05 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 73.54 kN*m

Curve,LT - b

XLT = 0.81

L_{cr,upp} = 3.23 m

Lam_LT = 0.81

fi,LT = 0.81

XLT,mod = 0.84

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.05 < 1.00 (6.2.4.(1))

(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.02 < 1.00 (6.2.9.1.(6))

V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 (6.2.6.(1))

V_{z,Ed}/V_{z,c,Rd} = 0.02 < 1.00 (6.2.6.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.17 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.17 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 603 Beam_603

POINT: 3

COORDINATE: x = 0.50 L = 1.61 m

LOADS:

Governing Load Case: 10 ULS /234/ 1*1.00 + 4*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 35.78 kN	My _{Ed} = 4.31 kN*m	Mz _{Ed} = -0.19 kN*m	Vy _{Ed} = 0.12 kN
N _{c,Rd} = 863.94 kN	My _{Ed,max} = 4.31 kN*m	Mz _{Ed,max} = -0.29 kN*m	Vy _{c,Rd} = 418.46 kN
Nb _{Rd} = 863.94 kN	My _{c,Rd} = 47.71 kN*m	Mz _{c,Rd} = 23.33 kN*m	Vz _{Ed} = 4.00 kN
	MN _{y,Rd} = 47.71 kN*m	MN _{z,Rd} = 23.33 kN*m	Vz _{c,Rd} = 160.73 kN
	Mb _{Rd} = 40.09 kN*m		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 73.83 kN*m	Curve,LT - b	XLT = 0.82
Lcr,upp=3.22 m	Lam_LT = 0.80	fi,LT = 0.81	XLT,mod = 0.84

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.02 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.02 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.16 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.6 \text{ cm}$ Verified
Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 1.6 \text{ cm}$ Verified
Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 604 Beam_604

POINT: 3

COORDINATE: x = 0.50 L = 1.61 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.9 cm

Wply=173.51 cm³

Wplz=84.85 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 9.24 kN

N_{c,Rd} = 863.94 kN

N_{b,Rd} = 863.94 kN

My_{Ed} = 13.70 kN*m

My_{Ed,max} = 13.70 kN*m

My_{c,Rd} = 47.71 kN*m

MN_{y,Rd} = 47.71 kN*m

Mb_{Rd} = 40.12 kN*m

Mz_{Ed} = -0.17 kN*m

Mz_{Ed,max} = -0.20 kN*m

Mz_{c,Rd} = 23.33 kN*m

MN_{z,Rd} = 23.33 kN*m

Vy_{Ed} = 0.10 kN

Vy_{c,Rd} = 418.46 kN

Vz_{Ed} = 0.13 kN

Vz_{c,Rd} = 160.73 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 3.21 m

M_{cr} = 74.06 kN*m

Lam_{LT} = 0.80

Curve,LT - b

fi_{LT} = 0.81

XLT = 0.82

XLT_{mod} = 0.84

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))

(My_{Ed}/M_{Ny,Rd})^{2.00} + (Mz_{Ed}/M_{Nz,Rd})^{1.00} = 0.09 < 1.00 (6.2.9.1.(6))

Vy_{Ed}/Vy_{c,Rd} = 0.00 < 1.00 (6.2.6.(1))

Vz_{Ed}/Vz_{c,Rd} = 0.00 < 1.00 (6.2.6.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.34 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + k_{yy}*My_{Ed,max}/(XLT*My_{Rk}/gM1) + k_{yz}*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.36 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + k_{zy}*My_{Ed,max}/(XLT*My_{Rk}/gM1) + k_{zz}*Mz_{Ed,max}/(Mz_{Rk}/gM1) = 0.36 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /95/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60

u_z = 0.5 cm < u_{z,max} = L/200.00 = 1.6 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 605 Beam_605

POINT: 3

COORDINATE: x = 0.50 L = 1.61 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm

b=14.0 cm

tw=0.5 cm

tf=0.9 cm

gM0=1.00

Ay=26.36 cm²

Iy=1033.13 cm⁴

Wply=173.51 cm³

gM1=1.00

Az=10.12 cm²

Iz=389.32 cm⁴

Wplz=84.85 cm³

Ax=31.42 cm²

Ix=7.97 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.78 kN

N_{c,Rd} = 863.94 kN

N_{b,Rd} = 863.94 kN

My_{Ed} = 13.80 kN*m

My_{Ed,max} = 13.82 kN*m

My_{c,Rd} = 47.71 kN*m

MN_{y,Rd} = 47.71 kN*m

Mb_{Rd} = 40.07 kN*m

Mz_{Ed} = -0.17 kN*m

Mz_{Ed,max} = -0.17 kN*m

Mz_{c,Rd} = 23.33 kN*m

MN_{z,Rd} = 23.33 kN*m

Vy_{Ed} = 0.10 kN

Vy_{c,Rd} = 418.46 kN

Vz_{Ed} = 0.13 kN

Vz_{c,Rd} = 160.73 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 3.23 \text{ m}$

$M_{cr} = 73.68 \text{ kN}\cdot\text{m}$

$\text{Lam}_{LT} = 0.80$

Curve,LT - b

$\text{fi}_{LT} = 0.81$

$\text{XLT} = 0.81$

$\text{XLT}_{mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.36 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.36 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.5 \text{ cm} < u_{z,max} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 606 Beam_606

POINT: 3

COORDINATE: $x = 0.50 \text{ L} = 1.61 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$b = 14.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.9 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 26.36 \text{ cm}^2$

$I_y = 1033.13 \text{ cm}^4$

$W_{ply} = 173.51 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 10.12 \text{ cm}^2$

$I_z = 389.32 \text{ cm}^4$

$W_{plz} = 84.85 \text{ cm}^3$

$A_x = 31.42 \text{ cm}^2$

$I_x = 7.97 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.68 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,Ed} = 13.82 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 13.82 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 47.71 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 47.71 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 40.07 \text{ kN}\cdot\text{m}$

$M_{z,Ed} = -0.15 \text{ kN}\cdot\text{m}$

$M_{z,Ed,max} = -0.18 \text{ kN}\cdot\text{m}$

$M_{z,c,Rd} = 23.33 \text{ kN}\cdot\text{m}$

$M_{N,z,Rd} = 23.33 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = 0.09 \text{ kN}$

$V_{y,c,Rd} = 418.46 \text{ kN}$

$V_{z,Ed} = 0.13 \text{ kN}$

$V_{z,c,Rd} = 160.73 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 3.23 \text{ m}$

$M_{cr} = 73.68 \text{ kN}\cdot\text{m}$

$\text{Lam}_{LT} = 0.80$

Curve,LT - b

$\text{fi}_{LT} = 0.81$

$\text{XLT} = 0.81$

$\text{XLT}_{mod} = 0.84$

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.36 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.36 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.5 \text{ cm} < u_{z,max} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 607 Beam_607

POINT: 3

COORDINATE: $x = 0.50 L = 1.61 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 14.0 \text{ cm}$

$A_y = 26.36 \text{ cm}^2$

$A_z = 10.12 \text{ cm}^2$

$A_x = 31.42 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 1033.13 \text{ cm}^4$

$I_z = 389.32 \text{ cm}^4$

$I_x = 7.97 \text{ cm}^4$

$t_f = 0.9 \text{ cm}$

$W_{ply} = 173.51 \text{ cm}^3$

$W_{plz} = 84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -17.81 \text{ kN}$

$M_{y,Ed} = -6.45 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = 0.18 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = -0.11 \text{ kN}$

$N_{t,Rd} = 863.94 \text{ kN}$

$M_{y,pl,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{z,pl,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$V_{y,c,Rd} = 418.46 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$V_{z,Ed} = -10.80 \text{ kN}$

$M_{N,y,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{N,z,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$V_{z,c,Rd} = 160.73 \text{ kN}$

$M_{b,Rd} = 40.07 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 73.68 \text{ kN} \cdot \text{m}$

Curve,LT - b

$X_{LT} = 0.81$

$L_{cr,low} = 3.23 \text{ m}$

$\lambda_{m_LT} = 0.80$

$\phi_{i,LT} = 0.81$

$X_{LT,mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.02 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.03 < 1.00$ (6.2.9.1.(6))

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

$V_{z,Ed}/V_{z,c,Rd} = 0.07 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed}/M_{b,Rd} = 0.16 < 1.00$ (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 608 Beam_608

POINT: 1

COORDINATE: $x = 0.50 L = 1.61 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=14.0 \text{ cm}$

$A_y=26.36 \text{ cm}^2$

$A_z=10.12 \text{ cm}^2$

$A_x=31.42 \text{ cm}^2$

$t_w=0.5 \text{ cm}$

$I_y=1033.13 \text{ cm}^4$

$I_z=389.32 \text{ cm}^4$

$I_x=7.97 \text{ cm}^4$

$t_f=0.9 \text{ cm}$

$W_{ply}=173.51 \text{ cm}^3$

$W_{plz}=84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{,Ed} = 13.94 \text{ kN}$

$M_{y,Ed} = 13.81 \text{ kN*m}$

$M_{z,Ed} = -0.24 \text{ kN*m}$

$V_{y,Ed} = -0.15 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$M_{y,Ed,max} = 13.82 \text{ kN*m}$

$M_{z,Ed,max} = -0.24 \text{ kN*m}$

$V_{y,T,Rd} = 416.81 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN*m}$

$M_{z,c,Rd} = 23.33 \text{ kN*m}$

$V_{z,Ed} = -0.13 \text{ kN}$

$M_{N,y,Rd} = 47.71 \text{ kN*m}$

$M_{N,z,Rd} = 23.33 \text{ kN*m}$

$V_{z,T,Rd} = 160.32 \text{ kN}$

$M_{b,Rd} = 40.07 \text{ kN*m}$

$T_{t,Ed} = 0.01 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 73.68 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.81$

$L_{cr,upp}=3.23 \text{ m}$

$\lambda_{m_LT} = 0.80$

$\phi_{i,LT} = 0.81$

$X_{LT,mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{,Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd}) = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{au,ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.01 < 1.00$ (6.2.6)

$\tau_{au,tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00$ (6.3.2.1.(1))

$N_{,Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.37 < 1.00$ (6.3.3.(4))

$N_{,Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.37 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.5 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 609 Beam_609

POINT: 1

COORDINATE: $x = 0.50 L = 1.62 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1*1.35 + 2*1.50 + 3*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=14.0 \text{ cm}$

$A_y=26.36 \text{ cm}^2$

$A_z=10.12 \text{ cm}^2$

$A_x=31.42 \text{ cm}^2$

$t_w=0.5 \text{ cm}$

$I_y=1033.13 \text{ cm}^4$

$I_z=389.32 \text{ cm}^4$

$I_x=7.97 \text{ cm}^4$

$t_f=0.9 \text{ cm}$

$W_{ply}=173.51 \text{ cm}^3$

$W_{plz}=84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -8.50 \text{ kN}$

$M_{y,Ed} = 13.97 \text{ kN*m}$

$M_{z,Ed} = 0.21 \text{ kN*m}$

$V_{y,Ed} = 0.13 \text{ kN}$

$N_{t,Rd} = 863.94 \text{ kN}$

$M_{y,pl,Rd} = 47.71 \text{ kN*m}$

$M_{z,pl,Rd} = 23.33 \text{ kN*m}$

$V_{y,T,Rd} = 417.36 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN*m}$

$M_{z,c,Rd} = 23.33 \text{ kN*m}$

$V_{z,Ed} = -0.14 \text{ kN}$

$M_{N,y,Rd} = 47.71 \text{ kN*m}$

$M_{N,z,Rd} = 23.33 \text{ kN*m}$

$V_{z,T,Rd} = 160.46 \text{ kN}$

$M_{b,Rd} = 40.00 \text{ kN*m}$

$T_{t,Ed} = 0.01 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 73.24 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.81$

$L_{cr,upp}=3.24 \text{ m}$

$\lambda_{m_LT} = 0.81$

$\phi_{i,LT} = 0.81$

$X_{LT,mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.09 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.01 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed}/M_{b,Rd} = 0.35 < 1.00$ (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.5 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 610 Beam_610

POINT: 1

COORDINATE: $x = 0.50 L = 1.62 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$tf=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.01 \text{ kN}$	$M_{y,Ed} = -6.16 \text{ kN*m}$	$M_{z,Ed} = 0.13 \text{ kN*m}$	$V_{y,Ed} = 0.08 \text{ kN}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = -6.16 \text{ kN*m}$	$M_{z,Ed,max} = 0.21 \text{ kN*m}$	$V_{y,T,Rd} = 415.49 \text{ kN}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN*m}$	$M_{z,c,Rd} = 23.33 \text{ kN*m}$	$V_{z,Ed} = 10.64 \text{ kN}$
	$MN_{y,Rd} = 47.71 \text{ kN*m}$	$MN_{z,Rd} = 23.33 \text{ kN*m}$	$V_{z,T,Rd} = 160.00 \text{ kN}$
	$M_{b,Rd} = 40.01 \text{ kN*m}$		$T_{t,Ed} = 0.03 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 73.31 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.81$
$L_{cr,low} = 3.24 \text{ m}$	$\lambda_{m,LT} = 0.81$	$f_{i,LT} = 0.81$	$X_{LT,mod} = 0.84$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.02 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.07 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.02 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.15 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.16 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 1.6 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 611 Beam_611

POINT: 1

COORDINATE: $x = 0.50 L = 1.78 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$

$b=14.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.9 \text{ cm}$

$gM0=1.00$

$A_y=26.36 \text{ cm}^2$

$I_y=1033.13 \text{ cm}^4$

$W_{ply}=173.51 \text{ cm}^3$

$gM1=1.00$

$A_z=10.12 \text{ cm}^2$

$I_z=389.32 \text{ cm}^4$

$W_{plz}=84.85 \text{ cm}^3$

$A_x=31.42 \text{ cm}^2$

$I_x=7.97 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 18.72 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,Ed} = 16.46 \text{ kN}^*\text{m}$

$M_{y,Ed,max} = 16.47 \text{ kN}^*\text{m}$

$M_{y,c,Rd} = 47.71 \text{ kN}^*\text{m}$

$MN_{y,Rd} = 47.71 \text{ kN}^*\text{m}$

$M_{b,Rd} = 38.83 \text{ kN}^*\text{m}$

$M_{z,Ed} = 0.21 \text{ kN}^*\text{m}$

$M_{z,Ed,max} = 0.21 \text{ kN}^*\text{m}$

$M_{z,c,Rd} = 23.33 \text{ kN}^*\text{m}$

$MN_{z,Rd} = 23.33 \text{ kN}^*\text{m}$

$V_{y,Ed} = 0.12 \text{ kN}$

$V_{y,T,Rd} = 418.45 \text{ kN}$

$V_{z,Ed} = 0.03 \text{ kN}$

$V_{z,T,Rd} = 160.73 \text{ kN}$

$T_{t,Ed} = -0.00 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp}=3.55 \text{ m}$

$M_{cr} = 66.15 \text{ kN}^*\text{m}$

$\Lambda_{m,LT} = 0.85$

Curve,LT - b

$\phi_{i,LT} = 0.85$

$X_{LT} = 0.79$

$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/MN_{y,Rd})^2 + (M_{z,Ed}/MN_{z,Rd})^2 = 0.13 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.42 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{yz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(X_{LT}*M_{y,Rk}/gM1) + k_{zz}*M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 612 Beam_612

POINT: 1

COORDINATE: x = 0.50 L = 1.78 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 13.36 kN	My,Ed = 16.43 kN*m	Mz,Ed = 0.16 kN*m	Vy,Ed = 0.09 kN
Nc,Rd = 863.94 kN	My,Ed,max = 16.43 kN*m	Mz,Ed,max = 0.17 kN*m	Vy,T,Rd = 418.42 kN
Nb,Rd = 863.94 kN	My,c,Rd = 47.71 kN*m	Mz,c,Rd = 23.33 kN*m	Vz,Ed = 0.02 kN
	MN,y,Rd = 47.71 kN*m	MN,z,Rd = 23.33 kN*m	Vz,T,Rd = 160.72 kN
	Mb,Rd = 38.84 kN*m		Tt,Ed = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 66.21 kN*m	Curve,LT - b	XLT = 0.79
Lcr,upp=3.55 m	Lam_LT = 0.85	fi,LT = 0.85	XLT,mod = 0.81

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.42 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
 $u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$ Verified
Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 613 Beam_613

POINT: 3

COORDINATE: x = 0.50 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²
$t_w=0.5$ cm	$I_y=1033.13$ cm ⁴	$I_z=389.32$ cm ⁴	$I_x=7.97$ cm ⁴
$t_f=0.9$ cm	$W_{ply}=173.51$ cm ³	$W_{plz}=84.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 10.31$ kN	$M_{y,Ed} = 16.85$ kN*m	$M_{z,Ed} = 0.15$ kN*m	$V_{y,Ed} = -0.08$ kN
$N_{c,Rd} = 863.94$ kN	$M_{y,Ed,max} = 16.85$ kN*m	$M_{z,Ed,max} = 0.17$ kN*m	$V_{y,c,Rd} = 418.46$ kN
$N_{b,Rd} = 863.94$ kN	$M_{y,c,Rd} = 47.71$ kN*m	$M_{z,c,Rd} = 23.33$ kN*m	$V_{z,Ed} = 0.28$ kN
	$MN_{y,Rd} = 47.71$ kN*m	$MN_{z,Rd} = 23.33$ kN*m	$V_{z,c,Rd} = 160.73$ kN
	$Mb,Rd = 38.68$ kN*m		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 65.32$ kN*m	Curve,LT - b	$X_{LT} = 0.79$
$L_{cr,upp}=3.60$ m	$\lambda_{m_LT} = 0.85$	$\phi_{LT} = 0.85$	$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.44 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_y \max = L/200.00 = 1.8$ cm Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.7$ cm < $u_z \max = L/200.00 = 1.8$ cm Verified
Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 614 Beam_614

POINT: 3

COORDINATE: $x = 0.50$ L = 1.79 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tw=0.5 cm
tf=0.9 cm

Iy=1033.13 cm⁴
Wply=173.51 cm³

Iz=389.32 cm⁴
Wplz=84.85 cm³

Ix=7.97 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 22.81 kN
N_{c,Rd} = 863.94 kN
N_{b,Rd} = 863.94 kN

My_{Ed} = 16.74 kN*m
My_{Ed,max} = 16.74 kN*m
My_{c,Rd} = 47.71 kN*m
MN_{y,Rd} = 47.71 kN*m
Mb_{Rd} = 38.71 kN*m

Mz_{Ed} = 0.19 kN*m
Mz_{Ed,max} = 0.19 kN*m
Mz_{c,Rd} = 23.33 kN*m
MN_{z,Rd} = 23.33 kN*m

Vy_{Ed} = -0.10 kN
Vy_{c,Rd} = 418.46 kN
Vz_{Ed} = 0.26 kN
Vz_{c,Rd} = 160.73 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
L_{cr,upp} = 3.59 m

M_{cr} = 65.51 kN*m
Lam_{LT} = 0.85

Curve_{LT} - b
fi_{LT} = 0.85

XLT = 0.79
XLT_{mod} = 0.81

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zz} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.03 < 1.00 (6.2.4.(1))
(My_{Ed}/MN_{y,Rd})^{2.00} + (Mz_{Ed}/MN_{z,Rd})^{1.00} = 0.13 < 1.00 (6.2.9.1.(6))
Vy_{Ed}/Vy_{c,Rd} = 0.00 < 1.00 (6.2.6.(1))
Vz_{Ed}/Vz_{c,Rd} = 0.00 < 1.00 (6.2.6.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.43 < 1.00 (6.3.2.1.(1))
N_{Ed}/(Xy*N_{Rk/gM1}) + k_{yy}*My_{Ed,max}/(XLT*My_{Rk/gM1}) + k_{yz}*Mz_{Ed,max}/(Mz_{Rk/gM1}) = 0.47 < 1.00 (6.3.3.(4))
N_{Ed}/(Xz*N_{Rk/gM1}) + k_{zy}*My_{Ed,max}/(XLT*My_{Rk/gM1}) + k_{zz}*Mz_{Ed,max}/(Mz_{Rk/gM1}) = 0.47 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.8 cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
u_z = 0.7 cm < u_{z,max} = L/200.00 = 1.8 cm Verified
Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 615 Beam_615

POINT: 3

COORDINATE: x = 0.50 L = 1.79 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm
b=14.0 cm
tw=0.5 cm
tf=0.9 cm

gM0=1.00
Ay=26.36 cm²
Iy=1033.13 cm⁴
Wply=173.51 cm³

gM1=1.00
Az=10.12 cm²
Iz=389.32 cm⁴
Wplz=84.85 cm³

Ax=31.42 cm²
Ix=7.97 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 17.69 kN
N_{c,Rd} = 863.94 kN
N_{b,Rd} = 863.94 kN

My_{Ed} = 16.63 kN*m
My_{Ed,max} = 16.63 kN*m
My_{c,Rd} = 47.71 kN*m
MN_{y,Rd} = 47.71 kN*m

Mz_{Ed} = 0.18 kN*m
Mz_{Ed,max} = 0.19 kN*m
Mz_{c,Rd} = 23.33 kN*m
MN_{z,Rd} = 23.33 kN*m

Vy_{Ed} = -0.10 kN
Vy_{c,Rd} = 418.46 kN
Vz_{Ed} = 0.27 kN
Vz_{c,Rd} = 160.73 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$M_{b,Rd} = 38.76 \text{ kN}\cdot\text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,upp} = 3.57 \text{ m}$$

$$M_{cr} = 65.76 \text{ kN}\cdot\text{m}$$

$$\lambda_{m,LT} = 0.85$$

Curve,LT - b

$$f_{i,LT} = 0.85$$

$$X_{LT} = 0.79$$

$$X_{LT,mod} = 0.81$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.13 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.46 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.46 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /90/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /12/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 616 Beam_616

POINT: 1

COORDINATE: x = 0.50 L = 1.78 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /11/ \quad 1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$$h = 13.3 \text{ cm}$$

$$b = 14.0 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.9 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 26.36 \text{ cm}^2$$

$$I_y = 1033.13 \text{ cm}^4$$

$$W_{ply} = 173.51 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 10.12 \text{ cm}^2$$

$$I_z = 389.32 \text{ cm}^4$$

$$W_{plz} = 84.85 \text{ cm}^3$$

$$A_x = 31.42 \text{ cm}^2$$

$$I_x = 7.97 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 8.71 \text{ kN}$$

$$N_{c,Rd} = 863.94 \text{ kN}$$

$$N_{b,Rd} = 863.94 \text{ kN}$$

$$M_{y,Ed} = 16.55 \text{ kN}\cdot\text{m}$$

$$M_{y,Ed,max} = 16.55 \text{ kN}\cdot\text{m}$$

$$M_{y,c,Rd} = 47.71 \text{ kN}\cdot\text{m}$$

$$M_{N,y,Rd} = 47.71 \text{ kN}\cdot\text{m}$$

$$M_{b,Rd} = 38.79 \text{ kN}\cdot\text{m}$$

$$M_{z,Ed} = -0.13 \text{ kN}\cdot\text{m}$$

$$M_{z,Ed,max} = -0.13 \text{ kN}\cdot\text{m}$$

$$M_{z,c,Rd} = 23.33 \text{ kN}\cdot\text{m}$$

$$M_{N,z,Rd} = 23.33 \text{ kN}\cdot\text{m}$$

$$V_{y,Ed} = -0.07 \text{ kN}$$

$$V_{y,T,Rd} = 418.44 \text{ kN}$$

$$V_{z,Ed} = 0.02 \text{ kN}$$

$$V_{z,T,Rd} = 160.73 \text{ kN}$$

$$T_{t,Ed} = 0.00 \text{ kN}\cdot\text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,upp} = 3.56 \text{ m}$$

$$M_{cr} = 65.95 \text{ kN}\cdot\text{m}$$

$$\lambda_{m,LT} = 0.85$$

Curve,LT - b

$$f_{i,LT} = 0.85$$

$$X_{LT} = 0.79$$

$$X_{LT,mod} = 0.81$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.44 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.44 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 617 Beam_617

POINT: 3

COORDINATE: $x = 0.50 L = 1.79 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 14.0 \text{ cm}$

$A_y = 26.36 \text{ cm}^2$

$A_z = 10.12 \text{ cm}^2$

$A_x = 31.42 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 1033.13 \text{ cm}^4$

$I_z = 389.32 \text{ cm}^4$

$I_x = 7.97 \text{ cm}^4$

$t_f = 0.9 \text{ cm}$

$W_{ply} = 173.51 \text{ cm}^3$

$W_{plz} = 84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.57 \text{ kN}$

$M_{y,Ed} = 16.70 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = -0.18 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.10 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$M_{y,Ed,max} = 16.70 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = -0.18 \text{ kN} \cdot \text{m}$

$V_{y,c,Rd} = 418.46 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$V_{z,Ed} = 0.28 \text{ kN}$

$M_{N,y,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{N,z,Rd} = 23.33 \text{ kN} \cdot \text{m}$

$V_{z,c,Rd} = 160.73 \text{ kN}$

$M_{b,Rd} = 38.73 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 65.63 \text{ kN} \cdot \text{m}$

Curve,LT - b

$X_{LT} = 0.79$

$L_{cr,upp} = 3.58 \text{ m}$

$\lambda_{m,LT} = 0.85$

$\phi_{i,LT} = 0.85$

$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.44 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.44 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 618 Beam_618

POINT: 3

COORDINATE: x = 0.50 L = 1.79 m

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$$h = 13.3 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 14.0 \text{ cm}$$

$$A_y = 26.36 \text{ cm}^2$$

$$A_z = 10.12 \text{ cm}^2$$

$$A_x = 31.42 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 1033.13 \text{ cm}^4$$

$$I_z = 389.32 \text{ cm}^4$$

$$I_x = 7.97 \text{ cm}^4$$

$$t_f = 0.9 \text{ cm}$$

$$W_{ply} = 173.51 \text{ cm}^3$$

$$W_{plz} = 84.85 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 2.16 \text{ kN}$$

$$M_{y,Ed} = 16.69 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 0.19 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.10 \text{ kN}$$

$$N_{c,Rd} = 863.94 \text{ kN}$$

$$M_{y,Ed,max} = 16.70 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 0.19 \text{ kN} \cdot \text{m}$$

$$V_{y,c,Rd} = 418.46 \text{ kN}$$

$$N_{b,Rd} = 863.94 \text{ kN}$$

$$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 0.27 \text{ kN}$$

$$M_{N,y,Rd} = 47.71 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 23.33 \text{ kN} \cdot \text{m}$$

$$V_{z,c,Rd} = 160.73 \text{ kN}$$

$$M_{b,Rd} = 38.73 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 65.63 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$X_{LT} = 0.79$$

$$L_{cr,upp} = 3.58 \text{ m}$$

$$\lambda_{m,LT} = 0.85$$

$$f_{i,LT} = 0.85$$

$$X_{LT,mod} = 0.81$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.13 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.44 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.44 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 619 Beam_619

POINT: 3

COORDINATE: $x = 0.50 \text{ L} = 1.79 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /12/ $1 \cdot 1.35 + 2 \cdot 1.50 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$t_f=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 18.90 \text{ kN}$	$M_{y,Ed} = 16.69 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = 0.18 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = -0.10 \text{ kN}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 16.69 \text{ kN} \cdot \text{m}$	$M_{z,Ed,max} = 0.21 \text{ kN} \cdot \text{m}$	$V_{y,c,Rd} = 418.46 \text{ kN}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 23.33 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = 0.27 \text{ kN}$
	$MN_{y,Rd} = 47.71 \text{ kN} \cdot \text{m}$	$MN_{z,Rd} = 23.33 \text{ kN} \cdot \text{m}$	$V_{z,c,Rd} = 160.73 \text{ kN}$
	$Mb_{,Rd} = 38.73 \text{ kN} \cdot \text{m}$		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 65.63 \text{ kN} \cdot \text{m}$	Curve,LT - b	$X_{LT} = 0.79$
$L_{cr,upp}=3.58 \text{ m}$	$\lambda_{m_LT} = 0.85$	$\phi_{i,LT} = 0.85$	$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$

$(M_{y,Ed}/MN_{y,Rd})^2 + (M_{z,Ed}/MN_{z,Rd})^2 = 0.13 < 1.00 \quad (6.2.9.1.(6))$

$V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$

$V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00 \quad (6.2.6.(1))$

Global stability check of member:

$M_{y,Ed,max}/Mb_{,Rd} = 0.43 < 1.00 \quad (6.3.2.1.(1))$

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.46 < 1.00 \quad (6.3.3.(4))$

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.46 < 1.00 \quad (6.3.3.(4))$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$ Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 620 Beam_620

POINT: 1

COORDINATE: $x = 0.50 L = 1.79 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /11/ $1 \cdot 1.35 + 2 \cdot 1.50 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$t_f=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.90 \text{ kN}$	$M_{y,Ed} = 16.70 \text{ kN}^*\text{m}$	$M_{z,Ed} = -0.15 \text{ kN}^*\text{m}$	$V_{y,Ed} = -0.08 \text{ kN}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 16.70 \text{ kN}^*\text{m}$	$M_{z,Ed,max} = -0.15 \text{ kN}^*\text{m}$	$V_{y,T,Rd} = 418.44 \text{ kN}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN}^*\text{m}$	$M_{z,c,Rd} = 23.33 \text{ kN}^*\text{m}$	$V_{z,Ed} = 0.02 \text{ kN}$
	$MN_{y,Rd} = 47.71 \text{ kN}^*\text{m}$	$MN_{z,Rd} = 23.33 \text{ kN}^*\text{m}$	$V_{z,T,Rd} = 160.73 \text{ kN}$
	$M_{b,Rd} = 38.73 \text{ kN}^*\text{m}$		$T_{t,Ed} = 0.00 \text{ kN}^*\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 65.63 \text{ kN}^*\text{m}$	Curve,LT - b	$XLT = 0.79$
$L_{cr,upp}=3.58 \text{ m}$	$\Lambda_{m_LT} = 0.85$	$f_{i,LT} = 0.85$	$XLT_{mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/MN_{y,Rd})^{2.00} + (M_{z,Ed}/MN_{z,Rd})^{1.00} = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.43 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.45 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$ Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.7 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 621 Beam_621

POINT: 3

COORDINATE: x = 0.50 L = 1.80 m

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²
$tw=0.5$ cm	$I_y=1033.13$ cm ⁴	$I_z=389.32$ cm ⁴	$I_x=7.97$ cm ⁴
$tf=0.9$ cm	$W_{ply}=173.51$ cm ³	$W_{plz}=84.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 10.39$ kN	$M_{y,Ed} = 16.88$ kN*m	$M_{z,Ed} = 0.23$ kN*m	$V_{y,Ed} = -0.13$ kN
$N_{c,Rd} = 863.94$ kN	$M_{y,Ed,max} = 16.88$ kN*m	$M_{z,Ed,max} = 0.23$ kN*m	$V_{y,c,Rd} = 418.46$ kN
$N_{b,Rd} = 863.94$ kN	$M_{y,c,Rd} = 47.71$ kN*m	$M_{z,c,Rd} = 23.33$ kN*m	$V_{z,Ed} = 0.28$ kN
	$MN_{y,Rd} = 47.71$ kN*m	$MN_{z,Rd} = 23.33$ kN*m	$V_{z,c,Rd} = 160.73$ kN
	$M_{b,Rd} = 38.66$ kN*m		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 65.25$ kN*m	Curve,LT - b	$XLT = 0.79$
$L_{cr,upp}=3.60$ m	$\Lambda_{m_LT} = 0.86$	$\phi_{i,LT} = 0.85$	$XLT_{mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.44 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.46 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.46 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.8$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

$u_z = 0.7$ cm < $u_{z,max} = L/200.00 = 1.8$ cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 622 Beam_622

POINT: 1

COORDINATE: x = 0.50 L = 1.80 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /12/ 1*1.35 + 2*1.50 + 4*0.90 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²
$t_w=0.5$ cm	$I_y=1033.13$ cm ⁴	$I_z=389.32$ cm ⁴	$I_x=7.97$ cm ⁴
$t_f=0.9$ cm	$W_{ply}=173.51$ cm ³	$W_{plz}=84.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 25.37$ kN	$M_{y,Ed} = 16.83$ kN*m	$M_{z,Ed} = 0.16$ kN*m	$V_{y,Ed} = 0.09$ kN
$N_{c,Rd} = 863.94$ kN	$M_{y,Ed,max} = 16.83$ kN*m	$M_{z,Ed,max} = 0.27$ kN*m	$V_{y,T,Rd} = 416.90$ kN
$N_{b,Rd} = 863.94$ kN	$M_{y,c,Rd} = 47.71$ kN*m	$M_{z,c,Rd} = 23.33$ kN*m	$V_{z,Ed} = 0.03$ kN
	$MN_{y,Rd} = 47.71$ kN*m	$MN_{z,Rd} = 23.33$ kN*m	$V_{z,T,Rd} = 160.35$ kN
	$M_{b,Rd} = 38.68$ kN*m		$T_{t,Ed} = 0.01$ kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 65.32$ kN*m	Curve,LT - b	$X_{LT} = 0.79$
$L_{cr,upp}=3.60$ m	$\Lambda_{m_LT} = 0.85$	$f_{i,LT} = 0.85$	$X_{LT,mod} = 0.81$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)
 $\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.01 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.44 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.48 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.48 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.8$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

$u_z = 0.7$ cm < $u_{z,max} = L/200.00 = 1.8$ cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 735 Simple bar_0.5_735

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$t_w=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$t_f=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 48.67$ kN
 $N_c, R_d = 354.20$ kN
 $N_b, R_d = 133.36$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.84$ m
 $L_{cr,y} = 3.42$ m
 $\lambda_{my} = 129.39$
 $\lambda_{my} = 1.49$
 $X_y = 0.38$



About z axis:

$L_z = 6.84$ m
 $L_{cr,z} = 3.42$ m
 $\lambda_{mz} = 129.39$
 $\lambda_{mz} = 1.49$
 $X_z = 0.38$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{by} = 129.39 < \lambda_{b,max} = 210.00$ $\lambda_{bz} = 129.39 < \lambda_{b,max} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.36 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 736 Simple bar_0.5_736 **POINT:** 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$t_w=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$t_f=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 54.72$ kN
 $N_c, R_d = 354.20$ kN
 $N_b, R_d = 133.36$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.84$ m
 $L_{cr,y} = 3.42$ m
 $\lambda_{my} = 1.49$
 $X_y = 0.38$



About z axis:

$L_z = 6.84$ m
 $L_{cr,z} = 3.42$ m
 $\lambda_{mz} = 1.49$
 $X_z = 0.38$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lamy = 129.39

Lamz = 129.39

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{y} = 129.39 < \lambda_{max} = 210.00$

$\lambda_{z} = 129.39 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 737 Simple bar_0.5_737

POINT: 3

COORDINATE: x = 1.00 L = 6.84 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 61.03$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 133.46$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.84$ m

$\lambda_{y} = 1.49$

$L_{cr,y} = 3.42$ m

$\chi_y = 0.38$

$L_{amy} = 129.33$



About z axis:

$L_z = 6.84$ m

$\lambda_{z} = 1.49$

$L_{cr,z} = 3.42$ m

$\chi_z = 0.38$

$L_{amz} = 129.33$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.17 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{y} = 129.33 < \lambda_{max} = 210.00$

$\lambda_{z} = 129.33 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.46 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 738 Simple bar_0.5_738

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ply}=31.75 \text{ cm}^3$	$W_{plz}=31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 53.09 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 133.46 \text{ kN}$

Class of section = 1



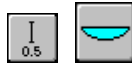
LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.84 \text{ m}$
 $L_{cr,y} = 3.42 \text{ m}$
 $L_{amy} = 129.33$
 $L_{m,y} = 1.49$
 $X_y = 0.38$



About z axis:

$L_z = 6.84 \text{ m}$
 $L_{cr,z} = 3.42 \text{ m}$
 $L_{amz} = 129.33$
 $L_{m,z} = 1.49$
 $X_z = 0.38$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 129.33 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 129.33 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.40 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 739 Simple bar_0.5_739 **POINT:** 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ply}=31.75 \text{ cm}^3$	$W_{plz}=31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 43.76 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 132.06 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.88 \text{ m}$
 $L_{m,y} = 1.50$



About z axis:

$L_z = 6.88 \text{ m}$
 $L_{m,z} = 1.50$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,y = 3.44 m
Lamy = 130.14

Xy = 0.37

Lcr,z = 3.44 m
Lamz = 130.14

Xz = 0.37

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.12 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 130.14 < Lambda,max = 210.00 Lambda,z = 130.14 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.33 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 740 Simple bar_0.5_740

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 61.52 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.06 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.88 m
Lcr,y = 3.44 m
Lamy = 130.14

Lam_y = 1.50
Xy = 0.37



About z axis:

Lz = 6.88 m
Lcr,z = 3.44 m
Lamz = 130.14

Lam_z = 1.50
Xz = 0.37

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.17 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 130.14 < Lambda,max = 210.00 Lambda,z = 130.14 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.47 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 741 Simple bar_0.5_741

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 52.25$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 132.36$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87$ m
 $L_{cr,y} = 3.44$ m
 $L_{amy} = 129.97$

$Lam_y = 1.50$
 $X_y = 0.37$



About z axis:

$L_z = 6.87$ m
 $L_{cr,z} = 3.44$ m
 $L_{amz} = 129.97$

$Lam_z = 1.50$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 129.97 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 129.97 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.39 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 742 Simple bar_0.5_742 **POINT:** 1 **COORDINATE:** $x = 0.00$ L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 49.93$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 132.36$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Ly = 6.87 m
Lcr,y = 3.44 m
Lamy = 129.97

Lam_y = 1.50
Xy = 0.37

Lz = 6.87 m
Lcr,z = 3.44 m
Lamz = 129.97

Lam_z = 1.50
Xz = 0.37

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{b,y} = 129.97 < \Lambda_{b,max} = 210.00$ $\Lambda_{b,z} = 129.97 < \Lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.38 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 743 Simple bar_0.5_743

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 51.01 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 132.76 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.86 m
Lcr,y = 3.43 m
Lamy = 129.74

Lam_y = 1.49
Xy = 0.37



About z axis:

Lz = 6.86 m
Lcr,z = 3.43 m
Lamz = 129.74

Lam_z = 1.49
Xz = 0.37

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{b,y} = 129.74 < \Lambda_{b,max} = 210.00$ $\Lambda_{b,z} = 129.74 < \Lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.38 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 744 Simple bar_0.5_744

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 49.73$ kN
 $N_c, Rd = 354.20$ kN
 $N_b, Rd = 132.76$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.86$ m
 $L_{cr,y} = 3.43$ m
 $L_{amy} = 129.74$

$Lam_y = 1.49$
 $X_y = 0.37$



About z axis:

$L_z = 6.86$ m
 $L_{cr,z} = 3.43$ m
 $L_{amz} = 129.74$

$Lam_z = 1.49$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N, Ed / N_c, Rd = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_y = 129.74 < Lambda_{max} = 210.00$ $Lambda_z = 129.74 < Lambda_{max} = 210.00$ STABLE

$N, Ed / N_b, Rd = 0.37 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 745 Simple bar_0.5_745

POINT: 1

COORDINATE: $x = 0.00$ L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 56.12$ kN
 $N_c, Rd = 354.20$ kN
 $N_b, Rd = 133.06$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$L_y = 6.85 \text{ m}$

$L_{cr,y} = 3.43 \text{ m}$

$\lambda_{my} = 129.56$

$\lambda_{my} = 1.49$

$\chi_y = 0.38$



About z axis:

$L_z = 6.85 \text{ m}$

$L_{cr,z} = 3.43 \text{ m}$

$\lambda_{mz} = 129.56$

$\lambda_{mz} = 1.49$

$\chi_z = 0.38$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.16 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 129.56 < \lambda_{max} = 210.00$

$\lambda_{mz} = 129.56 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.42 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 746 Simple bar_0.5_746

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 47.62 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 133.06 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.85 \text{ m}$

$L_{cr,y} = 3.43 \text{ m}$

$\lambda_{my} = 129.56$

$\lambda_{my} = 1.49$

$\chi_y = 0.38$



About z axis:

$L_z = 6.85 \text{ m}$

$L_{cr,z} = 3.43 \text{ m}$

$\lambda_{mz} = 129.56$

$\lambda_{mz} = 1.49$

$\chi_z = 0.38$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 129.56 < \lambda_{max} = 210.00$

$\lambda_{mz} = 129.56 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.36 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 747 Simple bar_0.5_747

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 50.02$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 132.56$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87$ m
 $L_{cr,y} = 3.43$ m
 $L_{amy} = 129.85$

$L_{m,y} = 1.50$
 $X_y = 0.37$



About z axis:

$L_z = 6.87$ m
 $L_{cr,z} = 3.43$ m
 $L_{amz} = 129.85$

$L_{m,z} = 1.50$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 129.85 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 129.85 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.38 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 748 Simple bar_0.5_748 **POINT:** 1 **COORDINATE:** $x = 0.00$ L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 63.21$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 132.56$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$
 $L_{cr,y} = 3.43 \text{ m}$
 $\lambda_{my} = 129.85$
 $\lambda_{my} = 1.50$
 $\chi_y = 0.37$



About z axis:

$L_z = 6.87 \text{ m}$
 $L_{cr,z} = 3.43 \text{ m}$
 $\lambda_{mz} = 129.85$
 $\lambda_{mz} = 1.50$
 $\chi_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.18 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{by} = 129.85 < \lambda_{b,max} = 210.00$ $\lambda_{bz} = 129.85 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/N_{b,Rd} = 0.48 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 749 Simple bar_0.5_749

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.0 \text{ cm}$	$A_y = 6.44 \text{ cm}^2$	$A_z = 6.44 \text{ cm}^2$	$A_x = 12.88 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 90.02 \text{ cm}^4$	$I_z = 90.02 \text{ cm}^4$	$I_x = 141.80 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 31.75 \text{ cm}^3$	$W_{plz} = 31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 53.22 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 132.56 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$
 $L_{cr,y} = 3.43 \text{ m}$
 $\lambda_{my} = 129.85$
 $\lambda_{my} = 1.50$
 $\chi_y = 0.37$



About z axis:

$L_z = 6.87 \text{ m}$
 $L_{cr,z} = 3.43 \text{ m}$
 $\lambda_{mz} = 129.85$
 $\lambda_{mz} = 1.50$
 $\chi_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{by} = 129.85 < \lambda_{b,max} = 210.00$ $\lambda_{bz} = 129.85 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/N_{b,Rd} = 0.40 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 750 Simple bar_0.5_750

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 49.66 kN

N_{c,Rd} = 354.20 kN

N_{b,Rd} = 132.56 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 6.87 m
L_{cr,y} = 3.43 m
L_{amy} = 129.85

Lam_y = 1.50
X_y = 0.37



About z axis:

L_z = 6.87 m
L_{cr,z} = 3.43 m
Lam_z = 129.85

Lam_z = 1.50
X_z = 0.37

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.14 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{b,y} = 129.85 < Lam_{b,max} = 210.00

Lam_{b,z} = 129.85 < Lam_{b,max} = 210.00

STABLE

N_{Ed}/N_{b,Rd} = 0.37 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 751 Simple bar_0.5_751

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 54.83 kN

N_{c,Rd} = 354.20 kN

N_{b,Rd} = 132.56 kN

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$

$\lambda_{m,y} = 1.50$

$L_{cr,y} = 3.43 \text{ m}$

$\chi_y = 0.37$

$\lambda_{m,y} = 129.85$



About z axis:

$L_z = 6.87 \text{ m}$

$\lambda_{m,z} = 1.50$

$L_{cr,z} = 3.43 \text{ m}$

$\chi_z = 0.37$

$\lambda_{m,z} = 129.85$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 129.85 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 129.85 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 752 Simple bar_0.5_752

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 6.44 \text{ cm}^2$

$A_z = 6.44 \text{ cm}^2$

$A_x = 12.88 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 90.02 \text{ cm}^4$

$I_z = 90.02 \text{ cm}^4$

$I_x = 141.80 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ply} = 31.75 \text{ cm}^3$

$W_{plz} = 31.75 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 49.85 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 132.56 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$

$\lambda_{m,y} = 1.50$

$L_{cr,y} = 3.43 \text{ m}$

$\chi_y = 0.37$

$\lambda_{m,y} = 129.85$



About z axis:

$L_z = 6.87 \text{ m}$

$\lambda_{m,z} = 1.50$

$L_{cr,z} = 3.43 \text{ m}$

$\chi_z = 0.37$

$\lambda_{m,z} = 129.85$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 129.85 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 129.85 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.38 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 753 Simple bar_0.5_753

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 50.36 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.56 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.87 m
Lcr,y = 3.43 m
Lamy = 129.85

Lam_y = 1.50
Xy = 0.37



About z axis:

Lz = 6.87 m
Lcr,z = 3.43 m
Lamz = 129.85

Lam_z = 1.50
Xz = 0.37

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.14 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 129.85 < Lambda,max = 210.00

Lambda,z = 129.85 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.38 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 754 Simple bar_0.5_754

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 42.90 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.56 kN

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.87 \text{ m}$
 $L_{cr,y} = 3.43 \text{ m}$
 $\lambda_{my} = 129.85$
 $\lambda_{my} = 1.50$
 $X_y = 0.37$



About z axis:

$L_z = 6.87 \text{ m}$
 $L_{cr,z} = 3.43 \text{ m}$
 $\lambda_{mz} = 129.85$
 $\lambda_{mz} = 1.50$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 129.85 < \lambda_{max} = 210.00$ $\lambda_{mz} = 129.85 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.32 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 755 Simple bar_0.5_755

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.0 \text{ cm}$	$A_y = 6.44 \text{ cm}^2$	$A_z = 6.44 \text{ cm}^2$	$A_x = 12.88 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 90.02 \text{ cm}^4$	$I_z = 90.02 \text{ cm}^4$	$I_x = 141.80 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 31.75 \text{ cm}^3$	$W_{plz} = 31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 47.43 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 131.96 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.88 \text{ m}$
 $L_{cr,y} = 3.44 \text{ m}$
 $\lambda_{my} = 130.20$
 $\lambda_{my} = 1.50$
 $X_y = 0.37$



About z axis:

$L_z = 6.88 \text{ m}$
 $L_{cr,z} = 3.44 \text{ m}$
 $\lambda_{mz} = 130.20$
 $\lambda_{mz} = 1.50$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 130.20 < \lambda_{max} = 210.00$ $\lambda_{mz} = 130.20 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.36 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 756 Simple bar_0.5_756

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 62.11 kN

Nc,Rd = 354.20 kN

Nb,Rd = 131.96 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 6.88 m

Lam_y = 1.50

Lcr,y = 3.44 m

Xy = 0.37

Lamy = 130.20



About z axis:

Lz = 6.88 m

Lam_z = 1.50

Lcr,z = 3.44 m

Xz = 0.37

Lamz = 130.20

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.18 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 130.20 < Lambda,max = 210.00

Lambda,z = 130.20 < Lambda,max = 210.00

STABLE

N,Ed/Nb,Rd = 0.47 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 757 Simple bar_0.5_757

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 56.00 kN

Nc,Rd = 354.20 kN

Nb,Rd = 132.06 kN

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.88 \text{ m}$
 $L_{cr,y} = 3.44 \text{ m}$
 $\Lambda_{my} = 130.14$
 $\Lambda_{m,y} = 1.50$
 $X_y = 0.37$



About z axis:

$L_z = 6.88 \text{ m}$
 $L_{cr,z} = 3.44 \text{ m}$
 $\Lambda_{mz} = 130.14$
 $\Lambda_{m,z} = 1.50$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.16 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{m,y} = 130.14 < \Lambda_{m,max} = 210.00$ $\Lambda_{m,z} = 130.14 < \Lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.42 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 758 Simple bar_0.5_758

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.0 \text{ cm}$	$A_y = 6.44 \text{ cm}^2$	$A_z = 6.44 \text{ cm}^2$	$A_x = 12.88 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 90.02 \text{ cm}^4$	$I_z = 90.02 \text{ cm}^4$	$I_x = 141.80 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 31.75 \text{ cm}^3$	$W_{plz} = 31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 37.48 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 132.06 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 6.88 \text{ m}$
 $L_{cr,y} = 3.44 \text{ m}$
 $\Lambda_{my} = 130.14$
 $\Lambda_{m,y} = 1.50$
 $X_y = 0.37$



About z axis:

$L_z = 6.88 \text{ m}$
 $L_{cr,z} = 3.44 \text{ m}$
 $\Lambda_{mz} = 130.14$
 $\Lambda_{m,z} = 1.50$
 $X_z = 0.37$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.11 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{m,y} = 130.14 < \Lambda_{m,max} = 210.00$ $\Lambda_{m,z} = 130.14 < \Lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.28 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 776 Beam_776

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /7/ 1*1.00 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = -3.00 kN

My,Ed = 0.13 kN*m

Mz,Ed = 0.07 kN*m

Vy,Ed = 0.21 kN

Nt,Rd = 354.20 kN

My,pl,Rd = 8.73 kN*m

Mz,pl,Rd = 8.73 kN*m

Vy,T,Rd = 102.07 kN

My,c,Rd = 8.73 kN*m

Mz,c,Rd = 8.73 kN*m

Vz,Ed = -0.10 kN

MN,y,Rd = 8.73 kN*m

MN,z,Rd = 8.73 kN*m

Vz,T,Rd = 102.07 kN

Tt,Ed = -0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 0.9$ cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 0.9$ cm

Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 777 Beam_777

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = -2.63 kN	My _{Ed} = 0.13 kN*m	Mz _{Ed} = -0.03 kN*m	Vy _{Ed} = -0.20 kN
N _{t,Rd} = 354.20 kN	My _{pl,Rd} = 8.73 kN*m	Mz _{pl,Rd} = 8.73 kN*m	Vy _{T,Rd} = 102.06 kN
	My _{c,Rd} = 8.73 kN*m	Mz _{c,Rd} = 8.73 kN*m	Vz _{Ed} = -0.10 kN
	MN _{y,Rd} = 8.73 kN*m	MN _{z,Rd} = 8.73 kN*m	Vz _{T,Rd} = 102.06 kN
			T _{t,Ed} = 0.01 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$
 $u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /56/ $1 \cdot 1.00 + 3 \cdot 0.60 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 778 Beam_778

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /1/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 2.34 kN	My _{Ed} = 0.13 kN*m	Mz _{Ed} = -0.01 kN*m	Vy _{Ed} = -0.02 kN
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Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Nc,Rd = 354.20 kN
Nb,Rd = 354.20 kN

My,pl,Rd = 8.73 kN*m
My,c,Rd = 8.73 kN*m
MN,y,Rd = 8.73 kN*m

Mz,pl,Rd = 8.73 kN*m
Mz,c,Rd = 8.73 kN*m
MN,z,Rd = 8.73 kN*m

Vy,T,Rd = 102.23 kN
Vz,Ed = -0.10 kN
Vz,T,Rd = 102.23 kN
Tt,Ed = -0.00 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))
(My,Ed/MN,y,Rd)^1.66 + (Mz,Ed/MN,z,Rd)^1.66 = 0.00 < 1.00 (6.2.9.1.(6))
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.00 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 0.9 cm Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00
uz = 0.0 cm < uz max = L/200.00 = 0.9 cm Verified
Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 779 Beam_779

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = -1.74 kN	My,Ed = 0.13 kN*m	Mz,Ed = 0.04 kN*m	Vy,Ed = -0.05 kN
Nt,Rd = 354.20 kN	My,pl,Rd = 8.73 kN*m	Mz,pl,Rd = 8.73 kN*m	Vy,T,Rd = 102.24 kN
	My,c,Rd = 8.73 kN*m	Mz,c,Rd = 8.73 kN*m	Vz,Ed = -0.10 kN
	MN,y,Rd = 8.73 kN*m	MN,z,Rd = 8.73 kN*m	Vz,T,Rd = 102.24 kN
			Tt,Ed = 0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.00 < 1.00 \quad (6.2.3.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /28/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /57/ \quad 1 \cdot 1.00 + 4 \cdot 0.60 + 7 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 780 Beam_780

POINT: 3

COORDINATE: x = 1.00 L = 1.79 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /4/ \quad 1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = -1.85 kN

M_{y,Ed} = -0.00 kN*m

M_{z,Ed} = -0.19 kN*m

V_{y,Ed} = 0.25 kN

N_{t,Rd} = 354.20 kN

M_{y,pl,Rd} = 8.73 kN*m

M_{z,pl,Rd} = 8.73 kN*m

V_{y,T,Rd} = 102.16 kN

M_{y,c,Rd} = 8.73 kN*m

M_{z,c,Rd} = 8.73 kN*m

V_{z,Ed} = -0.19 kN

M_{N,y,Rd} = 8.73 kN*m

M_{N,z,Rd} = 8.73 kN*m

V_{z,T,Rd} = 102.16 kN

T_{t,Ed} = -0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.01 < 1.00 \quad (6.2.3.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /56/ $1*1.00 + 3*0.60 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 781 Beam_781

POINT: 1

COORDINATE: $x = 0.50 \text{ L} = 0.90 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1*1.00 + 2*0.30 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 6.44 \text{ cm}^2$

$A_z = 6.44 \text{ cm}^2$

$A_x = 12.88 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 90.02 \text{ cm}^4$

$I_z = 90.02 \text{ cm}^4$

$I_x = 141.80 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ply} = 31.75 \text{ cm}^3$

$W_{plz} = 31.75 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -2.34 \text{ kN}$

$M_{y,Ed} = 0.13 \text{ kN}^*\text{m}$

$M_{z,Ed} = -0.03 \text{ kN}^*\text{m}$

$V_{y,Ed} = -0.19 \text{ kN}$

$N_{t,Rd} = 354.20 \text{ kN}$

$M_{y,pl,Rd} = 8.73 \text{ kN}^*\text{m}$

$M_{z,pl,Rd} = 8.73 \text{ kN}^*\text{m}$

$V_{y,T,Rd} = 102.11 \text{ kN}$

$M_{y,c,Rd} = 8.73 \text{ kN}^*\text{m}$

$M_{z,c,Rd} = 8.73 \text{ kN}^*\text{m}$

$V_{z,Ed} = -0.10 \text{ kN}$

$M_{N,y,Rd} = 8.73 \text{ kN}^*\text{m}$

$M_{N,z,Rd} = 8.73 \text{ kN}^*\text{m}$

$V_{z,T,Rd} = 102.11 \text{ kN}$

$T_{t,Ed} = 0.01 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /37/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /56/ $1*1.00 + 3*0.60 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 782 Beam_782

POINT: 3

COORDINATE: x = 1.00 L = 1.79 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = -2.67 kN

My,Ed = -0.00 kN*m

Mz,Ed = -0.22 kN*m

Vy,Ed = 0.29 kN

Nt,Rd = 354.20 kN

My,pl,Rd = 8.73 kN*m

Mz,pl,Rd = 8.73 kN*m

Vy,T,Rd = 102.07 kN

My,c,Rd = 8.73 kN*m

Mz,c,Rd = 8.73 kN*m

Vz,Ed = -0.19 kN

MN,y,Rd = 8.73 kN*m

MN,z,Rd = 8.73 kN*m

Vz,T,Rd = 102.07 kN

Tt,Ed = -0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3})gM0) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 0.9$ cm

Verified

Governing Load Case: 13 SLS /37/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 0.9$ cm

Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 783 Beam_783

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: T-CAR 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ply}=31.75 \text{ cm}^3$	$W_{plz}=31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -2.99 \text{ kN}$	$M_{y,Ed} = 0.13 \text{ kN}^*\text{m}$	$M_{z,Ed} = -0.06 \text{ kN}^*\text{m}$	$V_{y,Ed} = -0.27 \text{ kN}$
$N_{t,Rd} = 354.20 \text{ kN}$	$M_{y,pl,Rd} = 8.73 \text{ kN}^*\text{m}$	$M_{z,pl,Rd} = 8.73 \text{ kN}^*\text{m}$	$V_{y,T,Rd} = 102.01 \text{ kN}$
	$M_{y,c,Rd} = 8.73 \text{ kN}^*\text{m}$	$M_{z,c,Rd} = 8.73 \text{ kN}^*\text{m}$	$V_{z,Ed} = -0.10 \text{ kN}$
	$MN_{y,Rd} = 8.73 \text{ kN}^*\text{m}$	$MN_{z,Rd} = 8.73 \text{ kN}^*\text{m}$	$V_{z,T,Rd} = 102.01 \text{ kN}$
			$T_{t,Ed} = 0.02 \text{ kN}^*\text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /37/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00
 $u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /57/ 1*1.00 + 4*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 784 Beam_784

POINT: 3

COORDINATE: x = 1.00 L = 1.79 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: T-CAR 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = -3.18 kN

Nt,Rd = 354.20 kN

My,Ed = 0.00 kN*m

My,pl,Rd = 8.73 kN*m

My,c,Rd = 8.73 kN*m

MN,y,Rd = 8.73 kN*m

Mz,Ed = -0.18 kN*m

Mz,pl,Rd = 8.73 kN*m

Mz,c,Rd = 8.73 kN*m

MN,z,Rd = 8.73 kN*m

Vy,Ed = 0.23 kN

Vy,T,Rd = 102.08 kN

Vz,Ed = -0.19 kN

Vz,T,Rd = 102.08 kN

Tt,Ed = -0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nt,Rd = 0.01 < 1.00 (6.2.3.(1))

(My,Ed/MN,y,Rd)^{1.66} + (Mz,Ed/MN,z,Rd)^{1.66} = 0.00 < 1.00 (6.2.9.1.(6))

Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)

Vz,Ed/Vz,T,Rd = 0.00 < 1.00 (6.2.6-7)

Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.00 < 1.00 (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 0.9 cm

Verified

Governing Load Case: 13 SLS /37/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00

uz = 0.0 cm < uz max = L/200.00 = 0.9 cm

Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 785 Beam_785

POINT: 3

COORDINATE: x = 1.00 L = 1.79 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

b=7.0 cm

tw=0.5 cm

tf=0.5 cm

gM0=1.00

Ay=6.44 cm²

Iy=90.02 cm⁴

Wply=31.75 cm³

gM1=1.00

Az=6.44 cm²

Iz=90.02 cm⁴

Wplz=31.75 cm³

Ax=12.88 cm²

Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = -3.29 kN

Nt,Rd = 354.20 kN

My,Ed = -0.00 kN*m

My,pl,Rd = 8.73 kN*m

My,c,Rd = 8.73 kN*m

MN,y,Rd = 8.73 kN*m

Mz,Ed = 0.20 kN*m

Mz,pl,Rd = 8.73 kN*m

Mz,c,Rd = 8.73 kN*m

MN,z,Rd = 8.73 kN*m

Vy,Ed = -0.27 kN

Vy,T,Rd = 102.08 kN

Vz,Ed = -0.19 kN

Vz,T,Rd = 102.08 kN

Tt,Ed = 0.01 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /37/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$
 $u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /56/ $1 \cdot 1.00 + 3 \cdot 0.60 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 786 Beam_786

POINT: 3

COORDINATE: $x = 1.00 \text{ L} = 1.79 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h=7.0 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=7.0 \text{ cm}$	$A_y=6.44 \text{ cm}^2$	$A_z=6.44 \text{ cm}^2$	$A_x=12.88 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=90.02 \text{ cm}^4$	$I_z=90.02 \text{ cm}^4$	$I_x=141.80 \text{ cm}^4$
$t_f=0.5 \text{ cm}$	$W_{ply}=31.75 \text{ cm}^3$	$W_{plz}=31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -3.15 \text{ kN}$	$M_{y,Ed} = -0.00 \text{ kN} \cdot \text{m}$	$M_{z,Ed} = -0.20 \text{ kN} \cdot \text{m}$	$V_{y,Ed} = 0.27 \text{ kN}$
$N_{t,Rd} = 354.20 \text{ kN}$	$M_{y,pl,Rd} = 8.73 \text{ kN} \cdot \text{m}$	$M_{z,pl,Rd} = 8.73 \text{ kN} \cdot \text{m}$	$V_{y,T,Rd} = 102.08 \text{ kN}$
	$M_{y,c,Rd} = 8.73 \text{ kN} \cdot \text{m}$	$M_{z,c,Rd} = 8.73 \text{ kN} \cdot \text{m}$	$V_{z,Ed} = -0.19 \text{ kN}$
	$M_{N,y,Rd} = 8.73 \text{ kN} \cdot \text{m}$	$M_{N,z,Rd} = 8.73 \text{ kN} \cdot \text{m}$	$V_{z,T,Rd} = 102.08 \text{ kN}$
			$T_{t,Ed} = -0.01 \text{ kN} \cdot \text{m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$\tau_{xy}, \tau_{yz}, E_d / (f_y / (\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz}, \tau_{yz}, E_d / (f_y / (\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /37/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00

$$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 787 Beam_787

POINT: 3

COORDINATE: x = 1.00 L = 1.79 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: T-CAR 70x5

$$h = 7.0 \text{ cm}$$

$$b = 7.0 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.5 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 6.44 \text{ cm}^2$$

$$I_y = 90.02 \text{ cm}^4$$

$$W_{ply} = 31.75 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 6.44 \text{ cm}^2$$

$$I_z = 90.02 \text{ cm}^4$$

$$W_{plz} = 31.75 \text{ cm}^3$$

$$A_x = 12.88 \text{ cm}^2$$

$$I_x = 141.80 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = -2.97 \text{ kN}$$

$$N_{t,Rd} = 354.20 \text{ kN}$$

$$M_{y,Ed} = -0.00 \text{ kN}\cdot\text{m}$$

$$M_{y,pl,Rd} = 8.73 \text{ kN}\cdot\text{m}$$

$$M_{y,c,Rd} = 8.73 \text{ kN}\cdot\text{m}$$

$$M_{N,y,Rd} = 8.73 \text{ kN}\cdot\text{m}$$

$$M_{z,Ed} = 0.24 \text{ kN}\cdot\text{m}$$

$$M_{z,pl,Rd} = 8.73 \text{ kN}\cdot\text{m}$$

$$M_{z,c,Rd} = 8.73 \text{ kN}\cdot\text{m}$$

$$M_{N,z,Rd} = 8.73 \text{ kN}\cdot\text{m}$$

$$V_{y,Ed} = -0.31 \text{ kN}$$

$$V_{y,T,Rd} = 102.08 \text{ kN}$$

$$V_{z,Ed} = -0.19 \text{ kN}$$

$$V_{z,T,Rd} = 102.08 \text{ kN}$$

$$T_{t,Ed} = 0.01 \text{ kN}\cdot\text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.01 < 1.00 \quad (6.2.3.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy}, \tau_{yz}, E_d / (f_y / (\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz}, \tau_{yz}, E_d / (f_y / (\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 788 Beam_788

POINT: 2

COORDINATE: $x = 0.75 L = 1.34 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /1/ $1*1.00 + 2*0.30 + 8*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h=7.0 \text{ cm}$
 $b=7.0 \text{ cm}$
 $tw=0.5 \text{ cm}$
 $tf=0.5 \text{ cm}$

$gM0=1.00$
 $A_y=6.44 \text{ cm}^2$
 $I_y=90.02 \text{ cm}^4$
 $W_{ply}=31.75 \text{ cm}^3$

$gM1=1.00$
 $A_z=6.44 \text{ cm}^2$
 $I_z=90.02 \text{ cm}^4$
 $W_{plz}=31.75 \text{ cm}^3$

$A_x=12.88 \text{ cm}^2$
 $I_x=141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -2.94 \text{ kN}$
 $N_{t,Rd} = 354.20 \text{ kN}$

$M_{y,Ed} = 0.07 \text{ kN*m}$
 $M_{y,pl,Rd} = 8.73 \text{ kN*m}$
 $M_{y,c,Rd} = 8.73 \text{ kN*m}$
 $MN_{y,Rd} = 8.73 \text{ kN*m}$

$M_{z,Ed} = -0.07 \text{ kN*m}$
 $M_{z,pl,Rd} = 8.73 \text{ kN*m}$
 $M_{z,c,Rd} = 8.73 \text{ kN*m}$
 $MN_{z,Rd} = 8.73 \text{ kN*m}$

$V_{y,Ed} = 0.13 \text{ kN}$
 $V_{y,T,Rd} = 102.16 \text{ kN}$
 $V_{z,Ed} = -0.14 \text{ kN}$
 $V_{z,T,Rd} = 102.16 \text{ kN}$
 $T_{t,Ed} = -0.01 \text{ kN*m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/MN_{y,Rd})^{1.66} + (M_{z,Ed}/MN_{z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3}*gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 0.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$ Verified

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 0.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /57/ $1*1.00 + 4*0.60 + 7*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 789 Beam_789

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 3.21 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 354.20 kN

M_{y,Ed} = 0.13 kN*m
M_{y,pl,Rd} = 8.73 kN*m
M_{y,c,Rd} = 8.73 kN*m
M_{N,y,Rd} = 8.73 kN*m

M_{z,Ed} = 0.03 kN*m
M_{z,pl,Rd} = 8.73 kN*m
M_{z,c,Rd} = 8.73 kN*m
M_{N,z,Rd} = 8.73 kN*m

V_{y,Ed} = 0.18 kN
V_{y,T,Rd} = 102.23 kN
V_{z,Ed} = -0.10 kN
V_{z,T,Rd} = 102.23 kN
T_{t,Ed} = -0.00 kN*m
Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 0.9 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.0 cm < u_z max = L/200.00 = 0.9 cm

Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 790 Beam_790

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = -3.20 kN	My,Ed = 0.13 kN*m	Mz,Ed = 0.02 kN*m	Vy,Ed = 0.15 kN
Nt,Rd = 354.20 kN	My,pl,Rd = 8.73 kN*m	Mz,pl,Rd = 8.73 kN*m	Vy,T,Rd = 102.07 kN
	My,c,Rd = 8.73 kN*m	Mz,c,Rd = 8.73 kN*m	Vz,Ed = -0.10 kN
	MN,y,Rd = 8.73 kN*m	MN,z,Rd = 8.73 kN*m	Vz,T,Rd = 102.07 kN
			Tt,Ed = -0.01 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /56/ 1*1.00 + 3*0.60 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 791 Beam_791

POINT: 1

COORDINATE: x = 0.50 L = 0.90 m

LOADS:

Governing Load Case: 25 ACC /2/ 1*1.00 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = -3.17 kN	My,Ed = 0.13 kN*m	Mz,Ed = -0.05 kN*m	Vy,Ed = -0.25 kN
Nt,Rd = 354.20 kN	My,pl,Rd = 8.73 kN*m	Mz,pl,Rd = 8.73 kN*m	Vy,T,Rd = 102.10 kN
	My,c,Rd = 8.73 kN*m	Mz,c,Rd = 8.73 kN*m	Vz,Ed = -0.10 kN
	MN,y,Rd = 8.73 kN*m	MN,z,Rd = 8.73 kN*m	Vz,T,Rd = 102.10 kN
			Tt,Ed = 0.01 kN*m
			Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.01 < 1.00 \quad (6.2.3.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /28/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 0.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /56/ \quad 1 \cdot 1.00 + 3 \cdot 0.60 + 7 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 792 Simple bar_792

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /53/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$$h = 7.0 \text{ cm}$$

$$g_{M0} = 1.00$$

$$g_{M1} = 1.00$$

$$b = 7.0 \text{ cm}$$

$$A_y = 3.50 \text{ cm}^2$$

$$A_z = 3.50 \text{ cm}^2$$

$$A_x = 6.84 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 31.23 \text{ cm}^4$$

$$I_z = 31.23 \text{ cm}^4$$

$$I_x = 0.56 \text{ cm}^4$$

$$t_f = 0.5 \text{ cm}$$

$$W_{ely} = 6.10 \text{ cm}^3$$

$$W_{elz} = 6.10 \text{ cm}^3$$

$$A_{eff} = 6.84 \text{ cm}^2$$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 19.77 \text{ kN}$$

$$N_{c,Rd} = 188.02 \text{ kN}$$

$$N_{b,Rd} = 102.61 \text{ kN}$$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$$L_y = 2.01 \text{ m}$$

$$\lambda_{m,y} = 1.08$$

$$L_{cr,y} = 2.01 \text{ m}$$

$$\chi_y = 0.55$$

$$\lambda_{m,y} = 93.97$$



About z axis:

$$L_z = 2.01 \text{ m}$$

$$\lambda_{m,z} = 1.08$$

$$L_{cr,z} = 2.01 \text{ m}$$

$$\chi_z = 0.55$$

$$\lambda_{m,z} = 93.97$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.11 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 93.97 < \lambda_{b,max} = 210.00$$

$$\lambda_{b,z} = 93.97 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.19 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 793 Simple bar_793

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /113/ 1*1.00 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=3.50 cm²

Az=3.50 cm²

Ax=6.84 cm²

tw=0.5 cm

Iy=31.23 cm⁴

Iz=31.23 cm⁴

Ix=0.56 cm⁴

tf=0.5 cm

Wely=6.10 cm³

Welz=6.10 cm³

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 21.63 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 112.50 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.85 m

Lam_y = 1.00

L_{cr,y} = 1.85 m

X_y = 0.60

Lam_y = 86.63



About z axis:

L_z = 1.85 m

Lam_z = 1.00

L_{cr,z} = 1.85 m

X_z = 0.60

Lam_z = 86.63

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.12 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 86.63 < \lambda_{b,max} = 210.00$$

$$\lambda_{b,z} = 86.63 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.19 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 794 Simple bar_794

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /113/ 1*1.00 + 3*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.66$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 102.61$ kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.01$ m
 $L_{cr,y} = 2.01$ m
 $L_{amy} = 93.97$

$L_{am,y} = 1.08$
 $X_y = 0.55$



About z axis:

$L_z = 2.01$ m
 $L_{cr,z} = 2.01$ m
 $L_{amz} = 93.97$

$L_{am,z} = 1.08$
 $X_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 93.97 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 93.97 < \lambda_{b,max} = 210.00$ STABLE
 $N_{Ed}/N_{b,Rd} = 0.21 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 795 Simple bar_795

POINT: 1

COORDINATE: $x = 0.00$ L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /53/ $1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 19.90$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 112.50$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$\lambda_{m,y} = 1.00$

$L_{cr,y} = 1.85 \text{ m}$

$\chi_y = 0.60$

$\lambda_{m,y} = 86.63$



About z axis:

$L_z = 1.85 \text{ m}$

$\lambda_{m,z} = 1.00$

$L_{cr,z} = 1.85 \text{ m}$

$\chi_z = 0.60$

$\lambda_{m,z} = 86.63$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.11 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.63 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.63 < \lambda_{m,max} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.18 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 796 Simple bar_796

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /227/ 1*1.00 + 3*1.50 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 27.37 \text{ kN}$

$N_c, R_d = 188.02 \text{ kN}$

$N_b, R_d = 112.42 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$\lambda_{m,y} = 1.00$

$L_{cr,y} = 1.85 \text{ m}$

$\chi_y = 0.60$

$\lambda_{m,y} = 86.69$



About z axis:

$L_z = 1.85 \text{ m}$

$\lambda_{m,z} = 1.00$

$L_{cr,z} = 1.85 \text{ m}$

$\chi_z = 0.60$

$\lambda_{m,z} = 86.69$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.69 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.69 < \lambda_{m,max} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.24 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 797 Simple bar_797

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /62/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N,Ed = 13.15 kN

Nc,Rd = 188.02 kN

Nb,Rd = 102.53 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 2.01 m
Lcr,y = 2.01 m
Lamy = 94.04

Lam_y = 1.08
Xy = 0.55



About z axis:

Lz = 2.01 m
Lcr,z = 2.01 m
Lamz = 94.04

Lam_z = 1.08
Xz = 0.55

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.07 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 94.04 < Lambda,max = 210.00

Lambda,z = 94.04 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.13 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 798 Simple bar_798

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /227/ 1*1.00 + 3*1.50 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 27.69 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 102.53 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.01 \text{ m}$

$L_{cr,y} = 2.01 \text{ m}$

$\lambda_{my} = 94.04$

$\lambda_{m,y} = 1.08$

$\chi_y = 0.55$



About z axis:

$L_z = 2.01 \text{ m}$

$L_{cr,z} = 2.01 \text{ m}$

$\lambda_{mz} = 94.04$

$\lambda_{m,z} = 1.08$

$\chi_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.15 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{m,y} = 94.04 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 94.04 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$

$N,Ed/Nb,Rd = 0.27 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 799 Simple bar_799

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /1/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$gM0 = 1.00$

$A_y = 3.50 \text{ cm}^2$

$I_y = 31.23 \text{ cm}^4$

$W_{ely} = 6.10 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 3.50 \text{ cm}^2$

$I_z = 31.23 \text{ cm}^4$

$W_{elz} = 6.10 \text{ cm}^3$

$A_x = 6.84 \text{ cm}^2$

$I_x = 0.56 \text{ cm}^4$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 17.94 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 112.42 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$L_{cr,y} = 1.85 \text{ m}$

$\lambda_{my} = 86.69$

$\lambda_{m,y} = 1.00$

$\chi_y = 0.60$



About z axis:

$L_z = 1.85 \text{ m}$

$L_{cr,z} = 1.85 \text{ m}$

$\lambda_{mz} = 86.69$

$\lambda_{m,z} = 1.00$

$\chi_z = 0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.69 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.69 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.16 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 800 Simple bar_800

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 17.23 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 103.05 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 2.00 m
L_{cr,y} = 2.00 m
L_{amy} = 93.64

L_{am,y} = 1.08
X_y = 0.55



About z axis:

L_z = 2.00 m
L_{cr,z} = 2.00 m
L_{amz} = 93.64

L_{am,z} = 1.08
X_z = 0.55

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.09 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 93.64 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 93.64 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.17 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 801 Simple bar_801

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.07$ kN

$N_{c,Rd} = 188.02$ kN

$N_{b,Rd} = 112.90$ kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85$ m	$\lambda_{m,y} = 0.99$
$L_{cr,y} = 1.85$ m	$X_y = 0.60$
$\lambda_{m,y} = 86.34$	



About z axis:

$L_z = 1.85$ m	$\lambda_{m,z} = 0.99$
$L_{cr,z} = 1.85$ m	$X_z = 0.60$
$\lambda_{m,z} = 86.34$	

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.11 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.34 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.34 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.19 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 802 Simple bar_802

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 10 ULS /233/ $1 \cdot 1.00 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.86$ kN

$N_{c,Rd} = 188.02$ kN

$N_{b,Rd} = 103.05$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$\text{Lam}_y = 1.08$

$L_{cr,y} = 2.00 \text{ m}$

$X_y = 0.55$

$\text{Lam}_y = 93.64$



About z axis:

$L_z = 2.00 \text{ m}$

$\text{Lam}_z = 1.08$

$L_{cr,z} = 2.00 \text{ m}$

$X_z = 0.55$

$\text{Lam}_z = 93.64$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\text{Lambda}_y = 93.64 < \text{Lambda}_{max} = 210.00$

$\text{Lambda}_z = 93.64 < \text{Lambda}_{max} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.21 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 803 Simple bar_803

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 16.37 \text{ kN}$

$N_c, R_d = 188.02 \text{ kN}$

$N_b, R_d = 112.90 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$\text{Lam}_y = 0.99$

$L_{cr,y} = 1.85 \text{ m}$

$X_y = 0.60$

$\text{Lam}_y = 86.34$



About z axis:

$L_z = 1.85 \text{ m}$

$\text{Lam}_z = 0.99$

$L_{cr,z} = 1.85 \text{ m}$

$X_z = 0.60$

$\text{Lam}_z = 86.34$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.09 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\text{Lambda}_y = 86.34 < \text{Lambda}_{max} = 210.00$

$\text{Lambda}_z = 86.34 < \text{Lambda}_{max} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.14 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 804 Simple bar_804

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /61/ 1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	Aeff=6.84 cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 13.87 kN
N_{c,Rd} = 188.02 kN
N_{b,Rd} = 103.05 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 2.00 m Lam_y = 1.08
L_{cr,y} = 2.00 m X_y = 0.55
Lam_y = 93.64



About z axis:

L_z = 2.00 m Lam_z = 1.08
L_{cr,z} = 2.00 m X_z = 0.55
Lam_z = 93.64

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.07 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{bda,y} = 93.64 < Lam_{bda,max} = 210.00 Lam_{bda,z} = 93.64 < Lam_{bda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.13 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 805 Simple bar_805

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 19.42 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 112.90 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$L_{cr,y} = 1.85 \text{ m}$

$\lambda_{my} = 86.34$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.85 \text{ m}$

$L_{cr,z} = 1.85 \text{ m}$

$\lambda_{mz} = 86.34$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.10 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.34 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.34 < \lambda_{m,max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.17 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 806 Simple bar_806

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /61/ 1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$

$b=7.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.5 \text{ cm}$

$gM0=1.00$

$A_y=3.50 \text{ cm}^2$

$I_y=31.23 \text{ cm}^4$

$W_{ely}=6.10 \text{ cm}^3$

$gM1=1.00$

$A_z=3.50 \text{ cm}^2$

$I_z=31.23 \text{ cm}^4$

$W_{elz}=6.10 \text{ cm}^3$

$A_x=6.84 \text{ cm}^2$

$I_x=0.56 \text{ cm}^4$

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 13.54 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 112.90 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$L_{cr,y} = 1.85 \text{ m}$

$\lambda_{my} = 86.34$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.85 \text{ m}$

$L_{cr,z} = 1.85 \text{ m}$

$\lambda_{mz} = 86.34$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.07 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.34 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.34 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.12 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 807 Simple bar_807

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 19.64 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 103.05 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 2.00 m
L_{cr,y} = 2.00 m
L_{amy} = 93.64

L_{am,y} = 1.08
X_y = 0.55



About z axis:

L_z = 2.00 m
L_{cr,z} = 2.00 m
L_{amz} = 93.64

L_{am,z} = 1.08
X_z = 0.55

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 93.64 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 93.64 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.19 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 808 Simple bar_808

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=3.50 \text{ cm}^2$	$A_z=3.50 \text{ cm}^2$	$A_x=6.84 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=31.23 \text{ cm}^4$	$I_z=31.23 \text{ cm}^4$	$I_x=0.56 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ely}=6.10 \text{ cm}^3$	$W_{elz}=6.10 \text{ cm}^3$	$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.31 \text{ kN}$
 $N_{c,Rd} = 188.02 \text{ kN}$
 $N_{b,Rd} = 103.05 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$
 $L_{cr,y} = 2.00 \text{ m}$
 $L_{amy} = 93.64$
 $L_{m,y} = 1.08$
 $X_y = 0.55$



About z axis:

$L_z = 2.00 \text{ m}$
 $L_{cr,z} = 2.00 \text{ m}$
 $L_{amz} = 93.64$
 $L_{m,z} = 1.08$
 $X_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.11 < 1.00$ (6.2.4.(1))

Global stability check of member:

$L_{am,y} = 93.64 < L_{am,max} = 210.00$ $\lambda_{m,z} = 93.64 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.21 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 809 Simple bar_809

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /8/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=3.50 \text{ cm}^2$	$A_z=3.50 \text{ cm}^2$	$A_x=6.84 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=31.23 \text{ cm}^4$	$I_z=31.23 \text{ cm}^4$	$I_x=0.56 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ely}=6.10 \text{ cm}^3$	$W_{elz}=6.10 \text{ cm}^3$	$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 24.24 \text{ kN}$
 $N_{c,Rd} = 188.02 \text{ kN}$
 $N_{b,Rd} = 112.90 \text{ kN}$

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$\text{Lam}_y = 0.99$

$\text{Lcr}_y = 1.85 \text{ m}$

$X_y = 0.60$

$\text{Lam}_y = 86.34$



About z axis:

$L_z = 1.85 \text{ m}$

$\text{Lam}_z = 0.99$

$\text{Lcr}_z = 1.85 \text{ m}$

$X_z = 0.60$

$\text{Lam}_z = 86.34$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.13 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\text{Lambda}_y = 86.34 < \text{Lambda}_{\text{max}} = 210.00$

$\text{Lambda}_z = 86.34 < \text{Lambda}_{\text{max}} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.21 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 810 Simple bar_810

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 20.17 \text{ kN}$

$N_c, R_d = 188.02 \text{ kN}$

$N_b, R_d = 103.05 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$\text{Lam}_y = 1.08$

$\text{Lcr}_y = 2.00 \text{ m}$

$X_y = 0.55$

$\text{Lam}_y = 93.64$



About z axis:

$L_z = 2.00 \text{ m}$

$\text{Lam}_z = 1.08$

$\text{Lcr}_z = 2.00 \text{ m}$

$X_z = 0.55$

$\text{Lam}_z = 93.64$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.11 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\text{Lambda}_y = 93.64 < \text{Lambda}_{\text{max}} = 210.00$

$\text{Lambda}_z = 93.64 < \text{Lambda}_{\text{max}} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.20 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 811 Simple bar_811

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 20.91 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 112.90 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.85 m
L_{cr,y} = 1.85 m
L_{amy} = 86.34

Lam_y = 0.99
X_y = 0.60



About z axis:

L_z = 1.85 m
L_{cr,z} = 1.85 m
L_{amz} = 86.34

Lam_z = 0.99
X_z = 0.60

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.11 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{bda,y} = 86.34 < Lam_{bda,max} = 210.00

Lam_{bda,z} = 86.34 < Lam_{bda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.19 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 812 Simple bar_812

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /62/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 19.40 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 103.05 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$L_{cr,y} = 2.00 \text{ m}$

$\lambda_{my} = 93.64$

$\lambda_{m,y} = 1.08$

$\chi_y = 0.55$



About z axis:

$L_z = 2.00 \text{ m}$

$L_{cr,z} = 2.00 \text{ m}$

$\lambda_{mz} = 93.64$

$\lambda_{m,z} = 1.08$

$\chi_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.10 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.64 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.64 < \lambda_{m,max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.19 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 813 Simple bar_813

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /206/ $1 \cdot 1.00 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 3.50 \text{ cm}^2$

$I_y = 31.23 \text{ cm}^4$

$W_{ely} = 6.10 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 3.50 \text{ cm}^2$

$I_z = 31.23 \text{ cm}^4$

$W_{elz} = 6.10 \text{ cm}^3$

$A_x = 6.84 \text{ cm}^2$

$I_x = 0.56 \text{ cm}^4$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 27.18 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 112.90 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$L_{cr,y} = 1.85 \text{ m}$

$\lambda_{my} = 86.34$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.85 \text{ m}$

$L_{cr,z} = 1.85 \text{ m}$

$\lambda_{mz} = 86.34$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.14 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.34 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.34 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.24 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 814 Simple bar_814

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /62/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 20.12 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 112.90 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.85 m
L_{cr,y} = 1.85 m
Λ_{my} = 86.34

Λ_{m,y} = 0.99
X_y = 0.60



About z axis:

L_z = 1.85 m
L_{cr,z} = 1.85 m
Λ_{mz} = 86.34

Λ_{m,z} = 0.99
X_z = 0.60

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.11 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.34 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.34 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.18 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 815 Simple bar_815

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=3.50 \text{ cm}^2$	$A_z=3.50 \text{ cm}^2$	$A_x=6.84 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=31.23 \text{ cm}^4$	$I_z=31.23 \text{ cm}^4$	$I_x=0.56 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ely}=6.10 \text{ cm}^3$	$W_{elz}=6.10 \text{ cm}^3$	$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 27.50 \text{ kN}$

$N_{c,Rd} = 188.02 \text{ kN}$

$N_{b,Rd} = 103.05 \text{ kN}$

Class of section = 4



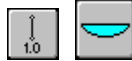
LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$	$\lambda_{m,y} = 1.08$
$L_{cr,y} = 2.00 \text{ m}$	$\chi_y = 0.55$
$\lambda_{m,y} = 93.64$	



About z axis:

$L_z = 2.00 \text{ m}$	$\lambda_{m,z} = 1.08$
$L_{cr,z} = 2.00 \text{ m}$	$\chi_z = 0.55$
$\lambda_{m,z} = 93.64$	

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.64 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.64 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.27 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 816 Simple bar_816

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.0 \text{ cm}$	$A_y=3.50 \text{ cm}^2$	$A_z=3.50 \text{ cm}^2$	$A_x=6.84 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=31.23 \text{ cm}^4$	$I_z=31.23 \text{ cm}^4$	$I_x=0.56 \text{ cm}^4$
$tf=0.5 \text{ cm}$	$W_{ely}=6.10 \text{ cm}^3$	$W_{elz}=6.10 \text{ cm}^3$	$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 26.82 \text{ kN}$

$N_{c,Rd} = 188.02 \text{ kN}$

$N_{b,Rd} = 103.48 \text{ kN}$

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.99 \text{ m}$

$\lambda_{m,y} = 1.07$

$L_{cr,y} = 1.99 \text{ m}$

$\chi_y = 0.55$

$\lambda_{m,y} = 93.31$



About z axis:

$L_z = 1.99 \text{ m}$

$\lambda_{m,z} = 1.07$

$L_{cr,z} = 1.99 \text{ m}$

$\chi_z = 0.55$

$\lambda_{m,z} = 93.31$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.31 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.31 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.26 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 817 Simple bar_817

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 27.96 \text{ kN}$

$N_{c,Rd} = 188.02 \text{ kN}$

$N_{b,Rd} = 113.30 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$\lambda_{m,y} = 0.99$

$L_{cr,y} = 1.84 \text{ m}$

$\chi_y = 0.60$

$\lambda_{m,y} = 86.05$



About z axis:

$L_z = 1.84 \text{ m}$

$\lambda_{m,z} = 0.99$

$L_{cr,z} = 1.84 \text{ m}$

$\chi_z = 0.60$

$\lambda_{m,z} = 86.05$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.05 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.05 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.25 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 818 Simple bar_818

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	Aeff=6.84 cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 22.04 kN
N_{c,Rd} = 188.02 kN
N_{b,Rd} = 103.48 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.99 m Lam_y = 1.07
L_{cr,y} = 1.99 m X_y = 0.55
Lam_y = 93.31



About z axis:

L_z = 1.99 m Lam_z = 1.07
L_{cr,z} = 1.99 m X_z = 0.55
Lam_z = 93.31

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.12 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{bda,y} = 93.31 < Lam_{bda,max} = 210.00 Lam_{bda,z} = 93.31 < Lam_{bda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.21 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 819 Simple bar_819

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 22.08 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 113.30 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$L_{cr,y} = 1.84 \text{ m}$

$\lambda_{my} = 86.05$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.84 \text{ m}$

$L_{cr,z} = 1.84 \text{ m}$

$\lambda_{mz} = 86.05$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.12 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{m,y} = 86.05 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.05 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$

$N,Ed/Nb,Rd = 0.19 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 820 Simple bar_820

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$

$b=7.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.5 \text{ cm}$

$gM0=1.00$

$A_y=3.50 \text{ cm}^2$

$I_y=31.23 \text{ cm}^4$

$W_{ely}=6.10 \text{ cm}^3$

$gM1=1.00$

$A_z=3.50 \text{ cm}^2$

$I_z=31.23 \text{ cm}^4$

$W_{elz}=6.10 \text{ cm}^3$

$A_x=6.84 \text{ cm}^2$

$I_x=0.56 \text{ cm}^4$

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 18.26 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 113.06 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$L_{cr,y} = 1.84 \text{ m}$

$\lambda_{my} = 86.22$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.84 \text{ m}$

$L_{cr,z} = 1.84 \text{ m}$

$\lambda_{mz} = 86.22$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.22 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.22 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.16 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 821 Simple bar_821

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 15.11 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 103.22 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 2.00 m
L_{cr,y} = 2.00 m
L_{amy} = 93.51

L_{am,y} = 1.08
X_y = 0.55



About z axis:

L_z = 2.00 m
L_{cr,z} = 2.00 m
L_{amz} = 93.51

L_{am,z} = 1.08
X_z = 0.55

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.08 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 93.51 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 93.51 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.15 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 822 Simple bar_822

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.45$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 113.06$ kN

Class of section = 4



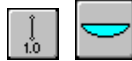
LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84$ m
 $L_{cr,y} = 1.84$ m
 $L_{my} = 86.22$
 $Lam_y = 0.99$
 $X_y = 0.60$



About z axis:

$L_z = 1.84$ m
 $L_{cr,z} = 1.84$ m
 $L_{mz} = 86.22$
 $Lam_z = 0.99$
 $X_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.11 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_{y} = 86.22 < Lambda_{max} = 210.00$

$Lambda_{z} = 86.22 < Lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.19 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 823 Simple bar_823

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 18.39$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 103.22$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$\lambda_{m,y} = 1.08$

$L_{cr,y} = 2.00 \text{ m}$

$\chi_y = 0.55$

$\lambda_{m,y} = 93.51$



About z axis:

$L_z = 2.00 \text{ m}$

$\lambda_{m,z} = 1.08$

$L_{cr,z} = 2.00 \text{ m}$

$\chi_z = 0.55$

$\lambda_{m,z} = 93.51$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.10 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.51 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.51 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.18 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 824 Simple bar_824

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.87 \text{ kN}$

$N_{c,Rd} = 188.02 \text{ kN}$

$N_{b,Rd} = 102.87 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$\lambda_{m,y} = 1.08$

$L_{cr,y} = 2.00 \text{ m}$

$\chi_y = 0.55$

$\lambda_{m,y} = 93.78$



About z axis:

$L_z = 2.00 \text{ m}$

$\lambda_{m,z} = 1.08$

$L_{cr,z} = 2.00 \text{ m}$

$\chi_z = 0.55$

$\lambda_{m,z} = 93.78$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.78 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.78 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.21 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 825 Simple bar_825

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N,Ed = 26.10 kN

Nc,Rd = 188.02 kN

Nb,Rd = 112.74 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 1.85 m
Lcr,y = 1.85 m
Lamy = 86.46

Lam_y = 1.00
Xy = 0.60



About z axis:

Lz = 1.85 m
Lcr,z = 1.85 m
Lamz = 86.46

Lam_z = 1.00
Xz = 0.60

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.14 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 86.46 < Lambda,max = 210.00 Lambda,z = 86.46 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.23 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 826 Simple bar_826

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 19.40 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 102.87 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$L_{cr,y} = 2.00 \text{ m}$

$\lambda_{my} = 93.78$

$\lambda_{m,y} = 1.08$

$\chi_y = 0.55$



About z axis:

$L_z = 2.00 \text{ m}$

$L_{cr,z} = 2.00 \text{ m}$

$\lambda_{mz} = 93.78$

$\lambda_{m,z} = 1.08$

$\chi_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.10 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.78 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.78 < \lambda_{m,max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.19 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 827 Simple bar_827

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$

$b=7.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.5 \text{ cm}$

$g_{M0}=1.00$

$A_y=3.50 \text{ cm}^2$

$I_y=31.23 \text{ cm}^4$

$W_{ely}=6.10 \text{ cm}^3$

$g_{M1}=1.00$

$A_z=3.50 \text{ cm}^2$

$I_z=31.23 \text{ cm}^4$

$W_{elz}=6.10 \text{ cm}^3$

$A_x=6.84 \text{ cm}^2$

$I_x=0.56 \text{ cm}^4$

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 18.53 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 112.74 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$L_{cr,y} = 1.85 \text{ m}$

$\lambda_{my} = 86.46$

$\lambda_{m,y} = 1.00$

$\chi_y = 0.60$



About z axis:

$L_z = 1.85 \text{ m}$

$L_{cr,z} = 1.85 \text{ m}$

$\lambda_{mz} = 86.46$

$\lambda_{m,z} = 1.00$

$\chi_z = 0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.46 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.46 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.16 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 828 Simple bar_828

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 18.60 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 102.61 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 2.01 m
L_{cr,y} = 2.01 m
L_{amy} = 93.97

L_{am,y} = 1.08
X_y = 0.55



About z axis:

L_z = 2.01 m
L_{cr,z} = 2.01 m
L_{amz} = 93.97

L_{am,z} = 1.08
X_z = 0.55

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.10 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 93.97 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 93.97 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.18 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 829 Simple bar_829

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 17.74$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 112.50$ kN

Class of section = 4



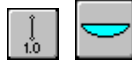
LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85$ m
 $L_{cr,y} = 1.85$ m
 $\lambda_{my} = 86.63$
 $\lambda_{my} = 1.00$
 $X_y = 0.60$



About z axis:

$L_z = 1.85$ m
 $L_{cr,z} = 1.85$ m
 $\lambda_{mz} = 86.63$
 $\lambda_{mz} = 1.00$
 $X_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.09 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 86.63 < \lambda_{max} = 210.00$ $\lambda_{mz} = 86.63 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.16 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 830 Simple bar_830

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 25 ACC /8/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 25.63$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 112.50$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85 \text{ m}$

$\text{Lam}_y = 1.00$

$\text{Lcr}_y = 1.85 \text{ m}$

$X_y = 0.60$

$\text{Lam}_y = 86.63$



About z axis:

$L_z = 1.85 \text{ m}$

$\text{Lam}_z = 1.00$

$\text{Lcr}_z = 1.85 \text{ m}$

$X_z = 0.60$

$\text{Lam}_z = 86.63$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.14 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\text{Lambda}_y = 86.63 < \text{Lambda}_{\text{max}} = 210.00$

$\text{Lambda}_z = 86.63 < \text{Lambda}_{\text{max}} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.23 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 831 Simple bar_831

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$tf = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 21.99 \text{ kN}$

$N_c, R_d = 188.02 \text{ kN}$

$N_b, R_d = 102.61 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.01 \text{ m}$

$\text{Lam}_y = 1.08$

$\text{Lcr}_y = 2.01 \text{ m}$

$X_y = 0.55$

$\text{Lam}_y = 93.97$



About z axis:

$L_z = 2.01 \text{ m}$

$\text{Lam}_z = 1.08$

$\text{Lcr}_z = 2.01 \text{ m}$

$X_z = 0.55$

$\text{Lam}_z = 93.97$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\text{Lambda}_y = 93.97 < \text{Lambda}_{\text{max}} = 210.00$

$\text{Lambda}_z = 93.97 < \text{Lambda}_{\text{max}} = 210.00$ STABLE

$N, E_d / N_b, R_d = 0.21 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 832 Simple bar_832

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	Aeff=6.84 cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N,Ed = 23.96 kN
 Nc,Rd = 188.02 kN
 Nb,Rd = 103.83 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 1.99 m Lam_y = 1.07
 Lcr,y = 1.99 m Xy = 0.55
 Lamy = 93.05



About z axis:

Lz = 1.99 m Lam_z = 1.07
 Lcr,z = 1.99 m Xz = 0.55
 Lamz = 93.05

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.13 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 93.05 < Lambda,max = 210.00 Lambda,z = 93.05 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.23 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 833 Simple bar_833

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 28.05 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 113.63 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.83 \text{ m}$

$L_{cr,y} = 1.83 \text{ m}$

$\lambda_{my} = 85.82$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.83 \text{ m}$

$L_{cr,z} = 1.83 \text{ m}$

$\lambda_{mz} = 85.82$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.15 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 85.82 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 85.82 < \lambda_{m,max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.25 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 834 Simple bar_834

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /206/ 1*1.00 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$

$b=7.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.5 \text{ cm}$

$g_{M0}=1.00$

$A_y=3.50 \text{ cm}^2$

$I_y=31.23 \text{ cm}^4$

$W_{ely}=6.10 \text{ cm}^3$

$g_{M1}=1.00$

$A_z=3.50 \text{ cm}^2$

$I_z=31.23 \text{ cm}^4$

$W_{elz}=6.10 \text{ cm}^3$

$A_x=6.84 \text{ cm}^2$

$I_x=0.56 \text{ cm}^4$

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 22.32 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 113.63 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.83 \text{ m}$

$L_{cr,y} = 1.83 \text{ m}$

$\lambda_{my} = 85.82$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.83 \text{ m}$

$L_{cr,z} = 1.83 \text{ m}$

$\lambda_{mz} = 85.82$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.12 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{bda,y} = 85.82 < \Lambda_{bda,max} = 210.00$$

$$\Lambda_{bda,z} = 85.82 < \Lambda_{bda,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.20 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 835 Simple bar_835

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 21.33 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 103.83 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.99 m
L_{cr,y} = 1.99 m
L_{amy} = 93.05

L_{am,y} = 1.07
X_y = 0.55



About z axis:

L_z = 1.99 m
L_{cr,z} = 1.99 m
L_{amz} = 93.05

L_{am,z} = 1.07
X_z = 0.55

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.11 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{bda,y} = 93.05 < \Lambda_{bda,max} = 210.00$$

$$\Lambda_{bda,z} = 93.05 < \Lambda_{bda,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.21 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 836 Simple bar_836

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 22.44$ kN

$N_{c,Rd} = 188.02$ kN

$N_{b,Rd} = 103.74$ kN

Class of section = 4



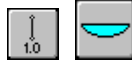
LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.99$ m
 $L_{cr,y} = 1.99$ m
 $L_{amy} = 93.11$
 $Lam_y = 1.07$
 $X_y = 0.55$



About z axis:

$L_z = 1.99$ m
 $L_{cr,z} = 1.99$ m
 $L_{amz} = 93.11$
 $Lam_z = 1.07$
 $X_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.12 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_{y} = 93.11 < Lambda_{max} = 210.00$

$Lambda_{z} = 93.11 < Lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.22 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 837 Simple bar_837

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.04$ kN

$N_{c,Rd} = 188.02$ kN

$N_{b,Rd} = 113.54$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$\text{Lam}_y = 0.99$

$\text{Lcr}_y = 1.84 \text{ m}$

$X_y = 0.60$

$\text{Lam}_y = 85.87$



About z axis:

$L_z = 1.84 \text{ m}$

$\text{Lam}_z = 0.99$

$\text{Lcr}_z = 1.84 \text{ m}$

$X_z = 0.60$

$\text{Lam}_z = 85.87$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.11 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\text{Lambda}_y = 85.87 < \text{Lambda}_{\text{max}} = 210.00$

$\text{Lambda}_z = 85.87 < \text{Lambda}_{\text{max}} = 210.00 \quad \text{STABLE}$

$N, E_d / N_b, R_d = 0.18 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 838 Simple bar_838

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /8/ 1*1.00 + 2*0.30 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, E_d = 28.85 \text{ kN}$

$N_c, R_d = 188.02 \text{ kN}$

$N_b, R_d = 113.54 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$\text{Lam}_y = 0.99$

$\text{Lcr}_y = 1.84 \text{ m}$

$X_y = 0.60$

$\text{Lam}_y = 85.87$



About z axis:

$L_z = 1.84 \text{ m}$

$\text{Lam}_z = 0.99$

$\text{Lcr}_z = 1.84 \text{ m}$

$X_z = 0.60$

$\text{Lam}_z = 85.87$

VERIFICATION FORMULAS:

Section strength check:

$N, E_d / N_c, R_d = 0.15 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\text{Lambda}_y = 85.87 < \text{Lambda}_{\text{max}} = 210.00$

$\text{Lambda}_z = 85.87 < \text{Lambda}_{\text{max}} = 210.00 \quad \text{STABLE}$

$N, E_d / N_b, R_d = 0.25 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 839 Simple bar_839

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /4/ 1*1.00 + 2*0.30 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N,Ed = 25.25 kN

Nc,Rd = 188.02 kN

Nb,Rd = 103.74 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 1.99 m
Lcr,y = 1.99 m
Lamy = 93.11

Lam_y = 1.07
Xy = 0.55



About z axis:

Lz = 1.99 m
Lcr,z = 1.99 m
Lamz = 93.11

Lam_z = 1.07
Xz = 0.55

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.13 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 93.11 < Lambda,max = 210.00

Lambda,z = 93.11 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.24 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 840 Simple bar_840

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 28.83 \text{ kN}$

$Nc, Rd = 188.02 \text{ kN}$

$Nb, Rd = 113.06 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$L_{cr,y} = 1.84 \text{ m}$

$\lambda_{my} = 86.22$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.84 \text{ m}$

$L_{cr,z} = 1.84 \text{ m}$

$\lambda_{mz} = 86.22$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N, Ed / Nc, Rd = 0.15 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{m,y} = 86.22 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.22 < \lambda_{m,max} = 210.00 \quad \text{STABLE}$

$N, Ed / Nb, Rd = 0.26 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 841 Simple bar_841

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 3.50 \text{ cm}^2$

$I_y = 31.23 \text{ cm}^4$

$W_{ely} = 6.10 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 3.50 \text{ cm}^2$

$I_z = 31.23 \text{ cm}^4$

$W_{elz} = 6.10 \text{ cm}^3$

$A_x = 6.84 \text{ cm}^2$

$I_x = 0.56 \text{ cm}^4$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 47.70 \text{ kN}$

$Nc, Rd = 188.02 \text{ kN}$

$Nb, Rd = 103.22 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$L_{cr,y} = 2.00 \text{ m}$

$\lambda_{my} = 93.51$

$\lambda_{m,y} = 1.08$

$\chi_y = 0.55$



About z axis:

$L_z = 2.00 \text{ m}$

$L_{cr,z} = 2.00 \text{ m}$

$\lambda_{mz} = 93.51$

$\lambda_{m,z} = 1.08$

$\chi_z = 0.55$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.25 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{bda,y} = 93.51 < \Lambda_{bda,max} = 210.00$$

$$\Lambda_{bda,z} = 93.51 < \Lambda_{bda,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.46 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 842 Simple bar_842

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 45.54 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 113.06 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.84 m
L_{cr,y} = 1.84 m
L_{amy} = 86.22

L_{am,y} = 0.99
X_y = 0.60



About z axis:

L_z = 1.84 m
L_{cr,z} = 1.84 m
L_{amz} = 86.22

L_{am,z} = 0.99
X_z = 0.60

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.24 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{bda,y} = 86.22 < \Lambda_{bda,max} = 210.00$$

$$\Lambda_{bda,z} = 86.22 < \Lambda_{bda,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.40 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 843 Simple bar_843

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$t_w=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$t_f=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 31.55$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 103.22$ kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00$ m
 $L_{cr,y} = 2.00$ m
 $L_{amy} = 93.51$
 $\lambda_{my} = 1.08$
 $\chi_y = 0.55$



About z axis:

$L_z = 2.00$ m
 $L_{cr,z} = 2.00$ m
 $L_{amz} = 93.51$
 $\lambda_{mz} = 1.08$
 $\chi_z = 0.55$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.17 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 93.51 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 93.51 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.31 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 844 Simple bar_844

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 10 ULS /233/ $1 \cdot 1.00 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$t_w=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$t_f=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 48.37$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 103.31$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$\lambda_{m,y} = 1.08$

$L_{cr,y} = 2.00 \text{ m}$

$\chi_y = 0.55$

$\lambda_{m,y} = 93.44$



About z axis:

$L_z = 2.00 \text{ m}$

$\lambda_{m,z} = 1.08$

$L_{cr,z} = 2.00 \text{ m}$

$\chi_z = 0.55$

$\lambda_{m,z} = 93.44$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.26 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.44 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.44 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.47 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 845 Simple bar_845

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 33.53 \text{ kN}$

$N_{c,Rd} = 188.02 \text{ kN}$

$N_{b,Rd} = 113.14 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$\lambda_{m,y} = 0.99$

$L_{cr,y} = 1.84 \text{ m}$

$\chi_y = 0.60$

$\lambda_{m,y} = 86.17$



About z axis:

$L_z = 1.84 \text{ m}$

$\lambda_{m,z} = 0.99$

$L_{cr,z} = 1.84 \text{ m}$

$\chi_z = 0.60$

$\lambda_{m,z} = 86.17$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.18 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.17 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.17 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.30 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 846 Simple bar_846

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N,Ed = 36.27 kN

Nc,Rd = 188.02 kN

Nb,Rd = 103.31 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 2.00 m
Lcr,y = 2.00 m
Lamy = 93.44

Lam_y = 1.08
Xy = 0.55



About z axis:

Lz = 2.00 m
Lcr,z = 2.00 m
Lamz = 93.44

Lam_z = 1.08
Xz = 0.55

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.19 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 93.44 < Lambda,max = 210.00

Lambda,z = 93.44 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.35 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 847 Simple bar_847

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=3.50 cm²
Iy=31.23 cm⁴
Wely=6.10 cm³

gM1=1.00
Az=3.50 cm²
Iz=31.23 cm⁴
Welz=6.10 cm³

Ax=6.84 cm²
Ix=0.56 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 45.84 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 113.14 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$L_{cr,y} = 1.84 \text{ m}$

$\lambda_{my} = 86.17$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.84 \text{ m}$

$L_{cr,z} = 1.84 \text{ m}$

$\lambda_{mz} = 86.17$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.24 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.17 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.17 < \lambda_{m,max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 848 Simple bar_848

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /227/ $1 \cdot 1.00 + 3 \cdot 1.50 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$

$b=7.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.5 \text{ cm}$

$g_{M0}=1.00$

$A_y=3.50 \text{ cm}^2$

$I_y=31.23 \text{ cm}^4$

$W_{ely}=6.10 \text{ cm}^3$

$g_{M1}=1.00$

$A_z=3.50 \text{ cm}^2$

$I_z=31.23 \text{ cm}^4$

$W_{elz}=6.10 \text{ cm}^3$

$A_x=6.84 \text{ cm}^2$

$I_x=0.56 \text{ cm}^4$

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 53.63 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 103.05 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$L_{cr,y} = 2.00 \text{ m}$

$\lambda_{my} = 93.64$

$\lambda_{m,y} = 1.08$

$\chi_y = 0.55$



About z axis:

$L_z = 2.00 \text{ m}$

$L_{cr,z} = 2.00 \text{ m}$

$\lambda_{mz} = 93.64$

$\lambda_{m,z} = 1.08$

$\chi_z = 0.55$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.29 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 93.64 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 93.64 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.52 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 849 Simple bar_849

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=3.50 cm²

Az=3.50 cm²

Ax=6.84 cm²

tw=0.5 cm

Iy=31.23 cm⁴

Iz=31.23 cm⁴

Ix=0.56 cm⁴

tf=0.5 cm

Wely=6.10 cm³

Welz=6.10 cm³

Aeff=6.84 cm²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 21.42 kN

N_{c,Rd} = 188.02 kN

N_{b,Rd} = 112.90 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.85 m

Λ_{m,y} = 0.99

L_{cr,y} = 1.85 m

X_y = 0.60

Λ_{my} = 86.34



About z axis:

L_z = 1.85 m

Λ_{m,z} = 0.99

L_{cr,z} = 1.85 m

X_z = 0.60

Λ_{mz} = 86.34

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.11 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 86.34 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 86.34 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.19 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 850 Simple bar_850

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /227/ 1*1.00 + 3*1.50 + 6*0.90

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 51.54$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 112.90$ kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.85$ m
 $L_{cr,y} = 1.85$ m
 $\lambda_{my} = 86.34$
 $\lambda_{my} = 0.99$
 $X_y = 0.60$



About z axis:

$L_z = 1.85$ m
 $L_{cr,z} = 1.85$ m
 $\lambda_{mz} = 86.34$
 $\lambda_{mz} = 0.99$
 $X_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.27 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 86.34 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.46 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 851 Simple bar_851

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CAE 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=3.50$ cm ²	$A_z=3.50$ cm ²	$A_x=6.84$ cm ²
$tw=0.5$ cm	$I_y=31.23$ cm ⁴	$I_z=31.23$ cm ⁴	$I_x=0.56$ cm ⁴
$tf=0.5$ cm	$W_{ely}=6.10$ cm ³	$W_{elz}=6.10$ cm ³	
			$A_{eff}=6.84$ cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 24.42$ kN
 $N_{c,Rd} = 188.02$ kN
 $N_{b,Rd} = 103.05$ kN

Class of section = 4

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.00 \text{ m}$

$\lambda_{m,y} = 1.08$

$L_{cr,y} = 2.00 \text{ m}$

$\chi_y = 0.55$

$\lambda_{m,y} = 93.64$



About z axis:

$L_z = 2.00 \text{ m}$

$\lambda_{m,z} = 1.08$

$L_{cr,z} = 2.00 \text{ m}$

$\chi_z = 0.55$

$\lambda_{m,z} = 93.64$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.13 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.64 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.64 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.24 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 852 Simple bar_852

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 3.50 \text{ cm}^2$

$A_z = 3.50 \text{ cm}^2$

$A_x = 6.84 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 31.23 \text{ cm}^4$

$I_z = 31.23 \text{ cm}^4$

$I_x = 0.56 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ely} = 6.10 \text{ cm}^3$

$W_{elz} = 6.10 \text{ cm}^3$

$A_{eff} = 6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 41.13 \text{ kN}$

$N_{c,Rd} = 188.02 \text{ kN}$

$N_{b,Rd} = 103.48 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.99 \text{ m}$

$\lambda_{m,y} = 1.07$

$L_{cr,y} = 1.99 \text{ m}$

$\chi_y = 0.55$

$\lambda_{m,y} = 93.31$



About z axis:

$L_z = 1.99 \text{ m}$

$\lambda_{m,z} = 1.07$

$L_{cr,z} = 1.99 \text{ m}$

$\chi_z = 0.55$

$\lambda_{m,z} = 93.31$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.22 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.31 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.31 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.40 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 853 Simple bar_853

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	Aeff=6.84 cm ²

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 46.18 kN
N_{c,Rd} = 188.02 kN
N_{b,Rd} = 113.30 kN

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 1.84 m
L_{cr,y} = 1.84 m
L_{amy} = 86.05
L_{m,y} = 0.99
X_y = 0.60



About z axis:

L_z = 1.84 m
L_{cr,z} = 1.84 m
L_{mz} = 86.05
L_{m,z} = 0.99
X_z = 0.60

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.25 < 1.00 (6.2.4.(1))

Global stability check of member:

L_{amda,y} = 86.05 < L_{amda,max} = 210.00 L_{amda,z} = 86.05 < L_{amda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.41 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 854 Simple bar_854

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: CEA 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=3.50 cm ²	Az=3.50 cm ²	Ax=6.84 cm ²
tw=0.5 cm	Iy=31.23 cm ⁴	Iz=31.23 cm ⁴	Ix=0.56 cm ⁴
tf=0.5 cm	Wely=6.10 cm ³	Welz=6.10 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 38.65 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 113.30 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.84 \text{ m}$

$L_{cr,y} = 1.84 \text{ m}$

$\lambda_{my} = 86.05$

$\lambda_{m,y} = 0.99$

$\chi_y = 0.60$



About z axis:

$L_z = 1.84 \text{ m}$

$L_{cr,z} = 1.84 \text{ m}$

$\lambda_{mz} = 86.05$

$\lambda_{m,z} = 0.99$

$\chi_z = 0.60$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.21 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 86.05 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 86.05 < \lambda_{m,max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.34 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 855 Simple bar_855

POINT: 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: CAE 70x5

$h=7.0 \text{ cm}$

$b=7.0 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.5 \text{ cm}$

$gM0=1.00$

$A_y=3.50 \text{ cm}^2$

$I_y=31.23 \text{ cm}^4$

$W_{ely}=6.10 \text{ cm}^3$

$gM1=1.00$

$A_z=3.50 \text{ cm}^2$

$I_z=31.23 \text{ cm}^4$

$W_{elz}=6.10 \text{ cm}^3$

$A_x=6.84 \text{ cm}^2$

$I_x=0.56 \text{ cm}^4$

$A_{eff}=6.84 \text{ cm}^2$

Attention: Section of the 4 class! The program does not perform a full analysis of the 4 class for these section types; they are treated as the 3 class sections.

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 48.42 \text{ kN}$

$Nc,Rd = 188.02 \text{ kN}$

$Nb,Rd = 103.48 \text{ kN}$

Class of section = 4



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 1.99 \text{ m}$

$L_{cr,y} = 1.99 \text{ m}$

$\lambda_{my} = 93.31$

$\lambda_{m,y} = 1.07$

$\chi_y = 0.55$



About z axis:

$L_z = 1.99 \text{ m}$

$L_{cr,z} = 1.99 \text{ m}$

$\lambda_{mz} = 93.31$

$\lambda_{m,z} = 1.07$

$\chi_z = 0.55$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.26 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\Lambda_{b,y} = 93.31 < \Lambda_{b,max} = 210.00$$

$$\Lambda_{b,z} = 93.31 < \Lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.47 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 856 Beam_856

POINT: 1

COORDINATE: x = 0.50 L = 2.67 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$$h = 13.3 \text{ cm}$$

$$b = 14.0 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.9 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 26.36 \text{ cm}^2$$

$$I_y = 1033.13 \text{ cm}^4$$

$$W_{ply} = 173.51 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 10.12 \text{ cm}^2$$

$$I_z = 389.32 \text{ cm}^4$$

$$W_{plz} = 84.85 \text{ cm}^3$$

$$A_x = 31.42 \text{ cm}^2$$

$$I_x = 7.97 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 34.55 \text{ kN}$$

$$N_{c,Rd} = 863.94 \text{ kN}$$

$$N_{b,Rd} = 863.94 \text{ kN}$$

$$M_{y,Ed} = -1.65 \text{ kN}\cdot\text{m}$$

$$M_{y,Ed,max} = -1.65 \text{ kN}\cdot\text{m}$$

$$M_{y,c,Rd} = 47.71 \text{ kN}\cdot\text{m}$$

$$M_{N,y,Rd} = 47.71 \text{ kN}\cdot\text{m}$$

$$M_{b,Rd} = 32.85 \text{ kN}\cdot\text{m}$$

$$V_{z,Ed} = 1.05 \text{ kN}$$

$$V_{z,c,Rd} = 160.73 \text{ kN}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,low} = 5.33 \text{ m}$$

$$M_{cr} = 43.44 \text{ kN}\cdot\text{m}$$

$$\Lambda_{m,LT} = 1.05$$

$$\text{Curve,LT} - b$$

$$f_{i,LT} = 1.02$$

$$X_{LT} = 0.67$$

$$X_{LT,mod} = 0.69$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00 \quad (6.2.5.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /37/ \quad 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /89/ \quad 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 857 Beam_857

POINT: 2

COORDINATE: $x = 0.50 L = 2.67 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /61/ $1*1.35 + 2*1.05 + 3*0.90 + 5*0.75 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$t_f=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 23.13 \text{ kN}$	$M_{y,Ed} = 1.16 \text{ kN*m}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 1.16 \text{ kN*m}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN*m}$
	$M_{N,y,Rd} = 47.71 \text{ kN*m}$
	$M_{b,Rd} = 32.83 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 43.41 \text{ kN*m}$	Curve,LT - b	$XLT = 0.67$
$L_{cr,upp}=5.34 \text{ m}$	$\lambda_{m_LT} = 1.05$	$\phi_{i,LT} = 1.02$	$XLT_{mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /37/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 7*1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 858 Beam_858

POINT: 2

COORDINATE: $x = 0.50 L = 2.66 \text{ m}$

LOADS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$tf=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 18.71 \text{ kN}$	$M_{y,Ed} = 1.15 \text{ kN*m}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 1.15 \text{ kN*m}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN*m}$
	$MN_{y,Rd} = 47.71 \text{ kN*m}$
	$Mb_{Rd} = 32.92 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 43.63 \text{ kN*m}$	Curve,LT - b	$XLT = 0.67$
$L_{cr,upp}=5.31 \text{ m}$	$Lam_LT = 1.05$	$f_i,LT = 1.02$	$XLT_{mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y*N_{c,Rd}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{c,Rd}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rd}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /101/ $1*1.00 + 3*1.00 + 5*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 859 Beam_859

POINT: 1

COORDINATE: $x = 0.50 \text{ L} = 2.66 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$gM0=1.00$	$gM1=1.00$
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Κύριος έργο: Δήμος Καλαμάτας

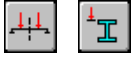
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 52.31 kN	My _{Ed} = -1.69 kN*m	
N _{c,Rd} = 863.94 kN	My _{Ed,max} = -1.69 kN*m	
N _{b,Rd} = 863.94 kN	My _{c,Rd} = 47.71 kN*m	Vz _{Ed} = 1.07 kN
	MN _{y,Rd} = 47.71 kN*m	Vz _{c,Rd} = 160.73 kN
	Mb _{Rd} = 32.92 kN*m	
		Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 43.63 kN*m	Curve,LT - b	XLT = 0.67
Lcr,low=5.31 m	Lam_LT = 1.05	fi,LT = 1.02	XLT,mod = 0.69

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.06 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00 \quad (6.2.5.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /95/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /89/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 860 Beam_860

POINT: 2

COORDINATE: x = 0.50 L = 2.66 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS /176/ } 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

h=13.3 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=26.36 cm ²	Az=10.12 cm ²	Ax=31.42 cm ²
tw=0.5 cm	Iy=1033.13 cm ⁴	Iz=389.32 cm ⁴	Ix=7.97 cm ⁴
tf=0.9 cm	Wply=173.51 cm ³	Wplz=84.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 40.93 kN	My _{Ed} = 1.15 kN*m
N _{c,Rd} = 863.94 kN	My _{Ed,max} = 1.15 kN*m
N _{b,Rd} = 863.94 kN	My _{c,Rd} = 47.71 kN*m
	MN _{y,Rd} = 47.71 kN*m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$M_{b,Rd} = 32.92 \text{ kN*m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,upp} = 5.31 \text{ m}$$

$$M_{cr} = 43.63 \text{ kN*m}$$

$$\lambda_{m,LT} = 1.05$$

$$\text{Curve}_{LT-b}$$

$$f_{i,LT} = 1.02$$

$$X_{LT} = 0.67$$

$$X_{LT,mod} = 0.69$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/g_{M1}) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/g_{M1}) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /108/ \quad 1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /26/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 861 Beam_861

POINT: 2

COORDINATE: $x = 0.50 L = 2.66 \text{ m}$

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /176/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$$h = 13.3 \text{ cm}$$

$$b = 14.0 \text{ cm}$$

$$t_w = 0.5 \text{ cm}$$

$$t_f = 0.9 \text{ cm}$$

$$g_{M0} = 1.00$$

$$A_y = 26.36 \text{ cm}^2$$

$$I_y = 1033.13 \text{ cm}^4$$

$$W_{ply} = 173.51 \text{ cm}^3$$

$$g_{M1} = 1.00$$

$$A_z = 10.12 \text{ cm}^2$$

$$I_z = 389.32 \text{ cm}^4$$

$$W_{plz} = 84.85 \text{ cm}^3$$

$$A_x = 31.42 \text{ cm}^2$$

$$I_x = 7.97 \text{ cm}^4$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 40.08 \text{ kN}$$

$$N_{c,Rd} = 863.94 \text{ kN}$$

$$N_{b,Rd} = 863.94 \text{ kN}$$

$$M_{y,Ed} = 1.15 \text{ kN*m}$$

$$M_{y,Ed,max} = 1.15 \text{ kN*m}$$

$$M_{y,c,Rd} = 47.71 \text{ kN*m}$$

$$M_{N,y,Rd} = 47.71 \text{ kN*m}$$

$$M_{b,Rd} = 32.92 \text{ kN*m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$L_{cr,upp} = 5.31 \text{ m}$$

$$M_{cr} = 43.63 \text{ kN*m}$$

$$\lambda_{m,LT} = 1.05$$

$$\text{Curve}_{LT-b}$$

$$f_{i,LT} = 1.02$$

$$X_{LT} = 0.67$$

$$X_{LT,mod} = 0.69$$

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /95/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 862 Beam_862

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.64 \text{ m}$

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /170/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 14.0 \text{ cm}$

$A_y = 26.36 \text{ cm}^2$

$A_z = 10.12 \text{ cm}^2$

$A_x = 31.42 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 1033.13 \text{ cm}^4$

$I_z = 389.32 \text{ cm}^4$

$I_x = 7.97 \text{ cm}^4$

$t_f = 0.9 \text{ cm}$

$W_{ply} = 173.51 \text{ cm}^3$

$W_{plz} = 84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 44.12 \text{ kN}$

$M_{y,Ed} = 1.14 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 863.94 \text{ kN}$

$M_{y,Ed,max} = 1.14 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 47.71 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 32.99 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 43.83 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.67$

$L_{cr,upp} = 5.29 \text{ m}$

$\lambda_{m_LT} = 1.04$

$\phi_{i,LT} = 1.02$

$XLT_{mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/(Xy \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(Xz \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_z \text{ max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /19/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 863 Beam_863

POINT: 1

COORDINATE: x = 0.50 L = 2.65 m

LOADS:

Governing Load Case: 10 ULS /170/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$$h = 13.3 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 14.0 \text{ cm}$$

$$A_y = 26.36 \text{ cm}^2$$

$$A_z = 10.12 \text{ cm}^2$$

$$A_x = 31.42 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 1033.13 \text{ cm}^4$$

$$I_z = 389.32 \text{ cm}^4$$

$$I_x = 7.97 \text{ cm}^4$$

$$t_f = 0.9 \text{ cm}$$

$$W_{ply} = 173.51 \text{ cm}^3$$

$$W_{plz} = 84.85 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 46.98 \text{ kN}$$

$$M_{y,Ed} = -1.80 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 863.94 \text{ kN}$$

$$M_{y,Ed,max} = -1.80 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 863.94 \text{ kN}$$

$$M_{y,c,Rd} = 47.71 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 1.11 \text{ kN}$$

$$M_{N,y,Rd} = 47.71 \text{ kN} \cdot \text{m}$$

$$V_{z,c,Rd} = 160.73 \text{ kN}$$

$$M_{b,Rd} = 32.95 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 43.71 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT - b}$$

$$XLT = 0.67$$

$$L_{cr,low} = 5.30 \text{ m}$$

$$\lambda_{m_LT} = 1.04$$

$$f_{i,LT} = 1.02$$

$$XLT_{mod} = 0.69$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00 \quad (6.2.5.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(Xy \cdot N_{Rk}/gM1) + k_{yy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(Xz \cdot N_{Rk}/gM1) + k_{zy} \cdot My_{Ed,max}/(XLT \cdot My_{Rk}/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.7 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_z \text{ max} = L/200.00 = 2.7 \text{ cm}$$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 864 Beam_864

POINT: 3

COORDINATE: x = 0.50 L = 2.66 m

LOADS:

Governing Load Case: 10 ULS /170/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm

gM0=1.00

gM1=1.00

b=14.0 cm

Ay=26.36 cm²

Az=10.12 cm²

Ax=31.42 cm²

tw=0.5 cm

Iy=1033.13 cm⁴

Iz=389.32 cm⁴

Ix=7.97 cm⁴

tf=0.9 cm

Wply=173.51 cm³

Wplz=84.85 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 45.29 kN

M_{y,Ed} = -1.80 kN*m

N_{c,Rd} = 863.94 kN

M_{y,Ed,max} = -1.80 kN*m

N_{b,Rd} = 863.94 kN

M_{y,c,Rd} = 47.71 kN*m

M_{N,y,Rd} = 47.71 kN*m

M_{b,Rd} = 32.89 kN*m

V_{z,Ed} = -1.11 kN

V_{z,c,Rd} = 160.73 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 43.56 kN*m

Curve,LT - b

XLT = 0.67

L_{cr,low} = 5.32 m

Lam_LT = 1.05

fi,LT = 1.02

XLT,mod = 0.69

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.05 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00 (6.2.5.(1))

V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00 (6.2.6.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.11 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.11 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.7 cm

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$

u_z = 0.1 cm < u_z max = L/200.00 = 2.7 cm

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 865 Beam_865

POINT: 2

COORDINATE: x = 0.50 L = 2.67 m

LOADS:

Governing Load Case: 10 ULS /170/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: HEA 140

h=13.3 cm

b=14.0 cm

tw=0.5 cm

tf=0.9 cm

gM0=1.00

Ay=26.36 cm²

Iy=1033.13 cm⁴

Wply=173.51 cm³

gM1=1.00

Az=10.12 cm²

Iz=389.32 cm⁴

Wplz=84.85 cm³

Ax=31.42 cm²

Ix=7.97 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 42.49 kN

N_{c,Rd} = 863.94 kN

N_{b,Rd} = 863.94 kN

M_{y,Ed} = 1.16 kN*m

M_{y,Ed,max} = 1.16 kN*m

M_{y,c,Rd} = 47.71 kN*m

M_{N,y,Rd} = 47.71 kN*m

M_{b,Rd} = 32.85 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 5.33 m

M_{cr} = 43.44 kN*m

Lam_{LT} = 1.05

Curve,LT - b

fi,LT = 1.02

XLT = 0.67

XLT,mod = 0.69

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.05 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.7 cm

Verified

Governing Load Case: 13 SLS /98/ 1*1.00 + 2*0.70 + 3*1.00 + 7*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.7 cm

Verified

Governing Load Case: 13 SLS /64/ 1*1.00 + 2*0.70 + 3*0.60 + 5*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 866 Beam_866

POINT: 2

COORDINATE: x = 0.50 L = 2.63 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²
$t_w=0.5$ cm	$I_y=1033.13$ cm ⁴	$I_z=389.32$ cm ⁴	$I_x=7.97$ cm ⁴
$t_f=0.9$ cm	$W_{ply}=173.51$ cm ³	$W_{plz}=84.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 43.30$ kN	$M_{y,Ed} = 1.13$ kN*m
$N_{c,Rd} = 863.94$ kN	$M_{y,Ed,max} = 1.13$ kN*m
$N_{b,Rd} = 863.94$ kN	$M_{y,c,Rd} = 47.71$ kN*m
	$MN_{y,Rd} = 47.71$ kN*m
	$Mb_{Rd} = 33.05$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 43.98$ kN*m	Curve,LT - b	$XLT = 0.67$
$L_{cr,upp}=5.27$ m	$\lambda_{m_LT} = 1.04$	$\phi_{i,LT} = 1.02$	$XLT_{mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /42/ $1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 867 Beam_867

POINT: 2

COORDINATE: $x = 0.50 L = 2.64$ m

LOADS:

Governing Load Case: 10 ULS /176/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 140

$h=13.3$ cm	$gM0=1.00$	$gM1=1.00$	
$b=14.0$ cm	$A_y=26.36$ cm ²	$A_z=10.12$ cm ²	$A_x=31.42$ cm ²
$t_w=0.5$ cm	$I_y=1033.13$ cm ⁴	$I_z=389.32$ cm ⁴	$I_x=7.97$ cm ⁴
$t_f=0.9$ cm	$W_{ply}=173.51$ cm ³	$W_{plz}=84.85$ cm ³	

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 46.51 \text{ kN}$	$M_{y,Ed} = 1.14 \text{ kN*m}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 1.14 \text{ kN*m}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN*m}$
	$MN_{y,Rd} = 47.71 \text{ kN*m}$
	$Mb,Rd = 33.03 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 43.94 \text{ kN*m}$	Curve,LT - b	$XLT = 0.67$
$L_{cr,upp} = 5.27 \text{ m}$	$\lambda_{m,LT} = 1.04$	$\phi_{LT} = 1.02$	$XLT_{mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/\gamma_{M1}) = 0.09 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/\gamma_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$ Verified
Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$ Verified
Governing Load Case: 13 SLS /15/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 868 Beam_868

POINT: 3

COORDINATE: x = 0.50 L = 2.65 m

LOADS:

Governing Load Case: 10 ULS /176/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$	$gM0 = 1.00$	$gM1 = 1.00$	
$b = 14.0 \text{ cm}$	$A_y = 26.36 \text{ cm}^2$	$A_z = 10.12 \text{ cm}^2$	$A_x = 31.42 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 1033.13 \text{ cm}^4$	$I_z = 389.32 \text{ cm}^4$	$I_x = 7.97 \text{ cm}^4$
$t_f = 0.9 \text{ cm}$	$W_{ply} = 173.51 \text{ cm}^3$	$W_{plz} = 84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 56.79 \text{ kN}$	$M_{y,Ed} = -1.69 \text{ kN*m}$	
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = -1.69 \text{ kN*m}$	
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN*m}$	$V_{z,Ed} = -1.07 \text{ kN}$
	$MN_{y,Rd} = 47.71 \text{ kN*m}$	$V_{z,c,Rd} = 160.73 \text{ kN}$
	$Mb,Rd = 32.95 \text{ kN*m}$	

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,low} = 5.30 \text{ m}$

$M_{cr} = 43.71 \text{ kN}\cdot\text{m}$
 $\lambda_{LT} = 1.04$

Curve,LT - b
 $\eta_{LT} = 1.02$

$X_{LT} = 0.67$
 $X_{LT,mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.07 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))

$V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.12 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.12 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 869 Beam_869

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.65 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$
 $b = 14.0 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.9 \text{ cm}$

$gM0 = 1.00$
 $A_y = 26.36 \text{ cm}^2$
 $I_y = 1033.13 \text{ cm}^4$
 $W_{ply} = 173.51 \text{ cm}^3$

$gM1 = 1.00$
 $A_z = 10.12 \text{ cm}^2$
 $I_z = 389.32 \text{ cm}^4$
 $W_{plz} = 84.85 \text{ cm}^3$

$A_x = 31.42 \text{ cm}^2$
 $I_x = 7.97 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.07 \text{ kN}$

$N_{c,Rd} = 863.94 \text{ kN}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,Ed} = 1.15 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 1.15 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 47.71 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 47.71 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 32.96 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.30 \text{ m}$

$M_{cr} = 43.75 \text{ kN}\cdot\text{m}$
 $\lambda_{LT} = 1.04$

Curve,LT - b
 $\eta_{LT} = 1.02$

$X_{LT} = 0.67$
 $X_{LT,mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:



About z axis:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$k_{yy} = 1.00$

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /96/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /74/ $1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 870 Beam_870

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.66 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /61/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h=13.3 \text{ cm}$	$g_{M0}=1.00$	$g_{M1}=1.00$	
$b=14.0 \text{ cm}$	$A_y=26.36 \text{ cm}^2$	$A_z=10.12 \text{ cm}^2$	$A_x=31.42 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=1033.13 \text{ cm}^4$	$I_z=389.32 \text{ cm}^4$	$I_x=7.97 \text{ cm}^4$
$t_f=0.9 \text{ cm}$	$W_{ply}=173.51 \text{ cm}^3$	$W_{plz}=84.85 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.92 \text{ kN}$	$M_{y,Ed} = 1.15 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 863.94 \text{ kN}$	$M_{y,Ed,max} = 1.15 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 863.94 \text{ kN}$	$M_{y,c,Rd} = 47.71 \text{ kN}\cdot\text{m}$
	$MN_{y,Rd} = 47.71 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 32.92 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 43.63 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.67$
$L_{cr,upp}=5.31 \text{ m}$	$\Lambda_{m_LT} = 1.05$	$\phi_{i,LT} = 1.02$	$X_{LT,mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 13 SLS /4/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 871 Beam_871

POINT: 3

COORDINATE: $x = 0.50 L = 2.64 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 140

$h = 13.3 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 14.0 \text{ cm}$

$A_y = 26.36 \text{ cm}^2$

$A_z = 10.12 \text{ cm}^2$

$A_x = 31.42 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 1033.13 \text{ cm}^4$

$I_z = 389.32 \text{ cm}^4$

$I_x = 7.97 \text{ cm}^4$

$t_f = 0.9 \text{ cm}$

$W_{ply} = 173.51 \text{ cm}^3$

$W_{plz} = 84.85 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 30.43 \text{ kN}$

$M_{y,Ed} = -1.67 \text{ kN*m}$

$N_{c,Rd} = 863.94 \text{ kN}$

$M_{y,Ed,max} = -1.67 \text{ kN*m}$

$N_{b,Rd} = 863.94 \text{ kN}$

$M_{y,c,Rd} = 47.71 \text{ kN*m}$

$V_{z,Ed} = -1.06 \text{ kN}$

$M_{N,y,Rd} = 47.71 \text{ kN*m}$

$V_{z,c,Rd} = 160.73 \text{ kN}$

$M_{b,Rd} = 32.99 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 43.83 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.67$

$L_{cr,low} = 5.29 \text{ m}$

$\lambda_{m_LT} = 1.04$

$\phi_{LT} = 1.02$

$X_{LT,mod} = 0.69$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

$V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 876 Beam_876

POINT: 3

COORDINATE: $x = 0.50 L = 2.65 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /7/ 1*1.00 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 50.32 \text{ kN}$	$M_{y,Ed} = -0.16 \text{ kN}\cdot\text{m}$	
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = -0.16 \text{ kN}\cdot\text{m}$	
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = -0.23 \text{ kN}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 121.34 \text{ kN}$
	$M_{b,Rd} = 8.53 \text{ kN}\cdot\text{m}$	

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.53 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.35$
$L_{cr,low} = 5.30 \text{ m}$	$\lambda_{m,LT} = 1.69$	$\phi_{i,LT} = 1.79$	$X_{LT,mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.11 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00
 $u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$ Verified
Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 877 Beam_877

POINT: 1

COORDINATE: $x = 0.50 L = 2.66 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /2/ $1*1.00 + 8*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 48.63 \text{ kN}$	$M_{y,Ed} = -0.17 \text{ kN*m}$		
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = -0.17 \text{ kN*m}$		
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$	$V_{z,Ed} = 0.23 \text{ kN}$	
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$	$V_{z,c,Rd} = 121.34 \text{ kN}$	
	$M_{b,Rd} = 8.50 \text{ kN*m}$		
		Class of section = 1	



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.50 \text{ kN*m}$	Curve,LT - b	$XLT = 0.35$
$L_{cr,low}=5.32 \text{ m}$	$\Lambda_{m_LT} = 1.69$	$f_{i,LT} = 1.79$	$XLT_{mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.11 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.13 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.7 \text{ cm}$ Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 886 Beam_886

POINT: 1

COORDINATE: $x = 0.50 L = 2.64 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

S275 (S275) $f_y = 275.00 \text{ MPa}$



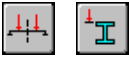
SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 35.12 \text{ kN}$	$M_{y,Ed} = -0.84 \text{ kN}\cdot\text{m}$		
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = -0.84 \text{ kN}\cdot\text{m}$		
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = 0.55 \text{ kN}$	
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 121.34 \text{ kN}$	
	$M_{b,Rd} = 8.55 \text{ kN}\cdot\text{m}$		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.55 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.35$
$L_{cr,low} = 5.29 \text{ m}$	$\lambda_{m_LT} = 1.69$	$\phi_{LT} = 1.78$	$X_{LT,mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.08 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.10 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/gM1) = 0.18 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/gM1) = 0.18 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$ Verified
Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$ Verified
Governing Load Case: 13 SLS /89/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 891 Beam_891

POINT: 2

COORDINATE: $x = 0.50 L = 2.10 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 4.23 kN

My,Ed = 0.38 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.38 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.29 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 10.67 kN*m

Curve,LT - b

XLT = 0.42

Lcr,upp=4.20 m

Lam_LT = 1.51

fi,LT = 1.54

XLT,mod = 0.42

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /26/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00

uz = 0.0 cm < uz max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /113/ 1*1.00 + 3*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 892 Beam_892

POINT: 2

COORDINATE: x = 0.50 L = 2.23 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 1.54 kN

My,Ed = 0.43 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.43 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.83 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.46 \text{ m}$

$M_{cr} = 10.05 \text{ kN}^*\text{m}$
 $\Lambda_{m_LT} = 1.55$

Curve,LT - b
 $\eta_{LT} = 1.60$

$X_{LT} = 0.40$
 $X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /19/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 893 Beam_893

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.37 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /74/ $1 \cdot 1.35 + 4 \cdot 0.90 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.14 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.48 \text{ kN}^*\text{m}$

$M_{y,Ed,max} = 0.48 \text{ kN}^*\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 9.41 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.73 \text{ m}$

$M_{cr} = 9.51 \text{ kN}^*\text{m}$
 $\Lambda_{m_LT} = 1.60$

Curve,LT - b
 $\eta_{LT} = 1.66$

$X_{LT} = 0.39$
 $X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /93/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /22/ } 1 \cdot 1.00 + 2 \cdot 1.00 + 7 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 894 Beam_894

POINT: 2

COORDINATE: x = 0.50 L = 2.50 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS /54/ } 1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 0.90 + 5 \cdot 0.75 + 6 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 6.18 \text{ kN}$$

$$M_{y,Ed} = 0.53 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.53 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.02 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 9.02 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$X_{LT} = 0.37$$

$$L_{cr,upp} = 5.00 \text{ m}$$

$$\lambda_{m,LT} = 1.64$$

$$f_{i,LT} = 1.72$$

$$X_{LT,mod} = 0.37$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /111/ $1*1.00 + 4*1.00 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /23/ $1*1.00 + 2*1.00 + 3*0.60 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 895 Beam_895

POINT: 2

COORDINATE: $x = 0.50 L = 2.63 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /54/ $1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=7.3 \text{ cm}$

$A_y=11.15 \text{ cm}^2$

$A_z=7.64 \text{ cm}^2$

$A_x=16.43 \text{ cm}^2$

$tw=0.5 \text{ cm}$

$I_y=541.22 \text{ cm}^4$

$I_z=44.92 \text{ cm}^4$

$I_x=2.54 \text{ cm}^4$

$tf=0.7 \text{ cm}$

$W_{ply}=88.35 \text{ cm}^3$

$W_{plz}=19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.73 \text{ kN}$

$M_{y,Ed} = 0.59 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.59 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 8.58 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 8.58 \text{ kN*m}$

Curve,LT - b

$XLT = 0.35$

$L_{cr,upp}=5.27 \text{ m}$

$\lambda_{m_LT} = 1.68$

$\phi_{i,LT} = 1.78$

$XLT_{mod} = 0.35$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /16/ $1*1.00 + 2*1.00 + 4*0.60 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 896 Beam_896

POINT: 2

COORDINATE: x = 0.50 L = 2.77 m

LOADS:

Governing Load Case: 10 ULS /198/ 1*1.35 + 4*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 1.97 kN

My,Ed = 0.65 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.65 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 8.19 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=5.54 m

Mcr = 8.19 kN*m

Lam_LT = 1.72

Curve,LT - b

fi,LT = 1.84

XLT = 0.34

XLT,mod = 0.34

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.03 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.08 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.8 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.8 cm

Verified

Governing Load Case: 13 SLS /3/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 897 Beam_897

POINT: 2

COORDINATE: x = 0.50 L = 2.90 m

LOADS:

Governing Load Case: 10 ULS /198/ 1*1.35 + 4*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.05$ kN	$M_{y,Ed} = 0.72$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.72$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 7.83$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 7.83$ kN*m	Curve,LT - b	$X_{LT} = 0.32$
$L_{cr,upp}=5.80$ m	$\Lambda_{m_LT} = 1.76$	$\phi_{i,LT} = 1.90$	$X_{LT,mod} = 0.32$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.03 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.09 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.10 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_y \max = L/200.00 = 2.9$ cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

$u_z = 0.2$ cm < $u_z \max = L/200.00 = 2.9$ cm Verified

Governing Load Case: 13 SLS /88/ 1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 898 Beam_898

POINT: 2

COORDINATE: x = 0.50 L = 3.04 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=11.75$ kN	$M_{y,Ed}=0.79$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.79$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=7.50$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=7.50$ kN*m	Curve,LT - b	$XLT=0.31$
$L_{cr,upp}=6.07$ m	$\lambda_{m,LT}=1.80$	$f_{i,LT}=1.95$	$XLT_{mod}=0.31$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.03 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.10 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.13 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.13 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.0 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.0 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /9/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 899 Beam_899

POINT: 2

COORDINATE: $x = 0.50 L = 3.17$ m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /170/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 65.64 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.86 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.86 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 7.20 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 6.34 \text{ m}$

$M_{cr} = 7.20 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.84$

Curve,LT - b

$f_{i,LT} = 2.01$

$XLT = 0.30$

$XLT_{mod} = 0.30$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.15 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.04 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.26 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.26 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.2 \text{ cm} < u_{z,max} = L/200.00 = 3.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /94/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 900 Beam_900

POINT: 2

COORDINATE: $x = 0.50 L = 2.21 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /171/ $1 \cdot 1.35 + 2 \cdot 1.05 + 4 \cdot 1.50 + 5 \cdot 0.75 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 23.98 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.42 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.42 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.89 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.14 \text{ kN}\cdot\text{m}$

Curve,LT - b

$XLT = 0.41$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=4.43 m

Lam_LT = 1.55

fi,LT = 1.59

XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.05 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.10 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.10 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.2 cm Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 901 Beam_901

POINT: 2

COORDINATE: x = 0.50 L = 2.28 m

LOADS:

Governing Load Case: 10 ULS /192/ 1*1.35 + 4*1.50 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 5.49 kN

My,Ed = 0.44 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.44 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.68 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 9.85 kN*m

Curve,LT - b

XLT = 0.40

Lcr,upp=4.56 m

Lam_LT = 1.57

fi,LT = 1.62

XLT,mod = 0.40

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.01 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /49/ $1 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /83/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 902 Beam_902

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.35 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.59 \text{ kN}$

$M_{y,Ed} = 0.47 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.47 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.46 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.57 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.39$

$L_{cr,upp} = 4.70 \text{ m}$

$\lambda_{m,LT} = 1.59$

$\phi_{i,LT} = 1.66$

$XLT_{mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$
 $uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 903 Beam_903

POINT: 2

COORDINATE: x = 0.50 L = 2.42 m

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$b=7.3 \text{ cm}$

$tw=0.5 \text{ cm}$

$tf=0.7 \text{ cm}$

$gM0=1.00$

$A_y=11.15 \text{ cm}^2$

$I_y=541.22 \text{ cm}^4$

$W_{ply}=88.35 \text{ cm}^3$

$gM1=1.00$

$A_z=7.64 \text{ cm}^2$

$I_z=44.92 \text{ cm}^4$

$W_{plz}=19.25 \text{ cm}^3$

$A_x=16.43 \text{ cm}^2$

$I_x=2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.26 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.50 \text{ kN*m}$

$M_{y,Ed,max} = 0.50 \text{ kN*m}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 9.25 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp}=4.84 \text{ m}$

$M_{cr} = 9.30 \text{ kN*m}$

$\lambda_{m,LT} = 1.62$

Curve,LT - b

$\phi_{i,LT} = 1.69$

$X_{LT} = 0.38$

$X_{LT,mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /16/ $1*1.00 + 2*1.00 + 4*0.60 + 6*0.60$

$uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /19/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 904 Beam_904

POINT: 2

COORDINATE: x = 0.50 L = 2.49 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 1.75 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.53 kN*m

M_{y,Ed,max} = 0.53 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb,Rd = 9.05 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.98 m

M_{cr} = 9.05 kN*m

Lam_{LT} = 1.64

Curve,LT - b

fi,LT = 1.72

XLT = 0.37

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /96/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /4/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 905 Beam_905

POINT: 2

COORDINATE: x = 0.50 L = 2.56 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.89 \text{ kN}$	$M_{y,Ed} = 0.56 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.56 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 8.81 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 8.81 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.36$
$L_{cr,upp}=5.13 \text{ m}$	$\Lambda_{m_LT} = 1.66$	$f_{i,LT} = 1.75$	$X_{LT,mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /19/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 906 Beam_906

POINT: 2

COORDINATE: $x = 0.50 L = 1.86 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 26.58 kN

My,Ed = 0.29 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.29 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 11.30 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 12.01 kN*m

Curve,LT - b

XLT = 0.46

Lcr,upp=3.72 m

Lam_LT = 1.42

fi,LT = 1.43

XLT,mod = 0.47

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.06 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

uz = 0.0 cm < uz max = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 907 Beam_907

POINT: 2

COORDINATE: x = 0.50 L = 1.93 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 12.00 kN

My,Ed = 0.24 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.24 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.98 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.86 \text{ m}$

$M_{cr} = 11.57 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.45$

Curve,LT - b
 $\eta_{LT} = 1.47$

$X_{LT} = 0.45$
 $X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 908 Beam_908

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 12.51 \text{ kN}$

$M_{y,Ed} = 0.25 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.25 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.68 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.00 \text{ m}$

$M_{cr} = 11.17 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.47$

Curve,LT - b
 $\eta_{LT} = 1.50$

$X_{LT} = 0.44$
 $X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /90/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /92/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 909 Beam_909

POINT: 2

COORDINATE: x = 0.50 L = 2.07 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC /5/ } 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 11.03 \text{ kN}$$

$$M_{y,Ed} = 0.27 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.27 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 10.39 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.80 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT - b}$$

$$XLT = 0.43$$

$$L_{cr,upp} = 4.14 \text{ m}$$

$$\lambda_{m,LT} = 1.50$$

$$f_{i,LT} = 1.53$$

$$XLT_{mod} = 0.43$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /117/ $1*1.00 + 4*1.00 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 910 Beam_910

POINT: 2

COORDINATE: $x = 0.50 L = 2.14 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /82/ $1*1.35 + 4*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 5.09 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.39 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$Mb_{Rd} = 10.13 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.45 \text{ kN*m}$

Curve,LT - b

$XLT = 0.42$

$L_{cr,upp} = 4.29 \text{ m}$

$\lambda_{m_LT} = 1.52$

$\phi_{i,LT} = 1.56$

$XLT_{mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /30/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 911 Beam_911

POINT: 2

COORDINATE: x = 0.50 L = 2.22 m

LOADS:

Governing Load Case: 10 ULS /177/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 15.57 kN

My,Ed = 0.42 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.42 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.87 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.44 m

Mcr = 10.11 kN*m

Lam_LT = 1.55

Curve,LT - b

fi,LT = 1.60

XLT = 0.41

XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.2 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.2 cm

Verified

Governing Load Case: 13 SLS /44/ 1*1.00 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 912 Beam_912

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 5.17 kN	My _{Ed} = 0.45 kN*m
N _{c,Rd} = 451.71 kN	My _{Ed,max} = 0.45 kN*m
Nb _{Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 9.66 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 9.83 kN*m	Curve,LT - b	XLT = 0.40
Lcr,upp=4.57 m	Lam_LT = 1.57	fi,LT = 1.63	XLT,mod = 0.40

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.01 < 1.00 (6.2.4.(1))
My_{Ed}/My_{c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.05 < 1.00 (6.3.2.1.(1))
N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))
N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.3 cm Verified
Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60
uz = 0.1 cm < uz max = L/200.00 = 2.3 cm Verified
Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 913 Beam_913

POINT: 2

COORDINATE: x = 0.50 L = 2.36 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=7.62$ kN	$M_{y,Ed}=0.47$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.47$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=9.44$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=9.54$ kN*m	Curve,LT - b	$XLT=0.39$
$L_{cr,upp}=4.71$ m	$\Lambda_{m,LT}=1.60$	$f_{i,LT}=1.66$	$XLT_{mod}=0.39$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /11/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 914 Beam_914

POINT: 2

COORDINATE: $x = 0.50 L = 2.43$ m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 15.98 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.37 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.37 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.23 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.86 \text{ m}$

$M_{cr} = 9.27 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.62$

Curve,LT - b

$\eta_{LT} = 1.69$

$XLT = 0.38$

$XLT_{mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 915 Beam_915

POINT: 2

COORDINATE: $x = 0.50 L = 2.50 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.62 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.02 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.02 \text{ kN}\cdot\text{m}$

Curve,LT - b

$XLT = 0.37$

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Lcr,upp=5.00 m

Lam_LT = 1.64

fi,LT = 1.72

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.5 cm Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.5 cm Verified

Governing Load Case: 13 SLS /26/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 916 Beam_916

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 7.38 kN

My,Ed = 0.56 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.56 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 8.78 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 8.78 kN*m

Curve,LT - b

XLT = 0.36

Lcr,upp=5.14 m

Lam_LT = 1.66

fi,LT = 1.75

XLT,mod = 0.36

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

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$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /93/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 917 Beam_917

POINT: 2

COORDINATE: x = 0.50 L = 1.85 m

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 10.18 \text{ kN}$

$M_{y,Ed} = 0.29 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.29 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 11.35 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 12.07 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.46$

$L_{cr,upp} = 3.70 \text{ m}$

$\lambda_{m,LT} = 1.42$

$\phi_{i,LT} = 1.43$

$XLT_{mod} = 0.47$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$
 $u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 1.8 \text{ cm}$ Verified

Governing Load Case: 13 SLS /65/ $1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 918 Beam_918

POINT: 2

COORDINATE: $x = 0.50 L = 1.92 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$b=7.3 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.7 \text{ cm}$

$g_{M0}=1.00$

$A_y=11.15 \text{ cm}^2$

$I_y=541.22 \text{ cm}^4$

$W_{ply}=88.35 \text{ cm}^3$

$g_{M1}=1.00$

$A_z=7.64 \text{ cm}^2$

$I_z=44.92 \text{ cm}^4$

$W_{plz}=19.25 \text{ cm}^3$

$A_x=16.43 \text{ cm}^2$

$I_x=2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.24 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.23 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.23 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 11.03 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp}=3.84 \text{ m}$

$M_{cr} = 11.63 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.45$

Curve,LT - b

$\eta_{LT} = 1.46$

$X_{LT} = 0.45$

$X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 919 Beam_919

POINT: 2

COORDINATE: x = 0.50 L = 1.99 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 15.09 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.25 kN*m

M_{y,Ed,max} = 0.25 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.72 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 3.98 m

M_{cr} = 11.23 kN*m

Lam_{LT} = 1.47

Curve,LT - b

fi,LT = 1.49

XLT = 0.44

XLT,mod = 0.44

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.03 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.0 cm < u_{z,max} = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 920 Beam_920

POINT: 2

COORDINATE: x = 0.50 L = 2.06 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 13.54 \text{ kN}$	$M_{y,Ed} = 0.27 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.27 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 10.43 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 10.86 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.43$
$L_{cr,upp}=4.12 \text{ m}$	$\Lambda_{m_LT} = 1.50$	$f_{i,LT} = 1.53$	$X_{LT,mod} = 0.43$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 921 Beam_921

POINT: 2

COORDINATE: $x = 0.50 L = 2.13 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 11.29 kN

My,Ed = 0.29 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.29 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.17 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 10.51 kN*m

Curve,LT - b

XLT = 0.42

Lcr,upp=4.26 m

Lam_LT = 1.52

fi,LT = 1.56

XLT,mod = 0.42

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.05 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.0 cm < uz max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /109/ 1*1.00 + 3*1.00 + 4*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 922 Beam_922

POINT: 2

COORDINATE: x = 0.50 L = 2.21 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 14.23 kN

My,Ed = 0.42 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.42 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.91 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.41 \text{ m}$

$M_{cr} = 10.16 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.55$

Curve,LT - b
 $\eta_{LT} = 1.59$

$X_{LT} = 0.41$
 $X_{LT,mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /32/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 923 Beam_923

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.27 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.42 \text{ kN}$

$M_{y,Ed} = 0.44 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.44 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.70 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.55 \text{ m}$

$M_{cr} = 9.88 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.57$

Curve,LT - b
 $\eta_{LT} = 1.62$

$X_{LT} = 0.40$
 $X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.05 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 2.3 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /33/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$$

$$u_z = 0.1 \text{ cm} < u_{z \max} = L/200.00 = 2.3 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /9/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 924 Beam_924

POINT: 2

COORDINATE: x = 0.50 L = 2.34 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /5/ \quad 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 16.24 \text{ kN}$$

$$M_{y,Ed} = 0.35 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,\max} = 0.35 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.48 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 9.59 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$X_{LT} = 0.39$$

$$L_{cr,upp} = 4.69 \text{ m}$$

$$\lambda_{m,LT} = 1.59$$

$$f_{i,LT} = 1.65$$

$$X_{LT,mod} = 0.39$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 925 Beam_925

POINT: 2

COORDINATE: $x = 0.50 L = 2.41 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 19.18 \text{ kN}$

$M_{y,Ed} = 0.37 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.37 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 9.27 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.32 \text{ kN*m}$

Curve,LT - b

$XLT = 0.38$

$L_{cr,upp} = 4.83 \text{ m}$

$\lambda_{m_LT} = 1.61$

$\phi_{i,LT} = 1.68$

$XLT_{mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 926 Beam_926

POINT: 2

COORDINATE: x = 0.50 L = 2.49 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 18.79 kN

My,Ed = 0.39 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.39 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.06 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.97 m

Mcr = 9.07 kN*m

Lam_LT = 1.64

Curve,LT - b

fi,LT = 1.71

XLT = 0.37

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 927 Beam_927

POINT: 2

COORDINATE: x = 0.50 L = 2.56 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 9.24 kN	My _{Ed} = 0.56 kN*m
N _{c,Rd} = 451.71 kN	My _{Ed,max} = 0.56 kN*m
Nb _{Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 8.83 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	M _{cr} = 8.83 kN*m	Curve,LT - b	XLT = 0.36
L _{cr,upp} = 5.11 m	Lam_LT = 1.66	fi,LT = 1.75	XLT _{mod} = 0.36

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))
My_{Ed}/My_{c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.06 < 1.00 (6.3.2.1.(1))
N_{Ed}/(Xy*N_{Rk}/gM1) + k_{yy}*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))
N_{Ed}/(Xz*N_{Rk}/gM1) + k_{zy}*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.6 cm Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00

u_z = 0.1 cm < u_z max = L/200.00 = 2.6 cm Verified

Governing Load Case: 13 SLS /9/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 928 Beam_928

POINT: 2

COORDINATE: x = 0.50 L = 1.85 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=11.35$ kN	$M_{y,Ed}=0.22$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.22$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=11.36$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=12.08$ kN*m	Curve,LT - b	$XLT=0.46$
$L_{cr,upp}=3.69$ m	$\Lambda_{m,LT}=1.42$	$f_{i,LT}=1.43$	$XLT_{mod}=0.47$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.02 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.8 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.8 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /88/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 929 Beam_929

POINT: 2

COORDINATE: $x = 0.50$ L = 1.92 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 15.55 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.23 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.23 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 11.04 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.83 \text{ m}$

$M_{cr} = 11.64 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.44$

Curve,LT - b
 $\phi_{i,LT} = 1.46$

$X_{LT} = 0.45$
 $X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /13/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$

Verified

Governing Load Case: 13 SLS /19/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 930 Beam_930

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.99 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 16.91 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.25 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.25 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 10.73 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.24 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.44$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=3.98 m

Lam_LT = 1.47

fi,LT = 1.49

XLT,mod = 0.44

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.02 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00

uz = 0.0 cm < uz max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /26/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 931 Beam_931

POINT: 2

COORDINATE: x = 0.50 L = 2.06 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 15.55 kN

My,Ed = 0.27 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.27 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.44 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 10.87 kN*m

Curve,LT - b

XLT = 0.43

Lcr,upp=4.12 m

Lam_LT = 1.50

fi,LT = 1.52

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /52/ $1 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 932 Beam_932

POINT: 2

COORDINATE: x = 0.50 L = 2.13 m

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.46 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.39 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 10.18 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.52 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.42$

$L_{cr,upp} = 4.26 \text{ m}$

$\lambda_{m,LT} = 1.52$

$\phi_{i,LT} = 1.56$

$XLT_{mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$
 $u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 2.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /43/ $1*1.00 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 933 Beam_933

POINT: 2

COORDINATE: x = 0.50 L = 2.20 m

LOADS:

Governing Load Case: 10 ULS /176/ $1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$b=7.3 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.7 \text{ cm}$

$g_{M0}=1.00$

$A_y=11.15 \text{ cm}^2$

$I_y=541.22 \text{ cm}^4$

$W_{ply}=88.35 \text{ cm}^3$

$g_{M1}=1.00$

$A_z=7.64 \text{ cm}^2$

$I_z=44.92 \text{ cm}^4$

$W_{plz}=19.25 \text{ cm}^3$

$A_x=16.43 \text{ cm}^2$

$I_x=2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.41 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.42 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.42 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.92 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp}=4.41 \text{ m}$

$M_{cr} = 10.17 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.55$

Curve,LT - b

$\eta_{LT} = 1.59$

$X_{LT} = 0.41$

$X_{LT,mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /52/ $1*1.00 + 3*0.60 + 5*0.50 + 7*1.00$

$u_z = 0.1 \text{ cm} < u_z \text{ max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /42/ $1*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 934 Beam_934

POINT: 2

COORDINATE: x = 0.50 L = 2.27 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 10.12 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.44 kN*m

M_{y,Ed,max} = 0.44 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 9.70 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.54 m

M_{cr} = 9.89 kN*m

Lam_{LT} = 1.57

Curve,LT - b

fi,LT = 1.62

XLT = 0.40

XLT,mod = 0.40

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.07 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /32/ 1*1.00 + 2*0.70 + 3*0.60 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 935 Beam_935

POINT: 2

COORDINATE: x = 0.50 L = 2.34 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 18.45$ kN	$M_{y,Ed} = 0.35$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.35$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 9.48$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.60$ kN*m	Curve,LT - b	$X_{LT} = 0.39$
$L_{cr,upp}=4.68$ m	$\Lambda_{m_LT} = 1.59$	$\phi_{i,LT} = 1.65$	$X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /46/ $1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 936 Beam_936

POINT: 2

COORDINATE: $x = 0.50 L = 2.41$ m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 21.53 kN

M_{y,Ed} = 0.37 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.37 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 9.27 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 9.33 kN*m

Curve,LT - b

XLT = 0.38

L_{cr,upp} = 4.83 m

Lam_LT = 1.61

fi,LT = 1.68

XLT,mod = 0.38

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.05 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /65/ 1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 937 Beam_937

POINT: 2

COORDINATE: x = 0.50 L = 2.48 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

A_y=11.15 cm²

A_z=7.64 cm²

A_x=16.43 cm²

tw=0.5 cm

I_y=541.22 cm⁴

I_z=44.92 cm⁴

I_x=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 20.90 kN

M_{y,Ed} = 0.39 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.39 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 9.07 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.97 \text{ m}$

$M_{cr} = 9.08 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.64$

Curve,LT - b
 $\eta_{LT} = 1.71$

$X_{LT} = 0.37$
 $X_{LT,mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /42/ $1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 938 Beam_938

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.55 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.62 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.56 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.56 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 8.84 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.11 \text{ m}$

$M_{cr} = 8.84 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.66$

Curve,LT - b
 $\eta_{LT} = 1.75$

$X_{LT} = 0.36$
 $X_{LT,mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /18/ $1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 939 Beam_939

POINT: 2

COORDINATE: x = 0.50 L = 1.87 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 11.04 kN

M_{y,Ed} = 0.22 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.22 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 11.25 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 11.93 kN*m

Curve,LT - b

XLT = 0.46

Lcr,upp=3.74 m

Lam_LT = 1.43

fi,LT = 1.44

XLT,mod = 0.46

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 940 Beam_940

POINT: 2

COORDINATE: $x = 0.50 L = 1.94 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$tw=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$tf=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 16.13 \text{ kN}$	$M_{y,Ed} = 0.24 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.24 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$
	$M_{b,Rd} = 10.93 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.50 \text{ kN*m}$	$\text{Curve,LT} - b$	$XLT = 0.45$
$L_{cr,upp}=3.88 \text{ m}$	$\text{Lam}_{LT} = 1.45$	$\text{fi,LT} = 1.47$	$XLT_{mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /10/ $1*1.00 + 2*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 941 Beam_941

POINT: 2

COORDINATE: x = 0.50 L = 2.01 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 17.94 kN

My,Ed = 0.26 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.26 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.63 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.03 m

Mcr = 11.11 kN*m

Lam_LT = 1.48

Curve,LT - b

fi,LT = 1.50

XLT = 0.44

XLT,mod = 0.44

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.02 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

uz = 0.0 cm < uz max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /44/ 1*1.00 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 942 Beam_942

POINT: 2

COORDINATE: x = 0.50 L = 2.08 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 17.01 kN	My,Ed = 0.27 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.27 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 10.34 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 10.74 kN*m	Curve,LT - b	XLT = 0.43
Lcr,upp=4.17 m	Lam_LT = 1.50	fi,LT = 1.54	XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))
My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))
N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))
N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm Verified
Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60
uz = 0.0 cm < uz max = L/200.00 = 2.1 cm Verified
Governing Load Case: 13 SLS /92/ 1*1.00 + 2*0.70 + 3*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 943 Beam_943

POINT: 2

COORDINATE: x = 0.50 L = 2.16 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=9.58$ kN	$M_{y,Ed}=0.40$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.40$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=10.08$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=10.39$ kN*m	Curve,LT - b	$XLT=0.41$
$L_{cr,upp}=4.31$ m	$Lam_{LT}=1.53$	$fi,LT=1.57$	$XLT,mod=0.41$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y=0.0 \text{ cm} < u_{y,max}=L/200.00=2.2 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /113/ \quad 1 \cdot 1.00 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$$

$$u_z=0.1 \text{ cm} < u_{z,max}=L/200.00=2.2 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /15/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 944 Beam_944

POINT: 2

COORDINATE: x = 0.50 L = 2.23 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /176/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 19.81 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.43 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.43 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.83 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.46 \text{ m}$

$M_{cr} = 10.05 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.55$

Curve,LT - b

$\eta_{LT} = 1.60$

$X_{LT} = 0.40$

$X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /23/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 7 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /20/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 945 Beam_945

POINT: 2

COORDINATE: $x = 0.50 L = 2.30 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 11.15 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.45 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.45 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.61 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.77 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.40$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=4.60 m

Lam_LT = 1.58

fi,LT = 1.63

XLT,mod = 0.40

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /45/ 1*1.00 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 946 Beam_946

POINT: 2

COORDINATE: x = 0.50 L = 2.37 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 19.99 kN

My,Ed = 0.36 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.36 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.39 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 9.49 kN*m

Curve,LT - b

XLT = 0.39

Lcr,upp=4.74 m

Lam_LT = 1.60

fi,LT = 1.66

XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /45/ $1 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /94/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 947 Beam_947

POINT: 2

COORDINATE: x = 0.50 L = 2.44 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 22.78 \text{ kN}$

$M_{y,Ed} = 0.38 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.38 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.19 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.22 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.38$

$L_{cr,upp} = 4.89 \text{ m}$

$\lambda_{m,LT} = 1.62$

$\phi_{i,LT} = 1.70$

$XLT_{mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /93/ $1*1.00 + 2*0.70 + 4*1.00 + 6*0.60$
 $uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /69/ $1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 7*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 948 Beam_948

POINT: 2

COORDINATE: x = 0.50 L = 2.51 m

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$b=7.3 \text{ cm}$

$tw=0.5 \text{ cm}$

$tf=0.7 \text{ cm}$

$gM0=1.00$

$Ay=11.15 \text{ cm}^2$

$Iy=541.22 \text{ cm}^4$

$Wply=88.35 \text{ cm}^3$

$gM1=1.00$

$Az=7.64 \text{ cm}^2$

$Iz=44.92 \text{ cm}^4$

$Wplz=19.25 \text{ cm}^3$

$Ax=16.43 \text{ cm}^2$

$Ix=2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 22.14 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.40 \text{ kN*m}$

$M_{y,Ed,max} = 0.40 \text{ kN*m}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$MN_{y,Rd} = 24.30 \text{ kN*m}$

$Mb,Rd = 8.97 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp}=5.03 \text{ m}$

$M_{cr} = 8.97 \text{ kN*m}$

$\lambda_{m_LT} = 1.65$

Curve,LT - b

$\eta_{LT} = 1.73$

$XLT = 0.37$

$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /45/ $1*1.00 + 4*0.60 + 5*0.50 + 6*1.00$

$uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /92/ $1*1.00 + 2*0.70 + 3*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 949 Beam_949

POINT: 2

COORDINATE: x = 0.50 L = 2.59 m

LOADS:

Governing Load Case: 10 ULS /197/ 1*1.35 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 9.31 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.57 kN*m

M_{y,Ed,max} = 0.57 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb,Rd = 8.73 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 5.17 m

M_{cr} = 8.73 kN*m

Lam_{LT} = 1.67

Curve,LT - b

fi,LT = 1.76

XLT = 0.36

XLT,mod = 0.36

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.07 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /50/ 1*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 950 Beam_950

POINT: 2

COORDINATE: x = 0.50 L = 1.86 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 11.31 \text{ kN}$	$M_{y,Ed} = 0.22 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.22 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 11.27 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.97 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.46$
$L_{cr,upp}=3.73 \text{ m}$	$\Lambda_{m_LT} = 1.42$	$f_{i,LT} = 1.44$	$X_{LT,mod} = 0.46$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /93/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 6 \cdot 0.60$
 $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$ Verified
Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 951 Beam_951

POINT: 2

COORDINATE: $x = 0.50 L = 1.94 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$t_f=0.7$ cm

$W_{ply}=88.35$ cm³

$W_{plz}=19.25$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=16.30$ kN

$M_{y,Ed}=0.24$ kN*m

$N_{c,Rd}=451.71$ kN

$M_{y,Ed,max}=0.24$ kN*m

$N_{b,Rd}=451.71$ kN

$M_{y,c,Rd}=24.30$ kN*m

$M_{N,y,Rd}=24.30$ kN*m

$M_{b,Rd}=10.95$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$

$M_{cr}=11.53$ kN*m

Curve,LT - b

$X_{LT}=0.45$

$L_{cr,upp}=3.87$ m

$\lambda_{m,LT}=1.45$

$\phi_{i,LT}=1.47$

$X_{LT,mod}=0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy}=1.00$



About z axis:

$k_{zy}=1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd}=0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd}=0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd}=0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y=0.0$ cm < $u_{y,max}=L/200.00=1.9$ cm

Verified

Governing Load Case: 13 SLS /16/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 0.60$

$u_z=0.0$ cm < $u_{z,max}=L/200.00=1.9$ cm

Verified

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 952 Beam_952

POINT: 2

COORDINATE: $x=0.50$ L = 2.01 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm

$g_{M0}=1.00$

$g_{M1}=1.00$

$b=7.3$ cm

$A_y=11.15$ cm²

$A_z=7.64$ cm²

$A_x=16.43$ cm²

$t_w=0.5$ cm

$I_y=541.22$ cm⁴

$I_z=44.92$ cm⁴

$I_x=2.54$ cm⁴

$t_f=0.7$ cm

$W_{ply}=88.35$ cm³

$W_{plz}=19.25$ cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=17.90$ kN

$M_{y,Ed}=0.25$ kN*m

$N_{c,Rd}=451.71$ kN

$M_{y,Ed,max}=0.25$ kN*m

$N_{b,Rd}=451.71$ kN

$M_{y,c,Rd}=24.30$ kN*m

$M_{N,y,Rd}=24.30$ kN*m

$M_{b,Rd}=10.65$ kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.01 \text{ m}$

$M_{cr} = 11.13 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.48$

Curve,LT - b
 $\eta_{LT} = 1.50$

$X_{LT} = 0.44$
 $X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$ Verified

Governing Load Case: 13 SLS /36/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 7 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 953 Beam_953

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.08 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 17.10 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.27 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.27 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.36 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.16 \text{ m}$

$M_{cr} = 10.76 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.50$

Curve,LT - b
 $\eta_{LT} = 1.53$

$X_{LT} = 0.43$
 $X_{LT,mod} = 0.43$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 954 Beam_954

POINT: 2

COORDINATE: x = 0.50 L = 2.15 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 16.70 kN

M_{y,Ed} = 0.29 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.29 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.10 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 10.42 kN*m

Curve,LT - b

XLT = 0.42

L_{cr,upp} = 4.30 m

Lam_LT = 1.53

f_{i,LT} = 1.57

XLT,mod = 0.42

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 955 Beam_955

POINT: 2

COORDINATE: $x = 0.50 L = 2.23 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1*1.00 + 2*0.30 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$tw = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$tf = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 18.97 \text{ kN}$

$M_{y,Ed} = 0.31 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.31 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.85 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.08 \text{ kN} \cdot \text{m}$

Curve,LT - b

$X_{LT} = 0.41$

$L_{cr,upp} = 4.45 \text{ m}$

$\lambda_{m_LT} = 1.55$

$\phi_{i,LT} = 1.60$

$X_{LT,mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /108/ $1*1.00 + 4*1.00 + 5*0.50 + 6*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.2 \text{ cm}$ Verified

Governing Load Case: 13 SLS /62/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 956 Beam_956

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 17.92 kN

My,Ed = 0.33 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.33 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.63 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.59 m

Mcr = 9.79 kN*m

Lam_LT = 1.58

Curve,LT - b

fi,LT = 1.63

XLT = 0.40

XLT,mod = 0.40

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /93/ 1*1.00 + 2*0.70 + 4*1.00 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.3 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 957 Beam_957

POINT: 2

COORDINATE: x = 0.50 L = 2.36 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 20.12 kN	My,Ed = 0.35 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.35 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 9.41 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 9.51 kN*m	Curve,LT - b	XLT = 0.39
Lcr,upp=4.73 m	Lam_LT = 1.60	fi,LT = 1.66	XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < u_y max = L/200.00 = 2.4 cm Verified
Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60
 $u_z = 0.1$ cm < u_z max = L/200.00 = 2.4 cm Verified
Governing Load Case: 13 SLS /3/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 958 Beam_958

POINT: 2

COORDINATE: x = 0.50 L = 2.44 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=22.67$ kN	$M_{y,Ed}=0.38$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.38$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=9.20$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=9.24$ kN*m	Curve,LT - b	$XLT=0.38$
$L_{cr,upp}=4.87$ m	$\Lambda_{m,LT}=1.62$	$f_{i,LT}=1.69$	$XLT_{mod}=0.38$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /49/ \quad 1 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 1.00$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /13/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 959 Beam_959

POINT: 2

COORDINATE: x = 0.50 L = 2.51 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /5/ \quad 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 22.42 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.40 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.40 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$Mb,Rd = 8.99 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 5.02 \text{ m}$

$M_{cr} = 8.99 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.64$

Curve,LT - b

$\eta_{LT} = 1.72$

$XLT = 0.37$

$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm}$

Verified

Governing Load Case: 13 SLS /31/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 960 Beam_960

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.58 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 17.28 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.42 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.42 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$Mb,Rd = 8.75 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 8.75 \text{ kN}\cdot\text{m}$

Curve,LT - b

$XLT = 0.36$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=5.16 m

Lam_LT = 1.67

fi,LT = 1.76

XLT,mod = 0.36

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /12/ 1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 961 Beam_961

POINT: 2

COORDINATE: x = 0.50 L = 1.86 m

LOADS:

Governing Load Case: 10 ULS /82/ 1*1.35 + 4*0.90 + 7*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 7.63 kN

My,Ed = 0.29 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.29 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 11.30 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 12.01 kN*m

Curve,LT - b

XLT = 0.46

Lcr,upp=3.72 m

Lam_LT = 1.42

fi,LT = 1.43

XLT,mod = 0.47

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 962 Beam_962

POINT: 2

COORDINATE: x = 0.50 L = 1.93 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.76 \text{ kN}$

$M_{y,Ed} = 0.24 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.24 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$MN_{y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 10.98 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 11.57 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.45$

$L_{cr,upp} = 3.86 \text{ m}$

$\lambda_{m,LT} = 1.45$

$\phi_{i,LT} = 1.47$

$XLT_{mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$ Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$
 $u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /11/ $1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 963 Beam_963

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 17.32 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.25 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.25 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.68 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.00 \text{ m}$

$M_{cr} = 11.17 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.47$

Curve,LT - b

$\eta_{LT} = 1.50$

$X_{LT} = 0.44$

$X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_z \text{ max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /26/ $1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 964 Beam_964

POINT: 2

COORDINATE: x = 0.50 L = 2.07 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 16.61 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.27 kN*m

M_{y,Ed,max} = 0.27 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.39 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.14 m

M_{cr} = 10.80 kN*m

Lam_{LT} = 1.50

Curve,LT - b

fi,LT = 1.53

XLT = 0.43

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.04 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.0 cm < u_{z,max} = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /13/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 965 Beam_965

POINT: 2

COORDINATE: x = 0.50 L = 2.14 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 17.36 \text{ kN}$	$M_{y,Ed} = 0.29 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.29 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$
	$M_{b,Rd} = 10.13 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 10.45 \text{ kN*m}$	Curve,LT - b	$XLT = 0.42$
$L_{cr,upp}=4.29 \text{ m}$	$\Lambda_{m_LT} = 1.52$	$f_{i,LT} = 1.56$	$XLT_{mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /108/ $1 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$
 $u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$ Verified
Governing Load Case: 13 SLS /15/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 966 Beam_966

POINT: 2

COORDINATE: $x = 0.50 L = 2.22 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /4/ $1 \cdot 1.00 + 2 \cdot 0.30 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 21.30 kN

M_{y,Ed} = 0.31 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.31 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 9.87 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 10.11 kN*m

Curve,LT - b

XLT = 0.41

L_{cr,upp} = 4.44 m

Lam_LT = 1.55

f_{i,LT} = 1.60

XLT,mod = 0.41

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.05 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.2 cm

Verified

Governing Load Case: 13 SLS /77/ 1*1.00 + 4*0.60 + 5*1.00 + 6*0.60

u_z = 0.1 cm < u_z max = L/200.00 = 2.2 cm

Verified

Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 967 Beam_967

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

A_y=11.15 cm²

A_z=7.64 cm²

A_x=16.43 cm²

tw=0.5 cm

I_y=541.22 cm⁴

I_z=44.92 cm⁴

I_x=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 18.61 kN

M_{y,Ed} = 0.33 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.33 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 9.66 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.57 \text{ m}$

$M_{cr} = 9.83 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.57$

Curve,LT - b
 $\eta_{LT} = 1.63$

$X_{LT} = 0.40$
 $X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /3/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 968 Beam_968

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.36 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 19.52 \text{ kN}$

$M_{y,Ed} = 0.35 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.35 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 9.44 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.71 \text{ m}$

$M_{cr} = 9.54 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.60$

Curve,LT - b
 $\eta_{LT} = 1.66$

$X_{LT} = 0.39$
 $X_{LT,mod} = 0.39$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /12/ } 1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS /49/ } 1 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 969 Beam_969

POINT: 2

COORDINATE: x = 0.50 L = 2.43 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC /5/ } 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 21.67 \text{ kN}$$

$$M_{y,Ed} = 0.37 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,max} = 0.37 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.23 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 9.27 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} = b$$

$$XLT = 0.38$$

$$L_{cr,upp} = 4.86 \text{ m}$$

$$\lambda_{m,LT} = 1.62$$

$$f_{i,LT} = 1.69$$

$$XLT_{mod} = 0.38$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /29/ $1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.4 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 970 Beam_970

POINT: 2

COORDINATE: $x = 0.50 L = 2.50 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 21.42 \text{ kN}$	$M_{y,Ed} = 0.39 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.39 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$M_{N,y,Rd} = 24.30 \text{ kN*m}$
	$M_{b,Rd} = 9.02 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.02 \text{ kN*m}$	$\text{Curve,LT} - b$	$XLT = 0.37$
$L_{cr,upp}=5.00 \text{ m}$	$\text{Lam}_{LT} = 1.64$	$\text{fi,LT} = 1.72$	$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /48/ $1*1.00 + 3*0.60 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 971 Beam_971

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 18.12 kN

My,Ed = 0.42 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.42 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 8.78 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=5.14 m

Mcr = 8.78 kN*m

Lam_LT = 1.66

Curve,LT - b

fi,LT = 1.75

XLT = 0.36

XLT,mod = 0.36

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.05 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /16/ 1*1.00 + 2*1.00 + 4*0.60 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.6 cm

Verified

Governing Load Case: 13 SLS /94/ 1*1.00 + 2*0.70 + 3*1.00 + 4*1.00 + 5*0.50 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 972 Beam_972

POINT: 2

COORDINATE: x = 0.50 L = 1.85 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 10.41 kN	My,Ed = 0.22 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.22 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 11.33 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 12.04 kN*m	Curve,LT - b	XLT = 0.46
Lcr,upp=3.71 m	Lam_LT = 1.42	fi,LT = 1.43	XLT,mod = 0.47

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.04 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.9$ cm Verified

Governing Load Case: 13 SLS /116/ 1*1.00 + 3*1.00 + 7*0.60

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.9$ cm Verified

Governing Load Case: 13 SLS /26/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 973 Beam_973

POINT: 2

COORDINATE: x = 0.50 L = 1.92 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.56$ kN	$M_{y,Ed} = 0.23$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.23$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 11.01$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.60$ kN*m	Curve,LT - b	$XLT = 0.45$
$L_{cr,upp}=3.85$ m	$\lambda_{m,LT} = 1.45$	$\phi_{i,LT} = 1.46$	$XLT_{mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /90/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS /82/ } 1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 974 Beam_974

POINT: 2

COORDINATE: x = 0.50 L = 2.00 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 16.16 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.25 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.25 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 10.70 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.99 \text{ m}$

$M_{cr} = 11.20 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.47$

Curve,LT - b
 $\eta_{LT} = 1.50$

$X_{LT} = 0.44$
 $X_{LT,mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/\gamma_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.0 \text{ cm}$

Verified

Governing Load Case: 13 SLS /10/ $1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 975 Beam_975

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.07 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.61 \text{ kN}$
 $N_{c,Rd} = 451.71 \text{ kN}$
 $N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.27 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = 0.27 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 10.41 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.83 \text{ kN}\cdot\text{m}$

Curve,LT - b

$X_{LT} = 0.43$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,upp=4.13 m

Lam_LT = 1.50

fi,LT = 1.53

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /108/ 1*1.00 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.0 cm < uz max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /89/ 1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 976 Beam_976

POINT: 2

COORDINATE: x = 0.50 L = 2.14 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 13.75 kN

My,Ed = 0.29 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.29 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.15 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 10.48 kN*m

Curve,LT - b

XLT = 0.42

Lcr,upp=4.27 m

Lam_LT = 1.52

fi,LT = 1.56

XLT,mod = 0.42

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /56/ $1 \cdot 1.00 + 3 \cdot 0.60 + 7 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$

Verified

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 977 Beam_977

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.21 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /61/ $1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 0.90 + 5 \cdot 0.75 + 7 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.65 \text{ kN}$

$M_{y,Ed} = 0.42 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.42 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.89 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 10.14 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.41$

$L_{cr,upp} = 4.43 \text{ m}$

$\lambda_{m,LT} = 1.55$

$\phi_{i,LT} = 1.59$

$XLT_{mod} = 0.41$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm}$

Verified

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /113/ $1*1.00 + 3*1.00 + 5*0.50 + 7*0.60$
 $uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /107/ $1*1.00 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 978 Beam_978

POINT: 2

COORDINATE: $x = 0.50 L = 2.28 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=7.3 \text{ cm}$

$A_y=11.15 \text{ cm}^2$

$A_z=7.64 \text{ cm}^2$

$A_x=16.43 \text{ cm}^2$

$t_w=0.5 \text{ cm}$

$I_y=541.22 \text{ cm}^4$

$I_z=44.92 \text{ cm}^4$

$I_x=2.54 \text{ cm}^4$

$t_f=0.7 \text{ cm}$

$W_{ply}=88.35 \text{ cm}^3$

$W_{plz}=19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.50 \text{ kN}$

$M_{y,Ed} = 0.44 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.44 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}^*\text{m}$

$M_{b,Rd} = 9.68 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.85 \text{ kN}^*\text{m}$

Curve,LT - b

$XLT = 0.40$

$L_{cr,upp}=4.56 \text{ m}$

$\lambda_{m_LT} = 1.57$

$f_{i,LT} = 1.62$

$XLT_{mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$

$uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 979 Beam_979

POINT: 2

COORDINATE: x = 0.50 L = 2.35 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 18.25 kN

M_{y,Ed} = 0.35 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.35 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 9.46 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 9.57 kN*m

Curve,LT - b

XLT = 0.39

L_{cr,upp} = 4.70 m

Lam_LT = 1.59

fi,LT = 1.66

XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.04 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.1 cm < u_{z,max} = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /26/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 980 Beam_980

POINT: 2

COORDINATE: x = 0.50 L = 2.42 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.21$ kN	$M_{y,Ed} = 0.37$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.37$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 9.25$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.30$ kN*m	Curve,LT - b	$X_{LT} = 0.38$
$L_{cr,upp}=4.84$ m	$\lambda_{m_LT} = 1.62$	$\phi_{i,LT} = 1.69$	$X_{LT,mod} = 0.38$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.04 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /12/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 981 Beam_981

POINT: 2

COORDINATE: $x = 0.50$ L = 2.49 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 19.80 kN

My,Ed = 0.39 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.39 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.05 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 9.05 kN*m

Curve,LT - b

XLT = 0.37

Lcr,upp=4.98 m

Lam_LT = 1.64

fi,LT = 1.72

XLT,mod = 0.37

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.09 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /16/ 1*1.00 + 2*1.00 + 4*0.60 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.5 cm

Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 982 Beam_982

POINT: 2

COORDINATE: x = 0.50 L = 2.56 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 17.45 kN

My,Ed = 0.42 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.42 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 8.81 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 5.13 \text{ m}$

$M_{cr} = 8.81 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.66$

Curve,LT - b
 $\eta_{LT} = 1.75$

$X_{LT} = 0.36$
 $X_{LT,mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.09 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /16/ $1 \cdot 1.00 + 2 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 0.60$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /92/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 983 Beam_983

POINT: 2

COORDINATE: $x = 0.50 L = 1.86 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.87 \text{ kN}$

$M_{y,Ed} = 0.22 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.22 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 11.29 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 3.72 \text{ m}$

$M_{cr} = 11.99 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.42$

Curve,LT - b
 $\eta_{LT} = 1.43$

$X_{LT} = 0.46$
 $X_{LT,mod} = 0.46$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.02 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.04 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 1.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /29/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 1.9 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /127/ \quad 1 \cdot 1.00 + 2 \cdot 0.30 + 3 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 984 Beam_984

POINT: 2

COORDINATE: x = 0.50 L = 1.93 m

LOADS:

$$\text{Governing Load Case: } 25 \text{ ACC } /5/ \quad 1 \cdot 1.00 + 9 \cdot 1.00$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 13.03 \text{ kN}$$

$$M_{y,Ed} = 0.24 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,\max} = 0.24 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 10.97 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 11.55 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} - b$$

$$X_{LT} = 0.45$$

$$L_{cr,upp} = 3.87 \text{ m}$$

$$\lambda_{m,LT} = 1.45$$

$$f_{i,LT} = 1.47$$

$$X_{LT,mod} = 0.45$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.02 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /12/ $1*1.00 + 2*1.00 + 4*0.60 + 5*0.50 + 6*0.60$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 985 Beam_985

POINT: 2

COORDINATE: $x = 0.50 L = 2.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1*1.00 + 9*1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$b=7.3 \text{ cm}$

$t_w=0.5 \text{ cm}$

$t_f=0.7 \text{ cm}$

$gM0=1.00$

$A_y=11.15 \text{ cm}^2$

$I_y=541.22 \text{ cm}^4$

$W_{ply}=88.35 \text{ cm}^3$

$gM1=1.00$

$A_z=7.64 \text{ cm}^2$

$I_z=44.92 \text{ cm}^4$

$W_{plz}=19.25 \text{ cm}^3$

$A_x=16.43 \text{ cm}^2$

$I_x=2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 14.40 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.25 \text{ kN*m}$

$M_{y,Ed,max} = 0.25 \text{ kN*m}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 10.66 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp}=4.01 \text{ m}$

$M_{cr} = 11.15 \text{ kN*m}$

$\lambda_{m_LT} = 1.48$

Curve,LT - b

$\phi_{i,LT} = 1.50$

$XLT = 0.44$

$XLT_{mod} = 0.44$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.03 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.0 \text{ cm}$ Verified

Governing Load Case: 13 SLS /33/ $1*1.00 + 2*0.70 + 4*0.60 + 6*1.00$

$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.0 \text{ cm}$ Verified

Governing Load Case: 13 SLS /9/ $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 986 Beam_986

POINT: 2

COORDINATE: x = 0.50 L = 2.08 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 13.52 kN

My,Ed = 0.27 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.27 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 10.37 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Lcr,upp=4.15 m

Mcr = 10.78 kN*m

Lam_LT = 1.50

Curve,LT - b

fi,LT = 1.53

XLT = 0.43

XLT,mod = 0.43

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.03 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /33/ 1*1.00 + 2*0.70 + 4*0.60 + 6*1.00

uz = 0.0 cm < uz max = L/200.00 = 2.1 cm

Verified

Governing Load Case: 13 SLS /9/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 987 Beam_987

POINT: 2

COORDINATE: x = 0.50 L = 2.15 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



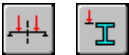
SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 7.90 kN	My _{Ed} = 0.39 kN*m
N _{c,Rd} = 451.71 kN	My _{Ed,max} = 0.39 kN*m
Nb _{Rd} = 451.71 kN	My _{c,Rd} = 24.30 kN*m
	MN _{y,Rd} = 24.30 kN*m
	Mb _{Rd} = 10.12 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 10.44 kN*m	Curve,LT - b	XLT = 0.42
Lcr,upp=4.29 m	Lam_LT = 1.53	fi,LT = 1.56	XLT,mod = 0.42

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))
My_{Ed}/My_{c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My_{Ed,max}/Mb_{Rd} = 0.04 < 1.00 (6.3.2.1.(1))
N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))
N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*My_{Ed,max}/(XLT*My_{Rk}/gM1) = 0.06 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.1 cm Verified
Governing Load Case: 13 SLS /65/ 1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 6*0.60
uz = 0.0 cm < uz max = L/200.00 = 2.1 cm Verified
Governing Load Case: 13 SLS /69/ 1*1.00 + 2*0.70 + 4*0.60 + 5*1.00 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 988 Beam_988

POINT: 2

COORDINATE: x = 0.50 L = 2.22 m

LOADS:

Governing Load Case: 10 ULS /176/ 1*1.35 + 2*1.05 + 3*1.50 + 5*0.75 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=13.18$ kN	$M_{y,Ed}=0.42$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.42$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$M_{b,Rd}=9.86$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=10.09$ kN*m	Curve,LT - b	$XLT=0.41$
$L_{cr,upp}=4.45$ m	$Lam_{LT}=1.55$	$fi_{LT}=1.60$	$XLT_{mod}=0.41$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd}=0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.2 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /113/ \quad 1 \cdot 1.00 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.2 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 13 \text{ SLS } /74/ \quad 1 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 1.00 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 989 Beam_989

POINT: 2

COORDINATE: x = 0.50 L = 2.29 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /81/ \quad 1 \cdot 1.35 + 3 \cdot 0.90 + 7 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 9.08 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.45 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.45 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$Mb,Rd = 9.64 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 4.58 \text{ m}$

$M_{cr} = 9.81 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.57$

Curve,LT - b

$\eta_{LT} = 1.63$

$XLT = 0.40$

$XLT_{mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,c,Rd}/gM1) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /29/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /15/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 990 Beam_990

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.36 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$gM0 = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.86 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.35 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.35 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$Mb,Rd = 9.43 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.53 \text{ kN}\cdot\text{m}$

Curve,LT - b

$XLT = 0.39$

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Lcr,upp=4.72 m

Lam_LT = 1.60

fi,LT = 1.66

XLT,mod = 0.39

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /108/ 1*1.00 + 4*1.00 + 5*0.50 + 6*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /53/ 1*1.00 + 4*0.60 + 5*0.50 + 7*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 991 Beam_991

POINT: 2

COORDINATE: x = 0.50 L = 2.43 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 18.12 kN

My,Ed = 0.37 kN*m

Nc,Rd = 451.71 kN

My,Ed,max = 0.37 kN*m

Nb,Rd = 451.71 kN

My,c,Rd = 24.30 kN*m

MN,y,Rd = 24.30 kN*m

Mb,Rd = 9.22 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 9.26 kN*m

Curve,LT - b

XLT = 0.38

Lcr,upp=4.86 m

Lam_LT = 1.62

fi,LT = 1.69

XLT,mod = 0.38

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.04 < 1.00 (6.2.4.(1))

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.4 \text{ cm}$

Verified

Governing Load Case: 13 SLS /28/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 992 Beam_992

POINT: 2

COORDINATE: x = 0.50 L = 2.50 m

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 17.87 \text{ kN}$

$M_{y,Ed} = 0.40 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.40 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 9.01 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.01 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.37$

$L_{cr,upp} = 5.01 \text{ m}$

$\lambda_{m,LT} = 1.64$

$\phi_{i,LT} = 1.72$

$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.04 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm}$

Verified

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Governing Load Case: 13 SLS /90/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60$
 $uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.5 \text{ cm}$ Verified

Governing Load Case: 13 SLS /28/ $1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 993 Beam_993

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

Governing Load Case: 10 ULS /197/ $1*1.35 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$

$gM0=1.00$

$gM1=1.00$

$b=7.3 \text{ cm}$

$A_y=11.15 \text{ cm}^2$

$A_z=7.64 \text{ cm}^2$

$A_x=16.43 \text{ cm}^2$

$tw=0.5 \text{ cm}$

$I_y=541.22 \text{ cm}^4$

$I_z=44.92 \text{ cm}^4$

$I_x=2.54 \text{ cm}^4$

$tf=0.7 \text{ cm}$

$W_{ply}=88.35 \text{ cm}^3$

$W_{plz}=19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 9.20 \text{ kN}$

$M_{y,Ed} = 0.57 \text{ kN}^*\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.57 \text{ kN}^*\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}^*\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}^*\text{m}$

$Mb,Rd = 8.77 \text{ kN}^*\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 8.77 \text{ kN}^*\text{m}$

Curve,LT - b

$XLT = 0.36$

$L_{cr,upp}=5.15 \text{ m}$

$\lambda_{m_LT} = 1.66$

$f_{i,LT} = 1.75$

$XLT_{mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_y \text{ max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /56/ $1*1.00 + 3*0.60 + 7*1.00$

$uz = 0.1 \text{ cm} < uz \text{ max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /89/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 994 Beam_994

POINT: 2

COORDINATE: x = 0.50 L = 1.86 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 8.88 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.22 kN*m

M_{y,Ed,max} = 0.22 kN*m

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 11.29 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 3.72 m

M_{cr} = 11.99 kN*m

Lam_{LT} = 1.42

Curve,LT - b

fi,LT = 1.43

XLT = 0.46

XLT,mod = 0.46

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00 (6.3.2.1.(1))

N_{Ed}/(Xy*N_{Rk}/gM1) + kyy*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

N_{Ed}/(Xz*N_{Rk}/gM1) + kzy*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.04 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /29/ 1*1.00 + 2*0.70 + 4*0.60 + 5*0.50 + 6*1.00

u_z = 0.0 cm < u_{z,max} = L/200.00 = 1.9 cm

Verified

Governing Load Case: 13 SLS /28/ 1*1.00 + 2*0.70 + 3*0.60 + 5*0.50 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 995 Beam_995

POINT: 2

COORDINATE: x = 0.50 L = 1.93 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$
$t_f=0.7 \text{ cm}$	$W_{ply}=88.35 \text{ cm}^3$	$W_{plz}=19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 11.12 \text{ kN}$	$M_{y,Ed} = 0.24 \text{ kN}\cdot\text{m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.24 \text{ kN}\cdot\text{m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$
	$M_{b,Rd} = 10.97 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 11.55 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.45$
$L_{cr,upp}=3.87 \text{ m}$	$\Lambda_{m_LT} = 1.45$	$f_{i,LT} = 1.47$	$X_{LT,mod} = 0.45$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/gM1) = 0.05 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rd}/gM1) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /113/ $1 \cdot 1.00 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.9 \text{ cm}$ Verified

Governing Load Case: 13 SLS /26/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 0.60 + 4 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 997 Beam_997

POINT: 2

COORDINATE: $x = 0.50 L = 2.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /5/ $1 \cdot 1.00 + 9 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h=14.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=7.3 \text{ cm}$	$A_y=11.15 \text{ cm}^2$	$A_z=7.64 \text{ cm}^2$	$A_x=16.43 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=541.22 \text{ cm}^4$	$I_z=44.92 \text{ cm}^4$	$I_x=2.54 \text{ cm}^4$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 11.97 kN

M_{y,Ed} = 0.25 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.25 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.66 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 11.15 kN*m

Curve,LT - b

XLT = 0.44

L_{cr,upp} = 4.01 m

Lam_LT = 1.48

fi,LT = 1.50

XLT,mod = 0.44

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.03 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.02 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.05 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{Rk}/gM1) = 0.05 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /93/ 1*1.00 + 2*0.70 + 4*1.00 + 6*0.60

u_z = 0.0 cm < u_z max = L/200.00 = 2.0 cm

Verified

Governing Load Case: 13 SLS /9/ 1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 998 Beam_998

POINT: 2

COORDINATE: x = 0.50 L = 2.08 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

A_y=11.15 cm²

A_z=7.64 cm²

A_x=16.43 cm²

t_w=0.5 cm

I_y=541.22 cm⁴

I_z=44.92 cm⁴

I_x=2.54 cm⁴

tf=0.7 cm

W_{ply}=88.35 cm³

W_{plz}=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 10.96 kN

M_{y,Ed} = 0.27 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.27 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 10.37 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.15 \text{ m}$

$M_{cr} = 10.78 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.50$

Curve,LT - b
 $\eta_{LT} = 1.53$

$X_{LT} = 0.43$
 $X_{LT,mod} = 0.43$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.03 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.05 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /90/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 2.1 \text{ cm}$ Verified

Governing Load Case: 13 SLS /13/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 4 \cdot 0.60 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1-2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 999 Beam_999

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.15 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$b = 7.3 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.7 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 11.15 \text{ cm}^2$

$I_y = 541.22 \text{ cm}^4$

$W_{ply} = 88.35 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 7.64 \text{ cm}^2$

$I_z = 44.92 \text{ cm}^4$

$W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$

$I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 6.65 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.39 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 10.12 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 4.29 \text{ m}$

$M_{cr} = 10.44 \text{ kN}\cdot\text{m}$
 $\Lambda_{m_LT} = 1.53$

Curve,LT - b
 $\eta_{LT} = 1.56$

$X_{LT} = 0.42$
 $X_{LT,mod} = 0.42$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.05 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /90/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 2.1 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 13 \text{ SLS } /106/ \quad 1 \cdot 1.00 + 3 \cdot 1.00 + 4 \cdot 1.00 + 5 \cdot 0.50 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1000 Beam_1000

POINT: 2

COORDINATE: x = 0.50 L = 2.22 m

LOADS:

$$\text{Governing Load Case: } 10 \text{ ULS } /176/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 3 \cdot 1.50 + 5 \cdot 0.75 + 7 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$$h = 14.0 \text{ cm}$$

$$gM0 = 1.00$$

$$gM1 = 1.00$$

$$b = 7.3 \text{ cm}$$

$$A_y = 11.15 \text{ cm}^2$$

$$A_z = 7.64 \text{ cm}^2$$

$$A_x = 16.43 \text{ cm}^2$$

$$t_w = 0.5 \text{ cm}$$

$$I_y = 541.22 \text{ cm}^4$$

$$I_z = 44.92 \text{ cm}^4$$

$$I_x = 2.54 \text{ cm}^4$$

$$t_f = 0.7 \text{ cm}$$

$$W_{ply} = 88.35 \text{ cm}^3$$

$$W_{plz} = 19.25 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 15.32 \text{ kN}$$

$$M_{y,Ed} = 0.42 \text{ kN} \cdot \text{m}$$

$$N_{c,Rd} = 451.71 \text{ kN}$$

$$M_{y,Ed,\max} = 0.42 \text{ kN} \cdot \text{m}$$

$$N_{b,Rd} = 451.71 \text{ kN}$$

$$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$$

$$M_{b,Rd} = 9.86 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 10.09 \text{ kN} \cdot \text{m}$$

$$\text{Curve,LT} - b$$

$$X_{LT} = 0.41$$

$$L_{cr,upp} = 4.45 \text{ m}$$

$$\lambda_{m,LT} = 1.55$$

$$f_{i,LT} = 1.60$$

$$X_{LT,mod} = 0.41$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /96/ $1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 7*0.60$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.2 \text{ cm}$

Verified

Governing Load Case: 13 SLS /9/ $1*1.00 + 2*1.00 + 3*0.60 + 4*0.60 + 5*0.50 + 6*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1001 Beam_1001

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 2.29 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /81/ $1*1.35 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 7.61 \text{ kN}$

$M_{y,Ed} = 0.45 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.45 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 9.64 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 9.81 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.40$

$L_{cr,upp} = 4.58 \text{ m}$

$\lambda_{m_LT} = 1.57$

$\phi_{i,LT} = 1.63$

$X_{LT,mod} = 0.40$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /33/ $1*1.00 + 2*0.70 + 4*0.60 + 6*1.00$

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 13 SLS /83/ $1*1.00 + 2*0.70 + 3*1.00 + 5*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1002 Beam_1002

POINT: 2

COORDINATE: x = 0.50 L = 2.36 m

LOADS:

Governing Load Case: 10 ULS /81/ 1*1.35 + 3*0.90 + 7*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 7.39 kN

M_{y,Ed} = 0.48 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.48 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

Mb_{Rd} = 9.43 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 4.72 m

M_{cr} = 9.53 kN*m

Lam_{LT} = 1.60

Curve,LT - b

f_{i,LT} = 1.66

XLT = 0.39

XLT_{mod} = 0.39

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.02 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.05 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.07 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_y max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /90/ 1*1.00 + 2*0.70 + 4*1.00 + 5*0.50 + 6*0.60

u_z = 0.1 cm < u_z max = L/200.00 = 2.4 cm

Verified

Governing Load Case: 13 SLS /66/ 1*1.00 + 2*0.70 + 3*0.60 + 4*0.60 + 5*1.00 + 7*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MEMBER: 1003 Beam_1003

POINT: 2

COORDINATE: x = 0.50 L = 2.43 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm	gM0=1.00	gM1=1.00	
b=7.3 cm	Ay=11.15 cm ²	Az=7.64 cm ²	Ax=16.43 cm ²
tw=0.5 cm	Iy=541.22 cm ⁴	Iz=44.92 cm ⁴	Ix=2.54 cm ⁴
tf=0.7 cm	Wply=88.35 cm ³	Wplz=19.25 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 15.27 kN	My,Ed = 0.37 kN*m
Nc,Rd = 451.71 kN	My,Ed,max = 0.37 kN*m
Nb,Rd = 451.71 kN	My,c,Rd = 24.30 kN*m
	MN,y,Rd = 24.30 kN*m
	Mb,Rd = 9.22 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 9.26 kN*m	Curve,LT - b	XLT = 0.38
Lcr,upp=4.86 m	Lam_LT = 1.62	fi,LT = 1.69	XLT,mod = 0.38

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzy = 1.00

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.03 < 1.00 (6.2.4.(1))

My,Ed/My,c,Rd = 0.02 < 1.00 (6.2.5.(1))

Global stability check of member:

My,Ed,max/Mb,Rd = 0.04 < 1.00 (6.3.2.1.(1))

N,Ed/(Xy*N,Rk/gM1) + kyy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

N,Ed/(Xz*N,Rk/gM1) + kzy*My,Ed,max/(XLT*My,Rk/gM1) = 0.07 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/200.00 = 2.4 cm Verified

Governing Load Case: 13 SLS /99/ 1*1.00 + 2*0.70 + 4*1.00 + 7*0.60

uz = 0.1 cm < uz max = L/200.00 = 2.4 cm Verified

Governing Load Case: 13 SLS /11/ 1*1.00 + 2*1.00 + 3*0.60 + 5*0.50 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1004 Beam_1004

POINT: 2

COORDINATE: x = 0.50 L = 2.50 m

LOADS:

Governing Load Case: 25 ACC /5/ 1*1.00 + 9*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 15.31$ kN	$M_{y,Ed} = 0.40$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.40$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 9.01$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 9.01$ kN*m	Curve,LT - b	$XLT = 0.37$
$L_{cr,upp} = 5.01$ m	$\lambda_{m,LT} = 1.64$	$f_{i,LT} = 1.72$	$XLT_{mod} = 0.37$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.04 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.08 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /33/ $1 \cdot 1.00 + 2 \cdot 0.70 + 4 \cdot 0.60 + 6 \cdot 1.00$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.5 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 13 SLS /11/ $1 \cdot 1.00 + 2 \cdot 1.00 + 3 \cdot 0.60 + 5 \cdot 0.50 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1005 Beam_1005

POINT: 2

COORDINATE: x = 0.50 L = 2.57 m

LOADS:

Governing Load Case: 10 ULS /197/ $1 \cdot 1.35 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 8.62 \text{ kN}$

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed} = 0.57 \text{ kN}\cdot\text{m}$

$M_{y,Ed,max} = 0.57 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 8.77 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 5.15 \text{ m}$

$M_{cr} = 8.77 \text{ kN}\cdot\text{m}$

$\Lambda_{m,LT} = 1.66$

Curve,LT - b

$\eta_{LT} = 1.75$

$X_{LT} = 0.36$

$X_{LT,mod} = 0.36$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.02 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.06 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,c,Rd}/g_{M1}) = 0.08 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /49/ $1 \cdot 1.00 + 4 \cdot 0.60 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 2.6 \text{ cm}$

Verified

Governing Load Case: 13 SLS /95/ $1 \cdot 1.00 + 2 \cdot 0.70 + 3 \cdot 1.00 + 5 \cdot 0.50 + 7 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1006 Simple bar_0.5_1006 **POINT:** 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /233/ $1 \cdot 1.00 + 3 \cdot 1.50 + 7 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 67.75 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 222.47 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

Ly = 4.84 m
Lcr,y = 2.42 m
Lamy = 91.47

Lam_y = 1.05
Xy = 0.63



About z axis:

Lz = 4.84 m
Lcr,z = 2.42 m
Lamz = 91.47

Lam_z = 1.05
Xz = 0.63

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.19 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 91.47 < Lambda,max = 210.00 Lambda,z = 91.47 < Lambda,max = 210.00 STABLE
N,Ed/Nb,Rd = 0.30 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1007 Simple bar_0.5_1007 **POINT:** 3

COORDINATE: x = 1.00 L = 4.84 m

LOADS:

Governing Load Case: 10 ULS /171/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 74.21 kN
Nc,Rd = 354.20 kN
Nb,Rd = 222.47 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.84 m
Lcr,y = 2.42 m
Lamy = 91.47

Lam_y = 1.05
Xy = 0.63



About z axis:

Lz = 4.84 m
Lcr,z = 2.42 m
Lamz = 91.47

Lam_z = 1.05
Xz = 0.63

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.21 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 91.47 < Lambda,max = 210.00 Lambda,z = 91.47 < Lambda,max = 210.00 STABLE
N,Ed/Nb,Rd = 0.33 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1008 Simple bar_0.5_1008 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 67.33$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 222.47$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84$ m
 $L_{cr,y} = 2.42$ m
 $L_{amy} = 91.47$
 $Lam_y = 1.05$
 $X_y = 0.63$



About z axis:

$L_z = 4.84$ m
 $L_{cr,z} = 2.42$ m
 $L_{amz} = 91.47$
 $Lam_z = 1.05$
 $X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.19 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_y = 91.47 < Lambda_{max} = 210.00$ $Lambda_z = 91.47 < Lambda_{max} = 210.00$ STABLE
 $N_{Ed}/N_{b,Rd} = 0.30 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1009 Simple bar_0.5_1009 **POINT:** 3

COORDINATE: $x = 1.00$ L = 4.84 m

LOADS:

Governing Load Case: 10 ULS /171/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$tw=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$tf=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 74.37$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 222.47$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$\lambda_{my} = 91.47$

$\lambda_{m,y} = 1.05$

$\chi_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$\lambda_{mz} = 91.47$

$\lambda_{m,z} = 1.05$

$\chi_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.21 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{b,y} = 91.47 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.47 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$

$N_{Ed}/N_{b,Rd} = 0.33 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 1010 Simple bar_0.5_1010 **POINT:** 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 10 ULS /113/ $1*1.00 + 3*0.90 + 7*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 56.75 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 246.76 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.38 \text{ m}$

$L_{cr,y} = 2.19 \text{ m}$

$\lambda_{my} = 82.93$

$\lambda_{m,y} = 0.96$

$\chi_y = 0.70$



About z axis:

$L_z = 4.38 \text{ m}$

$L_{cr,z} = 2.19 \text{ m}$

$\lambda_{mz} = 82.93$

$\lambda_{m,z} = 0.96$

$\chi_z = 0.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.16 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{b,y} = 82.93 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 82.93 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$

$N_{Ed}/N_{b,Rd} = 0.23 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 1011 Simple bar_0.5_1011 **POINT:** 3

COORDINATE: x = 1.00 L = 4.38 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 77.88 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 246.76 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.38 m
L_{cr,y} = 2.19 m
L_{amy} = 82.93

Lam_y = 0.96
X_y = 0.70



About z axis:

L_z = 4.38 m
L_{cr,z} = 2.19 m
Lam_z = 82.93

Lam_z = 0.96
X_z = 0.70

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.22 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{bda,y} = 82.93 < Lam_{bda,max} = 210.00

Lam_{bda,z} = 82.93 < Lam_{bda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.32 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1012 Simple bar_0.5_1012 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 88.36 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 246.68 kN

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39 \text{ m}$

$\lambda_{m,y} = 0.96$

$L_{cr,y} = 2.19 \text{ m}$

$\chi_y = 0.70$

$\lambda_{m,y} = 82.96$



About z axis:

$L_z = 4.39 \text{ m}$

$\lambda_{m,z} = 0.96$

$L_{cr,z} = 2.19 \text{ m}$

$\chi_z = 0.70$

$\lambda_{m,z} = 82.96$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.25 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 82.96 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 82.96 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.36 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1013 Simple bar_0.5_1013 **POINT:** 3

COORDINATE: $x = 1.00 \text{ L} = 4.39 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /1/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.0 \text{ cm}$

$A_y = 6.44 \text{ cm}^2$

$A_z = 6.44 \text{ cm}^2$

$A_x = 12.88 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 90.02 \text{ cm}^4$

$I_z = 90.02 \text{ cm}^4$

$I_x = 141.80 \text{ cm}^4$

$t_f = 0.5 \text{ cm}$

$W_{ply} = 31.75 \text{ cm}^3$

$W_{plz} = 31.75 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 85.36 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 246.68 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39 \text{ m}$

$\lambda_{m,y} = 0.96$

$L_{cr,y} = 2.19 \text{ m}$

$\chi_y = 0.70$

$\lambda_{m,y} = 82.96$



About z axis:

$L_z = 4.39 \text{ m}$

$\lambda_{m,z} = 0.96$

$L_{cr,z} = 2.19 \text{ m}$

$\chi_z = 0.70$

$\lambda_{m,z} = 82.96$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.24 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 82.96 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 82.96 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.35 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1014 Simple bar_0.5_1014 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$t_w=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$t_f=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 117.66$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 246.57$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39$ m
 $L_{cr,y} = 2.19$ m
 $L_{amy} = 83.00$

$L_{am,y} = 0.96$
 $X_y = 0.70$



About z axis:

$L_z = 4.39$ m
 $L_{cr,z} = 2.19$ m
 $L_{amz} = 83.00$

$L_{am,z} = 0.96$
 $X_z = 0.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.33 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 83.00 < \lambda_{b,max} = 210.00$ $\lambda_{b,z} = 83.00 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.48 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1015 Simple bar_0.5_1015 **POINT:** 3

COORDINATE: x = 1.00 L = 4.39 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$t_w=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$t_f=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 118.30$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 246.57$ kN

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39 \text{ m}$
 $L_{cr,y} = 2.19 \text{ m}$
 $\lambda_{my} = 83.00$
 $\lambda_{my} = 0.96$
 $X_y = 0.70$



About z axis:

$L_z = 4.39 \text{ m}$
 $L_{cr,z} = 2.19 \text{ m}$
 $\lambda_{mz} = 83.00$
 $\lambda_{mz} = 0.96$
 $X_z = 0.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.33 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 83.00 < \lambda_{max} = 210.00$ $\lambda_{mz} = 83.00 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.48 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1016 Simple bar_0.5_1016 **POINT:** 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$	$gM0 = 1.00$	$gM1 = 1.00$	
$b = 7.0 \text{ cm}$	$A_y = 6.44 \text{ cm}^2$	$A_z = 6.44 \text{ cm}^2$	$A_x = 12.88 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 90.02 \text{ cm}^4$	$I_z = 90.02 \text{ cm}^4$	$I_x = 141.80 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 31.75 \text{ cm}^3$	$W_{plz} = 31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 121.21 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 246.68 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39 \text{ m}$
 $L_{cr,y} = 2.19 \text{ m}$
 $\lambda_{my} = 82.96$
 $\lambda_{my} = 0.96$
 $X_y = 0.70$



About z axis:

$L_z = 4.39 \text{ m}$
 $L_{cr,z} = 2.19 \text{ m}$
 $\lambda_{mz} = 82.96$
 $\lambda_{mz} = 0.96$
 $X_z = 0.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.34 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 82.96 < \lambda_{max} = 210.00$ $\lambda_{mz} = 82.96 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.49 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1017 Simple bar_0.5_1017 **POINT:** 3

COORDINATE: x = 1.00 L = 4.39 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 120.81 kN

Nc,Rd = 354.20 kN

Nb,Rd = 246.68 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.39 m
Lcr,y = 2.19 m
Lamy = 82.96

Lam_y = 0.96
Xy = 0.70



About z axis:

Lz = 4.39 m
Lcr,z = 2.19 m
Lamz = 82.96

Lam_z = 0.96
Xz = 0.70

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.34 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 82.96 < Lambda,max = 210.00 Lambda,z = 82.96 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.49 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1018 Simple bar_0.5_1018 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 119.05 kN

Nc,Rd = 354.20 kN

Nb,Rd = 246.63 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39 \text{ m}$

$L_{cr,y} = 2.19 \text{ m}$

$\lambda_{my} = 82.98$

$\lambda_{m,y} = 0.96$

$\chi_y = 0.70$



About z axis:

$L_z = 4.39 \text{ m}$

$L_{cr,z} = 2.19 \text{ m}$

$\lambda_{mz} = 82.98$

$\lambda_{m,z} = 0.96$

$\chi_z = 0.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.34 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 82.98 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 82.98 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.48 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1019 Simple bar_0.5_1019 **POINT:** 3

COORDINATE: $x = 1.00$ $L = 4.39 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /1/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 122.10 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 246.63 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.39 \text{ m}$

$L_{cr,y} = 2.19 \text{ m}$

$\lambda_{my} = 82.98$

$\lambda_{m,y} = 0.96$

$\chi_y = 0.70$



About z axis:

$L_z = 4.39 \text{ m}$

$L_{cr,z} = 2.19 \text{ m}$

$\lambda_{mz} = 82.98$

$\lambda_{m,z} = 0.96$

$\chi_z = 0.70$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.34 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 82.98 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 82.98 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.50 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1020 Simple bar_0.5_1020 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /9/ 1*1.00 + 9*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 88.54 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 246.49 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.39 m
L_{cr,y} = 2.20 m
L_{amy} = 83.03
L_{am,y} = 0.96
X_y = 0.70



About z axis:

L_z = 4.39 m
L_{cr,z} = 2.20 m
L_{amz} = 83.03
L_{am,z} = 0.96
X_z = 0.70

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.25 < 1.00 (6.2.4.(1))

Global stability check of member:

L_{amda,y} = 83.03 < L_{amda,max} = 210.00 L_{amda,z} = 83.03 < L_{amda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.36 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1021 Simple bar_0.5_1021 **POINT:** 3

COORDINATE: x = 1.00 L = 4.39 m

LOADS:

Governing Load Case: 10 ULS /54/ 1*1.35 + 2*1.05 + 4*0.90 + 5*0.75 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 97.04 kN
N_{c,Rd} = 354.20 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Nb,Rd = 246.49 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.39 m

Lcr,y = 2.20 m

Lamy = 83.03

Lam_y = 0.96

Xy = 0.70



About z axis:

Lz = 4.39 m

Lcr,z = 2.20 m

Lamz = 83.03

Lam_z = 0.96

Xz = 0.70

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.27 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 83.03 < Lambda,max = 210.00

Lambda,z = 83.03 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.39 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1022 Simple bar_0.5_1022 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /2/ 1*1.00 + 8*1.00

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

b=7.0 cm

tw=0.5 cm

tf=0.5 cm

gM0=1.00

Ay=6.44 cm²

Iy=90.02 cm⁴

Wply=31.75 cm³

gM1=1.00

Az=6.44 cm²

Iz=90.02 cm⁴

Wplz=31.75 cm³

Ax=12.88 cm²

Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 67.77 kN

Nc,Rd = 354.20 kN

Nb,Rd = 222.26 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.84 m

Lcr,y = 2.42 m

Lamy = 91.54

Lam_y = 1.05

Xy = 0.63



About z axis:

Lz = 4.84 m

Lcr,z = 2.42 m

Lamz = 91.54

Lam_z = 1.05

Xz = 0.63

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.19 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 91.54 < Lambda,max = 210.00

Lambda,z = 91.54 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.30 < 1.00 (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1023 Simple bar_0.5_1023 POINT: 3

COORDINATE: x = 1.00 L = 4.84 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 71.35 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 222.26 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.84 m
L_{cr,y} = 2.42 m
L_{amy} = 91.54

Lam_y = 1.05
X_y = 0.63



About z axis:

L_z = 4.84 m
L_{cr,z} = 2.42 m
Lam_z = 91.54

Lam_z = 1.05
X_z = 0.63

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.20 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_z = 91.54 < Lam_{z,max} = 210.00 Lambda_z = 91.54 < Lambda_{z,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.32 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1024 Simple bar_0.5_1024 POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /2/ 1*1.00 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 67.59 kN

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 222.26 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$\lambda_{my} = 91.54$

$\lambda_{m,y} = 1.05$

$\chi_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$\lambda_{mz} = 91.54$

$\lambda_{m,z} = 1.05$

$\chi_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.19 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 91.54 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.54 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.30 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1025 Simple bar_0.5_1025 **POINT:** 3

COORDINATE: $x = 1.00 \text{ L} = 4.84 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /6/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot -1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 71.17 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 222.26 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$\lambda_{my} = 91.54$

$\lambda_{m,y} = 1.05$

$\chi_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$\lambda_{mz} = 91.54$

$\lambda_{m,z} = 1.05$

$\chi_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.20 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{b,y} = 91.54 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.54 < \lambda_{b,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.32 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1026 Simple bar_0.5_1026 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 93.60 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 221.98 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.85 m
L_{cr,y} = 2.42 m
L_{amy} = 91.64
Lam_y = 1.06
X_y = 0.63



About z axis:

L_z = 4.85 m
L_{cr,z} = 2.42 m
Lam_z = 91.64
Lam_z = 1.06
X_z = 0.63

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.26 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{bda,y} = 91.64 < Lam_{bda,max} = 210.00 Lam_{bda,z} = 91.64 < Lam_{bda,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.42 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1027 Simple bar_0.5_1027 **POINT:** 3

COORDINATE: x = 1.00 L = 4.85 m

LOADS:

Governing Load Case: 25 ACC /7/ 1*1.00 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 92.28 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 221.98 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.85 \text{ m}$
 $L_{cr,y} = 2.42 \text{ m}$
 $\lambda_{my} = 91.64$
 $\lambda_{m,y} = 1.06$
 $X_y = 0.63$



About z axis:

$L_z = 4.85 \text{ m}$
 $L_{cr,z} = 2.42 \text{ m}$
 $\lambda_{mz} = 91.64$
 $\lambda_{m,z} = 1.06$
 $X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.26 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 91.64 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 91.64 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.42 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1028 Simple bar_0.5_1028 **POINT:** 1

COORDINATE: $x = 0.00$ $L = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /2/ $1 \cdot 1.00 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.0 \text{ cm}$	$A_y = 6.44 \text{ cm}^2$	$A_z = 6.44 \text{ cm}^2$	$A_x = 12.88 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 90.02 \text{ cm}^4$	$I_z = 90.02 \text{ cm}^4$	$I_x = 141.80 \text{ cm}^4$
$t_f = 0.5 \text{ cm}$	$W_{ply} = 31.75 \text{ cm}^3$	$W_{plz} = 31.75 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 91.49 \text{ kN}$
 $N_{c,Rd} = 354.20 \text{ kN}$
 $N_{b,Rd} = 221.98 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.85 \text{ m}$
 $L_{cr,y} = 2.42 \text{ m}$
 $\lambda_{my} = 91.64$
 $\lambda_{m,y} = 1.06$
 $X_y = 0.63$



About z axis:

$L_z = 4.85 \text{ m}$
 $L_{cr,z} = 2.42 \text{ m}$
 $\lambda_{mz} = 91.64$
 $\lambda_{m,z} = 1.06$
 $X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.26 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 91.64 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 91.64 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1029 Simple bar_0.5_1029 **POINT:** 3

COORDINATE: x = 1.00 L = 4.85 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 94.18 kN
N_{c,Rd} = 354.20 kN
N_{b,Rd} = 221.98 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.85 m
Lcr,y = 2.42 m
Lamy = 91.64
Lam_y = 1.06
Xy = 0.63



About z axis:

Lz = 4.85 m
Lcr,z = 2.42 m
Lamz = 91.64
Lam_z = 1.06
Xz = 0.63

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.27 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 91.64 < Lambda,max = 210.00 Lambda,z = 91.64 < Lambda,max = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.42 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.
ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1030 Simple bar_0.5_1030 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm	gM0=1.00	gM1=1.00	
b=7.0 cm	Ay=6.44 cm ²	Az=6.44 cm ²	Ax=12.88 cm ²
tw=0.5 cm	Iy=90.02 cm ⁴	Iz=90.02 cm ⁴	Ix=141.80 cm ⁴
tf=0.5 cm	Wply=31.75 cm ³	Wplz=31.75 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 97.01 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 222.26 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$\lambda_{my} = 91.54$

$\lambda_{my} = 1.05$

$\chi_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$\lambda_{mz} = 91.54$

$\lambda_{mz} = 1.05$

$\chi_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.27 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{b,y} = 91.54 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.54 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$

$N_{Ed}/N_{b,Rd} = 0.44 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1031 Simple bar_0.5_1031 **POINT:** 3

COORDINATE: $x = 1.00 \text{ L} = 4.84 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /7/ $1 \cdot 1.00 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$t_w = 0.5 \text{ cm}$

$t_f = 0.5 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 94.35 \text{ kN}$

$N_{c,Rd} = 354.20 \text{ kN}$

$N_{b,Rd} = 222.26 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$\lambda_{my} = 91.54$

$\lambda_{my} = 1.05$

$\chi_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$\lambda_{mz} = 91.54$

$\lambda_{mz} = 1.05$

$\chi_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.27 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{b,y} = 91.54 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.54 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$

$N_{Ed}/N_{b,Rd} = 0.42 < 1.00 \quad (6.3.1.1.(1))$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1032 Simple bar_0.5_1032 POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /2/ 1*1.00 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 94.71 kN

Nc,Rd = 354.20 kN

Nb,Rd = 222.26 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.84 m

Lam_y = 1.05

L_{cr,y} = 2.42 m

X_y = 0.63

Lam_y = 91.54



About z axis:

L_z = 4.84 m

Lam_z = 1.05

L_{cr,z} = 2.42 m

X_z = 0.63

Lam_z = 91.54

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.27 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_z = 91.54 < Lam_{z,max} = 210.00

Lam_z = 91.54 < Lam_{z,max} = 210.00 STABLE

N,Ed/Nb,Rd = 0.43 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1033 Simple bar_0.5_1033 POINT: 3

COORDINATE: x = 1.00 L = 4.84 m

LOADS:

Governing Load Case: 25 ACC /6/ 1*1.00 + 2*0.30 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

Ay=6.44 cm²

Az=6.44 cm²

Ax=12.88 cm²

tw=0.5 cm

Iy=90.02 cm⁴

Iz=90.02 cm⁴

Ix=141.80 cm⁴

tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 96.07 \text{ kN}$

$Nc, Rd = 354.20 \text{ kN}$

$Nb, Rd = 222.26 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$L_{amy} = 91.54$

$L_{am,y} = 1.05$

$X_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$L_{amz} = 91.54$

$L_{am,z} = 1.05$

$X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N, Ed / Nc, Rd = 0.27 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{b,y} = 91.54 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.54 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$

$N, Ed / Nb, Rd = 0.43 < 1.00 \quad (6.3.1.1.(1))$

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 1034 Simple bar_0.5_1034 **POINT:** 1

COORDINATE: $x = 0.00 \text{ L} = 0.00 \text{ m}$

LOADS:

Governing Load Case: 25 ACC /1/ $1 \cdot 1.00 + 2 \cdot 0.30 + 8 \cdot 1.00$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 70x5

$h = 7.0 \text{ cm}$

$b = 7.0 \text{ cm}$

$tw = 0.5 \text{ cm}$

$tf = 0.5 \text{ cm}$

$gM0 = 1.00$

$A_y = 6.44 \text{ cm}^2$

$I_y = 90.02 \text{ cm}^4$

$W_{ply} = 31.75 \text{ cm}^3$

$gM1 = 1.00$

$A_z = 6.44 \text{ cm}^2$

$I_z = 90.02 \text{ cm}^4$

$W_{plz} = 31.75 \text{ cm}^3$

$A_x = 12.88 \text{ cm}^2$

$I_x = 141.80 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N, Ed = 94.05 \text{ kN}$

$Nc, Rd = 354.20 \text{ kN}$

$Nb, Rd = 222.12 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.84 \text{ m}$

$L_{cr,y} = 2.42 \text{ m}$

$L_{amy} = 91.59$

$L_{am,y} = 1.06$

$X_y = 0.63$



About z axis:

$L_z = 4.84 \text{ m}$

$L_{cr,z} = 2.42 \text{ m}$

$L_{amz} = 91.59$

$L_{am,z} = 1.06$

$X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N, Ed / Nc, Rd = 0.27 < 1.00 \quad (6.2.4.(1))$

Global stability check of member:

$\lambda_{b,y} = 91.59 < \lambda_{b,max} = 210.00$

$\lambda_{b,z} = 91.59 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$

$N, Ed / Nb, Rd = 0.42 < 1.00 \quad (6.3.1.1.(1))$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1035 Simple bar_0.5_1035 **POINT:** 3

COORDINATE: x = 1.00 L = 4.84 m

LOADS:

Governing Load Case: 25 ACC /7/ 1*1.00 + 8*-1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴
Wply=31.75 cm³

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴
Wplz=31.75 cm³

Ax=12.88 cm²
Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 90.51 kN

Nc,Rd = 354.20 kN

Nb,Rd = 222.12 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.84 m
Lcr,y = 2.42 m
Lamy = 91.59

Lam_y = 1.06
Xy = 0.63



About z axis:

Lz = 4.84 m
Lcr,z = 2.42 m
Lamz = 91.59

Lam_z = 1.06
Xz = 0.63

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.26 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 91.59 < Lambda,max = 210.00

Lambda,z = 91.59 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.41 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1036 Simple bar_0.5_1036 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 25 ACC /1/ 1*1.00 + 2*0.30 + 8*1.00

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm

gM0=1.00
Ay=6.44 cm²
Iy=90.02 cm⁴

gM1=1.00
Az=6.44 cm²
Iz=90.02 cm⁴

Ax=12.88 cm²
Ix=141.80 cm⁴

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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tf=0.5 cm

Wply=31.75 cm³

Wplz=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 93.88 kN

N_{c,Rd} = 354.20 kN

N_{b,Rd} = 222.12 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.84 m

Lam_y = 1.06

L_{cr,y} = 2.42 m

X_y = 0.63

Lam_y = 91.59



About z axis:

L_z = 4.84 m

Lam_z = 1.06

L_{cr,z} = 2.42 m

X_z = 0.63

Lam_z = 91.59

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.27 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{b,y} = 91.59 < Lam_{b,max} = 210.00

Lam_{b,z} = 91.59 < Lam_{b,max} = 210.00 STABLE

N_{Ed}/N_{b,Rd} = 0.42 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1037 Simple bar_0.5_1037 **POINT:** 3

COORDINATE: x = 1.00 L = 4.84 m

LOADS:

Governing Load Case: 25 ACC /7/ 1*1.00 + 8*-1.00

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm

gM0=1.00

gM1=1.00

b=7.0 cm

A_y=6.44 cm²

A_z=6.44 cm²

A_x=12.88 cm²

tw=0.5 cm

I_y=90.02 cm⁴

I_z=90.02 cm⁴

I_x=141.80 cm⁴

tf=0.5 cm

W_{ply}=31.75 cm³

W_{plz}=31.75 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 90.34 kN

N_{c,Rd} = 354.20 kN

N_{b,Rd} = 222.12 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.84 m

Lam_y = 1.06

L_{cr,y} = 2.42 m

X_y = 0.63

Lam_y = 91.59



About z axis:

L_z = 4.84 m

Lam_z = 1.06

L_{cr,z} = 2.42 m

X_z = 0.63

Lam_z = 91.59

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.26 < 1.00 (6.2.4.(1))

Global stability check of member:

Lam_{b,y} = 91.59 < Lam_{b,max} = 210.00

Lam_{b,z} = 91.59 < Lam_{b,max} = 210.00 STABLE

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1038 Simple bar_0.5_1038 POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 10 ULS /171/ $1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$t_w=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$t_f=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 75.48$ kN

$N_{c,Rd} = 354.20$ kN

$N_{b,Rd} = 221.78$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.85$ m
 $L_{cr,y} = 2.42$ m
 $\lambda_{my} = 91.71$
 $\lambda_{my} = 1.06$
 $X_y = 0.63$



About z axis:

$L_z = 4.85$ m
 $L_{cr,z} = 2.42$ m
 $\lambda_{mz} = 91.71$
 $\lambda_{mz} = 1.06$
 $X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.21 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 91.71 < \lambda_{max} = 210.00$ $\lambda_{mz} = 91.71 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.34 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1039 Simple bar_0.5_1039 POINT: 3

COORDINATE: $x = 1.00$ $L = 4.85$ m

LOADS:

Governing Load Case: 10 ULS /233/ $1*1.00 + 3*1.50 + 7*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²

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Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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tw=0.5 cm
tf=0.5 cm

Iy=90.02 cm⁴
Wply=31.75 cm³

Iz=90.02 cm⁴
Wplz=31.75 cm³

Ix=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 68.88 kN
Nc,Rd = 354.20 kN
Nb,Rd = 221.78 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.85 m
L_{cr,y} = 2.42 m
L_{amy} = 91.71
L_{am,y} = 1.06
X_y = 0.63



About z axis:

L_z = 4.85 m
L_{cr,z} = 2.42 m
L_{amz} = 91.71
L_{am,z} = 1.06
X_z = 0.63

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.19 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda_y = 91.71 < Lambda_{max} = 210.00
Lambda_z = 91.71 < Lambda_{max} = 210.00 STABLE
N,Ed/Nb,Rd = 0.31 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1040 Simple bar_0.5_1040 **POINT:** 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 10 ULS /171/ 1*1.35 + 2*1.05 + 4*1.50 + 5*0.75 + 6*0.90

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: TCAR 70x5

h=7.0 cm
b=7.0 cm
tw=0.5 cm
tf=0.5 cm
gM0=1.00
A_y=6.44 cm²
I_y=90.02 cm⁴
Wply=31.75 cm³
gM1=1.00
A_z=6.44 cm²
I_z=90.02 cm⁴
Wplz=31.75 cm³
A_x=12.88 cm²
I_x=141.80 cm⁴

INTERNAL FORCES AND CAPACITIES:

N,Ed = 75.62 kN
Nc,Rd = 354.20 kN
Nb,Rd = 221.78 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.85 m
L_{cr,y} = 2.42 m
L_{amy} = 91.71
L_{am,y} = 1.06
X_y = 0.63



About z axis:

L_z = 4.85 m
L_{cr,z} = 2.42 m
L_{amz} = 91.71
L_{am,z} = 1.06
X_z = 0.63

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.21 < 1.00 (6.2.4.(1))

Global stability check of member:

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$\Lambda_{y,y} = 91.71 < \Lambda_{y,max} = 210.00$ $\Lambda_{z,z} = 91.71 < \Lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/N_{b,Rd} = 0.34 < 1.00$ (6.3.1.1.(1))

Section OK !!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1041 Simple bar_0.5_1041 **POINT:** 3

COORDINATE: x = 1.00 L = 4.85 m

LOADS:

Governing Load Case: 10 ULS /233/ 1*1.00 + 3*1.50 + 7*0.90

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 70x5

$h=7.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.0$ cm	$A_y=6.44$ cm ²	$A_z=6.44$ cm ²	$A_x=12.88$ cm ²
$t_w=0.5$ cm	$I_y=90.02$ cm ⁴	$I_z=90.02$ cm ⁴	$I_x=141.80$ cm ⁴
$t_f=0.5$ cm	$W_{ply}=31.75$ cm ³	$W_{plz}=31.75$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 68.46$ kN
 $N_{c,Rd} = 354.20$ kN
 $N_{b,Rd} = 221.78$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.85$ m $\Lambda_{m,y} = 1.06$
 $L_{cr,y} = 2.42$ m $X_y = 0.63$
 $\Lambda_{m,y} = 91.71$



About z axis:

$L_z = 4.85$ m $\Lambda_{m,z} = 1.06$
 $L_{cr,z} = 2.42$ m $X_z = 0.63$
 $\Lambda_{m,z} = 91.71$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.19 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\Lambda_{y,y} = 91.71 < \Lambda_{y,max} = 210.00$ $\Lambda_{z,z} = 91.71 < \Lambda_{z,max} = 210.00$ STABLE
 $N_{Ed}/N_{b,Rd} = 0.31 < 1.00$ (6.3.1.1.(1))

Section OK !!!

5.1.8 ΘΕΜΕΛΙΩΣΗ

Η θεμελίωση του μεταλλικού σκελετού γίνεται με πεδιλοδοκούς 50/80/120/80 και οπλισμό 6Φ18 άνω κάτω, ο οποίος φαίνεται στα σχέδια που συνοδεύουν την τεχνική έκθεση.

Bar/Position (m)	Top required reinforcement (My) (cm ²)	Top reinforcement - distribution (My)	Bottom required reinforcement (My) (cm ²)	Bottom reinforcement - distribution (My)	Transversal reinforcement - type/distribution
1042					2f10 85*20.0
1042/ 0.40	8.9	4f18	5.21	3f18	

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1042/ 8.50	8.87	4f18	5.21	3f18	
1042/ 16.60	8.86	4f18	5.21	3f18	
1043					2f10 85*20.0
1043/ 0.40	8.91	4f18	5.21	3f18	
1043/ 8.50	8.87	4f18	5.21	3f18	
1043/ 16.60	8.86	4f18	5.21	3f18	
1045					2f10 85*20.0
1045/ 0.40	11.29	5f18	5.21	3f18	
1045/ 8.50	12.49	5f18	5.21	3f18	
1045/ 16.60	8.87	4f18	5.21	3f18	
1047					2f10 85*20.0
1047/ 0.40	10.23	5f18	5.21	3f18	
1047/ 8.50	8.87	4f18	5.21	3f18	
1047/ 16.60	8.87	4f18	5.21	3f18	
1049					2f10 85*20.0
1049/ 0.40	9.36	4f18	5.21	3f18	
1049/ 8.50	8.87	4f18	5.21	3f18	
1049/ 16.60	8.87	4f18	5.21	3f18	
1051					2f10 85*20.0
1051/ 0.40	9.06	4f18	5.21	3f18	
1051/ 8.50	8.87	4f18	5.21	3f18	
1051/ 16.60	8.87	4f18	5.21	3f18	
1053					2f10 85*20.0
1053/ 0.40	9.13	4f18	5.21	3f18	
1053/ 8.50	8.87	4f18	5.21	3f18	
1053/ 16.60	8.87	4f18	5.21	3f18	
1055					2f10 85*20.0
1055/ 0.40	9.43	4f18	5.21	3f18	
1055/ 8.50	8.87	4f18	5.21	3f18	
1055/ 16.60	8.87	4f18	5.21	3f18	
1057					2f10 85*20.0
1057/ 0.40	8.93	4f18	5.21	3f18	
1057/ 8.50	8.87	4f18	5.21	3f18	
1057/ 16.60	8.87	4f18	5.21	3f18	
1058					2f10 19*20.0
1058/ 0.40	8.85	4f18	5.21	3f18	
1058/ 1.98	8.85	4f18	5.21	3f18	
1058/ 3.56	12.49	5f18	5.21	3f18	
1059					2f10 19*20.0
1059/ 0.40	12.49	5f18	5.21	3f18	
1059/ 1.97	12.49	5f18	5.21	3f18	
1059/ 3.54	12.49	5f18	5.21	3f18	
1060					2f10 19*20.0

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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1060/ 0.40	12.49	5f18	5.21	3f18	
1060/ 1.97	12.49	5f18	5.21	3f18	
1060/ 3.54	12.49	5f18	5.21	3f18	
1061					2f10 19*20.0
1061/ 0.40	12.49	5f18	5.21	3f18	
1061/ 1.96	12.49	5f18	5.21	3f18	
1061/ 3.52	12.49	5f18	5.21	3f18	
1062					2f10 19*20.0
1062/ 0.40	12.49	5f18	5.21	3f18	
1062/ 1.97	12.49	5f18	5.21	3f18	
1062/ 3.55	12.49	5f18	5.21	3f18	
1063					2f10 19*20.0
1063/ 0.40	12.49	5f18	5.21	3f18	
1063/ 1.95	12.49	5f18	5.21	3f18	
1063/ 3.51	12.49	5f18	5.21	3f18	
1064					2f10 19*20.0
1064/ 0.40	12.49	5f18	5.21	3f18	
1064/ 1.96	12.49	5f18	5.21	3f18	
1064/ 3.53	12.49	5f18	5.21	3f18	
1065					2f10 19*20.0
1065/ 0.40	12.49	5f18	5.21	3f18	
1065/ 1.96	12.49	5f18	5.21	3f18	
1065/ 3.53	12.49	5f18	5.21	3f18	
1066					2f10 26*20.0
1066/ 0.40	8.85	4f18	5.21	3f18	
1066/ 2.64	8.88	4f18	5.21	3f18	
1066/ 4.89	13.07	6f18	7.17	3f18	
1067					2f10 26*20.0
1067/ 0.40	13	6f18	6.56	3f18	
1067/ 2.66	8.87	4f18	5.21	3f18	
1067/ 4.91	12.49	5f18	5.21	3f18	
1068					2f10 26*20.0
1068/ 0.40	12.49	5f18	5.21	3f18	
1068/ 2.65	12.49	5f18	5.21	3f18	
1068/ 4.90	8.95	4f18	5.21	3f18	
1069					2f10 26*20.0
1069/ 0.40	8.94	4f18	5.21	3f18	
1069/ 2.65	12.49	5f18	5.21	3f18	
1069/ 4.90	12.49	5f18	5.21	3f18	
1070					2f10 26*20.0
1070/ 0.40	12.49	5f18	5.21	3f18	
1070/ 2.64	12.49	5f18	5.21	3f18	
1070/ 4.87	12.49	5f18	5.21	3f18	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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1071					2f10 26*20.0
1071/ 0.40	12.49	5f18	5.21	3f18	
1071/ 2.63	12.49	5f18	5.21	3f18	
1071/ 4.87	12.25	5f18	5.21	3f18	
1072					2f10 26*20.0
1072/ 0.40	11.57	5f18	5.21	3f18	
1072/ 2.67	12.49	5f18	5.21	3f18	
1072/ 4.93	12.49	5f18	5.21	3f18	
1073					2f10 26*20.0
1073/ 0.40	12.49	5f18	5.21	3f18	
1073/ 2.66	12.49	5f18	5.21	3f18	
1073/ 4.92	10.32	5f18	5.21	3f18	
1074					2f10 26*20.0
1074/ 0.40	10.45	5f18	5.21	3f18	
1074/ 2.65	12.49	5f18	5.21	3f18	
1074/ 4.90	12.49	5f18	5.21	3f18	
1075					2f10 26*20.0
1075/ 0.40	12.49	5f18	5.21	3f18	
1075/ 2.64	12.49	5f18	5.21	3f18	
1075/ 4.89	12.03	5f18	5.21	3f18	
1076					2f10 26*20.0
1076/ 0.40	12.49	5f18	5.21	3f18	
1076/ 2.66	12.49	5f18	5.21	3f18	
1076/ 4.91	12.49	5f18	5.21	3f18	
1077					2f10 26*20.0
1077/ 0.40	12.49	5f18	5.21	3f18	
1077/ 2.66	12.49	5f18	5.21	3f18	
1077/ 4.91	8.92	4f18	5.21	3f18	
1078					2f10 26*20.0
1078/ 0.40	9.48	4f18	5.21	3f18	
1078/ 2.66	12.49	5f18	5.21	3f18	
1078/ 4.91	8.97	4f18	5.21	3f18	
1079					2f10 26*20.0
1079/ 0.40	8.98	4f18	5.21	3f18	
1079/ 2.66	12.49	5f18	5.21	3f18	
1079/ 4.91	12.49	5f18	5.21	3f18	
1080					2f10 26*20.0
1080/ 0.40	12.49	5f18	5.21	3f18	
1080/ 2.67	8.87	4f18	5.21	3f18	
1080/ 4.94	13.47	6f18	6.58	3f18	
1081					2f10 26*20.0
1081/ 0.40	13.51	6f18	7.19	3f18	
1081/ 2.67	8.88	4f18	5.21	3f18	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

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1081/ 4.93	8.85	4f18	5.21	3f18	
1082					2f10 22*20.0
1082/ 0.40	8.87	4f18	5.21	3f18	
1082/ 2.23	12.49	5f18	5.21	3f18	
1082/ 4.06	10.97	5f18	6.41	3f18	
1083					2f10 22*20.0
1083/ 0.40	10.1	4f18	6.24	3f18	
1083/ 2.23	11.36	5f18	5.21	3f18	
1083/ 4.07	8.87	4f18	5.21	3f18	
1084					2f10 22*20.0
1084/ 0.40	8.88	4f18	5.21	3f18	
1084/ 2.22	8.87	4f18	5.21	3f18	
1084/ 4.05	10.42	5f18	6.22	3f18	
1085					2f10 22*20.0
1085/ 0.40	10.31	5f18	6.12	3f18	
1085/ 2.22	8.87	4f18	5.21	3f18	
1085/ 4.05	8.88	4f18	5.21	3f18	
1086					2f10 22*20.0
1086/ 0.40	8.88	4f18	5.21	3f18	
1086/ 2.22	9.31	4f18	5.21	3f18	
1086/ 4.05	12.11	5f18	6.1	3f18	
1087					2f10 22*20.0
1087/ 0.40	12.31	5f18	6.21	3f18	
1087/ 2.22	9.3	4f18	5.21	3f18	
1087/ 4.05	8.88	4f18	5.21	3f18	
1088					2f10 22*20.0
1088/ 0.40	8.88	4f18	5.21	3f18	
1088/ 2.21	9.61	4f18	5.21	3f18	
1088/ 4.03	12.1	5f18	6.17	3f18	
1089					2f10 22*20.0
1089/ 0.40	12.05	5f18	6.12	3f18	
1089/ 2.22	9.58	4f18	5.21	3f18	
1089/ 4.04	8.88	4f18	5.21	3f18	
1090					2f10 22*20.0
1090/ 0.40	8.88	4f18	5.21	3f18	
1090/ 2.23	9.65	4f18	5.21	3f18	
1090/ 4.05	12.3	5f18	6.12	3f18	
1091					2f10 22*20.0
1091/ 0.40	12.32	5f18	6.18	3f18	
1091/ 2.23	9.5	4f18	5.21	3f18	
1091/ 4.06	8.88	4f18	5.21	3f18	
1092					2f10 22*20.0
1092/ 0.40	8.88	4f18	5.21	3f18	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

1092/ 2.20	9.25	4f18	5.21	3f18	
1092/ 4.01	12.32	5f18	6.2	3f18	
1093					2f10 22*20.0
1093/ 0.40	12.14	5f18	6.09	3f18	
1093/ 2.21	9.24	4f18	5.21	3f18	
1093/ 4.01	8.88	4f18	5.21	3f18	
1094					2f10 22*20.0
1094/ 0.40	8.88	4f18	5.21	3f18	
1094/ 2.22	8.87	4f18	5.21	3f18	
1094/ 4.04	10.49	5f18	6.11	3f18	
1095					2f10 22*20.0
1095/ 0.40	10.57	5f18	6.21	3f18	
1095/ 2.22	8.87	4f18	5.21	3f18	
1095/ 4.03	8.88	4f18	5.21	3f18	
1096					2f10 22*20.0
1096/ 0.40	8.87	4f18	5.21	3f18	
1096/ 2.22	12.49	5f18	5.21	3f18	
1096/ 4.05	9.99	4f18	6.22	3f18	
1097					2f10 22*20.0
1097/ 0.40	10.42	5f18	6.39	3f18	
1097/ 2.21	12.49	5f18	5.21	3f18	
1097/ 4.03	8.86	4f18	5.21	3f18	
1098					2f10 17*20.0
1098/ 0.40	8.86	4f18	5.21	3f18	
1098/ 1.78	11.77	5f18	5.21	3f18	
1098/ 3.16	8.92	4f18	5.21	3f18	
1099					2f10 17*20.0
1099/ 0.40	8.91	4f18	5.21	3f18	
1099/ 1.79	8.86	4f18	5.21	3f18	
1099/ 3.18	8.86	4f18	5.21	3f18	
1100					2f10 17*20.0
1100/ 0.40	8.86	4f18	5.21	3f18	
1100/ 1.79	12.49	5f18	5.21	3f18	
1100/ 3.17	8.89	4f18	5.21	3f18	
1101					2f10 17*20.0
1101/ 0.40	8.89	4f18	5.21	3f18	
1101/ 1.79	12.49	5f18	5.21	3f18	
1101/ 3.17	8.86	4f18	5.21	3f18	
1102					2f10 17*20.0
1102/ 0.40	8.85	4f18	5.21	3f18	
1102/ 1.78	12.49	5f18	5.21	3f18	
1102/ 3.15	8.89	4f18	5.21	3f18	
1103					2f10 17*20.0

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

1103/ 0.40	8.89	4f18	5.21	3f18	
1103/ 1.78	12.49	5f18	5.21	3f18	
1103/ 3.15	8.86	4f18	5.21	3f18	
1104					2f10 18*20.0
1104/ 0.40	8.86	4f18	5.21	3f18	
1104/ 1.80	12.49	5f18	5.21	3f18	
1104/ 3.20	8.89	4f18	5.21	3f18	
1105					2f10 18*20.0
1105/ 0.40	8.89	4f18	5.21	3f18	
1105/ 1.79	12.49	5f18	5.21	3f18	
1105/ 3.19	8.86	4f18	5.21	3f18	
1106					2f10 17*20.0
1106/ 0.40	8.86	4f18	5.21	3f18	
1106/ 1.79	12.49	5f18	5.21	3f18	
1106/ 3.17	8.89	4f18	5.21	3f18	
1107					2f10 17*20.0
1107/ 0.40	9	4f18	5.21	3f18	
1107/ 1.78	12.49	5f18	5.21	3f18	
1107/ 3.16	8.86	4f18	5.21	3f18	
1108					2f10 17*20.0
1108/ 0.40	8.85	4f18	5.21	3f18	
1108/ 1.79	12.49	5f18	5.21	3f18	
1108/ 3.18	8.89	4f18	5.21	3f18	
1109					2f10 17*20.0
1109/ 0.40	12.49	5f18	5.21	3f18	
1109/ 1.79	12.49	5f18	5.21	3f18	
1109/ 3.18	8.86	4f18	5.21	3f18	
1110					2f10 17*20.0
1110/ 0.40	8.86	4f18	5.21	3f18	
1110/ 1.79	12.49	5f18	5.21	3f18	
1110/ 3.18	10.73	5f18	5.21	3f18	
1111					2f10 17*20.0
1111/ 0.40	11.51	5f18	5.21	3f18	
1111/ 1.79	12.49	5f18	5.21	3f18	
1111/ 3.18	8.86	4f18	5.21	3f18	
1112					2f10 18*20.0
1112/ 0.40	8.86	4f18	5.21	3f18	
1112/ 1.80	8.86	4f18	5.21	3f18	
1112/ 3.20	8.91	4f18	5.21	3f18	
1113					2f10 18*20.0
1113/ 0.40	10.97	5f18	5.21	3f18	
1113/ 1.80	8.89	4f18	5.21	3f18	
1113/ 3.20	9.36	4f18	5.21	3f18	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

1114					2f10 16*20.0
1114/ 0.40	12.49	5f18	5.21	3f18	
1114/ 1.61	12.21	5f18	5.21	3f18	
1114/ 2.81	8.89	4f18	5.21	3f18	
1115					2f10 16*20.0
1115/ 0.40	9.45	4f18	5.21	3f18	
1115/ 1.61	8.89	4f18	5.21	3f18	
1115/ 2.83	8.92	4f18	5.21	3f18	
1116					2f10 16*20.0
1116/ 0.40	9.83	4f18	5.21	3f18	
1116/ 1.61	12.49	5f18	5.21	3f18	
1116/ 2.82	12.49	5f18	5.21	3f18	
1117					2f10 16*20.0
1117/ 0.40	8.9	4f18	5.21	3f18	
1117/ 1.61	12.49	5f18	5.21	3f18	
1117/ 2.82	9.47	4f18	5.21	3f18	
1118					2f10 16*20.0
1118/ 0.40	10.43	5f18	5.21	3f18	
1118/ 1.60	12.49	5f18	5.21	3f18	
1118/ 2.80	8.87	4f18	5.21	3f18	
1119					2f10 16*20.0
1119/ 0.40	8.87	4f18	5.21	3f18	
1119/ 1.60	12.49	5f18	5.21	3f18	
1119/ 2.80	12.49	5f18	5.21	3f18	
1120					2f10 16*20.0
1120/ 0.40	12.49	5f18	5.21	3f18	
1120/ 1.62	12.49	5f18	5.21	3f18	
1120/ 2.84	8.91	4f18	5.21	3f18	
1121					2f10 16*20.0
1121/ 0.40	8.98	4f18	5.21	3f18	
1121/ 1.62	12.49	5f18	5.21	3f18	
1121/ 2.83	12.49	5f18	5.21	3f18	
1122					2f10 16*20.0
1122/ 0.40	12.49	5f18	5.21	3f18	
1122/ 1.61	12.49	5f18	5.21	3f18	
1122/ 2.82	10.65	5f18	5.21	3f18	
1123					2f10 16*20.0
1123/ 0.40	12.49	5f18	5.21	3f18	
1123/ 1.61	12.49	5f18	5.21	3f18	
1123/ 2.81	9.87	4f18	5.21	3f18	
1124					2f10 16*20.0
1124/ 0.40	10.25	5f18	5.21	3f18	
1124/ 1.61	11.33	5f18	5.21	3f18	

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

1124/ 2.83	11.03	5f18	5.21	3f18	
1125					2f10 16*20.0
1125/ 0.40	9.99	4f18	5.21	3f18	
1125/ 1.61	10.7	5f18	5.21	3f18	
1125/ 2.83	12.49	5f18	5.21	3f18	
1126					2f10 16*20.0
1126/ 0.40	12.49	5f18	5.21	3f18	
1126/ 1.61	10.79	5f18	5.21	3f18	
1126/ 2.83	12.49	5f18	5.21	3f18	
1127					2f10 16*20.0
1127/ 0.40	8.91	4f18	5.21	3f18	
1127/ 1.61	11.6	5f18	5.21	3f18	
1127/ 2.83	12.49	5f18	5.21	3f18	
1128					2f10 16*20.0
1128/ 0.40	12.49	5f18	5.21	3f18	
1128/ 1.62	10.45	5f18	5.21	3f18	
1128/ 2.84	9.16	4f18	5.21	3f18	
1129					2f10 16*20.0
1129/ 0.40	12.49	5f18	5.21	3f18	
1129/ 1.62	12.49	5f18	5.21	3f18	
1129/ 2.84	12.49	5f18	5.21	3f18	

6 ΚΕΝΤΡΙΚΟ ΚΛΙΜΑΚΟΣΤΑΣΙΟ

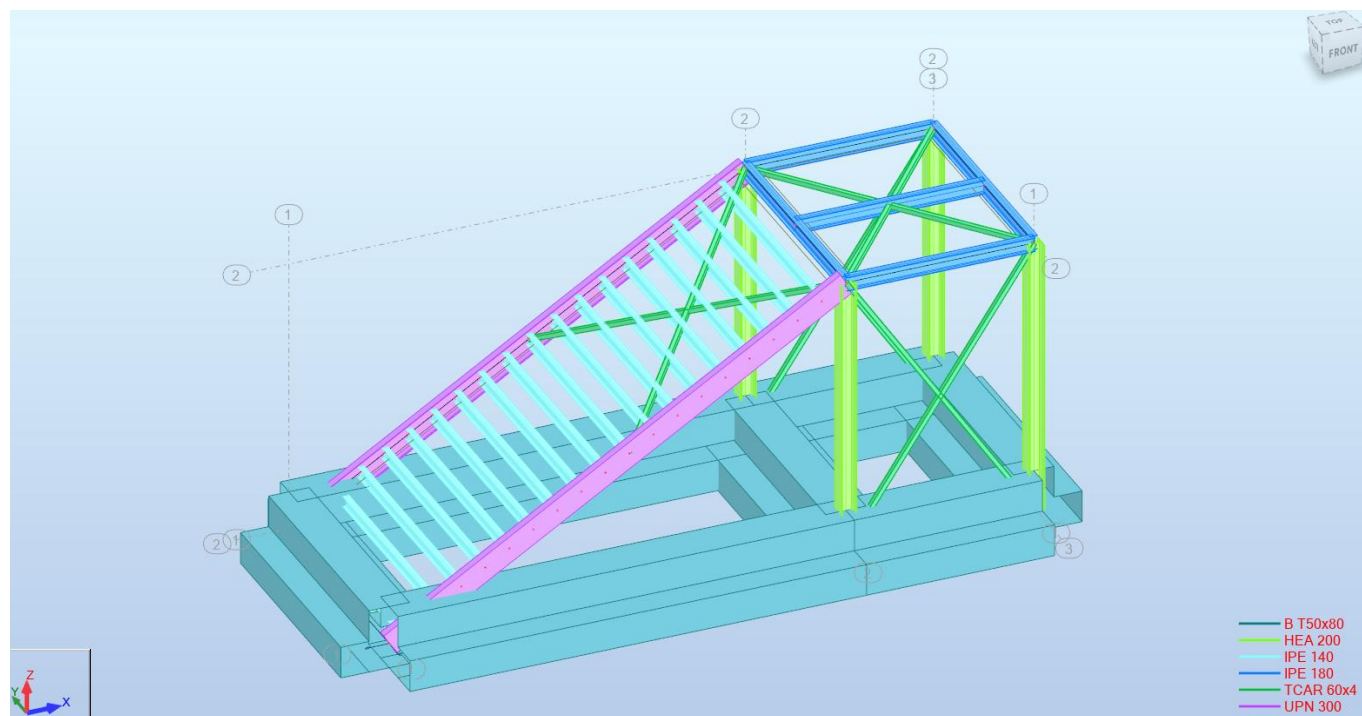
6.1.1 ΔΙΑΤΟΜΕΣ

Section name	Bar list	AX (cm2)	AY (cm2)	AZ (cm2)	IX (cm4)	IY (cm4)	IZ (cm4)
B T50x80	41to47	6800.00	4800.00	4000.00	2583936.19	3165490.20	6176666.67
IPE 180	6 8to10 18	23.95	14.32	9.55	4.90	1316.96	100.85
HEA 200	1to4	53.83	38.68	13.28	18.60	3692.15	1335.51
TCAR 60x4	7 12to17 32	8.88	3.95	3.95	72.41	46.14	46.14
IPE 140	19to31 33to3-8	16.43	9.89	6.57	2.54	541.22	44.92
UPN 300	5 11	58.56	32.24	29.18	51.37	8025.80	493.32

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Εικόνα 4: Τρισδιάστατη απεικόνιση φορέα

6.1.2 ΥΛΙΚΑ

	Material	E (MPa)	G (MPa)	NI	LX (1/°C)	RO (kN/m3)	Re (MPa)
1	S275	210000.00	80800.00	0.30	0.00	77.01	275.00
2	C25/30	31000.00	12916.67	0.20	0.00	24.53	25.00

6.1.3 ΦΟΡΤΙΣΕΙΣ

Case	Label	Case name	Nature	Analysis type
1	DL1	DL1	Structural	Static - Linear
2	LL1	LL1	live	Static - Linear
3	WIND1	WIND1	wind	Static - Linear
4	WIND2	WIND2	wind	Static - Linear
5	TEMP1	TEMP1	temperature	Static - Linear
6	TEMP2	TEMP2	temperature	Static - Linear
7	SN1	SN1	snow	Static - Linear
8		ULS		Static - Linear
9		ULS+		Static - Linear
10		ULS-		Static - Linear
11		SLS		Static - Linear
12		SLS+		Static - Linear
13		SLS-		Static - Linear
14		SLS:CHR		Static - Linear

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Case	Label	Case name	Nature	Analysis type
15		SLS:CHR+		Static - Linear
16		SLS:CHR-		Static - Linear
17		SLS:FRE		Static - Linear
18		SLS:FRE+		Static - Linear
19		SLS:FRE-		Static - Linear
20	SEIS1	Ex+0.3Ey	seismic	Static - Linear
21	SEIS2	0.3Ex+Ey	seismic	Static - Linear
22		SLS:QPR		Static - Linear
23		SLS:QPR+		Static - Linear
24		SLS:QPR-		Static - Linear
25		ACC		Static - Linear
26		ACC+		Static - Linear
27		ACC-		Static - Linear
28		SPEC		Static - Linear
29		SPEC+		Static - Linear
30		SPEC-		Static - Linear

6.1.4 ΤΙΜΕΣ ΦΟΡΤΙΣΕΩΝ

Case	Load type	List	Load values
1	self-weight	1to47	PZ Negative Factor=1.00
1	(FE) uniform	39 40	PZ=-3.00(kN/m2) projected
1	uniform load	5 11	PZ=-0.50(kN/m) projected
1	uniform load	8 10	PZ=-0.50(kN/m)
2	(FE) uniform	39 40	PZ=-5.00(kN/m2) projected
3	uniform load	3 4 8 11	PY=3.00(kN/m)
4	uniform load	1to4 9 10	PX=-3.00(kN/m)
5	thermal load	1to6 8to31 33to38	TX=20.00(°C)
6	thermal load	1to6 8to31 33to38	TX=-20.00(°C)
7	(FE) uniform	39	PZ=-0.39(kN/m2)
7	(FE) uniform	40	PZ=-0.39(kN/m2) projected
20	(FE) uniform	39 40	PX=2.00(kN/m2) PY=0.60(kN/m2)
21	(FE) uniform	39 40	PX=0.60(kN/m2) PY=2.00(kN/m2)

6.1.5 ΣΥΝΔΥΑΣΜΟΙ ΦΟΡΤΙΣΗΣ

ULS/t1 $1*1.35 + 2*1.50$
 ULS/t2 $1*1.35 + 2*1.50 + 5*0.90$
 ULS/t3 $1*1.35 + 2*1.50 + 6*0.90$
 ULS/t4 $1*1.35$
 ULS/t5 $1*1.00 + 2*1.50$
 ULS/t6 $1*1.00 + 2*1.50 + 5*0.90$
 ULS/t7 $1*1.00 + 2*1.50 + 6*0.90$
 ULS/t8 $1*1.00$
 ULS/t9 $1*1.35 + 2*1.05 + 5*1.50$
 ULS/t10 $1*1.35 + 2*1.05 + 6*1.50$
 ULS/t11 $1*1.35 + 5*1.50$
 ULS/t12 $1*1.35 + 6*1.50$
 ULS/t13 $1*1.00 + 2*1.05 + 5*1.50$
 ULS/t14 $1*1.00 + 2*1.05 + 6*1.50$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

ULS/\t15 1*1.00 + 5*1.50
ULS/\t16 1*1.00 + 6*1.50
SLS:CHR/\t1 1*1.00 + 2*1.00
SLS:CHR/\t2 1*1.00 + 2*1.00 + 5*0.60
SLS:CHR/\t3 1*1.00 + 2*1.00 + 6*0.60
SLS:CHR/\t4 1*1.00
SLS:CHR/\t5 1*1.00 + 2*0.70 + 5*1.00
SLS:CHR/\t6 1*1.00 + 2*0.70 + 6*1.00
SLS:CHR/\t7 1*1.00 + 5*1.00
SLS:CHR/\t8 1*1.00 + 6*1.00
SLS:FRE/\t9 1*1.00 + 2*0.50
SLS:FRE/\t10 1*1.00
SLS:FRE/\t11 1*1.00 + 2*0.30 + 5*0.50
SLS:FRE/\t12 1*1.00 + 2*0.30 + 6*0.50
SLS:FRE/\t13 1*1.00 + 5*0.50
SLS:FRE/\t14 1*1.00 + 6*0.50
SLS:QPR/\t15 1*1.00 + 2*0.30
SLS:QPR/\t16 1*1.00
SLS:CHR/\t1 1*1.00 + 2*1.00
SLS:CHR/\t2 1*1.00 + 2*1.00 + 5*0.60
SLS:CHR/\t3 1*1.00 + 2*1.00 + 6*0.60
SLS:CHR/\t4 1*1.00
SLS:CHR/\t5 1*1.00 + 2*0.70 + 5*1.00
SLS:CHR/\t6 1*1.00 + 2*0.70 + 6*1.00
SLS:CHR/\t7 1*1.00 + 5*1.00
SLS:CHR/\t8 1*1.00 + 6*1.00
SLS:FRE/\t1 1*1.00 + 2*0.50
SLS:FRE/\t2 1*1.00
SLS:FRE/\t3 1*1.00 + 2*0.30 + 5*0.50
SLS:FRE/\t4 1*1.00 + 2*0.30 + 6*0.50
SLS:FRE/\t5 1*1.00 + 5*0.50
SLS:FRE/\t6 1*1.00 + 6*0.50
SLS:QPR/\t1 1*1.00 + 2*0.30
SLS:QPR/\t2 1*1.00
ACC:SEI/\t1 1*1.00 + 2*0.30 + 20*1.00
ACC:SEI/\t2 1*1.00 + 2*0.30 + 21*1.00
ACC:SEI/\t3 1*1.00
ACC:SEI/\t4 1*1.00 + 20*1.00
ACC:SEI/\t5 1*1.00 + 21*1.00
ACC:SEI/\t6 1*1.00 + 2*0.30 + 20*-1.00
ACC:SEI/\t7 1*1.00 + 2*0.30 + 21*-1.00
ACC:SEI/\t8 1*1.00 + 20*-1.00
ACC:SEI/\t9 1*1.00 + 21*-1.00
SPEC/\t1 1*1.00 + 2*0.50
SPEC/\t2 1*1.00
SPEC/\t3 1*1.00 + 2*0.30 + 5*0.50
SPEC/\t4 1*1.00 + 2*0.30 + 6*0.50
SPEC/\t5 1*1.00 + 5*0.50
SPEC/\t6 1*1.00 + 6*0.50

6.1.6 ΜΕΓΙΣΤΕΣ ΜΕΤΑΤΟΠΙΣΕΙΣ – SLS

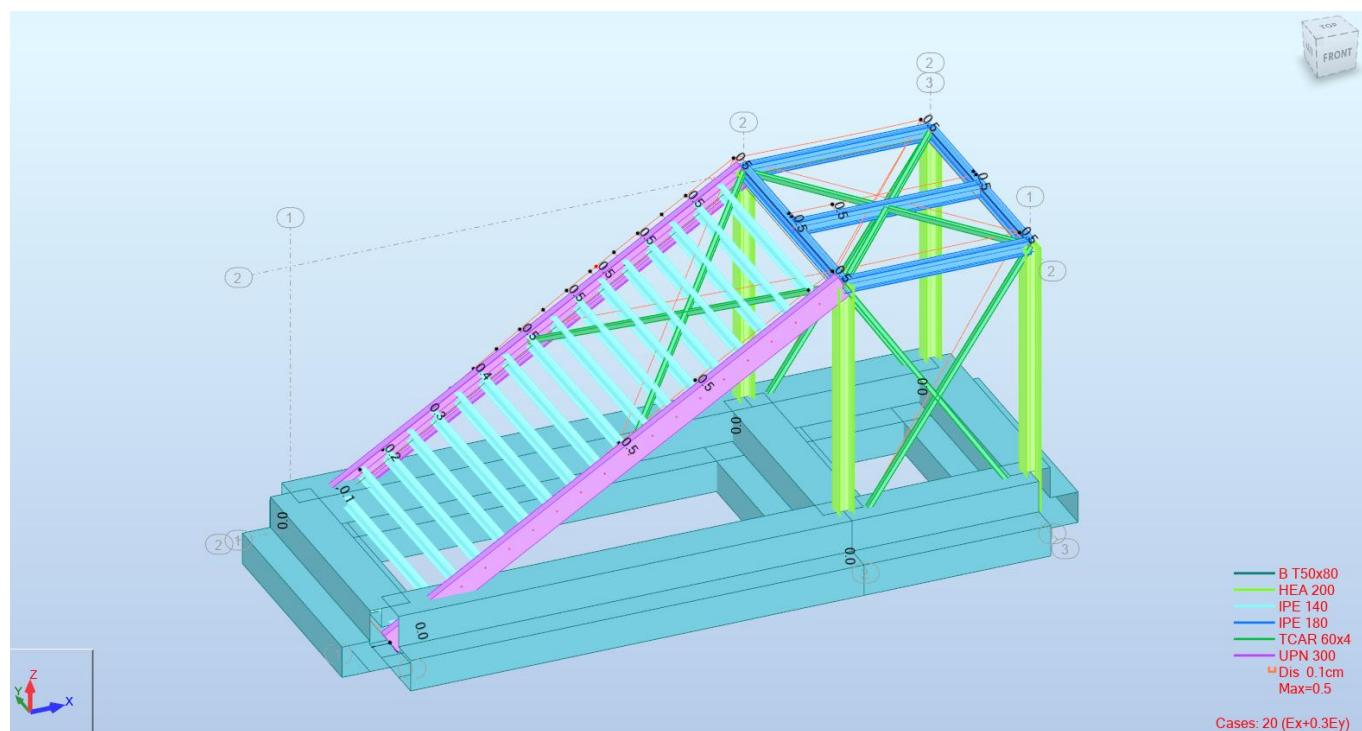
	UX (cm)	UY (cm)	UZ (cm)	RX (Rad)	RY (Rad)	RZ (Rad)
MAX	0.2	1.8	0.1	0.001	0.002	0.005
Node	60	63	12	12	54	54
Case	SLS/2	21	5	21	SLS/3	21
MIN	-0.4	-0.0	-0.5	-0.004	-0.002	-0.003

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

	UX (cm)	UY (cm)	UZ (cm)	RX (Rad)	RY (Rad)	RZ (Rad)
Node	13	34	60	37	66	2
Case	4	SLS/5	SLS/3	21	SLS/3	4

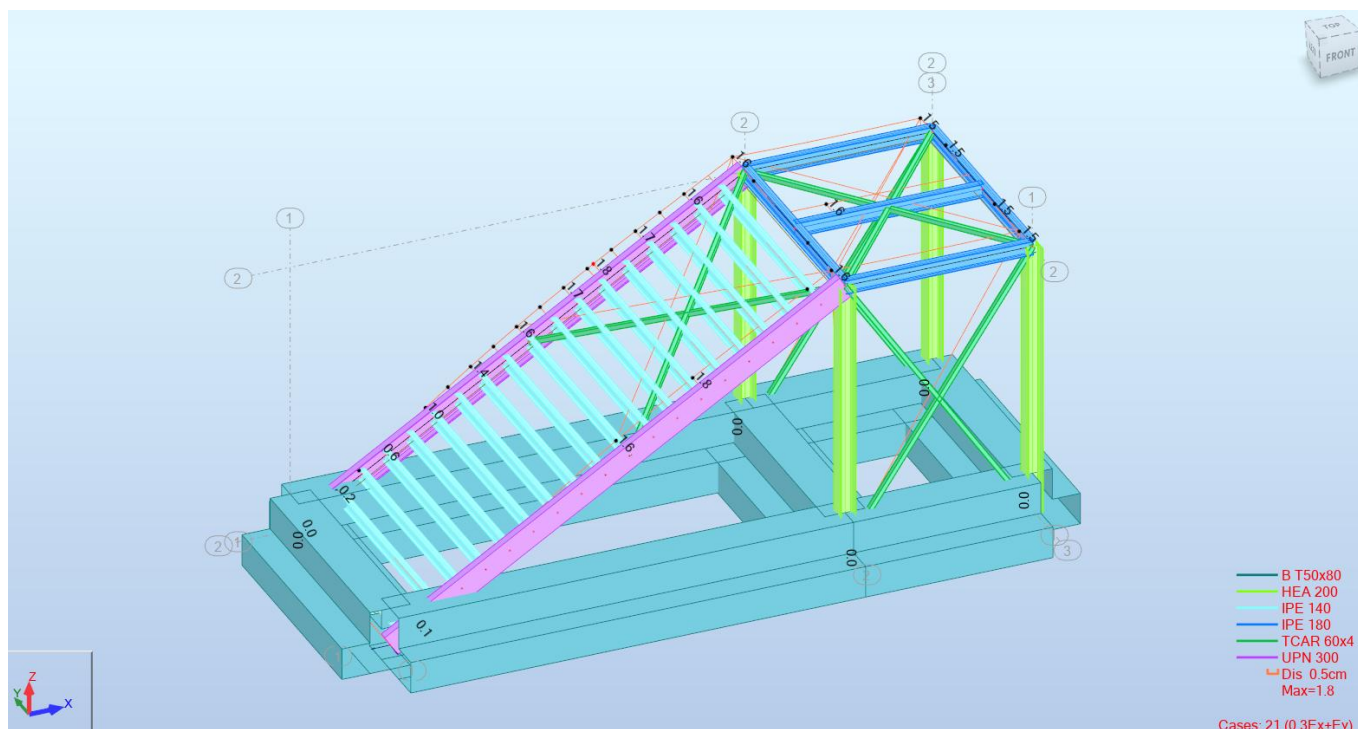


Εικόνα 5: Μετατοπίσεις φορέα για σεισμική διέγερση +X

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Εικόνα 6: Μετατοπίσεις φορέα για σεισμική διέγερση +Y

6.1.7 ΕΛΕΓΧΟΣ ΜΕΛΩΝ

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 1 Column_1

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /9/ 1*1.35 + 2*1.05 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: HEA 200

$h=19.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=20.0$ cm	$A_y=45.12$ cm ²	$A_z=18.08$ cm ²	$A_x=53.83$ cm ²
$t_w=0.7$ cm	$I_y=3692.15$ cm ⁴	$I_z=1335.51$ cm ⁴	$I_x=18.60$ cm ⁴
$t_f=1.0$ cm	$W_{ply}=429.52$ cm ³	$W_{plz}=203.82$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{,Ed} = 30.66$ kN	$M_{y,Ed} = -2.77$ kN*m	$M_{z,Ed} = -1.45$ kN*m	$V_{y,Ed} = -1.07$ kN
$N_{c,Rd} = 1480.36$ kN	$M_{y,Ed,max} = -2.77$ kN*m	$M_{z,Ed,max} = 2.24$ kN*m	$V_{y,T,Rd} = 716.38$ kN
$N_{b,Rd} = 980.08$ kN	$M_{y,c,Rd} = 118.12$ kN*m	$M_{z,c,Rd} = 56.05$ kN*m	$V_{z,Ed} = 0.71$ kN
	$MN_{y,Rd} = 118.12$ kN*m	$MN_{z,Rd} = 56.05$ kN*m	$V_{z,T,Rd} = 287.07$ kN
			$T_{t,Ed} = -0.00$ kN*m

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 3.46 \text{ m}$

$L_{cr,y} = 3.46 \text{ m}$

$\lambda_{my} = 41.78$

$\lambda_{m,y} = 0.48$

$\chi_y = 0.89$

$\kappa_{zy} = 0.42$



About z axis:

$L_z = 3.46 \text{ m}$

$L_{cr,z} = 3.46 \text{ m}$

$\lambda_{mz} = 69.47$

$\lambda_{m,z} = 0.80$

$\chi_z = 0.66$

$\kappa_{zz} = 0.65$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.03 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 41.78 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 69.47 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \kappa_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \kappa_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \kappa_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.07 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /7/ $1 \cdot 1.00 + 5 \cdot 1.00$

$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 2 Column_2

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /3/ $1 \cdot 1.35 + 2 \cdot 1.50 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 200

$h = 19.0 \text{ cm}$

$b = 20.0 \text{ cm}$

$t_w = 0.7 \text{ cm}$

$t_f = 1.0 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 45.12 \text{ cm}^2$

$I_y = 3692.15 \text{ cm}^4$

$W_{ply} = 429.52 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 18.08 \text{ cm}^2$

$I_z = 1335.51 \text{ cm}^4$

$W_{plz} = 203.82 \text{ cm}^3$

$A_x = 53.83 \text{ cm}^2$

$I_x = 18.60 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 93.26 \text{ kN}$

$N_{c,Rd} = 1480.36 \text{ kN}$

$N_{b,Rd} = 980.08 \text{ kN}$

$M_{y,Ed} = -5.79 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = 14.17 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 118.12 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 118.12 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = -0.65 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = 1.74 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 56.05 \text{ kN} \cdot \text{m}$

$M_{N,z,Rd} = 56.05 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = -0.69 \text{ kN}$

$V_{y,T,Rd} = 716.19 \text{ kN}$

$V_{z,Ed} = 5.77 \text{ kN}$

$V_{z,T,Rd} = 287.02 \text{ kN}$

$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

BUCKLING PARAMETERS:



About y axis:

$L_y = 3.46 \text{ m}$

$L_{cr,y} = 3.46 \text{ m}$

$\lambda_{my} = 41.78$

$\lambda_{m,y} = 0.48$

$\chi_y = 0.89$

$\eta_{yy} = 0.71$



About z axis:

$L_z = 3.46 \text{ m}$

$L_{cr,z} = 3.46 \text{ m}$

$\lambda_{mz} = 69.47$

$\lambda_{m,z} = 0.80$

$\chi_z = 0.66$

$\eta_{yz} = 0.49$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.06 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{m,y} = 41.78 < \lambda_{m,max} = 210.00$ $\lambda_{m,z} = 69.47 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/(\chi_y \cdot N_{Rk}/g_{M1}) + \eta_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.17 < 1.00$ (6.3.3.(4))

$N_{Ed}/(\chi_z \cdot N_{Rk}/g_{M1}) + \eta_{yz} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + \eta_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.16 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 2.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 3 Column_3

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /9/ $1 \cdot 1.35 + 2 \cdot 1.05 + 5 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 200

$h = 19.0 \text{ cm}$

$b = 20.0 \text{ cm}$

$t_w = 0.7 \text{ cm}$

$t_f = 1.0 \text{ cm}$

$g_{M0} = 1.00$

$A_y = 45.12 \text{ cm}^2$

$I_y = 3692.15 \text{ cm}^4$

$W_{ply} = 429.52 \text{ cm}^3$

$g_{M1} = 1.00$

$A_z = 18.08 \text{ cm}^2$

$I_z = 1335.51 \text{ cm}^4$

$W_{plz} = 203.82 \text{ cm}^3$

$A_x = 53.83 \text{ cm}^2$

$I_x = 18.60 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 31.35 \text{ kN}$

$N_{c,Rd} = 1480.36 \text{ kN}$

$N_{b,Rd} = 980.08 \text{ kN}$

$M_{y,Ed} = -2.88 \text{ kN} \cdot \text{m}$

$M_{y,Ed,max} = -2.88 \text{ kN} \cdot \text{m}$

$M_{y,c,Rd} = 118.12 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 118.12 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = 1.44 \text{ kN} \cdot \text{m}$

$M_{z,Ed,max} = -2.23 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 56.05 \text{ kN} \cdot \text{m}$

$M_{N,z,Rd} = 56.05 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 1.06 \text{ kN}$

$V_{y,T,Rd} = 716.38 \text{ kN}$

$V_{z,Ed} = 0.81 \text{ kN}$

$V_{z,T,Rd} = 287.07 \text{ kN}$

$T_{t,Ed} = 0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 3.46 \text{ m}$

$L_{cr,y} = 3.46 \text{ m}$

$\lambda_{m,y} = 0.48$

$\chi_y = 0.89$



About z axis:

$L_z = 3.46 \text{ m}$

$L_{cr,z} = 3.46 \text{ m}$

$\lambda_{m,z} = 0.80$

$\chi_z = 0.66$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lamy = 41.78

kzy = 0.41

Lamz = 69.47

kzz = 0.65

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.03 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(\sqrt{3} \cdot gM_0) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(\sqrt{3} \cdot gM_0) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{y,Ed} = 41.78 < \lambda_{y,max} = 210.00 \quad \lambda_{z,Ed} = 69.47 < \lambda_{z,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM_1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM_1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM_1) = 0.06 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM_1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM_1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM_1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 2.3 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /7/ 1*1.00 + 5*1.00

$$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 2.3 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /7/ 1*1.00 + 5*1.00

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 4 Column_4

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /3/ 1*1.35 + 2*1.50 + 6*0.90

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: HEA 200

h=19.0 cm

gM0=1.00

gM1=1.00

b=20.0 cm

Ay=45.12 cm²

Az=18.08 cm²

Ax=53.83 cm²

tw=0.7 cm

Iy=3692.15 cm⁴

Iz=1335.51 cm⁴

Ix=18.60 cm⁴

tf=1.0 cm

Wply=429.52 cm³

Wplz=203.82 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 94.02 kN

M_{y,Ed} = -5.72 kN*m

M_{z,Ed} = 0.66 kN*m

V_{y,Ed} = 0.69 kN

N_{c,Rd} = 1480.36 kN

M_{y,Ed,max} = 14.03 kN*m

M_{z,Ed,max} = -1.75 kN*m

V_{y,T,Rd} = 716.19 kN

N_{b,Rd} = 980.08 kN

M_{y,c,Rd} = 118.12 kN*m

M_{z,c,Rd} = 56.05 kN*m

V_{z,Ed} = 5.71 kN

M_{N,y,Rd} = 118.12 kN*m

M_{N,z,Rd} = 56.05 kN*m

V_{z,T,Rd} = 287.02 kN

T_{t,Ed} = 0.00 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 3.46 m

Lam_y = 0.48

L_{cr,y} = 3.46 m

X_y = 0.89

Lamy = 41.78

k_{yy} = 0.71



About z axis:

L_z = 3.46 m

Lam_z = 0.80

L_{cr,z} = 3.46 m

X_z = 0.66

Lamz = 69.47

k_{yz} = 0.49

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.06 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.01 < 1.00 \quad (6.2.9.1.(6))$$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 41.78 < \lambda_{b,max} = 210.00 \quad \lambda_{b,z} = 69.47 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.17 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.16 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.1 \text{ cm} < v_{x,max} = L/150.00 = 2.3 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 11 \text{ SLS } /7/ \quad 1 \cdot 1.00 + 5 \cdot 1.00$$

$$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 2.3 \text{ cm}$$

Verified

$$\text{Governing Load Case: } 11 \text{ SLS } /7/ \quad 1 \cdot 1.00 + 5 \cdot 1.00$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 5 Beam_main_5

POINT: 3

COORDINATE: x = 0.84 L = 5.59 m

LOADS:

$$\text{Governing Load Case: } 8 \text{ ULS } /9/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 5 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: UPN 300

$$h = 30.0 \text{ cm}$$

$$g_{M0} = 1.00$$

$$g_{M1} = 1.00$$

$$b = 10.0 \text{ cm}$$

$$A_y = 34.96 \text{ cm}^2$$

$$A_z = 30.72 \text{ cm}^2$$

$$A_x = 58.56 \text{ cm}^2$$

$$t_w = 1.0 \text{ cm}$$

$$I_y = 8025.80 \text{ cm}^4$$

$$I_z = 493.32 \text{ cm}^4$$

$$I_x = 51.37 \text{ cm}^4$$

$$t_f = 1.6 \text{ cm}$$

$$W_{ply} = 632.23 \text{ cm}^3$$

$$W_{plz} = 130.16 \text{ cm}^3$$

INTERNAL FORCES AND CAPACITIES:

$$N_{Ed} = 76.94 \text{ kN}$$

$$M_{y,Ed} = 0.76 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed} = 0.03 \text{ kN} \cdot \text{m}$$

$$V_{y,Ed} = -0.03 \text{ kN}$$

$$N_{c,Rd} = 1610.32 \text{ kN}$$

$$M_{y,Ed,max} = 50.12 \text{ kN} \cdot \text{m}$$

$$M_{z,Ed,max} = 17.92 \text{ kN} \cdot \text{m}$$

$$V_{y,T,Rd} = 554.92 \text{ kN}$$

$$N_{b,Rd} = 1610.32 \text{ kN}$$

$$M_{y,c,Rd} = 173.86 \text{ kN} \cdot \text{m}$$

$$M_{z,c,Rd} = 35.80 \text{ kN} \cdot \text{m}$$

$$V_{z,Ed} = 18.84 \text{ kN}$$

$$M_{N,y,Rd} = 173.47 \text{ kN} \cdot \text{m}$$

$$M_{N,z,Rd} = 35.71 \text{ kN} \cdot \text{m}$$

$$V_{z,T,Rd} = 487.65 \text{ kN}$$

$$M_{b,Rd} = 122.81 \text{ kN} \cdot \text{m}$$

$$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$$z = 1.00$$

$$M_{cr} = 269.10 \text{ kN} \cdot \text{m}$$

$$\text{Curve}_{LT} - d$$

$$X_{LT} = 0.69$$

$$L_{cr,upp} = 1.66 \text{ m}$$

$$\lambda_{m_LT} = 0.80$$

$$f_{i,LT} = 0.90$$

$$X_{LT,mod} = 0.71$$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.05 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^1 \cdot 1.00 + (M_{z,Ed}/M_{N,z,Rd})^1 \cdot 1.00 = 0.01 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.41 < 1.00 \quad (6.3.2.1.(1))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.96 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.96 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /5/ $1 \cdot 1.00 + 2 \cdot 0.70 + 5 \cdot 1.00$

$u_z = 0.4 \text{ cm} < u_{z,max} = L/200.00 = 3.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /3/ $1 \cdot 1.00 + 2 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 6 Beam_6

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /3/ $1 \cdot 1.35 + 2 \cdot 1.50 + 6 \cdot 0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 180

$h = 18.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 9.1 \text{ cm}$

$A_y = 16.21 \text{ cm}^2$

$A_z = 11.25 \text{ cm}^2$

$A_x = 23.95 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 1316.96 \text{ cm}^4$

$I_z = 100.85 \text{ cm}^4$

$I_x = 4.90 \text{ cm}^4$

$t_f = 0.8 \text{ cm}$

$W_{ply} = 166.42 \text{ cm}^3$

$W_{plz} = 34.60 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = -7.39 \text{ kN}$

$M_{y,Ed} = -8.00 \text{ kN} \cdot \text{m}$

$M_{z,Ed} = 0.19 \text{ kN} \cdot \text{m}$

$V_{y,Ed} = 0.13 \text{ kN}$

$N_{t,Rd} = 658.55 \text{ kN}$

$M_{y,pl,Rd} = 45.77 \text{ kN} \cdot \text{m}$

$M_{z,pl,Rd} = 9.52 \text{ kN} \cdot \text{m}$

$V_{y,T,Rd} = 257.33 \text{ kN}$

$M_{y,c,Rd} = 45.77 \text{ kN} \cdot \text{m}$

$M_{z,c,Rd} = 9.52 \text{ kN} \cdot \text{m}$

$V_{z,Ed} = 5.22 \text{ kN}$

$MN_{y,Rd} = 45.77 \text{ kN} \cdot \text{m}$

$MN_{z,Rd} = 9.52 \text{ kN} \cdot \text{m}$

$V_{z,T,Rd} = 178.63 \text{ kN}$

$Mb,Rd = 31.85 \text{ kN} \cdot \text{m}$

$T_{t,Ed} = -0.00 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 42.60 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.68$

$L_{cr,low} = 2.33 \text{ m}$

$\lambda_{m_LT} = 1.04$

$\phi_{i,LT} = 1.01$

$XLT_{mod} = 0.70$

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.01 < 1.00$ (6.2.3.(1))

$(M_{y,Ed}/MN_{y,Rd})^{2.00} + (M_{z,Ed}/MN_{z,Rd})^{1.00} = 0.05 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed}/M_{b,Rd} = 0.25 < 1.00$ (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.2 \text{ cm}$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$u_z = 0.1 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.2 \text{ cm}$

Verified

Governing Load Case: 11 SLS /2/ $1*1.00 + 2*1.00 + 5*0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 7 Simple bar_0.5_7

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /10/ $1*1.35 + 2*1.05 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 60x4

$h=6.0 \text{ cm}$
 $b=6.0 \text{ cm}$
 $tw=0.4 \text{ cm}$
 $tf=0.4 \text{ cm}$

$gM0=1.00$
 $A_y=4.44 \text{ cm}^2$
 $I_y=46.14 \text{ cm}^4$
 $W_{ply}=18.85 \text{ cm}^3$

$gM1=1.00$
 $A_z=4.44 \text{ cm}^2$
 $I_z=46.14 \text{ cm}^4$
 $W_{plz}=18.85 \text{ cm}^3$

$A_x=8.88 \text{ cm}^2$
 $I_x=72.41 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 60.46 \text{ kN}$

$N_{c,Rd} = 244.28 \text{ kN}$

$N_{b,Rd} = 148.80 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.28 \text{ m}$
 $L_{cr,y} = 2.14 \text{ m}$
 $\lambda_{my} = 93.84$

$\lambda_{m,y} = 1.08$
 $\chi_y = 0.61$



About z axis:

$L_z = 4.28 \text{ m}$
 $L_{cr,z} = 2.14 \text{ m}$
 $\lambda_{mz} = 93.84$

$\lambda_{m,z} = 1.08$
 $\chi_z = 0.61$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.25 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{m,y} = 93.84 < \lambda_{m,max} = 210.00$

$\lambda_{m,z} = 93.84 < \lambda_{m,max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 8 Beam_8

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /3/ $1*1.35 + 2*1.50 + 6*0.90$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 180

h=18.0 cm	gM0=1.00	gM1=1.00	
b=9.1 cm	Ay=16.21 cm ²	Az=11.25 cm ²	Ax=23.95 cm ²
tw=0.5 cm	Iy=1316.96 cm ⁴	Iz=100.85 cm ⁴	Ix=4.90 cm ⁴
tf=0.8 cm	Wply=166.42 cm ³	Wplz=34.60 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = -7.33 kN	My _{Ed} = -8.29 kN*m	Mz _{Ed} = -0.19 kN*m	Vy _{Ed} = -0.13 kN
Nt _{Rd} = 658.55 kN	My _{pl,Rd} = 45.77 kN*m	Mz _{pl,Rd} = 9.52 kN*m	Vy _{T,Rd} = 257.33 kN
	My _{c,Rd} = 45.77 kN*m	Mz _{c,Rd} = 9.52 kN*m	Vz _{Ed} = 6.03 kN
	MN _{y,Rd} = 45.77 kN*m	MN _{z,Rd} = 9.52 kN*m	Vz _{T,Rd} = 178.63 kN
	Mb _{Rd} = 31.85 kN*m		Tt _{Ed} = 0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 42.60 kN*m	Curve _{LT} - b	XLT = 0.68
Lcr,low = 2.33 m	Lam _{LT} = 1.04	fi _{LT} = 1.01	XLT _{mod} = 0.70

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{t,Rd} = 0.01 < 1.00 \quad (6.2.3.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.05 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$
$$V_{z,Ed}/V_{z,T,Rd} = 0.03 < 1.00 \quad (6.2.6-7)$$
$$\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$
$$\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3} \cdot gM0)) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.26 < 1.00 \quad (6.3.2.1.(1))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y \text{ max}} = L/200.00 = 1.2 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 11 SLS /6/ 1*1.00 + 2*0.70 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z \text{ max}} = L/200.00 = 1.2 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 11 SLS /2/ 1*1.00 + 2*1.00 + 5*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 9 Beam_9

POINT: 3

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /2/ 1*1.35 + 2*1.50 + 5*0.90

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 180

h=18.0 cm	gM0=1.00	gM1=1.00	
b=9.1 cm	Ay=16.21 cm ²	Az=11.25 cm ²	Ax=23.95 cm ²
tw=0.5 cm	Iy=1316.96 cm ⁴	Iz=100.85 cm ⁴	Ix=4.90 cm ⁴
tf=0.8 cm	Wply=166.42 cm ³	Wplz=34.60 cm ³	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 20.33 \text{ kN}$	$M_{y,Ed} = 3.02 \text{ kN*m}$	$M_{z,Ed} = 0.01 \text{ kN*m}$	$V_{y,Ed} = -0.03 \text{ kN}$
$N_{c,Rd} = 658.55 \text{ kN}$	$M_{y,Ed,max} = 3.02 \text{ kN*m}$	$M_{z,Ed,max} = -0.04 \text{ kN*m}$	$V_{y,T,Rd} = 256.81 \text{ kN}$
$N_{b,Rd} = 658.55 \text{ kN}$	$M_{y,c,Rd} = 45.77 \text{ kN*m}$	$M_{z,c,Rd} = 9.52 \text{ kN*m}$	$V_{z,Ed} = 0.15 \text{ kN}$
	$M_{N,y,Rd} = 45.77 \text{ kN*m}$	$M_{N,z,Rd} = 9.52 \text{ kN*m}$	$V_{z,T,Rd} = 178.39 \text{ kN}$
	$M_{b,Rd} = 27.64 \text{ kN*m}$		$T_{t,Ed} = -0.01 \text{ kN*m}$
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 32.89 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.59$
$L_{cr,upp} = 2.90 \text{ m}$	$\lambda_{m,LT} = 1.18$	$f_{i,LT} = 1.15$	$X_{LT,mod} = 0.60$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zz} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.03 < 1.00 \quad (6.2.4.(1))$$
$$(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.01 < 1.00 \quad (6.2.9.1.(6))$$
$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$
$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$
$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.01 < 1.00 \quad (6.2.6)$$
$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.14 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.14 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.5 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 11 \text{ SLS } /6/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$$
$$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 1.5 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 11 \text{ SLS } /3/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 6 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 10 Beam_10

POINT: 3

COORDINATE: $x = 0.50 \text{ L} = 1.45 \text{ m}$

LOADS:

$$\text{Governing Load Case: } 8 \text{ ULS } /3/ \quad 1 \cdot 1.35 + 2 \cdot 1.50 + 6 \cdot 0.90$$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 180

$h = 18.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 9.1 \text{ cm}$	$A_y = 16.21 \text{ cm}^2$	$A_z = 11.25 \text{ cm}^2$	$A_x = 23.95 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 1316.96 \text{ cm}^4$	$I_z = 100.85 \text{ cm}^4$	$I_x = 4.90 \text{ cm}^4$
$t_f = 0.8 \text{ cm}$	$W_{ply} = 166.42 \text{ cm}^3$	$W_{plz} = 34.60 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.84 \text{ kN}$	$M_{y,Ed} = 3.74 \text{ kN*m}$	$M_{z,Ed} = -0.10 \text{ kN*m}$	$V_{y,Ed} = 0.14 \text{ kN}$
$N_{c,Rd} = 658.55 \text{ kN}$	$M_{y,Ed,max} = 3.74 \text{ kN*m}$	$M_{z,Ed,max} = 0.10 \text{ kN*m}$	$V_{y,T,Rd} = 257.34 \text{ kN}$
$N_{b,Rd} = 658.55 \text{ kN}$	$M_{y,c,Rd} = 45.77 \text{ kN*m}$	$M_{z,c,Rd} = 9.52 \text{ kN*m}$	$V_{z,Ed} = 0.14 \text{ kN}$
	$M_{N,y,Rd} = 45.77 \text{ kN*m}$	$M_{N,z,Rd} = 9.52 \text{ kN*m}$	$V_{z,T,Rd} = 178.63 \text{ kN}$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$M_{b,Rd} = 27.64 \text{ kN}\cdot\text{m}$

$T_{t,Ed} = 0.00 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 2.90 \text{ m}$

$M_{cr} = 32.89 \text{ kN}\cdot\text{m}$
 $\lambda_{m,LT} = 1.18$

Curve,LT - b
 $\eta_{LT} = 1.15$

$X_{LT} = 0.59$
 $X_{LT,mod} = 0.60$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.02 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3}) \cdot g_{M0}) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3}) \cdot g_{M0}) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.14 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.15 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.15 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.5 \text{ cm}$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

$u_z = 0.1 \text{ cm} < u_{z,max} = L/200.00 = 1.5 \text{ cm}$

Verified

Governing Load Case: 11 SLS /3/ $1 \cdot 1.00 + 2 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 11

POINT: 3

COORDINATE: $x = 0.84 L = 5.59 \text{ m}$

LOADS:

Governing Load Case: 8 ULS /9/ $1 \cdot 1.35 + 2 \cdot 1.05 + 5 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: UPN 300

$h = 30.0 \text{ cm}$
 $b = 10.0 \text{ cm}$
 $t_w = 1.0 \text{ cm}$
 $t_f = 1.6 \text{ cm}$

$g_{M0} = 1.00$
 $A_y = 34.96 \text{ cm}^2$
 $I_y = 8025.80 \text{ cm}^4$
 $W_{ply} = 632.23 \text{ cm}^3$

$g_{M1} = 1.00$
 $A_z = 30.72 \text{ cm}^2$
 $I_z = 493.32 \text{ cm}^4$
 $W_{plz} = 130.16 \text{ cm}^3$

$A_x = 58.56 \text{ cm}^2$
 $I_x = 51.37 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 76.99 \text{ kN}$
 $N_{c,Rd} = 1610.32 \text{ kN}$
 $N_{b,Rd} = 1610.32 \text{ kN}$

$M_{y,Ed} = -0.87 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = -50.05 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 173.86 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 173.47 \text{ kN}\cdot\text{m}$
 $M_{b,Rd} = 122.81 \text{ kN}\cdot\text{m}$

$M_{z,Ed} = 0.03 \text{ kN}\cdot\text{m}$
 $M_{z,Ed,max} = 17.92 \text{ kN}\cdot\text{m}$
 $M_{z,c,Rd} = 35.80 \text{ kN}\cdot\text{m}$
 $M_{N,z,Rd} = 35.71 \text{ kN}\cdot\text{m}$

$V_{y,Ed} = -0.04 \text{ kN}$
 $V_{y,T,Rd} = 554.92 \text{ kN}$
 $V_{z,Ed} = -18.87 \text{ kN}$
 $V_{z,T,Rd} = 487.65 \text{ kN}$
 $T_{t,Ed} = 0.00 \text{ kN}\cdot\text{m}$
Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 269.10 \text{ kN}\cdot\text{m}$

Curve,LT - d

$X_{LT} = 0.69$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Lcr,low=1.66 m

Lam_LT = 0.80

fi,LT = 0.90

XLT,mod = 0.71

BUCKLING PARAMETERS:



About y axis:

kyy = 1.00



About z axis:

kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$(M_{y,Ed}/M_{N,y,Rd})^1 + (M_{z,Ed}/M_{N,z,Rd})^1 = 0.01 < 1.00$ (6.2.9.1.(6))

$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00$ (6.2.6-7)

$V_{z,Ed}/V_{z,T,Rd} = 0.04 < 1.00$ (6.2.6-7)

$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.41 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.96 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.96 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 3.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /5/ $1 \cdot 1.00 + 2 \cdot 0.70 + 5 \cdot 1.00$

$u_z = 0.4 \text{ cm} < u_{z,max} = L/200.00 = 3.3 \text{ cm}$

Verified

Governing Load Case: 11 SLS /3/ $1 \cdot 1.00 + 2 \cdot 1.00 + 6 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 12 Simple bar_0.5_12

POINT: 3

COORDINATE: x = 1.00 L = 4.17 m

LOADS:

Governing Load Case: 8 ULS /9/ $1 \cdot 1.35 + 2 \cdot 1.05 + 5 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: TCAR 60x4

h=6.0 cm

gM0=1.00

gM1=1.00

b=6.0 cm

Ay=4.44 cm²

Az=4.44 cm²

Ax=8.88 cm²

tw=0.4 cm

Iy=46.14 cm⁴

Iz=46.14 cm⁴

Ix=72.41 cm⁴

tf=0.4 cm

Wply=18.85 cm³

Wplz=18.85 cm³

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 41.79 \text{ kN}$

$N_{c,Rd} = 244.28 \text{ kN}$

$N_{b,Rd} = 153.27 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.17 \text{ m}$

$Lam_y = 1.05$

$L_{cr,y} = 2.09 \text{ m}$

$X_y = 0.63$

$Lam_y = 91.55$



About z axis:

$L_z = 4.17 \text{ m}$

$Lam_z = 1.05$

$L_{cr,z} = 2.09 \text{ m}$

$X_z = 0.63$

$Lam_z = 91.55$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.17 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 91.55 < \lambda_{b,max} = 210.00$$

$$\lambda_{b,z} = 91.55 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.27 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 13 Simple bar_0.5_13

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 60x4

h=6.0 cm

gM0=1.00

gM1=1.00

b=6.0 cm

Ay=4.44 cm²

Az=4.44 cm²

Ax=8.88 cm²

tw=0.4 cm

Iy=46.14 cm⁴

Iz=46.14 cm⁴

Ix=72.41 cm⁴

tf=0.4 cm

Wply=18.85 cm³

Wplz=18.85 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 19.45 kN

N_{c,Rd} = 244.28 kN

N_{b,Rd} = 153.27 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 4.17 m

Lam_y = 1.05

L_{cr,y} = 2.09 m

X_y = 0.63

Lam_y = 91.55



About z axis:

L_z = 4.17 m

Lam_z = 1.05

L_{cr,z} = 2.09 m

X_z = 0.63

Lam_z = 91.55

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.08 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 91.55 < \lambda_{b,max} = 210.00$$

$$\lambda_{b,z} = 91.55 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.13 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 14 Simple bar_0.5_14

POINT: 3

COORDINATE: x = 1.00 L = 4.17 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: TCAR 60x4

$h=6.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=6.0$ cm	$Ay=4.44$ cm ²	$Az=4.44$ cm ²	$Ax=8.88$ cm ²
$tw=0.4$ cm	$Iy=46.14$ cm ⁴	$Iz=46.14$ cm ⁴	$Ix=72.41$ cm ⁴
$tf=0.4$ cm	$Wply=18.85$ cm ³	$Wplz=18.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 19.37$ kN
 $Nc,Rd = 244.28$ kN
 $Nb,Rd = 153.27$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.17$ m
 $L_{cr,y} = 2.09$ m
 $L_{my} = 91.55$
 $Lam_y = 1.05$
 $X_y = 0.63$



About z axis:

$L_z = 4.17$ m
 $L_{cr,z} = 2.09$ m
 $L_{mz} = 91.55$
 $Lam_z = 1.05$
 $X_z = 0.63$

VERIFICATION FORMULAS:

Section strength check:

$N,Ed/Nc,Rd = 0.08 < 1.00$ (6.2.4.(1))

Global stability check of member:

$Lambda_y = 91.55 < Lambda_{max} = 210.00$ $Lambda_z = 91.55 < Lambda_{max} = 210.00$ STABLE

$N,Ed/Nb,Rd = 0.13 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: [EN 1993-1:2005/A1:2014](#), [Eurocode 3: Design of steel structures](#).

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 15 Simple bar_0.5_15

POINT: 1

COORDINATE: $x = 0.00$ $L = 0.00$ m

LOADS:

Governing Load Case: 8 ULS /9/ $1*1.35 + 2*1.05 + 5*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 60x4

$h=6.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=6.0$ cm	$Ay=4.44$ cm ²	$Az=4.44$ cm ²	$Ax=8.88$ cm ²
$tw=0.4$ cm	$Iy=46.14$ cm ⁴	$Iz=46.14$ cm ⁴	$Ix=72.41$ cm ⁴
$tf=0.4$ cm	$Wply=18.85$ cm ³	$Wplz=18.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N,Ed = 41.70$ kN
 $Nc,Rd = 244.28$ kN
 $Nb,Rd = 153.27$ kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.17$ m
 $L_{cr,y} = 2.09$ m
 $L_{my} = 91.55$
 $Lam_y = 1.05$
 $X_y = 0.63$



About z axis:

$L_z = 4.17$ m
 $L_{cr,z} = 2.09$ m
 $L_{mz} = 91.55$
 $Lam_z = 1.05$
 $X_z = 0.63$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.17 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 91.55 < \lambda_{b,max} = 210.00$$

$$\lambda_{b,z} = 91.55 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.27 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 16 Simple bar_0.5_16

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /15/ 1*1.00 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: TCAR 60x4

h=6.0 cm

gM0=1.00

gM1=1.00

b=6.0 cm

Ay=4.44 cm²

Az=4.44 cm²

Ax=8.88 cm²

tw=0.4 cm

Iy=46.14 cm⁴

Iz=46.14 cm⁴

Ix=72.41 cm⁴

tf=0.4 cm

Wply=18.85 cm³

Wplz=18.85 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 4.45 kN

N_{c,Rd} = 244.28 kN

N_{b,Rd} = 172.64 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

L_y = 3.72 m

Lam_y = 0.94

L_{cr,y} = 1.86 m

X_y = 0.71

Lam_y = 81.65



About z axis:

L_z = 3.72 m

Lam_z = 0.94

L_{cr,z} = 1.86 m

X_z = 0.71

Lam_z = 81.65

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

Global stability check of member:

$$\lambda_{b,y} = 81.65 < \lambda_{b,max} = 210.00$$

$$\lambda_{b,z} = 81.65 < \lambda_{b,max} = 210.00 \quad \text{STABLE}$$

$$N_{Ed}/N_{b,Rd} = 0.03 < 1.00 \quad (6.3.1.1.(1))$$

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 17 Simple bar_0.5_17

POINT: 1

COORDINATE: x = 0.00 L = 0.00 m

LOADS:

Governing Load Case: 8 ULS /15/ 1*1.00 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: TCAR 60x4

h=6.0 cm	gM0=1.00	gM1=1.00	
b=6.0 cm	Ay=4.44 cm ²	Az=4.44 cm ²	Ax=8.88 cm ²
tw=0.4 cm	Iy=46.14 cm ⁴	Iz=46.14 cm ⁴	Ix=72.41 cm ⁴
tf=0.4 cm	Wply=18.85 cm ³	Wplz=18.85 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 4.44 kN
Nc,Rd = 244.28 kN
Nb,Rd = 172.64 kN

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 3.72 m
Lcr,y = 1.86 m
Lamy = 81.65
Lam_y = 0.94
Xy = 0.71



About z axis:

Lz = 3.72 m
Lcr,z = 1.86 m
Lamz = 81.65
Lam_z = 0.94
Xz = 0.71

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.02 < 1.00 (6.2.4.(1))

Global stability check of member:

Lambda,y = 81.65 < Lambda,max = 210.00 Lambda,z = 81.65 < Lambda,max = 210.00 STABLE

N,Ed/Nb,Rd = 0.03 < 1.00 (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 18 Beam_18

POINT: 2

COORDINATE: x = 0.50 L = 1.17 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) fy = 275.00 MPa



SECTION PARAMETERS: IPE 180

h=18.0 cm	gM0=1.00	gM1=1.00	
b=9.1 cm	Ay=16.21 cm ²	Az=11.25 cm ²	Ax=23.95 cm ²
tw=0.5 cm	Iy=1316.96 cm ⁴	Iz=100.85 cm ⁴	Ix=4.90 cm ⁴
tf=0.8 cm	Wply=166.42 cm ³	Wplz=34.60 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 0.31 kN	My,Ed = 0.17 kN*m	Mz,Ed = -0.00 kN*m	Vy,Ed = -0.00 kN
Nc,Rd = 658.55 kN	My,Ed,max = 0.17 kN*m	Mz,Ed,max = -0.00 kN*m	Vy,T,Rd = 257.36 kN
Nb,Rd = 658.55 kN	My,c,Rd = 45.77 kN*m	Mz,c,Rd = 9.52 kN*m	Vz,Ed = 0.00 kN
	MN,y,Rd = 45.77 kN*m	MN,z,Rd = 9.52 kN*m	Vz,T,Rd = 178.64 kN
	Mb,Rd = 31.85 kN*m		Tt,Ed = -0.00 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00 Mcr = 42.60 kN*m Curve,LT - b XLT = 0.68
Lcr,upp=2.33 m Lam_LT = 1.04 fi,LT = 1.01 XLT,mod = 0.70

BUCKLING PARAMETERS:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$(M_{y,Ed}/M_{N,y,Rd})^2 + (M_{z,Ed}/M_{N,z,Rd})^2 = 0.00 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$V_{z,Ed}/V_{z,T,Rd} = 0.00 < 1.00 \quad (6.2.6-7)$$

$$\tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

$$\tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.00 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$M_{y,Ed}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed}/(M_{z,Rk}/g_{M1}) = 0.01 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed}/(M_{z,Rk}/g_{M1}) = 0.01 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.2 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /8/ 1*1.00 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.2 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /8/ 1*1.00 + 6*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 19 Beam_19

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /11/ 1*1.35 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 32.83 \text{ kN}$

$M_{y,Ed} = 0.18 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.18 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 13.53 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 15.38 \text{ kN} \cdot \text{m}$

Curve,LT - b

$XLT = 0.55$

$L_{cr,upp} = 2.90 \text{ m}$

$\lambda_{m,LT} = 1.26$

$\phi_{LT} = 1.24$

$XLT_{mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/N_{c,Rd} = 0.07 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.09 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /6/ 1*1.00 + 2*0.70 + 6*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /9/ 1*1.00 + 2*0.50



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 20 Beam_20

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /12/ 1*1.35 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 5.32 kN

M_{y,Ed} = 0.18 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.18 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 13.53 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 15.38 kN*m

Curve,LT - b

XLT = 0.55

L_{cr,upp} = 2.90 m

Lam_LT = 1.26

fi,LT = 1.24

XLT,mod = 0.56

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /2/ $1*1.00 + 2*1.00 + 5*0.60$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /8/ $1*1.00 + 6*1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 21 Beam_21

POINT: 2

COORDINATE: $x = 0.50 L = 1.45 \text{ m}$

LOADS:

Governing Load Case: 8 ULS /10/ $1*1.35 + 2*1.05 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$gM0 = 1.00$

$gM1 = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 3.70 \text{ kN}$

$M_{y,Ed} = 0.18 \text{ kN*m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.18 \text{ kN*m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN*m}$

$M_{N,y,Rd} = 24.30 \text{ kN*m}$

$M_{b,Rd} = 13.53 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 15.38 \text{ kN*m}$

Curve,LT - b

$X_{LT} = 0.55$

$L_{cr,upp} = 2.90 \text{ m}$

$\lambda_{m,LT} = 1.26$

$\eta_{LT} = 1.24$

$X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.01 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.02 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.02 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /2/ $1*1.00 + 2*1.00 + 5*0.60$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /9/ $1*1.00 + 2*0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 22 Beam_22

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm

b=7.3 cm

tw=0.5 cm

tf=0.7 cm

gM0=1.00

Ay=11.15 cm²

Iy=541.22 cm⁴

Wply=88.35 cm³

gM1=1.00

Az=7.64 cm²

Iz=44.92 cm⁴

Wplz=19.25 cm³

Ax=16.43 cm²

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 0.21 kN

N_{c,Rd} = 451.71 kN

N_{b,Rd} = 451.71 kN

M_{y,Ed} = 0.18 kN*m

M_{y,Ed,max} = 0.18 kN*m

M_{y,c,Rd} = 24.30 kN*m

M_{N,y,Rd} = 24.30 kN*m

M_{b,Rd} = 13.53 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

L_{cr,upp} = 2.90 m

M_{cr} = 15.38 kN*m

Lam_{LT} = 1.26

Curve,LT - b

φ_{LT} = 1.24

XLT = 0.55

XLT,mod = 0.56

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))

M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 (6.3.2.1.(1))

N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.01 < 1.00 (6.3.3.(4))

N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.01 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.4 cm

Verified

Governing Load Case: 11 SLS /2/ 1*1.00 + 2*1.00 + 5*0.60

u_z = 0.0 cm < u_{z,max} = L/200.00 = 1.4 cm

Verified

Governing Load Case: 11 SLS /3/ 1*1.00 + 2*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 23 Beam_23

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /11/ 1*1.35 + 5*1.50

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.31$ kN	$M_{y,Ed} = 0.18$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.18$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38$ kN*m	Curve,LT - b	$X_{LT} = 0.55$
$L_{cr,upp}=2.90$ m	$\lambda_{m_LT} = 1.26$	$\phi_{LT} = 1.24$	$X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /2/ $1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.60$

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /2/ $1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.60$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 24 Beam_24

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /12/ $1 \cdot 1.35 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

tw=0.5 cm
tf=0.7 cm

Iy=541.22 cm⁴
Wply=88.35 cm³

Iz=44.92 cm⁴
Wplz=19.25 cm³

Ix=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 0.04 kN
N_{c,Rd} = 451.71 kN
N_{b,Rd} = 451.71 kN
M_{y,Ed} = 0.18 kN*m
M_{y,Ed,max} = 0.18 kN*m
M_{y,c,Rd} = 24.30 kN*m
M_{N,y,Rd} = 24.30 kN*m
M_{b,Rd} = 13.53 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00
L_{cr,upp} = 2.90 m

M_{cr} = 15.38 kN*m
L_{am_LT} = 1.26

Curve,LT - b
f_{i,LT} = 1.24

XLT = 0.55
XLT,mod = 0.56

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

N_{Ed}/N_{c,Rd} = 0.00 < 1.00 (6.2.4.(1))
M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 (6.2.5.(1))

Global stability check of member:

M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 (6.3.2.1.(1))
N_{Ed}/(X_y*N_{Rk}/gM1) + k_{yy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.01 < 1.00 (6.3.3.(4))
N_{Ed}/(X_z*N_{Rk}/gM1) + k_{zy}*M_{y,Ed,max}/(XLT*M_{y,Rk}/gM1) = 0.01 < 1.00 (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

u_y = 0.0 cm < u_{y,max} = L/200.00 = 1.4 cm

Verified

Governing Load Case: 11 SLS /2/ 1*1.00 + 2*1.00 + 5*0.60

u_z = 0.0 cm < u_{z,max} = L/200.00 = 1.4 cm

Verified

Governing Load Case: 11 SLS /3/ 1*1.00 + 2*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 25 Beam_25

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) f_y = 275.00 MPa



SECTION PARAMETERS: IPE 140

h=14.0 cm
b=7.3 cm
tw=0.5 cm
tf=0.7 cm

gM0=1.00
A_y=11.15 cm²
I_y=541.22 cm⁴
Wply=88.35 cm³

gM1=1.00
A_z=7.64 cm²
I_z=44.92 cm⁴
Wplz=19.25 cm³

A_x=16.43 cm²
I_x=2.54 cm⁴

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 0.78 kN
N_{c,Rd} = 451.71 kN
N_{b,Rd} = 451.71 kN
M_{y,Ed} = 0.18 kN*m
M_{y,Ed,max} = 0.18 kN*m
M_{y,c,Rd} = 24.30 kN*m
M_{N,y,Rd} = 24.30 kN*m
M_{b,Rd} = 13.53 kN*m

Class of section = 1

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 2.90 \text{ m}$

$M_{cr} = 15.38 \text{ kN}\cdot\text{m}$
 $\Lambda_{m,LT} = 1.26$

Curve,LT - b
 $\eta_{i,LT} = 1.24$

$X_{LT} = 0.55$
 $X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /2/ $1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /5/ $1 \cdot 1.00 + 2 \cdot 0.70 + 5 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 26 Beam_26

POINT: 2

COORDINATE: $x = 0.50 L = 1.45 \text{ m}$

LOADS:

Governing Load Case: 8 ULS /10/ $1 \cdot 1.35 + 2 \cdot 1.05 + 6 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$
 $b = 7.3 \text{ cm}$
 $t_w = 0.5 \text{ cm}$
 $t_f = 0.7 \text{ cm}$

$gM0 = 1.00$
 $A_y = 11.15 \text{ cm}^2$
 $I_y = 541.22 \text{ cm}^4$
 $W_{ply} = 88.35 \text{ cm}^3$

$gM1 = 1.00$
 $A_z = 7.64 \text{ cm}^2$
 $I_z = 44.92 \text{ cm}^4$
 $W_{plz} = 19.25 \text{ cm}^3$

$A_x = 16.43 \text{ cm}^2$
 $I_x = 2.54 \text{ cm}^4$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.36 \text{ kN}$

$M_{y,Ed} = 0.18 \text{ kN}\cdot\text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.18 \text{ kN}\cdot\text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$MN_{y,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 13.53 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$
 $L_{cr,upp} = 2.90 \text{ m}$

$M_{cr} = 15.38 \text{ kN}\cdot\text{m}$
 $\Lambda_{m,LT} = 1.26$

Curve,LT - b
 $\eta_{i,LT} = 1.24$

$X_{LT} = 0.55$
 $X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:



About z axis:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$k_{yy} = 1.00$

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.01 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.01 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /9/ $1 \cdot 1.00 + 2 \cdot 0.50$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 27 Beam_27

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.45 \text{ m}$

LOADS:

Governing Load Case: 8 ULS /11/ $1 \cdot 1.35 + 5 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.48 \text{ kN}$

$M_{y,Ed} = 0.18 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.18 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 13.53 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 15.38 \text{ kN} \cdot \text{m}$

Curve,LT - b

$X_{LT} = 0.55$

$L_{cr,upp} = 2.90 \text{ m}$

$\lambda_{m,LT} = 1.26$

$\phi_{LT} = 1.24$

$X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.02 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.03 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.03 < 1.00 \quad (6.3.3.(4))$$

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /5/ $1 \cdot 1.00 + 2 \cdot 0.70 + 5 \cdot 1.00$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /5/ $1 \cdot 1.00 + 2 \cdot 0.70 + 5 \cdot 1.00$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 28 Beam_28

POINT: 2

COORDINATE: $x = 0.50 L = 1.45 \text{ m}$

LOADS:

Governing Load Case: 8 ULS /11/ $1 \cdot 1.35 + 5 \cdot 1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$

$g_{M0} = 1.00$

$g_{M1} = 1.00$

$b = 7.3 \text{ cm}$

$A_y = 11.15 \text{ cm}^2$

$A_z = 7.64 \text{ cm}^2$

$A_x = 16.43 \text{ cm}^2$

$t_w = 0.5 \text{ cm}$

$I_y = 541.22 \text{ cm}^4$

$I_z = 44.92 \text{ cm}^4$

$I_x = 2.54 \text{ cm}^4$

$t_f = 0.7 \text{ cm}$

$W_{ply} = 88.35 \text{ cm}^3$

$W_{plz} = 19.25 \text{ cm}^3$

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 22.74 \text{ kN}$

$M_{y,Ed} = 0.18 \text{ kN} \cdot \text{m}$

$N_{c,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.18 \text{ kN} \cdot \text{m}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,c,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{N,y,Rd} = 24.30 \text{ kN} \cdot \text{m}$

$M_{b,Rd} = 13.53 \text{ kN} \cdot \text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$M_{cr} = 15.38 \text{ kN} \cdot \text{m}$

Curve,LT - b

$X_{LT} = 0.55$

$L_{cr,upp} = 2.90 \text{ m}$

$\lambda_{m,LT} = 1.26$

$\phi_{i,LT} = 1.24$

$X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.05 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) = 0.06 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /2/ $1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.60$

$u_z = 0.0 \text{ cm} < u_{z \max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /6/ $1 \cdot 1.00 + 2 \cdot 0.70 + 6 \cdot 1.00$

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 29 Beam_29

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /11/ 1*1.35 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 8.48$ kN	$M_{y,Ed} = 0.18$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.18$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38$ kN*m	Curve,LT - b	$XLT = 0.55$
$L_{cr,upp}=2.90$ m	$\lambda_{m_LT} = 1.26$	$\phi_{LT} = 1.24$	$XLT_{mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.02 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.03 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /5/ 1*1.00 + 2*0.70 + 5*1.00

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /3/ 1*1.00 + 2*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 30 Beam_30

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



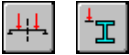
SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.35$ kN	$M_{y,Ed} = 0.18$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.18$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38$ kN*m	Curve,LT - b	$XLT = 0.55$
$L_{cr,upp}=2.90$ m	$\lambda_{m_LT} = 1.26$	$\phi_{i,LT} = 1.24$	$XLT_{mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{c,Rd}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{c,Rd}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rd}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /3/ 1*1.00 + 2*1.00 + 6*0.60

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /1/ 1*1.00 + 2*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 31 Beam_31

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /12/ 1*1.35 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed}=0.76$ kN	$M_{y,Ed}=0.18$ kN*m
$N_{c,Rd}=451.71$ kN	$M_{y,Ed,max}=0.18$ kN*m
$N_{b,Rd}=451.71$ kN	$M_{y,c,Rd}=24.30$ kN*m
	$MN_{y,Rd}=24.30$ kN*m
	$Mb,Rd=13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z=1.00$	$M_{cr}=15.38$ kN*m	Curve,LT - b	$XLT=0.55$
$L_{cr,upp}=2.90$ m	$\lambda_{m,LT}=1.26$	$\phi_{i,LT}=1.24$	$XLT_{mod}=0.56$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy}=1.00$$



About z axis:

$$k_{zy}=1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd}=0.00 < 1.00 \quad (6.2.4.(1))$$
$$M_{y,Ed}/M_{y,c,Rd}=0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd}=0.01 < 1.00 \quad (6.3.2.1.(1))$$
$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00 \quad (6.3.3.(4))$$
$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y=0.0 \text{ cm} < u_{y,max}=L/200.00=1.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 11 \text{ SLS } /2/ \quad 1 \cdot 1.00 + 2 \cdot 1.00 + 5 \cdot 0.60$$

$$u_z=0.0 \text{ cm} < u_{z,max}=L/200.00=1.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 11 \text{ SLS } /9/ \quad 1 \cdot 1.00 + 2 \cdot 0.50$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 32 Simple bar_0.5_32

POINT: 1

COORDINATE: $x=0.00$ L = 0.00 m

LOADS:

$$\text{Governing Load Case: } 8 \text{ ULS } /10/ \quad 1 \cdot 1.35 + 2 \cdot 1.05 + 6 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y=275.00$ MPa



SECTION PARAMETERS: TCAR 60x4

$h=6.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=6.0$ cm	$Ay=4.44$ cm ²	$Az=4.44$ cm ²	$Ax=8.88$ cm ²
$tw=0.4$ cm	$Iy=46.14$ cm ⁴	$Iz=46.14$ cm ⁴	$Ix=72.41$ cm ⁴
$tf=0.4$ cm	$Wply=18.85$ cm ³	$Wplz=18.85$ cm ³	

INTERNAL FORCES AND CAPACITIES:

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{Ed} = 60.45 \text{ kN}$
 $N_{c,Rd} = 244.28 \text{ kN}$
 $N_{b,Rd} = 148.80 \text{ kN}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 4.28 \text{ m}$
 $L_{cr,y} = 2.14 \text{ m}$
 $\lambda_{my} = 93.84$
 $\lambda_{my} = 1.08$
 $\chi_y = 0.61$



About z axis:

$L_z = 4.28 \text{ m}$
 $L_{cr,z} = 2.14 \text{ m}$
 $\lambda_{mz} = 93.84$
 $\lambda_{mz} = 1.08$
 $\chi_z = 0.61$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.25 < 1.00$ (6.2.4.(1))

Global stability check of member:

$\lambda_{my} = 93.84 < \lambda_{max} = 210.00$ $\lambda_{mz} = 93.84 < \lambda_{max} = 210.00$ STABLE

$N_{Ed}/N_{b,Rd} = 0.41 < 1.00$ (6.3.1.1.(1))

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 33 Beam_33

POINT: 2

COORDINATE: $x = 0.50 \text{ L} = 1.45 \text{ m}$

LOADS:

Governing Load Case: 8 ULS /10/ $1*1.35 + 2*1.05 + 6*1.50$

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

$h = 14.0 \text{ cm}$	$g_{M0} = 1.00$	$g_{M1} = 1.00$	
$b = 7.3 \text{ cm}$	$A_y = 11.15 \text{ cm}^2$	$A_z = 7.64 \text{ cm}^2$	$A_x = 16.43 \text{ cm}^2$
$t_w = 0.5 \text{ cm}$	$I_y = 541.22 \text{ cm}^4$	$I_z = 44.92 \text{ cm}^4$	$I_x = 2.54 \text{ cm}^4$
$t_f = 0.7 \text{ cm}$	$W_{ply} = 88.35 \text{ cm}^3$	$W_{plz} = 19.25 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.07 \text{ kN}$	$M_{y,Ed} = 0.18 \text{ kN*m}$
$N_{c,Rd} = 451.71 \text{ kN}$	$M_{y,Ed,max} = 0.18 \text{ kN*m}$
$N_{b,Rd} = 451.71 \text{ kN}$	$M_{y,c,Rd} = 24.30 \text{ kN*m}$
	$MN_{y,Rd} = 24.30 \text{ kN*m}$
	$Mb_{Rd} = 13.53 \text{ kN*m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38 \text{ kN*m}$	Curve,LT - b	$X_{LT} = 0.55$
$L_{cr,upp} = 2.90 \text{ m}$	$\lambda_{m,LT} = 1.26$	$f_{i,LT} = 1.24$	$X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /5/ 1*1.00 + 2*0.70 + 5*1.00

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /5/ 1*1.00 + 2*0.70 + 5*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 34 Beam_34

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /9/ 1*1.35 + 2*1.05 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00 \text{ MPa}$



SECTION PARAMETERS: IPE 140

h=14.0 cm

gM0=1.00

gM1=1.00

b=7.3 cm

Ay=11.15 cm²

Az=7.64 cm²

Ax=16.43 cm²

tw=0.5 cm

Iy=541.22 cm⁴

Iz=44.92 cm⁴

Ix=2.54 cm⁴

tf=0.7 cm

Wply=88.35 cm³

Wplz=19.25 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 0.04 kN

M_{y,Ed} = 0.18 kN*m

N_{c,Rd} = 451.71 kN

M_{y,Ed,max} = 0.18 kN*m

N_{b,Rd} = 451.71 kN

M_{y,c,Rd} = 24.30 kN*m

MN_{y,Rd} = 24.30 kN*m

M_{b,Rd} = 13.53 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 15.38 kN*m

Curve,LT - b

XLT = 0.55

L_{cr,upp} = 2.90 m

Lam_LT = 1.26

fi,LT = 1.24

XLT,mod = 0.56

BUCKLING PARAMETERS:



About y axis:

k_{yy} = 1.00



About z axis:

k_{zy} = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.00 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /3/ 1*1.00 + 2*1.00 + 6*0.60

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm}$$

Verified

Governing Load Case: 11 SLS /8/ 1*1.00 + 6*1.00

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 35 Beam_35

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /10/ 1*1.35 + 2*1.05 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.53$ kN	$M_{y,Ed} = 0.18$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.18$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38$ kN*m	Curve,LT - b	$XLT = 0.55$
$L_{cr,upp}=2.90$ m	$\lambda_{m_LT} = 1.26$	$\phi_{LT} = 1.24$	$XLT_{mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.01 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /2/ 1*1.00 + 2*1.00 + 5*0.60

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /1/ 1*1.00 + 2*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

CODE GROUP:

MEMBER: 36 Beam_36

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /12/ 1*1.35 + 6*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$A_y=11.15$ cm ²	$A_z=7.64$ cm ²	$A_x=16.43$ cm ²
$t_w=0.5$ cm	$I_y=541.22$ cm ⁴	$I_z=44.92$ cm ⁴	$I_x=2.54$ cm ⁴
$t_f=0.7$ cm	$W_{ply}=88.35$ cm ³	$W_{plz}=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 0.94$ kN	$M_{y,Ed} = 0.18$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.18$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$M_{N,y,Rd} = 24.30$ kN*m
	$M_{b,Rd} = 13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38$ kN*m	Curve,LT - b	$XLT = 0.55$
$L_{cr,upp}=2.90$ m	$\lambda_{m_LT} = 1.26$	$\phi_{i,LT} = 1.24$	$XLT_{mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.02 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.02 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0$ cm < $u_{y,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /2/ 1*1.00 + 2*1.00 + 5*0.60

$u_z = 0.0$ cm < $u_{z,max} = L/200.00 = 1.4$ cm

Verified

Governing Load Case: 11 SLS /1/ 1*1.00 + 2*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 37 Beam_37

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

Governing Load Case: 8 ULS /11/ 1*1.35 + 5*1.50

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 4.04$ kN	$M_{y,Ed} = 0.18$ kN*m
$N_{c,Rd} = 451.71$ kN	$M_{y,Ed,max} = 0.18$ kN*m
$N_{b,Rd} = 451.71$ kN	$M_{y,c,Rd} = 24.30$ kN*m
	$MN_{y,Rd} = 24.30$ kN*m
	$Mb,Rd = 13.53$ kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 15.38$ kN*m	Curve,LT - b	$XLT = 0.55$
$L_{cr,upp}=2.90$ m	$Lam_{LT} = 1.26$	$\phi_{LT} = 1.24$	$XLT_{mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$$k_{yy} = 1.00$$



About z axis:

$$k_{zy} = 1.00$$

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} = 0.01 < 1.00 \quad (6.2.4.(1))$$

$$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00 \quad (6.2.5.(1))$$

Global stability check of member:

$$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.02 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) = 0.02 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 11 \text{ SLS } /5/ \quad 1 \cdot 1.00 + 2 \cdot 0.70 + 5 \cdot 1.00$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 11 \text{ SLS } /1/ \quad 1 \cdot 1.00 + 2 \cdot 1.00$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

STEEL DESIGN

CODE: EN 1993-1:2005/A1:2014, Eurocode 3: Design of steel structures.

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 38 Beam_38

POINT: 2

COORDINATE: x = 0.50 L = 1.45 m

LOADS:

$$\text{Governing Load Case: } 8 \text{ ULS } /11/ \quad 1 \cdot 1.35 + 5 \cdot 1.50$$

MATERIAL:

S275 (S275) $f_y = 275.00$ MPa



SECTION PARAMETERS: IPE 140

$h=14.0$ cm	$gM0=1.00$	$gM1=1.00$	
$b=7.3$ cm	$Ay=11.15$ cm ²	$Az=7.64$ cm ²	$Ax=16.43$ cm ²
$tw=0.5$ cm	$Iy=541.22$ cm ⁴	$Iz=44.92$ cm ⁴	$Ix=2.54$ cm ⁴
$tf=0.7$ cm	$Wply=88.35$ cm ³	$Wplz=19.25$ cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 92.22$ kN	$M_{y,Ed} = 0.18$ kN*m
---------------------	------------------------

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$N_{c,Rd} = 451.71 \text{ kN}$

$N_{b,Rd} = 451.71 \text{ kN}$

$M_{y,Ed,max} = 0.18 \text{ kN}\cdot\text{m}$

$M_{y,c,Rd} = 24.30 \text{ kN}\cdot\text{m}$

$M_{N,y,Rd} = 23.97 \text{ kN}\cdot\text{m}$

$M_{b,Rd} = 13.53 \text{ kN}\cdot\text{m}$

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$

$L_{cr,upp} = 2.90 \text{ m}$

$M_{cr} = 15.38 \text{ kN}\cdot\text{m}$

$\lambda_{m,LT} = 1.26$

Curve,LT - b

$\eta_{LT} = 1.24$

$X_{LT} = 0.55$

$X_{LT,mod} = 0.56$

BUCKLING PARAMETERS:



About y axis:

$k_{yy} = 1.00$



About z axis:

$k_{zy} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.20 < 1.00$ (6.2.4.(1))

$M_{y,Ed}/M_{y,c,Rd} = 0.01 < 1.00$ (6.2.5.(1))

$M_{y,Ed}/M_{N,y,Rd} = 0.01 < 1.00$ (6.2.9.1.(2))

Global stability check of member:

$M_{y,Ed,max}/M_{b,Rd} = 0.01 < 1.00$ (6.3.2.1.(1))

$N_{Ed}/(X_y \cdot N_{Rk}/\gamma_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.22 < 1.00$ (6.3.3.(4))

$N_{Ed}/(X_z \cdot N_{Rk}/\gamma_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/\gamma_{M1}) = 0.22 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /5/ 1*1.00 + 2*0.70 + 5*1.00

$u_z = 0.0 \text{ cm} < u_{z,max} = L/200.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 11 SLS /3/ 1*1.00 + 2*1.00 + 6*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

6.1.8 ΘΕΜΕΛΙΩΣΗ

Η θεμελίωση του κλιμακοστασίου θα ακολουθήσει τη θεμελίωση του μεταλλικού φορέα με πεδίοδοκούς 50/80/120/80 και ίδια όπλιση.

Bar/Position (m)	Top required reinforcement (My) (cm ²)	Top reinforcement - distribution (My)	Bottom required reinforcement (My) (cm ²)	Bottom reinforcement - distribution (My)	Transversal reinforcement - type/distribution
41					2f6 5*14.0+5*14.0+5*14.0
41/ 0.40	8.87	5f16	5.21	3f16	

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

41/ 0.78	12.49	7f16	5.21	3f16	
41/ 1.17	8.9	5f16	5.21	3f16	
41/ 1.55	12.49	7f16	5.21	3f16	
41/ 1.93	8.92	5f16	5.21	3f16	
42					2f6 13*14.0+13*14.0+13*14.0
42/ 0.40	8.92	5f16	5.21	3f16	
42/ 1.62	8.9	5f16	5.21	3f16	
42/ 2.83	8.88	5f16	5.21	3f16	
42/ 4.05	8.88	5f16	5.21	3f16	
42/ 5.26	8.89	5f16	5.21	3f16	
43					2f6 6*14.0+7*14.0+6*14.0
43/ 0.40	8.85	5f16	5.21	3f16	
43/ 0.93	8.85	5f16	5.21	3f16	
43/ 1.45	8.85	5f16	5.21	3f16	
43/ 1.98	8.85	5f16	5.21	3f16	
43/ 2.50	8.85	5f16	5.21	3f16	
44					2f6 6*14.0+7*14.0+6*14.0
44/ 0.40	8.86	5f16	5.21	3f16	
44/ 0.93	8.85	5f16	5.21	3f16	
44/ 1.45	8.85	5f16	5.21	3f16	
44/ 1.98	8.86	5f16	5.21	3f16	
44/ 2.50	8.86	5f16	5.21	3f16	
45					2f6 5*14.0+5*14.0+5*14.0
45/ 0.40	8.87	5f16	5.21	3f16	
45/ 0.78	12.49	7f16	5.21	3f16	
45/ 1.17	8.9	5f16	5.21	3f16	
45/ 1.55	12.49	7f16	5.21	3f16	
45/ 1.93	8.92	5f16	5.21	3f16	
46					2f6 13*14.0+13*14.0+13*14.0
46/ 0.40	8.92	5f16	5.21	3f16	
46/ 1.62	8.9	5f16	5.21	3f16	
46/ 2.83	8.88	5f16	5.21	3f16	
46/ 4.05	8.88	5f16	5.21	3f16	
46/ 5.26	8.89	5f16	5.21	3f16	
47					2f6 6*14.0+7*14.0+6*14.0
47/ 0.40	12.49	7f16	5.21	3f16	
47/ 0.93	12.49	7f16	5.21	3f16	
47/ 1.45	12.49	7f16	5.21	3f16	
47/ 1.98	12.49	7f16	5.21	3f16	
47/ 2.50	12.49	7f16	5.21	3f16	

Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Κύριος έργου: Δήμος Καλαμάτας

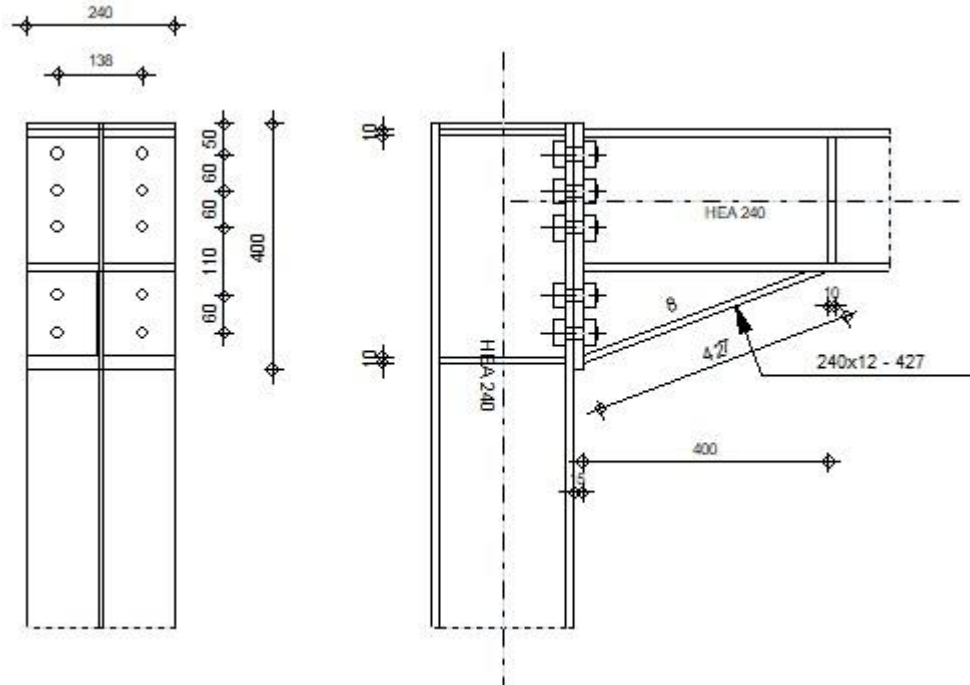
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

7 ΠΑΡΑΡΤΗΜΑ ΣΥΝΔΕΣΕΩΝ

Κύριος έργο: Δήμος Καλαμάτας
Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας
Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

	Autodesk	Robot	Structural	Analysis	Professional	2017	
	Design of fixed beam-to-column connection EN 1993-1-8:2005/AC:2009						



GENERAL

Connection no.: 1
 Connection name: Frame knee

GEOMETRY

COLUMN

Section: HEA 240

$\alpha =$	-90.0	[Deg]	Inclination angle
$h_c =$	230	[mm]	Height of column section
$b_{fc} =$	240	[mm]	Width of column section
$t_{wc} =$	8	[mm]	Thickness of the web of column section
$t_{fc} =$	12	[mm]	Thickness of the flange of column section
$r_c =$	21	[mm]	Radius of column section fillet
$A_c =$	76.84	[cm ²]	Cross-sectional area of a column
$I_{xc} =$	7763.18	[cm ⁴]	Moment of inertia of the column section
Material: S275			
$f_{yc} =$	320.00	[MPa]	Resistance

BEAM

Section: HEA 240

$\alpha =$	0.0	[Deg]	Inclination angle
$h_b =$	230	[mm]	Height of beam section
$b_f =$	240	[mm]	Width of beam section
$t_{wb} =$	8	[mm]	Thickness of the web of beam section
$t_{fb} =$	12	[mm]	Thickness of the flange of beam section
$r_b =$	21	[mm]	Radius of beam section fillet
$r_b =$	21	[mm]	Radius of beam section fillet
$A_b =$	76.84	[cm ²]	Cross-sectional area of a beam
$I_{xb} =$	7763.18	[cm ⁴]	Moment of inertia of the beam section
Material: S275			

Κύριος έργο: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

$f_{yb} = 320.00$ [MPa] Resistance

BOLTS

The shear plane passes through the UNTHREADED portion of the bolt.

$d = 20$ [mm] Bolt diameter

Class = 8.8 Bolt class

$F_{tRd} = 141.12$ [kN] Tensile resistance of a bolt

$n_h = 2$ Number of bolt columns

$n_v = 5$ Number of bolt rows

$h_1 = 50$ [mm] Distance between first bolt and upper edge of front plate

Horizontal spacing $e_i = 138$ [mm]

Vertical spacing $p_i = 60;60;110;60$ [mm]

PLATE

$h_p = 400$ [mm] Plate height

$b_p = 240$ [mm] Plate width

$t_p = 15$ [mm] Plate thickness

Material: S235

$f_{yp} = 235.00$ [MPa] Resistance

LOWER STIFFENER

$w_d = 240$ [mm] Plate width

$t_{fd} = 12$ [mm] Flange thickness

$h_d = 150$ [mm] Plate height

$t_{wd} = 8$ [mm] Web thickness

$l_d = 400$ [mm] Plate length

$\alpha = 20.6$ [Deg] Inclination angle

Material: S275

$f_{ybu} = 320.00$ [MPa] Resistance

COLUMN STIFFENER

Upper

$h_{su} = 206$ [mm] Stiffener height

$b_{su} = 116$ [mm] Stiffener width

$t_{hu} = 10$ [mm] Stiffener thickness

Material: S275

$f_{ysu} = 320.00$ [MPa] Resistance

Lower

$h_{sd} = 206$ [mm] Stiffener height

$b_{sd} = 116$ [mm] Stiffener width

$t_{hd} = 10$ [mm] Stiffener thickness

Material: S275

$f_{ysu} = 320.00$ [MPa] Resistance

FILLET WELDS

$a_w = 5$ [mm] Web weld

$a_f = 5$ [mm] Flange weld

$a_s = 5$ [mm] Stiffener weld

$a_{fd} = 5$ [mm] Horizontal weld

MATERIAL FACTORS

$\gamma_{M0} = 1.00$ Partial safety factor [2.2]

$\gamma_{M1} = 1.00$ Partial safety factor [2.2]

$\gamma_{M2} = 1.25$ Partial safety factor [2.2]

$\gamma_{M3} = 1.25$ Partial safety factor [2.2]

LOADS

Ultimate limit state

Case: Manual calculations.

$M_{b1,Ed} = 46.63$ [kN*m] Bending moment in the right beam

$V_{b1,Ed} = 100.52$ [kN] Shear force in the right beam

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$M_{b1,Ed}$	= 46.63	[kN*m]	Bending moment in the right beam
$N_{b1,Ed}$	= -38.31	[kN]	Axial force in the right beam
$M_{c2,Ed}$	= -46.63	[kN*m]	Bending moment in the upper column
$V_{c2,Ed}$	= 10.20	[kN]	Shear force in the upper column
$N_{c2,Ed}$	= -114.58	[kN]	Axial force in the upper column

RESULTS

BEAM RESISTANCES

COMPRESSION

A_b = 76.84 [cm²] Area EN1993-1-1:[6.2.4]

$N_{cb,Rd} = A_b f_{yb} / \gamma_{M0}$

$N_{cb,Rd}$ = 2458.74 [kN] Design compressive resistance of the section EN1993-1-1:[6.2.4]

SHEAR

A_{vb} = 37.18 [cm²] Shear area EN1993-1-1:[6.2.6.(3)]

$V_{cb,Rd} = A_{vb} (f_{yb} / \gamma_{M0})$

$V_{cb,Rd}$ = 686.83 [kN] Design sectional resistance for shear EN1993-1-1:[6.2.6.(2)]

$V_{b1,Ed} / V_{cb,Rd} \leq 1,0$ 0.15 < 1.00 **verified** (0.15)

BENDING - PLASTIC MOMENT (WITHOUT BRACKETS)

W_{plb} = 744.68 [cm³] Plastic section modulus EN1993-1-1:[6.2.5.(2)]

$M_{b,pl,Rd} = W_{plb} f_{yb} / \gamma_{M0}$

$M_{b,pl,Rd}$ = 238.30 [kN*m] Plastic resistance of the section for bending (without stiffeners) EN1993-1-1:[6.2.5.(2)]

BENDING ON THE CONTACT SURFACE WITH PLATE OR CONNECTED ELEMENT

W_{el} = 1181.64 [cm³] Elastic section modulus EN1993-1-1:[6.2.5]

$M_{cb,Rd} = W_{el} f_{yb} / \gamma_{M0}$

$M_{cb,Rd}$ = 378.12 [kN*m] Design resistance of the section for bending EN1993-1-1:[6.2.5]

BENDING WITH AXIAL FORCE ON THE CONTACT SURFACE WITH PLATE OR CONNECTED ELEMENT

n = 0.02 Ratio of the axial force to the sectional resistance EN1993-1-1:[6.2.9.1.(5)]

$M_{Nb,Rd} = M_{cb,Rd} (1 - n)$

$M_{Nb,Rd}$ = 372.23 [kN*m] Reduced resistance (axial force) of the section for bending EN1993-1-1:[6.2.9.2.(1)]

FLANGE AND WEB - COMPRESSION

$M_{cb,Rd}$ = 378.12 [kN*m] Design resistance of the section for bending EN1993-1-1:[6.2.5]

h_f = 368 [mm] Distance between the centroids of flanges [6.2.6.7.(1)]

$F_{c,fb,Rd} = M_{cb,Rd} / h_f$

$F_{c,fb,Rd}$ = 1028.65 [kN] Resistance of the compressed flange and web [6.2.6.7.(1)]

WEB OR BRACKET FLANGE - COMPRESSION - LEVEL OF THE BEAM BOTTOM FLANGE

Bearing:

α = 0.0 [Deg] Angle between the front plate and the beam

α = 20.6 [Deg] Inclination angle of the bracket plate

$b_{eff,c,wb}$ = 213 [mm] Effective width of the web for compression [6.2.6.2.(1)]

A_{vb} = 25.18 [cm²] Shear area EN1993-1-1:[6.2.6.(3)]

α = 0.81 Reduction factor for interaction with shear [6.2.6.2.(1)]

$\sigma_{com,Ed}$ = 54.24 [MPa] Maximum compressive stress in web [6.2.6.2.(2)]

k_{wc} = 1.00 Reduction factor conditioned by compressive stresses [6.2.6.2.(2)]

A_s = 23.25 [cm²] Area of the web stiffener EN1993-1-1:[6.2.4]

$F_{c,wb,Rd1} = [\alpha k_{wc} b_{eff,c,wb} t_{wb} f_{yb} / \gamma_{M0} + A_s f_{yb} / \gamma_{M0}] \cos(\alpha) / \sin(\alpha - \alpha)$

$F_{c,wb,Rd1}$ = 2562.53 [kN] Beam web resistance [6.2.6.2.(1)]

Buckling:

d_{wb} = 164 [mm] Height of compressed web [6.2.6.2.(1)]

α_p = 0.91 Plate slenderness of an element [6.2.6.2.(1)]

α = 0.86 Reduction factor for element buckling [6.2.6.2.(1)]

α_s = 2.33 Stiffener slenderness EN1993-1-1:[6.3.1.2]

α = 1.00 Buckling coefficient of the stiffener EN1993-1-1:[6.3.1.2]

$F_{c,wb,Rd2} = [\alpha k_{wc} b_{eff,c,wb} t_{wb} f_{yb} / \gamma_{M1} + A_s f_{yb} / \gamma_{M1}] \cos(\alpha) / \sin(\alpha - \alpha)$

$F_{c,wb,Rd2}$ = 2406.88 [kN] Beam web resistance [6.2.6.2.(1)]

Final resistance:

$F_{c,wb,Rd,low} = \min (F_{c,wb,Rd1} , F_{c,wb,Rd2})$

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$F_{c,wb,Rd,low} = 2406.88$ [kN] Beam web resistance [6.2.6.2.(1)]

COLUMN RESISTANCES

WEB PANEL - SHEAR

$M_{b1,Ed} = 46.63$ [kN*m] Bending moment (right beam) [5.3.(3)]
 $M_{b2,Ed} = 0.00$ [kN*m] Bending moment (left beam) [5.3.(3)]
 $V_{c1,Ed} = 0.00$ [kN] Shear force (lower column) [5.3.(3)]
 $V_{c2,Ed} = 10.20$ [kN] Shear force (upper column) [5.3.(3)]
 $z = 304$ [mm] Lever arm [6.2.5]
 $V_{wp,Ed} = (M_{b1,Ed} - M_{b2,Ed}) / z - (V_{c1,Ed} - V_{c2,Ed}) / 2$
 $V_{wp,Ed} = 158.69$ [kN] Shear force acting on the web panel [5.3.(3)]
 $A_{vs} = 25.18$ [cm²] Shear area of the column web EN1993-1-1:[6.2.6.(3)]
 $A_{vc} = 25.18$ [cm²] Shear area EN1993-1-1:[6.2.6.(3)]
 $d_s = 370$ [mm] Distance between the centroids of stiffeners [6.2.6.1.(4)]
 $M_{pl,fc,Rd} = 2.76$ [kN*m] Plastic resistance of the column flange for bending [6.2.6.1.(4)]
 $M_{pl,stu,Rd} = 1.92$ [kN*m] Plastic resistance of the upper transverse stiffener for bending [6.2.6.1.(4)]
 $M_{pl,sti,Rd} = 1.92$ [kN*m] Plastic resistance of the lower transverse stiffener for bending [6.2.6.1.(4)]
 $V_{wp,Rd} = 0.9 (A_{vs} f_{y,wc}) / (\sqrt{3} \sigma_{M0}) + \text{Min}(4 M_{pl,fc,Rd} / d_s, (2 M_{pl,fc,Rd} + M_{pl,stu,Rd} + M_{pl,sti,Rd}) / d_s)$
 $V_{wp,Rd} = 443.94$ [kN] Resistance of the column web panel for shear [6.2.6.1]
 $V_{wp,Ed} / V_{wp,Rd} \leq 1.0$ $0.36 < 1.00$ **verified** (0.36)

WEB - TRANSVERSE COMPRESSION - LEVEL OF THE BEAM BOTTOM FLANGE

Bearing:

$t_{wc} = 8$ [mm] Effective thickness of the column web [6.2.6.2.(6)]
 $b_{eff,c,wc} = 222$ [mm] Effective width of the web for compression [6.2.6.2.(1)]
 $A_{vc} = 25.18$ [cm²] Shear area EN1993-1-1:[6.2.6.(3)]
 $\sigma = 0.80$ Reduction factor for interaction with shear [6.2.6.2.(1)]
 $\sigma_{com,Ed} = 64.17$ [MPa] Maximum compressive stress in web [6.2.6.2.(2)]
 $k_{wc} = 1.00$ Reduction factor conditioned by compressive stresses [6.2.6.2.(2)]
 $A_s = 23.25$ [cm²] Area of the web stiffener EN1993-1-1:[6.2.4]
 $F_{c,wc,Rd1} = \sigma k_{wc} b_{eff,c,wc} t_{wc} f_{yc} / \sigma_{M0} + A_s f_{ys} / \sigma_{M0}$
 $F_{c,wc,Rd1} = 1169.36$ [kN] Column web resistance [6.2.6.2.(1)]

Buckling:

$d_{wc} = 164$ [mm] Height of compressed web [6.2.6.2.(1)]
 $\sigma_p = 0.93$ Plate slenderness of an element [6.2.6.2.(1)]
 $\sigma = 0.85$ Reduction factor for element buckling [6.2.6.2.(1)]
 $\sigma_s = 2.33$ Stiffener slenderness EN1993-1-1:[6.3.1.2]
 $\sigma_s = 1.00$ Buckling coefficient of the stiffener EN1993-1-1:[6.3.1.2]
 $F_{c,wc,Rd2} = \sigma k_{wc} \sigma b_{eff,c,wc} t_{wc} f_{yc} / \sigma_{M1} + A_s \sigma_s f_{ys} / \sigma_{M1}$
 $F_{c,wc,Rd2} = 1104.28$ [kN] Column web resistance [6.2.6.2.(1)]

Final resistance:

$F_{c,wc,Rd,low} = \text{Min}(F_{c,wc,Rd1}, F_{c,wc,Rd2})$
 $F_{c,wc,Rd} = 1104.28$ [kN] Column web resistance [6.2.6.2.(1)]

WEB - TRANSVERSE COMPRESSION - LEVEL OF THE BEAM TOP FLANGE

Bearing:

$t_{wc} = 8$ [mm] Effective thickness of the column web [6.2.6.2.(6)]
 $b_{eff,c,wc} = 221$ [mm] Effective width of the web for compression [6.2.6.2.(1)]
 $A_{vc} = 25.18$ [cm²] Shear area EN1993-1-1:[6.2.6.(3)]
 $\sigma = 0.80$ Reduction factor for interaction with shear [6.2.6.2.(1)]
 $\sigma_{com,Ed} = 64.17$ [MPa] Maximum compressive stress in web [6.2.6.2.(2)]
 $k_{wc} = 1.00$ Reduction factor conditioned by compressive stresses [6.2.6.2.(2)]
 $A_s = 23.25$ [cm²] Area of the web stiffener EN1993-1-1:[6.2.4]
 $F_{c,wc,Rd1} = \sigma k_{wc} b_{eff,c,wc} t_{wc} f_{yc} / \sigma_{M0} + A_s f_{ys} / \sigma_{M0}$
 $F_{c,wc,Rd1} = 1168.36$ [kN] Column web resistance [6.2.6.2.(1)]

Buckling:

$d_{wc} = 164$ [mm] Height of compressed web [6.2.6.2.(1)]
 $\sigma_p = 0.92$ Plate slenderness of an element [6.2.6.2.(1)]
 $\sigma = 0.85$ Reduction factor for element buckling [6.2.6.2.(1)]

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$d_{wc} =$	164	[mm]	Height of compressed web	[6.2.6.2.(1)]
$\square_s =$	2.33		Stiffener slenderness	EN1993-1-1:[6.3.1.2]
$\square_s =$	1.00		Buckling coefficient of the stiffener	EN1993-1-1:[6.3.1.2]
$F_{c,wc,Rd2} = \square k_{wc} \square b_{eff,c,wc} t_{wc} f_{yc} / \square M1 + A_s \square_s f_{ys} / \square M1$				
$F_{c,wc,Rd2} =$	1103.91	[kN]	Column web resistance	[6.2.6.2.(1)]
Final resistance:				
$F_{c,wc,Rd,upp} = \text{Min} (F_{c,wc,Rd1} , F_{c,wc,Rd2})$				
$F_{c,wc,Rd,upp} =$	1103.91	[kN]	Column web resistance	[6.2.6.2.(1)]

GEOMETRICAL PARAMETERS OF A CONNECTION

EFFECTIVE LENGTHS AND PARAMETERS - COLUMN FLANGE

Nr	m	m_x	e	e_x	p	$l_{eff,cp}$	$l_{eff,nc}$	$l_{eff,1}$	$l_{eff,2}$	$l_{eff,cp,g}$	$l_{eff,nc,g}$	$l_{eff,1,g}$	$l_{eff,2,g}$
1	48	-	51	-	60	304	339	304	339	212	240	212	240
2	48	-	51	-	60	304	258	258	258	120	60	60	60
3	48	-	51	-	85	304	258	258	258	170	85	85	85
4	48	-	51	-	85	304	258	258	258	170	85	85	85
5	48	-	51	-	60	304	309	304	309	212	210	210	210

EFFECTIVE LENGTHS AND PARAMETERS - FRONT PLATE

Nr	m	m_x	e	e_x	p	$l_{eff,cp}$	$l_{eff,nc}$	$l_{eff,1}$	$l_{eff,2}$	$l_{eff,cp,g}$	$l_{eff,nc,g}$	$l_{eff,1,g}$	$l_{eff,2,g}$
1	60	-	51	-	60	374	404	374	404	247	283	247	283
2	60	-	51	-	60	374	302	302	302	120	60	60	60
3	60	-	51	-	85	374	302	302	302	170	85	85	85
4	60	-	51	-	85	374	302	302	302	170	85	85	85
5	60	-	51	-	60	374	302	302	302	247	181	181	181

m	– Bolt distance from the web
m_x	– Bolt distance from the beam flange
e	– Bolt distance from the outer edge
e_x	– Bolt distance from the horizontal outer edge
p	– Distance between bolts
$l_{eff,cp}$	– Effective length for a single bolt in the circular failure mode
$l_{eff,nc}$	– Effective length for a single bolt in the non-circular failure mode
$l_{eff,1}$	– Effective length for a single bolt for mode 1
$l_{eff,2}$	– Effective length for a single bolt for mode 2
$l_{eff,cp,g}$	– Effective length for a group of bolts in the circular failure mode
$l_{eff,nc,g}$	– Effective length for a group of bolts in the non-circular failure mode
$l_{eff,1,g}$	– Effective length for a group of bolts for mode 1
$l_{eff,2,g}$	– Effective length for a group of bolts for mode 2

CONNECTION RESISTANCE FOR COMPRESSION

$N_{j,Rd} = \text{Min} (N_{cb,Rd2} F_{c,wb,Rd,low} , 2 F_{c,wc,Rd,low} , 2 F_{c,wc,Rd,upp})$	
$N_{j,Rd} =$	2207.82 [kN] Connection resistance for compression [6.2]
$N_{b1,Ed} / N_{j,Rd} \leq 1,0$	0.02 < 1.00 verified (0.02)

CONNECTION RESISTANCE FOR BENDING

$F_{t,Rd} =$	141.12 [kN]	Bolt resistance for tension	[Table 3.4]
$B_{p,Rd} =$	211.72 [kN]	Punching shear resistance of a bolt	[Table 3.4]
$F_{t,fc,Rd}$ – column flange resistance due to bending			
$F_{t,wc,Rd}$ – column web resistance due to tension			
$F_{t,ep,Rd}$ – resistance of the front plate due to bending			
$F_{t,wb,Rd}$ – resistance of the web in tension			
$F_{t,fc,Rd} = \text{Min} (F_{T,1,fc,Rd} , F_{T,2,fc,Rd} , F_{T,3,fc,Rd})$			[6.2.6.4] , [Tab.6.2]
$F_{t,wc,Rd} = \square b_{eff,t,wc} t_{wc} f_{yc} / \square M0$			[6.2.6.3.(1)]
$F_{t,ep,Rd} = \text{Min} (F_{T,1,ep,Rd} , F_{T,2,ep,Rd} , F_{T,3,ep,Rd})$			[6.2.6.5] , [Tab.6.2]
$F_{t,wb,Rd} = b_{eff,t,wb} t_{wb} f_{yb} / \square M0$			[6.2.6.8.(1)]

RESISTANCE OF THE BOLT ROW NO. 1

$F_{t1,Rd,comp}$ - Formula	$F_{t1,Rd,comp}$	Component
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F_{t1,Rd,comp} - Formula	F_{t1,Rd,comp}	Component
$F_{t1,Rd} = \text{Min} (F_{t1,Rd,comp})$	223.16	Bolt row resistance
$F_{t,fc,Rd(1)} = 223.16$	223.16	Column flange - tension
$F_{t,wc,Rd(1)} = 507.91$	507.91	Column web - tension
$F_{t,ep,Rd(1)} = 226.71$	226.71	Front plate - tension
$F_{t,wb,Rd(1)} = 898.64$	898.64	Beam web - tension
$B_{p,Rd} = 423.44$	423.44	Bolts due to shear punching
$V_{wp,Rd}/\square = 443.94$	443.94	Web panel - shear
$F_{c,wc,Rd} = 1104.28$	1104.28	Column web - compression
$F_{c,fb,Rd} = 1028.65$	1028.65	Beam flange - compression
$F_{c,wb,Rd} = 2406.88$	2406.88	Beam web - compression

RESISTANCE OF THE BOLT ROW NO. 2

F_{t2,Rd,comp} - Formula	F_{t2,Rd,comp}	Component
$F_{t2,Rd} = \text{Min} (F_{t2,Rd,comp})$	61.91	Bolt row resistance
$F_{t,fc,Rd(2)} = 204.41$	204.41	Column flange - tension
$F_{t,wc,Rd(2)} = 465.23$	465.23	Column web - tension
$F_{t,ep,Rd(2)} = 202.38$	202.38	Front plate - tension
$F_{t,wb,Rd(2)} = 725.09$	725.09	Beam web - tension
$B_{p,Rd} = 423.44$	423.44	Bolts due to shear punching
$V_{wp,Rd}/\square - \sum_1^1 F_{tj,Rd} = 443.94 - 223.16$	220.77	Web panel - shear
$F_{c,wc,Rd} - \sum_1^1 F_{tj,Rd} = 1104.28 - 223.16$	881.12	Column web - compression
$F_{c,fb,Rd} - \sum_1^1 F_{tj,Rd} = 1028.65 - 223.16$	805.49	Beam flange - compression
$F_{c,wb,Rd} - \sum_1^1 F_{tj,Rd} = 2406.88 - 223.16$	2183.72	Beam web - compression
$F_{t,fc,Rd(2+1)} - \sum_1^1 F_{tj,Rd} = 285.07 - 223.16$	61.91	Column flange - tension - group
$F_{t,wc,Rd(2+1)} - \sum_1^1 F_{tj,Rd} = 504.08 - 223.16$	280.92	Column web - tension - group
$F_{t,ep,Rd(2+1)} - \sum_1^1 F_{tj,Rd} = 304.19 - 223.16$	81.03	Front plate - tension - group
$F_{t,wb,Rd(2+1)} - \sum_1^1 F_{tj,Rd} = 822.82 - 223.16$	599.66	Beam web - tension - group

RESISTANCE OF THE BOLT ROW NO. 3

F_{t3,Rd,comp} - Formula	F_{t3,Rd,comp}	Component
$F_{t3,Rd} = \text{Min} (F_{t3,Rd,comp})$	66.75	Bolt row resistance
$F_{t,fc,Rd(3)} = 204.41$	204.41	Column flange - tension
$F_{t,wc,Rd(3)} = 465.23$	465.23	Column web - tension
$F_{t,ep,Rd(3)} = 202.38$	202.38	Front plate - tension
$F_{t,wb,Rd(3)} = 725.09$	725.09	Beam web - tension
$B_{p,Rd} = 423.44$	423.44	Bolts due to shear punching
$V_{wp,Rd}/\square - \sum_1^2 F_{tj,Rd} = 443.94 - 285.07$	158.87	Web panel - shear
$F_{c,wc,Rd} - \sum_1^2 F_{tj,Rd} = 1104.28 - 285.07$	819.21	Column web - compression
$F_{c,fb,Rd} - \sum_1^2 F_{tj,Rd} = 1028.65 - 285.07$	743.58	Beam flange - compression
$F_{c,wb,Rd} - \sum_1^2 F_{tj,Rd} = 2406.88 - 285.07$	2121.82	Beam web - compression
$F_{t,fc,Rd(3+2)} - \sum_2^2 F_{tj,Rd} = 137.91 - 61.91$	76.00	Column flange - tension - group
$F_{t,wc,Rd(3+2)} - \sum_2^2 F_{tj,Rd} = 312.19 - 61.91$	250.28	Column web - tension - group
$F_{t,fc,Rd(3+2+1)} - \sum_2^1 F_{tj,Rd} = 365.91 - 285.07$	80.84	Column flange - tension - group
$F_{t,wc,Rd(3+2+1)} - \sum_2^1 F_{tj,Rd} = 561.13 - 285.07$	276.06	Column web - tension - group
$F_{t,ep,Rd(3+2)} - \sum_2^2 F_{tj,Rd} = 128.65 - 61.91$	66.75	Front plate - tension - group
$F_{t,wb,Rd(3+2)} - \sum_2^2 F_{tj,Rd} = 348.00 - 61.91$	286.09	Beam web - tension - group
$F_{t,ep,Rd(3+2+1)} - \sum_2^1 F_{tj,Rd} = 379.61 - 285.07$	94.54	Front plate - tension - group
$F_{t,wb,Rd(3+2+1)} - \sum_2^1 F_{tj,Rd} = 1026.82 - 285.07$	741.75	Beam web - tension - group

RESISTANCE OF THE BOLT ROW NO. 4

F_{t4,Rd,comp} - Formula	F_{t4,Rd,comp}	Component
$F_{t4,Rd} = \text{Min} (F_{t4,Rd,comp})$	75.42	Bolt row resistance
$F_{t,fc,Rd(4)} = 204.41$	204.41	Column flange - tension
$F_{t,wc,Rd(4)} = 465.23$	465.23	Column web - tension
$F_{t,ep,Rd(4)} = 202.38$	202.38	Front plate - tension

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F_{t4,Rd,comp} - Formula	F_{t4,Rd,comp}	Component
$F_{t,wb,Rd(4)} = 725.09$	725.09	Beam web - tension
$B_{p,Rd} = 423.44$	423.44	Bolts due to shear punching
$V_{wp,Rd}/\square - \sum_1^3 F_{ti,Rd} = 443.94 - 351.82$	92.12	Web panel - shear
$F_{c,wc,Rd} - \sum_1^3 F_{tj,Rd} = 1104.28 - 351.82$	752.46	Column web - compression
$F_{c,fb,Rd} - \sum_1^3 F_{tj,Rd} = 1028.65 - 351.82$	676.84	Beam flange - compression
$F_{c,wb,Rd} - \sum_1^3 F_{tj,Rd} = 2406.88 - 351.82$	2055.07	Beam web - compression
$F_{t,fc,Rd(4+3)} - \sum_3^3 F_{tj,Rd} = 161.68 - 66.75$	94.94	Column flange - tension - group
$F_{t,wc,Rd(4+3)} - \sum_3^3 F_{tj,Rd} = 353.33 - 66.75$	286.58	Column web - tension - group
$F_{t,fc,Rd(4+3+2)} - \sum_3^2 F_{tj,Rd} = 218.75 - 128.65$	90.10	Column flange - tension - group
$F_{t,wc,Rd(4+3+2)} - \sum_3^2 F_{tj,Rd} = 434.99 - 128.65$	306.34	Column web - tension - group
$F_{t,fc,Rd(4+3+2+1)} - \sum_3^1 F_{tj,Rd} = 446.75 - 351.82$	94.94	Column flange - tension - group
$F_{t,wc,Rd(4+3+2+1)} - \sum_3^1 F_{tj,Rd} = 598.70 - 351.82$	246.89	Column web - tension - group
$F_{t,ep,Rd(4+3)} - \sum_3^3 F_{tj,Rd} = 150.84 - 66.75$	84.09	Front plate - tension - group
$F_{t,wb,Rd(4+3)} - \sum_3^3 F_{tj,Rd} = 408.00 - 66.75$	341.25	Beam web - tension - group
$F_{t,ep,Rd(4+3+2)} - \sum_3^2 F_{tj,Rd} = 204.07 - 128.65$	75.42	Front plate - tension - group
$F_{t,wb,Rd(4+3+2)} - \sum_3^2 F_{tj,Rd} = 552.00 - 128.65$	423.35	Beam web - tension - group
$F_{t,ep,Rd(4+3+2+1)} - \sum_3^1 F_{tj,Rd} = 455.03 - 351.82$	103.21	Front plate - tension - group
$F_{t,wb,Rd(4+3+2+1)} - \sum_3^1 F_{tj,Rd} = 1230.82 - 351.82$	879.00	Beam web - tension - group

RESISTANCE OF THE BOLT ROW NO. 5

F_{t5,Rd,comp} - Formula	F_{t5,Rd,comp}	Component
$F_{t5,Rd} = \text{Min} (F_{t5,Rd,comp})$	16.70	Bolt row resistance
$F_{t,fc,Rd(5)} = 216.27$	216.27	Column flange - tension
$F_{t,wc,Rd(5)} = 507.91$	507.91	Column web - tension
$F_{t,ep,Rd(5)} = 202.38$	202.38	Front plate - tension
$F_{t,wb,Rd(5)} = 725.09$	725.09	Beam web - tension
$B_{p,Rd} = 423.44$	423.44	Bolts due to shear punching
$V_{wp,Rd}/\square - \sum_1^4 F_{ti,Rd} = 443.94 - 427.23$	16.70	Web panel - shear
$F_{c,wc,Rd} - \sum_1^4 F_{tj,Rd} = 1104.28 - 427.23$	677.05	Column web - compression
$F_{c,fb,Rd} - \sum_1^4 F_{tj,Rd} = 1028.65 - 427.23$	601.42	Beam flange - compression
$F_{c,wb,Rd} - \sum_1^4 F_{tj,Rd} = 2406.88 - 427.23$	1979.65	Beam web - compression
$F_{t,fc,Rd(5+4)} - \sum_4^4 F_{tj,Rd} = 280.56 - 75.42$	205.15	Column flange - tension - group
$F_{t,wc,Rd(5+4)} - \sum_4^4 F_{tj,Rd} = 500.12 - 75.42$	424.70	Column web - tension - group
$F_{t,fc,Rd(5+4+3)} - \sum_4^3 F_{tj,Rd} = 361.40 - 142.16$	219.24	Column flange - tension - group
$F_{t,wc,Rd(5+4+3)} - \sum_4^3 F_{tj,Rd} = 558.55 - 142.16$	416.39	Column web - tension - group
$F_{t,fc,Rd(5+4+3+2)} - \sum_4^2 F_{tj,Rd} = 418.47 - 204.07$	214.40	Column flange - tension - group
$F_{t,wc,Rd(5+4+3+2)} - \sum_4^2 F_{tj,Rd} = 587.24 - 204.07$	383.17	Column web - tension - group
$F_{t,fc,Rd(5+4+3+2+1)} - \sum_4^1 F_{tj,Rd} = 646.47 - 427.23$	219.24	Column flange - tension - group
$F_{t,wc,Rd(5+4+3+2+1)} - \sum_4^1 F_{tj,Rd} = 648.37 - 427.23$	221.14	Column web - tension - group
$F_{t,ep,Rd(5+4)} - \sum_4^4 F_{tj,Rd} = 236.07 - 75.42$	160.65	Front plate - tension - group
$F_{t,wb,Rd(5+4)} - \sum_4^4 F_{tj,Rd} = 638.55 - 75.42$	563.13	Beam web - tension - group
$F_{t,ep,Rd(5+4+3)} - \sum_4^3 F_{tj,Rd} = 311.48 - 142.16$	169.32	Front plate - tension - group
$F_{t,wb,Rd(5+4+3)} - \sum_4^3 F_{tj,Rd} = 842.55 - 142.16$	700.38	Beam web - tension - group
$F_{t,ep,Rd(5+4+3+2)} - \sum_4^2 F_{tj,Rd} = 364.72 - 204.07$	160.65	Front plate - tension - group
$F_{t,wb,Rd(5+4+3+2)} - \sum_4^2 F_{tj,Rd} = 986.55 - 204.07$	782.48	Beam web - tension - group
$F_{t,ep,Rd(5+4+3+2+1)} - \sum_4^1 F_{tj,Rd} = 615.68 - 427.23$	188.44	Front plate - tension - group
$F_{t,wb,Rd(5+4+3+2+1)} - \sum_4^1 F_{tj,Rd} = 1665.37 - 427.23$	1238.13	Beam web - tension - group

SUMMARY TABLE OF FORCES

Nr	h_j	F_{tj,Rd}	F_{t,fc,Rd}	F_{t,wc,Rd}	F_{t,ep,Rd}	F_{t,wb,Rd}	F_{t,Rd}	B_{p,Rd}
1	334	223.16	223.16	507.91	226.71	898.64	282.24	423.44
2	274	61.91	204.41	465.23	202.38	725.09	282.24	423.44
3	214	66.75	204.41	465.23	202.38	725.09	282.24	423.44
4	104	75.42	204.41	465.23	202.38	725.09	282.24	423.44

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Nr	h _j	F _{tj,Rd}	F _{t,fc,Rd}	F _{t,wc,Rd}	F _{t,ep,Rd}	F _{t,wb,Rd}	F _{t,Rd}	B _{p,Rd}
5	44	16.70	216.27	507.91	202.38	725.09	282.24	423.44

CONNECTION RESISTANCE FOR BENDING M_{j,Rd}

$$M_{j,Rd} = \sum h_j F_{tj,Rd}$$

$$M_{j,Rd} = 114.18 \quad [\text{kN}\cdot\text{m}] \quad \text{Connection resistance for bending} \quad [6.2]$$

$$M_{b1,Ed} / M_{j,Rd} \leq 1,0 \quad 0.41 < 1.00 \quad \text{verified} \quad (0.41)$$

CONNECTION RESISTANCE FOR SHEAR

$$\alpha_v = 0.60 \quad \text{Coefficient for calculation of } F_{v,Rd} \quad [\text{Table 3.4}]$$

$$F_{v,Rd} = 120.64 \quad [\text{kN}] \quad \text{Shear resistance of a single bolt} \quad [\text{Table 3.4}]$$

$$F_{t,Rd,max} = 141.12 \quad [\text{kN}] \quad \text{Tensile resistance of a single bolt} \quad [\text{Table 3.4}]$$

$$F_{b,Rd,int} = 123.38 \quad [\text{kN}] \quad \text{Bearing resistance of an intermediate bolt} \quad [\text{Table 3.4}]$$

$$F_{b,Rd,ext} = 163.64 \quad [\text{kN}] \quad \text{Bearing resistance of an outermost bolt} \quad [\text{Table 3.4}]$$

Nr	F _{tj,Rd,N}	F _{tj,Ed,N}	F _{tj,Rd,M}	F _{tj,Ed,M}	F _{tj,Ed}	F _{vj,Rd}
1	282.24	-7.66	223.16	91.14	83.48	190.30
2	282.24	-7.66	61.91	25.28	17.62	230.52
3	282.24	-7.66	66.75	27.26	19.60	229.31
4	282.24	-7.66	75.42	30.80	23.14	227.15
5	282.24	-7.66	16.70	6.82	-0.84	241.27

F_{tj,Rd,N} – Bolt row resistance for simple tension

F_{tj,Ed,N} – Force due to axial force in a bolt row

F_{tj,Rd,M} – Bolt row resistance for simple bending

F_{tj,Ed,M} – Force due to moment in a bolt row

F_{tj,Ed} – Maximum tensile force in a bolt row

F_{vj,Rd} – Reduced bolt row resistance

$$F_{tj,Ed,N} = N_{j,Ed} F_{tj,Rd,N} / N_{j,Rd}$$

$$F_{tj,Ed,M} = M_{j,Ed} F_{tj,Rd,M} / M_{j,Rd}$$

$$F_{tj,Ed} = F_{tj,Ed,N} + F_{tj,Ed,M}$$

$$F_{vj,Rd} = \text{Min} (n_h F_{v,Rd} (1 - F_{tj,Ed} / (1.4 n_h F_{t,Rd,max})), n_h F_{v,Rd}, n_h F_{b,Rd})$$

$$V_{j,Rd} = n_h \sum_i^n F_{vji,Rd} \quad [\text{Table 3.4}]$$

$$V_{j,Rd} = 1118.55 \quad [\text{kN}] \quad \text{Connection resistance for shear} \quad [\text{Table 3.4}]$$

$$V_{b1,Ed} / V_{j,Rd} \leq 1,0 \quad 0.09 < 1.00 \quad \text{verified} \quad (0.09)$$

WELD RESISTANCE

$$A_w = 95.37 \quad [\text{cm}^2] \quad \text{Area of all welds} \quad [4.5.3.2(2)]$$

$$A_{wy} = 65.25 \quad [\text{cm}^2] \quad \text{Area of horizontal welds} \quad [4.5.3.2(2)]$$

$$A_{wz} = 30.12 \quad [\text{cm}^2] \quad \text{Area of vertical welds} \quad [4.5.3.2(2)]$$

$$I_{wy} = 18439.38 \quad [\text{cm}^4] \quad \text{Moment of inertia of the weld arrangement with respect to the hor. axis} \quad [4.5.3.2(5)]$$

$$\sigma_{\square max} = \sigma_{\square max} = -38.43 \quad [\text{MPa}] \quad \text{Normal stress in a weld} \quad [4.5.3.2(5)]$$

$$\sigma_{\square} = \sigma_{\square} = -35.49 \quad [\text{MPa}] \quad \text{Stress in a vertical weld} \quad [4.5.3.2(5)]$$

$$\sigma_{II} = 33.37 \quad [\text{MPa}] \quad \text{Tangent stress} \quad [4.5.3.2(5)]$$

$$\rho_w = 0.80 \quad \text{Correlation coefficient} \quad [4.5.3.2(7)]$$

$$\sigma_{\square} [\sigma_{\square max}^2 + 3(\sigma_{\square max}^2)] \leq f_u / (\rho_w \sigma_{\square M2}) \quad 76.86 < 360.00 \quad \text{verified} \quad (0.21)$$

$$\sigma_{\square} [\sigma_{\square}^2 + 3(\sigma_{\square}^2 + \sigma_{II}^2)] \leq f_u / (\rho_w \sigma_{\square M2}) \quad 91.55 < 360.00 \quad \text{verified} \quad (0.25)$$

$$\sigma_{\square} \leq 0.9 f_u / \sigma_{\square M2} \quad 38.43 < 259.20 \quad \text{verified} \quad (0.15)$$

CONNECTION STIFFNESS

$$t_{wash} = 4 \quad [\text{mm}] \quad \text{Washer thickness} \quad [6.2.6.3.(2)]$$

$$h_{head} = 14 \quad [\text{mm}] \quad \text{Bolt head height} \quad [6.2.6.3.(2)]$$

$$h_{nut} = 20 \quad [\text{mm}] \quad \text{Bolt nut height} \quad [6.2.6.3.(2)]$$

$$L_b = 52 \quad [\text{mm}] \quad \text{Bolt length} \quad [6.2.6.3.(2)]$$

$$k_{10} = 8 \quad [\text{mm}] \quad \text{Stiffness coefficient of bolts} \quad [6.3.2.(1)]$$

STIFFNESSES OF BOLT ROWS

Nr	h _j	k ₃	k ₄	k ₅	k _{eff,j}	k _{eff,j} h _j	k _{eff,j} h _j ²
					Sum	6.21	168.11
1	334	5	3	4	1	3.53	117.89

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Nr	h _j	k ₃	k ₄	k ₅	k _{eff,j}	k _{eff,j} h _j	k _{eff,j} h _j ²
2	274	2	1	1	0	0.86	23.64
3	214	2	1	1	0	0.94	20.06
4	104	2	1	1	0	0.46	4.72
5	44	5	3	3	1	0.41	1.81

$$k_{eff,j} = 1 / (\sum_{i=1}^5 (1 / k_{i,j}))$$

[6.3.3.1.(2)]

$$z_{eq} = \sum_j k_{eff,j} h_j^2 / \sum_j k_{eff,j} h_j$$

$$z_{eq} = 271 \quad [mm]$$

Equivalent force arm

[6.3.3.1.(3)]

$$k_{eq} = \sum_j k_{eff,j} h_j / z_{eq}$$

$$k_{eq} = 2 \quad [mm]$$

Equivalent stiffness coefficient of a bolt arrangement [6.3.3.1.(1)]

$$A_{vc} = 25.18 \quad [cm^2]$$

Shear area

EN1993-1-1:[6.2.6.(3)]

$$\square = 1.00$$

Transformation parameter

[5.3.(7)]

$$z = 271 \quad [mm]$$

Lever arm

[6.2.5]

$$k_1 = 4 \quad [mm]$$

Stiffness coefficient of the column web panel subjected to shear [6.3.2.(1)]

$$k_2 =$$

Stiffness coefficient of the compressed column web

[6.3.2.(1)]

$$S_{j,ini} = E z_{eq}^2 / \sum_i (1 / k_1 + 1 / k_2 + 1 / k_{eq})$$

[6.3.1.(4)]

$$S_{j,ini} = 21411.31 \quad [kN*m]$$

Initial rotational stiffness

[6.3.1.(4)]

$$\square = 1.00$$

Stiffness coefficient of a connection

[6.3.1.(6)]

$$S_j = S_{j,ini} / \square$$

[6.3.1.(4)]

$$S_j = 21411.31 \quad [kN*m]$$

Final rotational stiffness

[6.3.1.(4)]

Connection classification due to stiffness.

$$S_{j,rig} = 26084.28 \quad [kN*m]$$

Stiffness of a rigid connection

[5.2.2.5]

$$S_{j,pin} = 1630.27 \quad [kN*m]$$

Stiffness of a pinned connection

[5.2.2.5]

$$S_{j,pin} \leq S_{j,ini} < S_{j,rig} \quad \text{SEMI-RIGID}$$

WEAKEST COMPONENT:

COLUMN WEB PANEL - SHEAR

Connection conforms to the code

Ratio

0.41

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Autodesk

Robot

Structural

Analysis

Professional

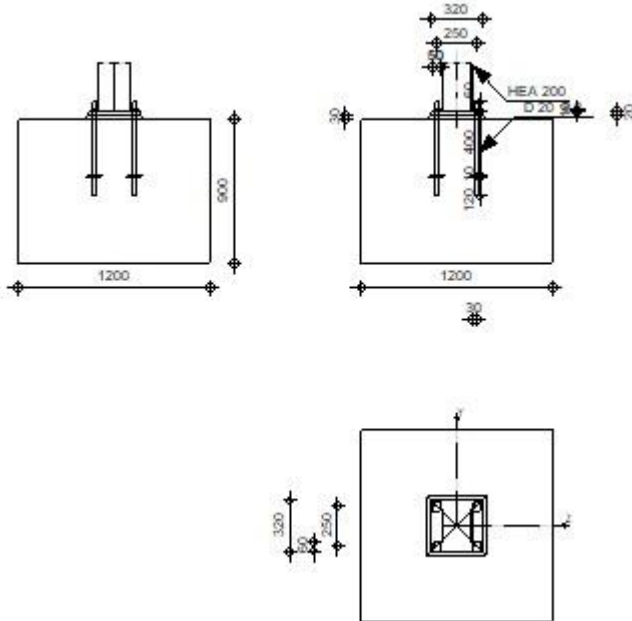
2017

Fixed column base design

Eurocode 3: EN 1993-1-8:2005/AC:2009 + CEB Design Guide: Design of fastenings in concrete



Ratio
0.87



GENERAL

Connection no.: 2
 Connection name: Fixed column base

GEOMETRY

COLUMN

Section: HEA 200

$L_c =$	5.00	[m]	Column length
$\alpha =$	0.0	[Deg]	Inclination angle
$h_c =$	190	[mm]	Height of column section
$b_{fc} =$	200	[mm]	Width of column section
$t_{wc} =$	7	[mm]	Thickness of the web of column section
$t_{fc} =$	10	[mm]	Thickness of the flange of column section
$r_c =$	18	[mm]	Radius of column section fillet
$A_c =$	53.83	[cm ²]	Cross-sectional area of a column
$I_{yc} =$	3692.15	[cm ⁴]	Moment of inertia of the column section

Material: S275

$f_{yc} =$	320.00	[MPa]	Resistance
$f_{uc} =$	390.00	[MPa]	Yield strength of a material

COLUMN BASE

$l_{pd} =$	320	[mm]	Length
$b_{pd} =$	320	[mm]	Width
$t_{pd} =$	20	[mm]	Thickness
Material: S275			
$f_{ypd} =$	320.00	[MPa]	Resistance
$f_{upd} =$	390.00	[MPa]	Yield strength of a material

ANCHORAGE

The shear plane passes through the UNTHREADED portion of the bolt.

Class =	8.8	Anchor class
$f_{yb} =$	640.00	[MPa] Yield strength of the anchor material

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Class = 8.8 Anchor class
 $f_{ub} = 800.00$ [MPa] Tensile strength of the anchor material
 $d = 20$ [mm] Bolt diameter
 $A_s = 2.45$ [cm²] Effective section area of a bolt
 $A_v = 3.14$ [cm²] Area of bolt section
 $n_H = 2$ Number of bolt columns
 $n_V = 2$ Number of bolt rows
Horizontal spacing $e_{Hi} = 250$ [mm]
Vertical spacing $e_{Vi} = 250$ [mm]

Anchor dimensions

$L_1 = 60$ [mm]
 $L_2 = 400$ [mm]
 $L_3 = 120$ [mm]

Anchor plate

$l_p = 100$ [mm] Length
 $b_p = 100$ [mm] Width
 $t_p = 10$ [mm] Thickness
Material: S235
 $f_y = 235.00$ [MPa] Resistance

Washer

$l_{wd} = 50$ [mm] Length
 $b_{wd} = 60$ [mm] Width
 $t_{wd} = 10$ [mm] Thickness

MATERIAL FACTORS

$\square_{M0} = 1.00$ Partial safety factor
 $\square_{M2} = 1.25$ Partial safety factor
 $\square_C = 1.50$ Partial safety factor

SPREAD FOOTING

$L = 1200$ [mm] Spread footing length
 $B = 1200$ [mm] Spread footing width
 $H = 900$ [mm] Spread footing height

Concrete

Class C20/25
 $f_{ck} = 20.00$ [MPa] Characteristic resistance for compression

Grout layer

$t_g = 30$ [mm] Thickness of leveling layer (grout)
 $f_{ck,g} = 12.00$ [MPa] Characteristic resistance for compression
 $C_{f,d} = 0.30$ Coeff. of friction between the base plate and concrete

WELDS

$a_p = 6$ [mm] Footing plate of the column base

LOADS

Case: Manual calculations.

$N_{j,Ed} = 41.52$ [kN] Axial force
 $V_{j,Ed,y} = 20.18$ [kN] Shear force
 $V_{j,Ed,z} = -2.89$ [kN] Shear force
 $M_{j,Ed,y} = 1.20$ [kN*m] Bending moment
 $M_{j,Ed,z} = 27.57$ [kN*m] Bending moment

RESULTS

COMPRESSION ZONE

COMPRESSION OF CONCRETE

$f_{cd} = 13.33$ [MPa] Design compressive resistance EN 1992-1:[3.1.6.(1)]
 $f_j = 26.67$ [MPa] Design bearing resistance under the base plate [6.2.5.(7)]
 $c = t_p \square (f_{yp}/(3*f_j*\square_{M0}))$

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$c = 40$	[mm]	Additional width of the bearing pressure zone	[6.2.5.(4)]
$b_{eff} = 90$	[mm]	Effective width of the bearing pressure zone under the flange	[6.2.5.(3)]
$l_{eff} = 280$	[mm]	Effective length of the bearing pressure zone under the flange	[6.2.5.(3)]
$A_{c0} = 252.00$	[cm ²]	Area of the joint between the base plate and the foundation	EN 1992-1:[6.7.(3)]
$A_{c1} = 2268.00$	[cm ²]	Maximum design area of load distribution	EN 1992-1:[6.7.(3)]
$F_{rd,u} = A_{c0} * f_{cd} * \alpha (A_{c1}/A_{c0}) \leq 3 * A_{c0} * f_{cd}$			
$F_{rd,u} = 1008.00$	[kN]	Bearing resistance of concrete	EN 1992-1:[6.7.(3)]
$\alpha_j = 0.67$		Reduction factor for compression	[6.2.5.(7)]
$f_{jd} = \alpha_j * F_{rd,u} / (b_{eff} * l_{eff})$			
$f_{jd} = 26.67$	[MPa]	Design bearing resistance	[6.2.5.(7)]
$A_{c,y} = 252.00$	[cm ²]	Bearing area for bending My	[6.2.8.3.(1)]
$A_{c,z} = 252.00$	[cm ²]	Bearing area for bending Mz	[6.2.8.3.(1)]
$F_{c,Rd,i} = A_{c,i} * f_{jd}$			
$F_{c,Rd,y} = 672.00$	[kN]	Bearing resistance of concrete for bending My	[6.2.8.3.(1)]
$F_{c,Rd,z} = 672.00$	[kN]	Bearing resistance of concrete for bending Mz	[6.2.8.3.(1)]
COLUMN FLANGE AND WEB IN COMPRESSION			
$CL = 3.00$		Section class	EN 1993-1-1:[5.5.2]
$W_{el,y} = 388.65$	[cm ³]	Elastic section modulus	EN1993-1-1:[6.2.5.(2)]
$M_{c,Rd,y} = 124.37$	[kN*m]	Design resistance of the section for bending	EN1993-1-1:[6.2.5]
$h_{f,y} = 180$	[mm]	Distance between the centroids of flanges	[6.2.6.7.(1)]
$F_{c,fc,Rd,y} = M_{c,Rd,y} / h_{f,y}$			
$F_{c,fc,Rd,y} = 690.93$	[kN]	Resistance of the compressed flange and web	[6.2.6.7.(1)]
$W_{el,z} = 133.55$	[cm ³]	Elastic section modulus	EN1993-1-1:[6.2.5.(2)]
$M_{c,Rd,z} = 42.74$	[kN*m]	Design resistance of the section for bending	EN1993-1-1:[6.2.5]
$h_{f,z} = 140$	[mm]	Distance between the centroids of flanges	[6.2.6.7.(1)]
$F_{c,fc,Rd,z} = M_{c,Rd,z} / h_{f,z}$			
$F_{c,fc,Rd,z} = 305.26$	[kN]	Resistance of the compressed flange and web	[6.2.6.7.(1)]
RESISTANCES OF SPREAD FOOTING IN THE COMPRESSION ZONE			
$F_{c,Rd,y} = \min(F_{c,Rd,y}, F_{c,fc,Rd,y})$			
$F_{c,Rd,y} = 672.00$	[kN]	Resistance of spread footing in the compression zone	[6.2.8.3]
$F_{c,Rd,z} = \min(F_{c,Rd,z}, F_{c,fc,Rd,z})$			
$F_{c,Rd,z} = 305.26$	[kN]	Resistance of spread footing in the compression zone	[6.2.8.3]
TENSION ZONE			
STEEL FAILURE			
$A_b = 2.45$	[cm ²]	Effective anchor area	[Table 3.4]
$f_{ub} = 800.00$	[MPa]	Tensile strength of the anchor material	[Table 3.4]
$\beta = 0.85$		Reduction factor of anchor resistance	[3.6.1.(3)]
$F_{t,Rd,s1} = \beta * 0.9 * f_{ub} * A_b / \alpha_{M2}$			
$F_{t,Rd,s1} = 119.95$	[kN]	Anchor resistance to steel failure	[Table 3.4]
$\alpha_{Ms} = 1.20$		Partial safety factor	CEB [3.2.3.2]
$f_{yb} = 640.00$	[MPa]	Yield strength of the anchor material	CEB [9.2.2]
$F_{t,Rd,s2} = f_{yb} * A_b / \alpha_{Ms}$			
$F_{t,Rd,s2} = 130.67$	[kN]	Anchor resistance to steel failure	CEB [9.2.2]
$F_{t,Rd,s} = \min(F_{t,Rd,s1}, F_{t,Rd,s2})$			
$F_{t,Rd,s} = 119.95$	[kN]	Anchor resistance to steel failure	
PULL-OUT FAILURE			
$f_{ck} = 20.00$	[MPa]	Characteristic compressive strength of concrete	EN 1992-1:[3.1.2]
$A_h = 96.86$	[cm ²]	Bearing area of the head	CEB [15.1.2.3]
$p_k = 140.00$	[MPa]	Characteristic strength of concrete (pull-out)	CEB [15.1.2.3]
$\alpha_{Mp} = 2.16$		Partial safety factor	CEB [3.2.3.1]
$F_{t,Rd,p} = p_k * A_h / \alpha_{Mp}$			
$F_{t,Rd,p} = 672.63$	[kN]	Design uplift capacity	CEB [9.2.3]
CONCRETE CONE FAILURE			
$h_{ef} = 317$	[mm]	Effective anchorage depth	CEB [9.2.4]
$N_{Rk,c}^0 = 9.0 [N^{0.5}/mm^{0.5}] * f_{ck} * h_{ef}^{1.5}$			
$N_{Rk,c}^0 = 226.81$	[kN]	Characteristic resistance of an anchor	CEB [9.2.4]

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$N_{Rk,c}^0 = 226.81$	[kN]	Characteristic resistance of an anchor	CEB [9.2.4]
$s_{cr,N} = 950$	[mm]	Critical width of the concrete cone	CEB [9.2.4]
$c_{cr,N} = 475$	[mm]	Critical edge distance	CEB [9.2.4]
$A_{c,N0} = 14400.00$	[cm ²]	Maximum area of concrete cone	CEB [9.2.4]
$A_{c,N} = 14400.00$	[cm ²]	Actual area of concrete cone	CEB [9.2.4]
$\square_{A,N} = A_{c,N}/A_{c,N0}$			
$\square_{A,N} = 1.00$		Factor related to anchor spacing and edge distance	CEB [9.2.4]
$c = 475$	[mm]	Minimum edge distance from an anchor	CEB [9.2.4]
$\square_{s,N} = 0.7 + 0.3 \cdot c/c_{cr,N} \leq 1.0$			
$\square_{s,N} = 1.0$		Factor taking account the influence of edges of the concrete member on the distribution of stresses in CEB the concrete	[9.2.4]
$\square_{ec,N} = 1.0$		Factor related to distribution of tensile forces acting on anchors	CEB [9.2.4]
$\square_{re,N} = 0.5 + h_{ef}[mm]/200 \leq 1.0$			
$\square_{re,N} = 1.00$		Shell spalling factor	CEB [9.2.4]
$\square_{ucr,N} = 1.00$		Factor taking into account whether the anchorage is in cracked or non-cracked concrete	CEB [9.2.4]
$\square_{Mc} = 2.16$		Partial safety factor	CEB [3.2.3.1]
$F_{t,Rd,c} = N_{Rk,c}^0 \cdot \square_{A,N} \cdot \square_{s,N} \cdot \square_{ec,N} \cdot \square_{re,N} \cdot \square_{ucr,N} / \square_{Mc}$			
$F_{t,Rd,c} = 105.00$	[kN]	Design anchor resistance to concrete cone failure	EN 1992-1:[8.4.2.(2)]
SPLITTING FAILURE			
$h_{ef} = 400$	[mm]	Effective anchorage depth	CEB [9.2.5]
$N_{Rk,c}^0 = 9.0[N^{0.5}/mm^{0.5}] \cdot f_{ck} \cdot h_{ef}^{1.5}$			
$N_{Rk,c}^0 = 321.99$	[kN]	Design uplift capacity	CEB [9.2.5]
$s_{cr,N} = 800$	[mm]	Critical width of the concrete cone	CEB [9.2.5]
$c_{cr,N} = 400$	[mm]	Critical edge distance	CEB [9.2.5]
$A_{c,N0} = 11025.00$	[cm ²]	Maximum area of concrete cone	CEB [9.2.5]
$A_{c,N} = 11025.00$	[cm ²]	Actual area of concrete cone	CEB [9.2.5]
$\square_{A,N} = A_{c,N}/A_{c,N0}$			
$\square_{A,N} = 1.00$		Factor related to anchor spacing and edge distance	CEB [9.2.5]
$c = 400$	[mm]	Minimum edge distance from an anchor	CEB [9.2.5]
$\square_{s,N} = 0.7 + 0.3 \cdot c/c_{cr,N} \leq 1.0$			
$\square_{s,N} = 1.0$		Factor taking account the influence of edges of the concrete member on the distribution of stresses in CEB the concrete	[9.2.5]
$\square_{ec,N} = 1.0$		Factor related to distribution of tensile forces acting on anchors	CEB [9.2.5]
$\square_{re,N} = 0.5 + h_{ef}[mm]/200 \leq 1.0$			
$\square_{re,N} = 1.00$		Shell spalling factor	CEB [9.2.5]
$\square_{ucr,N} = 1.00$		Factor taking into account whether the anchorage is in cracked or non-cracked concrete	CEB [9.2.5]
$\square_{h,N} = (h/(2 \cdot h_{ef}))^{2/3} \leq 1.2$			
$\square_{h,N} = 1.08$		Coeff. related to the foundation height	CEB [9.2.5]
$\square_{M,sp} = 2.16$		Partial safety factor	CEB [3.2.3.1]
$F_{t,Rd,sp} = N_{Rk,c}^0 \cdot \square_{A,N} \cdot \square_{s,N} \cdot \square_{ec,N} \cdot \square_{re,N} \cdot \square_{ucr,N} \cdot \square_{h,N} / \square_{M,sp}$			
$F_{t,Rd,sp} = 161.25$	[kN]	Design anchor resistance to splitting of concrete	CEB [9.2.5]
TENSILE RESISTANCE OF AN ANCHOR			
$F_{t,Rd} = \min(F_{t,Rd,s}, F_{t,Rd,p}, F_{t,Rd,c}, F_{t,Rd,sp})$			
$F_{t,Rd} = 105.00$	[kN]	Tensile resistance of an anchor	
BENDING OF THE BASE PLATE			
Bending moment $M_{j,Ed,y}$			
$l_{eff,1} = 144$	[mm]	Effective length for a single bolt for mode 1	[6.2.6.5]
$l_{eff,2} = 144$	[mm]	Effective length for a single bolt for mode 2	[6.2.6.5]
$m = 39$	[mm]	Distance of a bolt from the stiffening edge	[6.2.6.5]
$M_{pl,1,Rd} = 4.60$	[kN*m]	Plastic resistance of a plate for mode 1	[6.2.4]
$M_{pl,2,Rd} = 4.60$	[kN*m]	Plastic resistance of a plate for mode 2	[6.2.4]
$F_{T,1,Rd} = 473.01$	[kN]	Resistance of a plate for mode 1	[6.2.4]
$F_{T,2,Rd} = 221.79$	[kN]	Resistance of a plate for mode 2	[6.2.4]
$F_{T,3,Rd} = 210.01$	[kN]	Resistance of a plate for mode 3	[6.2.4]
$F_{t,pl,Rd,y} = \min(F_{T,1,Rd}, F_{T,2,Rd}, F_{T,3,Rd})$			
$F_{t,pl,Rd,y} = 210.01$	[kN]	Tension resistance of a plate	[6.2.4]

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Bending moment $M_{j,Ed,z}$

$l_{eff,1} =$	144	[mm]	Effective length for a single bolt for mode 1	[6.2.6.5]
$l_{eff,2} =$	144	[mm]	Effective length for a single bolt for mode 2	[6.2.6.5]
$m =$	39	[mm]	Distance of a bolt from the stiffening edge	[6.2.6.5]
$M_{pl,1,Rd} =$	4.60	[kN*m]	Plastic resistance of a plate for mode 1	[6.2.4]
$M_{pl,2,Rd} =$	4.60	[kN*m]	Plastic resistance of a plate for mode 2	[6.2.4]
$F_{T,1,Rd} =$	473.01	[kN]	Resistance of a plate for mode 1	[6.2.4]
$F_{T,2,Rd} =$	221.79	[kN]	Resistance of a plate for mode 2	[6.2.4]
$F_{T,3,Rd} =$	210.01	[kN]	Resistance of a plate for mode 3	[6.2.4]
$F_{t,pl,Rd,z} = \min(F_{T,1,Rd}, F_{T,2,Rd}, F_{T,3,Rd})$				
$F_{t,pl,Rd,z} =$	210.01	[kN]	Tension resistance of a plate	[6.2.4]

RESISTANCES OF SPREAD FOOTING IN THE TENSION ZONE

$N_{j,Rd} =$	420.02	[kN]	Resistance of a spread footing for axial tension	[6.2.8.3]
$F_{T,Rd,y} = F_{t,pl,Rd,y}$				
$F_{T,Rd,y} =$	210.01	[kN]	Resistance of a column base in the tension zone	[6.2.8.3]
$F_{T,Rd,z} = F_{t,pl,Rd,z}$				
$F_{T,Rd,z} =$	210.01	[kN]	Resistance of a column base in the tension zone	[6.2.8.3]

CONNECTION CAPACITY CHECK

$N_{j,Ed} / N_{j,Rd} \leq 1,0$ (6.24)		0.10 < 1.00	verified	(0.10)
$e_y =$	29	[mm]	Axial force eccentricity	[6.2.8.3]
$z_{c,y} =$	90	[mm]	Lever arm $F_{C,Rd,y}$	[6.2.8.1.(2)]
$z_{t,y} =$	125	[mm]	Lever arm $F_{T,Rd,y}$	[6.2.8.1.(3)]
$M_{j,Rd,y} =$	9.86	[kN*m]	Connection resistance for bending	[6.2.8.3]
$M_{j,Ed,y} / M_{j,Rd,y} \leq 1,0$ (6.23)		0.12 < 1.00	verified	(0.12)
$e_z =$	664	[mm]	Axial force eccentricity	[6.2.8.3]
$z_{c,z} =$	70	[mm]	Lever arm $F_{C,Rd,z}$	[6.2.8.1.(2)]
$z_{t,z} =$	125	[mm]	Lever arm $F_{T,Rd,z}$	[6.2.8.1.(3)]
$M_{j,Rd,z} =$	37.05	[kN*m]	Connection resistance for bending	[6.2.8.3]
$M_{j,Ed,z} / M_{j,Rd,z} \leq 1,0$ (6.23)		0.74 < 1.00	verified	(0.74)
$M_{j,Ed,y} / M_{j,Rd,y} + M_{j,Ed,z} / M_{j,Rd,z} \leq 1,0$		0.87 < 1.00	verified	(0.87)

SHEAR

BEARING PRESSURE OF AN ANCHOR BOLT ONTO THE BASE PLATE

Shear force $V_{j,Ed,y}$

$\phi_{d,y} = 0.53$	Coeff. taking account of the bolt position - in the direction of shear	[Table 3.4]
$\phi_{b,y} = 0.53$	Coeff. for resistance calculation $F_{1,vb,Rd}$	[Table 3.4]
$k_{1,y} = 2.50$	Coeff. taking account of the bolt position - perpendicularly to the direction of shear	[Table 3.4]
$F_{1,vb,Rd,y} = k_{1,y} * \phi_{b,y} * f_{up} * d * t_p / \phi_{M2}$		
$F_{1,vb,Rd,y} =$	165.45 [kN]	Resistance of an anchor bolt for bearing pressure onto the base plate [6.2.2.(7)]

Shear force $V_{j,Ed,z}$

$\phi_{d,z} = 0.53$	Coeff. taking account of the bolt position - in the direction of shear	[Table 3.4]
$\phi_{b,z} = 0.53$	Coeff. for resistance calculation $F_{1,vb,Rd}$	[Table 3.4]
$k_{1,z} = 2.50$	Coeff. taking account of the bolt position - perpendicularly to the direction of shear	[Table 3.4]
$F_{1,vb,Rd,z} = k_{1,z} * \phi_{b,z} * f_{up} * d * t_p / \phi_{M2}$		
$F_{1,vb,Rd,z} =$	165.45 [kN]	Resistance of an anchor bolt for bearing pressure onto the base plate [6.2.2.(7)]

SHEAR OF AN ANCHOR BOLT

$\phi_b =$	0.25	Coeff. for resistance calculation $F_{2,vb,Rd}$	[6.2.2.(7)]
$A_{vb} =$	3.14 [cm ²]	Area of bolt section	[6.2.2.(7)]
$f_{ub} =$	800.00 [MPa]	Tensile strength of the anchor material	[6.2.2.(7)]
$\phi_{M2} =$	1.25	Partial safety factor	[6.2.2.(7)]
$F_{2,vb,Rd} = \phi_b * f_{ub} * A_{vb} / \phi_{M2}$			
$F_{2,vb,Rd} =$	49.86 [kN]	Shear resistance of a bolt - without lever arm	[6.2.2.(7)]
$\phi_M =$	2.00	Factor related to the fastening of an anchor in the foundation CEB	[9.3.2.2]
$M_{Rk,s} =$	0.29 [kN*m]	Characteristic bending resistance of an anchor	CEB [9.3.2.2]
$l_{sm} =$	50 [mm]	Lever arm length	CEB [9.3.2.2]
$\phi_{Ms} =$	1.20	Partial safety factor	CEB [3.2.3.2]

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$$F_{v,Rd,sm} = \alpha_M \cdot M_{Rk,s} / (l_{sm} \cdot \alpha_{Ms})$$

$$F_{v,Rd,sm} = 9.64 \quad [\text{kN}] \quad \text{Shear resistance of a bolt - with lever arm} \quad \text{CEB [9.3.1]}$$

CONCRETE PRY-OUT FAILURE

$$N_{Rk,c} = 226.81 \quad [\text{kN}] \quad \text{Design uplift capacity} \quad \text{CEB [9.2.4]}$$

$$k_3 = 2.00 \quad \text{Factor related to the anchor length} \quad \text{CEB [9.3.3]}$$

$$\alpha_{Mc} = 2.16 \quad \text{Partial safety factor} \quad \text{CEB [3.2.3.1]}$$

$$F_{v,Rd,cp} = k_3 \cdot N_{Rk,c} / \alpha_{Mc}$$

$$F_{v,Rd,cp} = 210.01 \quad [\text{kN}] \quad \text{Concrete resistance for pry-out failure} \quad \text{CEB [9.3.1]}$$

CONCRETE EDGE FAILURE

Shear force $V_{j,Ed,y}$

$$V_{Rk,c,y} = 715.8 \quad [\text{kN}] \quad \text{Characteristic resistance of an anchor} \quad \text{CEB [9.3.4.(a)]}$$

$$\alpha_{A,V,y} = 0.67 \quad \text{Factor related to anchor spacing and edge distance} \quad \text{CEB [9.3.4]}$$

$$\alpha_{h,V,y} = 1.00 \quad \text{Factor related to the foundation thickness} \quad \text{CEB [9.3.4.(c)]}$$

$$\alpha_{s,V,y} = 0.90 \quad \text{Factor related to the influence of edges parallel to the shear load direction} \quad \text{CEB [9.3.4.(d)]}$$

$$\alpha_{ec,V,y} = 1.00 \quad \text{Factor taking account a group effect when different shear loads are acting on the individual anchors in a group} \quad \text{CEB [9.3.4.(e)]}$$

$$\alpha_{\phi,V,y} = 1.00 \quad \text{Factor related to the angle at which the shear load is applied} \quad \text{CEB [9.3.4.(f)]}$$

$$\alpha_{ucr,V,y} = 1.00 \quad \text{Factor related to the type of edge reinforcement used} \quad \text{CEB [9.3.4.(g)]}$$

$$\alpha_{Mc} = 2.16 \quad \text{Partial safety factor} \quad \text{CEB [3.2.3.1]}$$

$$F_{v,Rd,c,y} = V_{Rk,c,y} \cdot \alpha_{A,V,y} \cdot \alpha_{h,V,y} \cdot \alpha_{s,V,y} \cdot \alpha_{ec,V,y} \cdot \alpha_{\phi,V,y} \cdot \alpha_{ucr,V,y} / \alpha_{Mc}$$

$$F_{v,Rd,c,y} = 198.85 \quad [\text{kN}] \quad \text{Concrete resistance for edge failure} \quad \text{CEB [9.3.1]}$$

Shear force $V_{j,Ed,z}$

$$V_{Rk,c,z} = 715.8 \quad [\text{kN}] \quad \text{Characteristic resistance of an anchor} \quad \text{CEB [9.3.4.(a)]}$$

$$\alpha_{A,V,z} = 0.67 \quad \text{Factor related to anchor spacing and edge distance} \quad \text{CEB [9.3.4]}$$

$$\alpha_{h,V,z} = 1.00 \quad \text{Factor related to the foundation thickness} \quad \text{CEB [9.3.4.(c)]}$$

$$\alpha_{s,V,z} = 0.90 \quad \text{Factor related to the influence of edges parallel to the shear load direction} \quad \text{CEB [9.3.4.(d)]}$$

$$\alpha_{ec,V,z} = 1.00 \quad \text{Factor taking account a group effect when different shear loads are acting on the individual anchors in a group} \quad \text{CEB [9.3.4.(e)]}$$

$$\alpha_{\phi,V,z} = 1.00 \quad \text{Factor related to the angle at which the shear load is applied} \quad \text{CEB [9.3.4.(f)]}$$

$$\alpha_{ucr,V,z} = 1.00 \quad \text{Factor related to the type of edge reinforcement used} \quad \text{CEB [9.3.4.(g)]}$$

$$\alpha_{Mc} = 2.16 \quad \text{Partial safety factor} \quad \text{CEB [3.2.3.1]}$$

$$F_{v,Rd,c,z} = V_{Rk,c,z} \cdot \alpha_{A,V,z} \cdot \alpha_{h,V,z} \cdot \alpha_{s,V,z} \cdot \alpha_{ec,V,z} \cdot \alpha_{\phi,V,z} \cdot \alpha_{ucr,V,z} / \alpha_{Mc}$$

$$F_{v,Rd,c,z} = 198.85 \quad [\text{kN}] \quad \text{Concrete resistance for edge failure} \quad \text{CEB [9.3.1]}$$

SPLITTING RESISTANCE

$$C_{f,d} = 0.30 \quad \text{Coeff. of friction between the base plate and concrete} \quad [6.2.2.(6)]$$

$$N_{c,Ed} = 0.00 \quad [\text{kN}] \quad \text{Compressive force} \quad [6.2.2.(6)]$$

$$F_{f,Rd} = C_{f,d} \cdot N_{c,Ed}$$

$$F_{f,Rd} = 0.00 \quad [\text{kN}] \quad \text{Slip resistance} \quad [6.2.2.(6)]$$

SHEAR CHECK

$$V_{j,Rd,y} = n_b \cdot \min(F_{1,vb,Rd,y}, F_{2,vb,Rd,y}, F_{v,Rd,sm}, F_{v,Rd,cp}, F_{v,Rd,c,y}) + F_{f,Rd}$$

$$V_{j,Rd,y} = 38.56 \quad [\text{kN}] \quad \text{Connection resistance for shear} \quad \text{CEB [9.3.1]}$$

$$V_{i,Ed,y} / V_{j,Rd,y} \leq 1,0 \quad 0.52 < 1.00 \quad \text{verified} \quad (0.52)$$

$$V_{j,Rd,z} = n_b \cdot \min(F_{1,vb,Rd,z}, F_{2,vb,Rd,z}, F_{v,Rd,sm}, F_{v,Rd,cp}, F_{v,Rd,c,z}) + F_{f,Rd}$$

$$V_{j,Rd,z} = 38.56 \quad [\text{kN}] \quad \text{Connection resistance for shear} \quad \text{CEB [9.3.1]}$$

$$V_{i,Ed,z} / V_{j,Rd,z} \leq 1,0 \quad 0.07 < 1.00 \quad \text{verified} \quad (0.07)$$

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$$V_{j,Ed,y} / V_{j,Rd,y} + V_{j,Ed,z} / V_{j,Rd,z} \leq 1,0 \quad 0.60 < 1.00 \quad \text{verified} \quad (0.60)$$

WELDS BETWEEN THE COLUMN AND THE BASE PLATE

$\sigma_{\square} =$	134.78	[MPa]	Normal stress in a weld	[4.5.3.(7)]
$\sigma_{\square}^{\perp} =$	134.78	[MPa]	Perpendicular tangent stress	[4.5.3.(7)]
$\sigma_{yII} =$	4.27	[MPa]	Tangent stress parallel to $V_{j,Ed,y}$	[4.5.3.(7)]
$\sigma_{zII} =$	-1.42	[MPa]	Tangent stress parallel to $V_{j,Ed,z}$	[4.5.3.(7)]
$\sigma_W =$	0.85		Resistance-dependent coefficient	[4.5.3.(7)]
$\sigma_{\square} / (0.9 \cdot f_u / \sigma_{M2}) \leq 1.0 \quad (4.1) \quad 0.48 < 1.00 \quad \text{verified} \quad (0.48)$				
$\sigma_{\square} (\sigma_{\square}^2 + 3.0 (\sigma_{yII}^2 + \sigma_{zII}^2)) / (f_u / (\sigma_W \cdot \sigma_{M2})) \leq 1.0 \quad (4.1) \quad 0.73 < 1.00 \quad \text{verified} \quad (0.73)$				
$\sigma_{\square} (\sigma_{\square}^2 + 3.0 (\sigma_{zII}^2 + \sigma_{\square}^2)) / (f_u / (\sigma_W \cdot \sigma_{M2})) \leq 1.0 \quad (4.1) \quad 0.03 < 1.00 \quad \text{verified} \quad (0.03)$				

CONNECTION STIFFNESS

Bending moment $M_{j,Ed,y}$

$b_{eff} =$	90	[mm]	Effective width of the bearing pressure zone under the flange	[6.2.5.(3)]
$l_{eff} =$	280	[mm]	Effective length of the bearing pressure zone under the flange	[6.2.5.(3)]
$k_{13,y} = E_c \cdot \sigma (b_{eff} \cdot l_{eff}) / (1.275 \cdot E)$				
$k_{13,y} =$	18	[mm]	Stiffness coeff. of compressed concrete	[Table 6.11]
$l_{eff} =$	144	[mm]	Effective length for a single bolt for mode 2	[6.2.6.5]
$m =$	39	[mm]	Distance of a bolt from the stiffening edge	[6.2.6.5]
$k_{15,y} = 0.425 \cdot l_{eff}^3 \cdot t_p^3 / (m^3)$				
$k_{15,y} =$	8	[mm]	Stiffness coeff. of the base plate subjected to tension	[Table 6.11]
$L_b =$	230	[mm]	Effective anchorage depth	[Table 6.11]
$k_{16,y} = 1.6 \cdot A_b / L_b$				
$k_{16,y} =$	2	[mm]	Stiffness coeff. of an anchor subjected to tension	[Table 6.11]
$\sigma_{0,y} =$	0.75		Column slenderness	[5.2.2.5.(2)]
$S_{j,ini,y} =$	9280.67	[kN*m]	Initial rotational stiffness	[Table 6.12]
$S_{j,rig,y} =$	46521.09	[kN*m]	Stiffness of a rigid connection	[5.2.2.5]
$S_{j,ini,y} < S_{j,rig,y}$ SEMI-RIGID				[5.2.2.5.(2)]

Bending moment $M_{j,Ed,z}$

$k_{13,z} = E_c \cdot \sigma (A_{c,z}) / (1.275 \cdot E)$				
$k_{13,z} =$	18	[mm]	Stiffness coeff. of compressed concrete	[Table 6.11]
$l_{eff} =$	144	[mm]	Effective length for a single bolt for mode 2	[6.2.6.5]
$m =$	39	[mm]	Distance of a bolt from the stiffening edge	[6.2.6.5]
$k_{15,z} = 0.425 \cdot l_{eff}^3 \cdot t_p^3 / (m^3)$				
$k_{15,z} =$	8	[mm]	Stiffness coeff. of the base plate subjected to tension	[Table 6.11]
$L_b =$	230	[mm]	Effective anchorage depth	[Table 6.11]
$k_{16,z} = 1.6 \cdot A_b / L_b$				
$k_{16,z} =$	2	[mm]	Stiffness coeff. of an anchor subjected to tension	[Table 6.11]
$\sigma_{0,z} =$	1.25		Column slenderness	[5.2.2.5.(2)]
$S_{j,ini,z} =$	7171.55	[kN*m]	Initial rotational stiffness	[6.3.1.(4)]
$S_{j,rig,z} =$	16827.43	[kN*m]	Stiffness of a rigid connection	[5.2.2.5]
$S_{j,ini,z} < S_{j,rig,z}$ SEMI-RIGID				[5.2.2.5.(2)]

WEAKEST COMPONENT:

FOUNDATION - CONCRETE CONE PULL-OUT FAILURE

Connection conforms to the code

Ratio

0.87

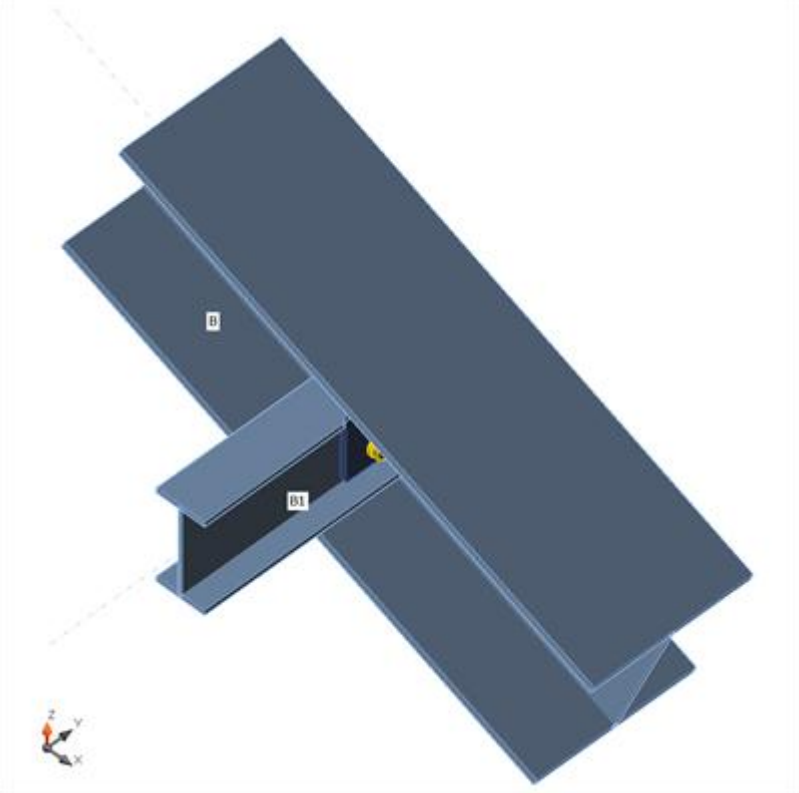
Κύριος έργου: Δήμος Καλαμάτας

Έργο: Κατασκευή ανοιχτού θεάτρου Καλαμάτας

Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in	X [mm]
B	1 - CON1(HEA240)	0.0	23.3	0.0	0	0	0	Node	0
B1	2 - CON1(IPE140)	-90.0	0.0	0.0	0	0	30	Bolts	59



Cross-sections

Name	Material
1 - CON1(HEA240)	S 275
2 - CON1(IPE140)	S 275

Bolts

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm ²]
M16 8.8	M16 8.8	16	800.0	201

Load effects (equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	B1	20.0	-6.0	-25.0	0.0	0.0	0.0

Check

Summary

Name	Value	Status
Analysis	100.0%	OK

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Plates	0.0 < 5%	OK
Bolts	38.1 < 100%	OK
Welds	98.0 < 100%	OK
Buckling	Not calculated	

Plates

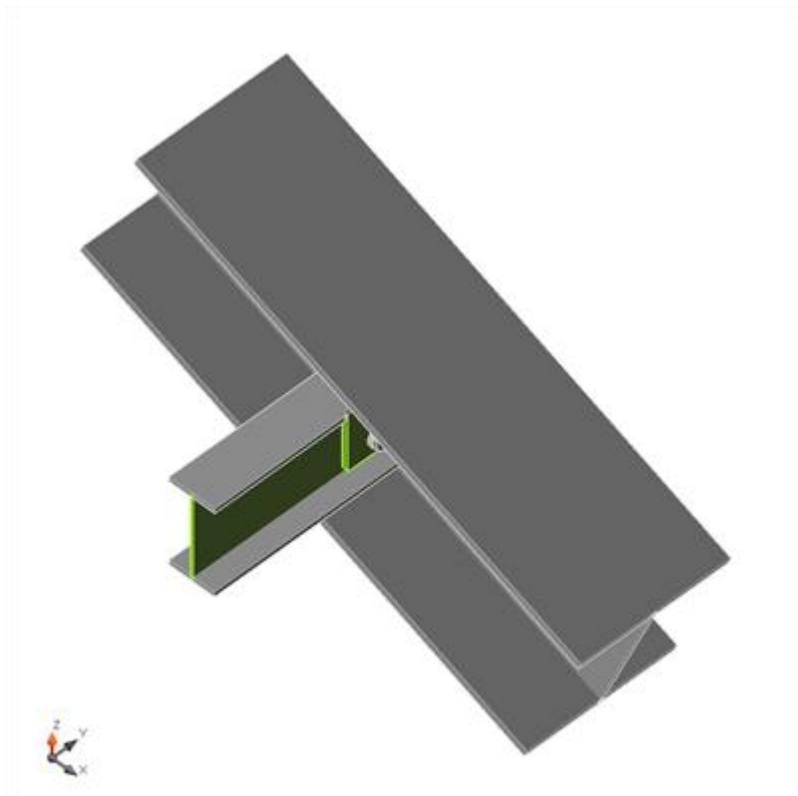
Name	Thickness [mm]	Loads	σ_{Ed} [MPa]	ϵ_{Pl} [1e-4]	Status
B-bfl 1	12.0	LE1	9.3	0.0	OK
B-tfl 1	12.0	LE1	64.2	0.0	OK
B-w 1	7.5	LE1	219.4	0.0	OK
B1-bfl 1	6.9	LE1	221.5	0.0	OK
B1-tfl 1	6.9	LE1	196.8	0.0	OK
B1-w 1	4.7	LE1	258.6	4.1	OK
FP1	10.0	LE1	275.1	3.6	OK

Design data

Material	f_y [MPa]	ϵ_{lim} [1e-4]
S 275	275.0	500.0

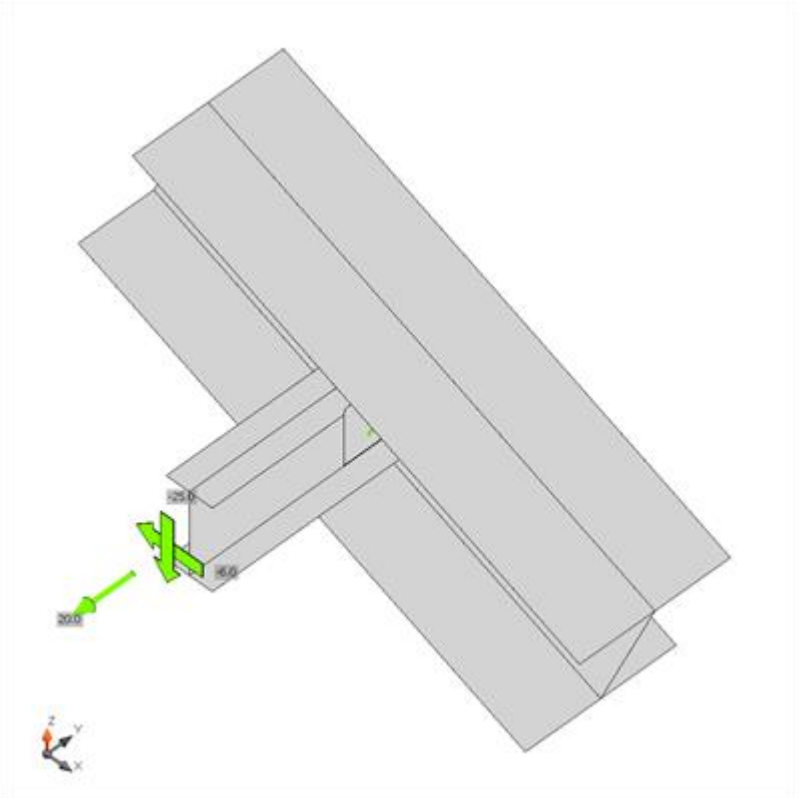
Symbol explanation

ϵ_{Pl}	Strain
σ_{Ed}	Eq. stress
f_y	Yield strength
ϵ_{lim}	Limit of plastic strain

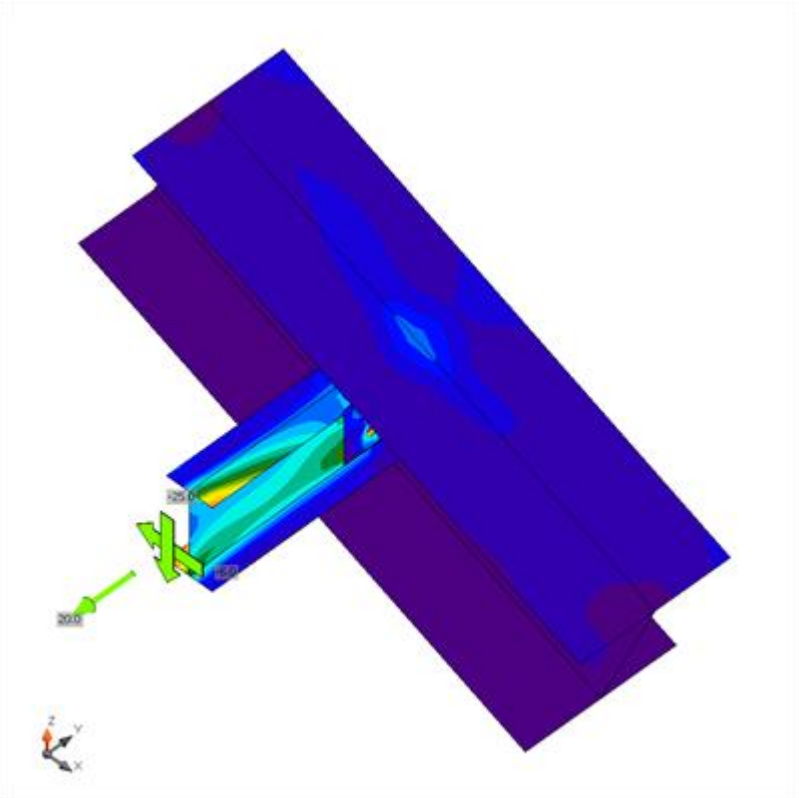


Overall check, LE1

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Strain check, LE1



Equivalent stress, LE1

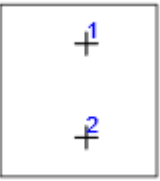
Bolts

	Name	Loads	$F_{t,Ed}$ [kN]	V [kN]	U_{t_t} [%]	$F_{b,Rd}$ [kN]	U_{t_s} [%]	$U_{t_{ts}}$ [%]	Status
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Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

	B1	LE1	15.2	15.7	20.0	56.7	27.7	38.1	OK
	B2	LE1	8.3	16.3	10.8	64.7	27.0	33.5	OK

Design data

Name	F _{t,Rd} [kN]	B _{p,Rd} [kN]	F _{v,Rd} [kN]
M16 8.8 - 1	90.4	76.2	60.3

Symbol explanation

- F_{t,Rd} Bolt tension resistance EN 1993-1-8 tab. 3.4
- F_{t,Ed} Tension force
- B_{p,Rd} Punching shear resistance
- V Resultant of shear forces V_y, V_z in bolt
- F_{v,Rd} Bolt shear resistance EN_1993-1-8 table 3.4
- F_{b,Rd} Plate bearing resistance EN 1993-1-8 tab. 3.4
- U_t Utilization in tension
- U_s Utilization in shear
- U_{ts} Utilization in tension and shear EN 1993-1-8 table 3.4

Welds (Plastic redistribution)

Item	Edge	Throat th. [mm]	Length [mm]	Loads	σ _{w,Ed} [MPa]	ε _{pl} [%]	σ _⊥ [MPa]	τ [MPa]	τ _⊥ [MPa]	U _t [%]	U _c [%]	Status
B-w 1	FP1	5.0	110	LE1	396.6	0.0	184.2	130.7	-155.0	98.0	26.5	OK
		5.0	110	LE1	273.6	0.0	66.2	-116.8	99.2	67.6	20.3	OK

Design data

	β _w [-]	σ _{w,Rd} [MPa]	0.9 σ [MPa]
S 275	0.85	404.7	309.6

Symbol explanation

- ε_{pl} Strain
- σ_{w,Ed} Equivalent stress
- σ_{w,Rd} Equivalent stress resistance
- σ_⊥ Perpendicular stress
- τ_{||} Shear stress parallel to weld axis
- τ_⊥ Shear stress perpendicular to weld axis
- 0.9 σ Perpendicular stress resistance - 0.9*fu/γM2
- β_w Corelation factor EN 1993-1-8 tab. 4.1
- U_t Utilization
- U_{tc} Weld capacity utilization

Buckling

Buckling analysis was not calculated.

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Θέση: Ο.Τ. 1183 του Ρ.Σ Καλαμάτας

Item	Value	Unit	Reference
γ_{M0}	1.00	-	EN 1993-1-1: 6.1
γ_{M1}	1.00	-	EN 1993-1-1: 6.1
γ_{M2}	1.25	-	EN 1993-1-1: 6.1
γ_{M3}	1.25	-	EN 1993-1-8: 2.2
γ_C	1.50	-	EN 1992-1-1: 2.4.2.4
γ_{Inst}	1.20	-	ETAG 001-C: 3.2.1
Joint coefficient β_j	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Weld stress evaluation	Plastic redistribution		
Detailing	No		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance	Yes		ETAG 001-C
Use calculated α_b in bearing check.	Yes		EN 1993-1-8: tab 3.4