

گزارش

CALCULATION CABLE TRAY SUPPORT-ALT02

صفحه 1 از 10

تاریخ تهیه: 1397/07/04

ویرایش: 00



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پروژه بیمارستان شریعتی

گزارش

**CALCULATION CABLE TRAY
SUPPORT-ALT02**



1- Loading

This document has been prepared to show for support analysis under dead loads and seismic loads.

Table 1- Load Cases

#	Load Case Type	Name in Model
1	Dead Load	DEAD
2	Live Load	LIVE
3	Earthquake Load (X)	EX
4	Earthquake Load (Y)	EY
5	Earthquake Load (Z)	EZ

Table 2- Load Combinations

#	Load Combination
1	1.4 DEAD
2	1.2 DEAD + 1.6 LIVE
3	1.2 DEAD + 1.0 LIVE + EX + EZ
4	1.2 DEAD + 1.0 LIVE + EX - EZ
5	1.2 DEAD + 1.0 LIVE - EX + EZ
6	1.2 DEAD + 1.0 LIVE - EX - EZ
7	1.2 DEAD + 1.0 LIVE + EY + EZ
8	1.2 DEAD + 1.0 LIVE + EY - EZ
9	1.2 DEAD + 1.0 LIVE - EY + EZ
10	1.2 DEAD + 1.0 LIVE - EY - EZ
11	0.9 DEAD + EX + EZ
12	0.9 DEAD + EX - EZ
13	0.9 DEAD - EX + EZ
14	0.9 DEAD - EX - EZ
15	0.9 DEAD + EY + EZ
16	0.9 DEAD + EY - EZ
17	0.9 DEAD - EY + EZ
18	0.9 DEAD - EY - EZ
19	1.2 DEAD + 1.0 LIVE + 0.3 EX + EY+EZ
20	1.2 DEAD + 1.0 LIVE + 0.3 EX - EY+EZ
21	1.2 DEAD + 1.0 LIVE - 0.3 EX + EY+EZ
22	1.2 DEAD + 1.0 LIVE - 0.3 EX - EY+EZ
23	1.2 DEAD + 1.0 LIVE + EX + 0.3 EY+EZ
24	1.2 DEAD + 1.0 LIVE + EX - 0.3 EY+EZ
25	1.2 DEAD + 1.0 LIVE - EX + 0.3 EY+EZ
26	1.2 DEAD + 1.0 LIVE - EX - 0.3 EY+EZ
27	1.2 DEAD + 1.0 LIVE + 0.3 EX + EY-EZ
28	1.2 DEAD + 1.0 LIVE + 0.3 EX - EY-EZ
29	1.2 DEAD + 1.0 LIVE - 0.3 EX + EY-EZ



30	1.2 DEAD + 1.0 LIVE - 0.3 EX - EY-EZ
31	1.2 DEAD + 1.0 LIVE + EX + 0.3 EY-EZ
32	1.2 DEAD + 1.0 LIVE + EX - 0.3 EY-EZ
33	1.2 DEAD + 1.0 LIVE - EX + 0.3 EY-EZ
34	1.2 DEAD + 1.0 LIVE - EX - 0.3 EY-EZ

Seismic Loads: ASCE 7 – Chapter 13 – Sec13.2

$$0.3S_{DS}I_PW_P \leq F_P = \frac{0.4a_P S_{DS}I_PW_P}{R_P} \left(1 + 2\left(\frac{Z}{H}\right)\right)$$

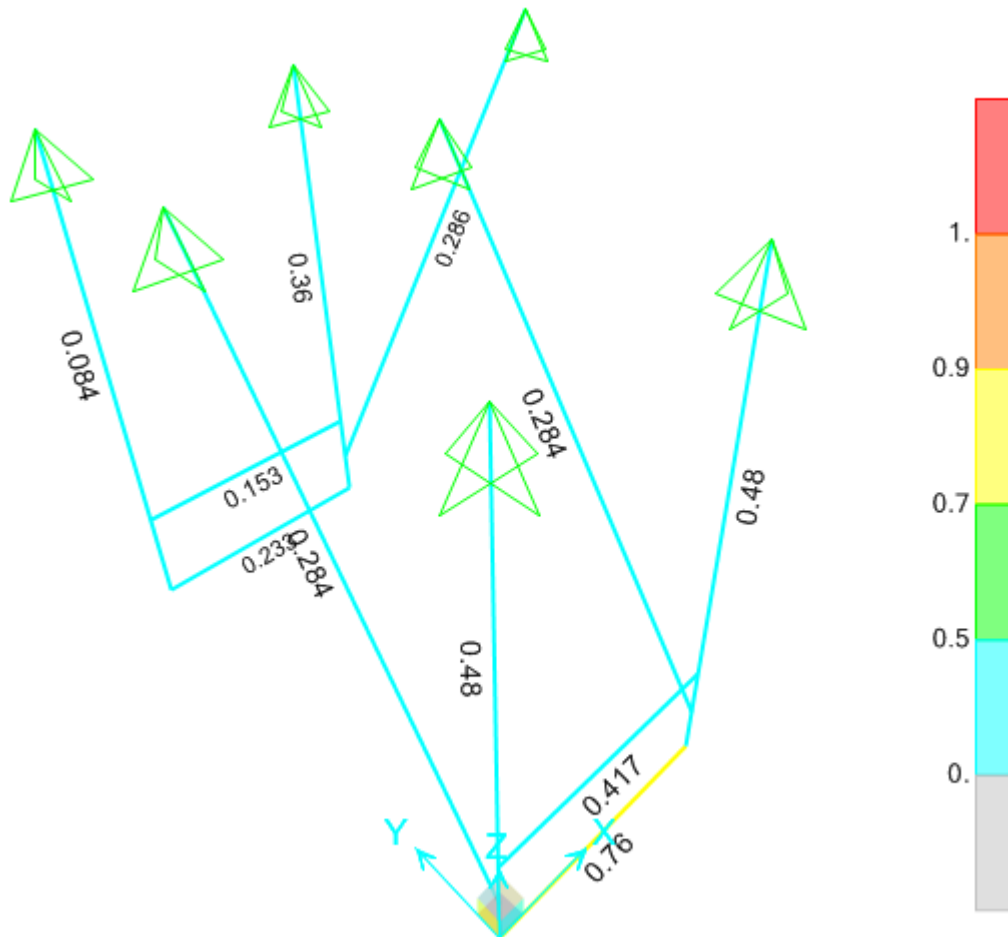
Equipment		1	1
Type	Str	Tray	Tray
SPECIFICATION			
Name	Str	T-50	T-50
Width (cm)	-	50	50
DEAD LOAD			
Unit Weight (kg/m)	-	40	25
Frame Spacing (m)	-	1.5	1.5
Loading Width (cm)	-	50	50
Weight (kg)	10	60	37.5
Distributed Dead Load (kg/cm)	-	1.2	0.75
Point Dead Load (kg)	0	0	0
LIVE LOAD			
Point Live Load (kg)	-	-	-
SEISMIC LOADS			
Z (m)	15.5	15.5	15.5
H (m)	68.8	68.8	68.8
I _p	1.4	1.4	1.4
a _p	2.5	2.5	2.5
S _{DS}	1.1629	1.1629	1.1629
R _p	6	6	6
C _{min}	0.488	0.488	0.488
C _{max}	2.605	2.605	2.605
C _{calc}	0.3936	0.3936	0.3936
C _x =C _y	0.488	0.488	0.488
C _z	0.326	0.326	0.326
Space Number of X Brace (S _x)	2	2	2



Space Number of Y Brace (Sy)	4	4	4
$F_x=C_{x/y}W (S_x)$	9.8	1.2	0.7
$F_y=C_{x/y}W (S_y)$	19.5	2.3	1.5
$F_z=C_zW$	3.3	0.4	0.2

2- Modeling & Design According to AISI-LRFD96 (SAP2000)

The structure was modeled in SAP2000 V19.2.2.



Stress Ration, According to AISI-LRFD96

3- Manual Design of Support According to AISI-2010

Design Basis:



Design basis is based on Load and Resistance Factor Design (LRFD) principles. The design shall be performed in accordance with following Equation:

$$R_u \leq \Phi R_n$$

- R_u = Required strength
- Φ = Resistance factor
- R_n = Nominal strength
- ΦR_n = Design strength

Abbreviations for Nominal Strength and Ultimate Applied Load:

- P_u : Applied factored compression
- P_n : Nominal axial compression strength
- T_u : Applied factored tension
- T_n : Nominal axial tensile strength
- V_u : Applied factored shear
- V_n : Nominal shear strength
- T_{Qu} : Applied factored torsion
- T_{Qn} : Nominal torsional strength
- M_u : Flexural applied factored moments
- M_n : Nominal flexural strength

Header		Description	Unit	
Section Specification		Member ID	-	Beam
		Section Name	-	
		Width	cm	3.50
		Height	cm	3.50
		Thickness	cm	0.15
		Hole Diameter Web 1	cm	1.05
		Hole Diameter Web 2	cm	3.50
		I _z	cm ⁴	3.53
		I _y	cm ⁴	3.04
		F _y	kg/cm ²	2350.00
		F _u	kg/cm ²	3750.00
		E	kg/cm ²	2000000.00
	(T)	Yieldin g in Cross Section	A _g	cm ²
		Φ _t	-	0.90



	Rupture in Net Section (Away from Connection)	$T_n = A_g F_y$	kg	4159.50	
		$\Phi_t T_n$	kg	3743.55	
		A_n	cm ²	1.61	
		Φ_t	-	0.75	
		$T_n = A_n F_u$	kg	6046.88	
		$\Phi_t T_n$	kg	4535.16	
		Total	$\Phi_t T_n$	kg	3743.55
			T_u	kg	0.00
			$R = T_u / \Phi_t T_n$	≤ 1	0.00
(M) BENDING	Z-Axis-22	S_{eZ}	cm ³	2.02	
		Φ_b	-	0.90	
		$M_{nz} = S_{eZ} F_y$	kg.cm	4747.00	
		$\Phi_b M_{nz}$	kg.cm	4272.30	
		M_{uz}	kg.cm	986.00	
		$R = M_{uz} / \Phi_b M_{nz}$	≤ 1	0.23	
	Y-Axis-33	S_{eY}	cm ³	1.60	
		Φ_b	-	0.90	
		$M_{ny} = S_{eY} F_y$	kg.cm	3760.00	
		$\Phi_b M_{ny}$	kg.cm	3384.00	
		M_{uy}	kg.cm	1644.00	
		$R = M_{uy} / \Phi_b M_{ny}$	≤ 1	0.49	
(V) SHEAR	Z-Axis	A_v	cm ²	0.53	
		Φ_v	-	0.95	
		h/t	-	23.33	
		F_v	kg/cm ²	1410.00	
		$V_{nz} = A_v F_v$	kg	740.25	
		$\Phi_v V_{nz}$	kg	703.24	
		V_{uz}	kg	10.00	
		$R = V_{uz} / \Phi_v V_{nz}$	≤ 1	0.01	
		Y-Axis	A_v	cm ²	1.05
	Φ_v		-	0.95	
	h/t		-	23.33	

		F_v	kg/cm ²	1410.00
		$V_{ny}=A_v F_v$	kg	1480.50
		$\Phi_v V_{ny}$	kg	1406.48
		V_{uy}	kg	2.00
		$R=V_{uy}/\Phi_v V_{ny}$	<=1	0.00
(C) COMPRESSION	Spec.	A_g	cm ²	1.77
		Φ_c	-	0.85
	Elastic Flexural Stress	L	cm	70.00
		rz	cm	1.41
		ry	cm	1.31
		K	-	1.00
		$\lambda=KL/r_{min}$	-	53.41
		$F_{eF}=\pi^2 E/\lambda^2$	kg/cm ²	6911.84
		Torsional Buckling	A	cm ²
	L_t		cm	70.00
	r_0		cm	1.93
	C_w		cm ⁶	4.69
	G		kg/cm ²	769231.00
	K_t		-	1.00
	J		cm ⁴	0.020
	ν		-	0.30
	$\lambda=KL/r$		-	36.33
	F_{eT}		kg/cm ²	13003.73
	Flexural-Torsional Buckling	$F_{FT}=F_{eF}.F_{eT}/(F_{eF}+F_{eT})$	kg/cm ²	4513.04
	Total	$F_e=\min\{F_{eF},F_{eT},F_{FT}\}$	kg/cm ²	4513.04
$\lambda_c=(F_y/F_e)^{0.5}$		-	0.72	
F_n		kg/cm ²	1284.49	
$P_n=A_g F_n$		kg	2207.00	
$\Phi_c P_n$		kg	1876.00	
P_u		kg	0.00	



		$R = P_u / \Phi_c P_n$	≤ 1	0.00
INTERACTION	V + M	$R = [(M_{uy} / \Phi_b M_{ny})^2 + (V_{uz} / \Phi_v V_{nz})^2]^{0.5}$	≤ 1	0.49
	T + M	$R = (M_{uy} / \Phi_b M_{ny}) + (M_{uz} / \Phi_b M_{nz}) + (T_u / \Phi_t T_n)$	≤ 1	0.72
	C + M	$R = (M_{uy} / \Phi_b M_{ny}) + (M_{uz} / \Phi_b M_{nz}) + (P_u / \Phi_c P_n)$	≤ 1	0.72
	V + M	$R = [(M_{uz} / \Phi_b M_{nz})^2 + (V_{uy} / \Phi_v V_{ny})^2]^{0.5}$	≤ 1	0.23

Design Connections:

Use: M10 FAZ II Anchor

$$\Phi_t T_n = 0.55 \times 9.3 \text{ KN} \\ = 5.1 \text{ KN}$$

$$\Phi_v V_n = 0.75 \times 16 \text{ KN} = 12 \text{ KN}$$

$$T_u \quad , \quad V_u \quad \dots$$
Anchor Design

Joint No	Load Combination	F1 (kN)	F2 (kN)	F3 (kN)	$T = T_u / \Phi_t T_n$	$V = V_u / \Phi_v V_n$	T+V	Req. Anchor No.
1	Env	0.0	0.0	2.3	0.5	0.0	0.5	0.4
1	Env	0.0	0.0	-1.3	0.0	0.0	0.0	0.0
3	Env	0.0	0.0	2.3	0.5	0.0	0.5	0.4
3	Env	0.0	0.0	-1.3	0.0	0.0	0.0	0.0
5	Env	0.0	0.0	0.7	0.1	0.0	0.1	0.1
5	Env	0.0	0.0	0.3	0.1	0.0	0.1	0.1
6	Env	0.0	0.0	2.4	0.5	0.0	0.5	0.4
6	Env	0.0	0.0	-1.3	0.0	0.0	0.0	0.0
7	Env	0.0	1.1	1.6	0.3	0.1	0.4	0.3
7	Env	0.0	-1.1	-1.6	0.0	0.1	0.1	0.1
9	Env	0.0	1.1	1.6	0.3	0.1	0.4	0.3
9	Env	0.0	-1.1	-1.6	0.0	0.1	0.1	0.1
18	Env	1.1	0.0	1.6	0.3	0.1	0.4	0.3
18	Env	-1.1	0.0	-1.6	0.0	0.1	0.1	0.1



Joint No.	Member Type	Anchor Type	Calculated Anchor No.	Rounded Anchor No.
1	COL	FAZ II M10	0.4	2
3	COL	FAZ II M10	0.4	2
5	COL	FAZ II M10	0.1	2
6	COL	FAZ II M10	0.4	2
7	BR-Y	FAZ II M10	0.3	1
9	BR-Y	FAZ II M10	0.3	1
18	BR-X	FAZ II M10	0.3	1

Connection Point (Profile to Profile) Loads (Worst Case)		
TP-SL		
Slipping Load	1	KN
Bolt Type	M10	-
Bolt No.	2	-
Slipping Load on Single Surface Lock	0.5	KN
Recommended Slip Resistance	6	KN
Safety Factor	12.000	OK
MF2		
Load on Single Corner Fitting	1	KN
Recommended Resistance	10	KN
Safety Factor	10	OK
Bolt Strength (Profile to Profile) Loads (Worst Case)		
Shear Load	1	KN
Bolt Type	M10	-
Bolt No.	2	-
Shear Load on Single Bolt	0.5	KN
Recommended Load	12.81	KN
Safety Factor	25.620	OK
Tension Load on Single Bolt	0.5	KN
Recommended Load	17.59	KN
Safety Factor	35.180	OK
Connection Point (Profile to Mount) Loads (Worst Case)		
Surface Lock Strength		



Slipping Load	4.5	KN
Bolt Type	M10	-
Bolt No.	2	-
Slipping Load on Single Surface Lock	2.25	KN
Recommended Slip Resistance	7	KN
Safety Factor	3.111	OK
TB-SB 35*35*1.5		
Tension Load on Base Connection Fitting	2.5	KN
Recommended Resistance	6	KN
Safety Factor	2.4	OK
Bolt Strength (Profile to Mount) Loads (Worst Case)		
Shear Load	0.2	KN
Bolt Type	M10	-
Bolt No.	2	-
Shear Load on Single Bolt	2.25	KN
Recommended Load	12.81	KN
Safety Factor	64	OK