



1.0 INPUT

1.1 Design Options

Foundation Type

Design Code

Unit

British Standard

SI Unit

1.2 Vessel Data

Vessel Number

VV123

Vessel Diameter

 $D_v = 2200$ mm

Vessel Height

 $H_v = 20000$ mm

Vessel Shell Thickness

 $T_s = 15$ mm

Bolt Center Diameter

 $D_{bcd} = 2000$ mm

Skirt Height

 $H_s = 1000$ mm

Corrosion Reduction Allowance

 $C_{af} = 0$ %

1.3 Foundation

Multi Pedestal

False

Pedestal Radially Aligned

True

Depth of Foundation

 $D_f = 1200$ mm

Pedestal Geometry

Octagonal

Size of Pedestal

 $L_p = 2500$ mm

Height of Pedestal Above Ground

 $H_{ag} = 750$ mm

Footing Geometry

Square

Size of Footing

 $L_f = 6000$ mm

Thickness of Footing

 $T_f = 500$ mm

1.3.1 Soil Cover

Reduction in Soil Cover

 $S_{rv} = 100$ mm

1.4 Soil

Allowable Safe Bearing Pressure

SBC = 300 kN/m²

Allowable Increase of SBC in Test

SBC_t = 20 %

Allowable Increase of SBC in Wind

SBC_w = 33 %

Allowable Increase of SBC in Seismic

SBC_s = 33 %

Contact Percentage

C_p = 85 %

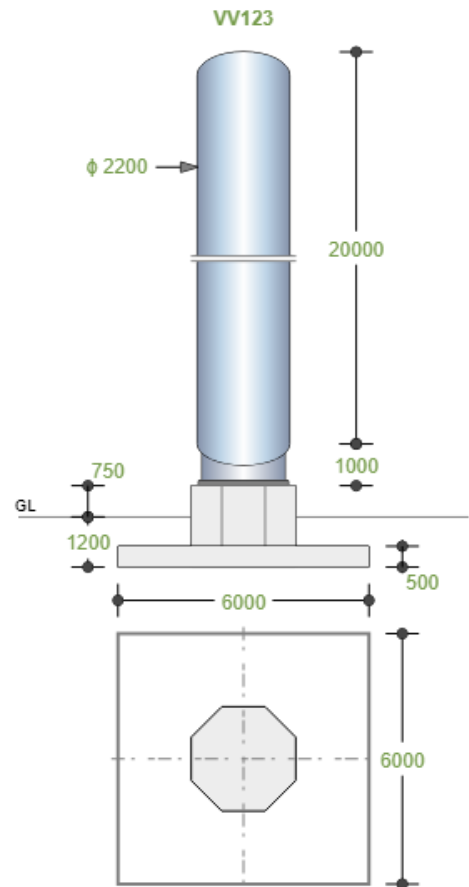
Density of Soil

 $\gamma_{soil} = 18$ kN/m³

Density of Ground Water

 $\gamma_w = 9.81$ kN/m³

Angle of Internal Friction

 $\Phi = 33$ deg

Pedestal: Octagonal - Size :2500

Co-efficient of Friction	μ	= 0.4
Poisson's Ratio	ν	= 0.28
Consider Ground Water Level		Yes
Ground Water Table depth below ground	H_{wt}	= 460 mm

1.5 Reinforced Concrete Properties

Density of Concrete	γ_{conc}	= 24 kN/m³
Modulus of Elasticity of Steel	E_s	= 200 kN/mm²
Strength of Concrete	f_{cu}	= 35 N/mm²
Strength of Reinforcement	f_y	= 500 N/mm²
Strength of Links	f_{yv}	= 500 N/mm²

1.6 Material Partial Safety Factors

Concrete in Flexure/Compression	γ_{mc}	= 1.5
Concrete in Shear	γ_{mcs}	= 1.25
Reinforcement	γ_{ms}	= 1.15

1.7 Stability Safety Factors

F.O.S against Sliding	γ_{Slide}	= 1.5
F.O.S against Overturning	γ_{Over}	= 1.5
F.O.S against Uplift	γ_{Up}	= 1.2

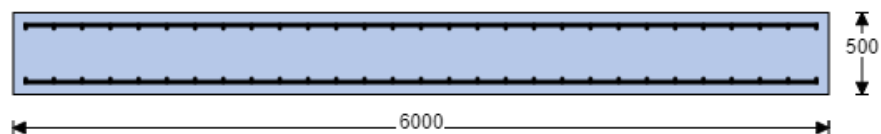
1.8 Crack Width

Check for Crack Width		Yes
Crack Width for		All Load Combinations (SLS)
Allowable Crack Width	W_c	= 0.2 mm

1.9 Reinforcement

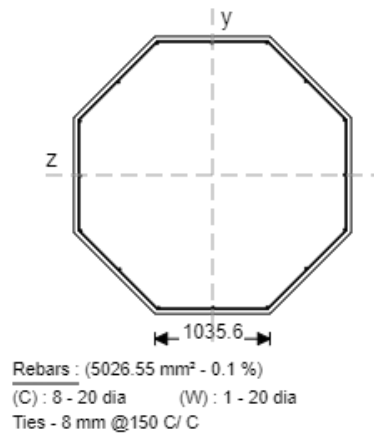
Clear Cover for Pedestal	C_p	= 50 mm
Clear Cover for Footing	C_f	= 50 mm

1.9.1 Pad Reinforcement Details



X - Direction - Bottom : #16 @ 150 mm C/C (1340.4 mm² - 0.27 %)
Top : #16 @ 150 mm C/C (1340.4 mm² - 0.27 %)
Z - Direction - Bottom : #12 @ 200 mm C/C (565.5 mm² - 0.11 %)
Top : #12 @ 200 mm C/C (565.5 mm² - 0.11 %)

1.9.2 Pedestal Reinforcement Details



1.10 Anchor Bolts Details

Bolt Grade	f_b	= 4.6
Bolt Yield Strength	Y_b	= 240 N/mm²
Bolt Ultimate Strength of Bolt	U_b	= 400 N/mm²
Bolt Size	d	= 24 mm
No of Anchor Bolts per pedestal	N_{ab}	= 4
Spacing in X - Direction	S_x	= 300 mm
Spacing in Z - Direction	S_z	= 1200 mm
Anchorage Tension Capacity	C_t	= 50 kN
Anchorage Shear Capacity	C_s	= 50 kN

1.11 Wind Load - Program (ASCE-7 2005)

Effective Length	L_{eff}	= 7000 mm
Effective Diameter	D_{eff}	= 1500 mm
Effective Height	H_{eff}	= 3000 mm
Basic Wind Speed	V	= 25 m/s
Site Altitude	Delta	= 100 m
Distance of Upwind Crest	L_h	= 25 m
Distance From Crest to Site	SL	= 5 m
Exposure Type	Terrain	= C
Importance Category	Category	= 2
Topography Condition	Topography	= Ridges
Wind Direction	Direction	= Upwind
Structure Shape	Shape	= Round
Surface Type	Surface	= Rough

1.12 Seismic Load - Program (ASCE-7 2005)

Site Class		= B
Spectral Acceleration 0.2 Sec	S_s	= 0.570

Spectral Acceleration 1 Sec	S_1	=	0.170
Short Period Site Coefficient	F_a	=	0.300
Long Period Site Coefficient	F_v	=	0.500
Importance Factor	I	=	1.500

1.13 Load Case / Load Data

1.13.1 Vessel Loads

Load Case	Notation	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kN)	M_z (kN)
Dead Load	Ds					
Fabricated Erection Weight	Df		12			
Empty Weight	De	21	22	23	24	25
Operating Weight	Do		32			
Test Weight	Dt		42			
Live Load	L		52			
Sustained Thermal Load from Piping	Tsp					

1.13.2 Environment Loads

Description	Shear (kN)	Moment (kN.m)
Wind	200	2000
Seismic	150	1500

1.14 Serviceability Load Combinations (BS 8110)

Comb No	Combination
SLS1	Ds + Do + Tsp
SLS2	Ds + Dt
SLS3	Ds + Do + Tsp + L
SLS4	Ds + Dt + L
SLS5	Ds + Do + Tsp + 0.75L
SLS6	Ds + Dt + 0.75L
SLS7	Ds + Do + Tsp + 0.6WX
SLS8	Ds + Do + Tsp - 0.6WX
SLS9	Ds + Do + Tsp + 0.6WZ
SLS10	Ds + Do + Tsp - 0.6WZ
SLS11	Ds + Do + Tsp + 0.7EoX
SLS12	Ds + Do + Tsp - 0.7EoX
SLS13	Ds + Do + Tsp + 0.7EoZ
SLS14	Ds + Do + Tsp - 0.7EoZ
SLS15	Ds + Dt + 0.45WX
SLS16	Ds + Dt - 0.45WX
SLS17	Ds + Dt + 0.45WZ
SLS18	Ds + Dt - 0.45WZ
SLS19	Ds + Do + Tsp + 0.75L + 0.45WX

1.14 Serviceability Load Combinations (BS 8110)

Comb No	Combination
SLS20	$D_s + D_o + T_{sp} + 0.75L - 0.45W_X$
SLS21	$D_s + D_o + T_{sp} + 0.75L + 0.45W_Z$
SLS22	$D_s + D_o + T_{sp} + 0.75L - 0.45W_Z$
SLS23	$D_s + D_t + 0.75L + 0.34W_X$
SLS24	$D_s + D_t + 0.75L - 0.34W_X$
SLS25	$D_s + D_t + 0.75L + 0.34W_Z$
SLS26	$D_s + D_t + 0.75L - 0.34W_Z$
SLS27	$D_s + D_o + T_{sp} + 0.75L + 0.53E_oX$
SLS28	$D_s + D_o + T_{sp} + 0.75L - 0.53E_oX$
SLS29	$D_s + D_o + T_{sp} + 0.75L + 0.53E_oZ$
SLS30	$D_s + D_o + T_{sp} + 0.75L - 0.53E_oZ$
SLS31	$0.6D_s + 0.6D_f + 0.45W_X$
SLS32	$0.6D_s + 0.6D_f - 0.45W_X$
SLS33	$0.6D_s + 0.6D_f + 0.45W_Z$
SLS34	$0.6D_s + 0.6D_f - 0.45W_Z$
SLS35	$0.6D_s + 0.6D_e + 0.6W_X$
SLS36	$0.6D_s + 0.6D_e - 0.6W_X$
SLS37	$0.6D_s + 0.6D_e + 0.6W_Z$
SLS38	$0.6D_s + 0.6D_e - 0.6W_Z$
SLS39	$0.6D_s + 0.6D_o + 0.6W_X$
SLS40	$0.6D_s + 0.6D_o - 0.6W_X$
SLS41	$0.6D_s + 0.6D_e + 0.7E_eX$
SLS42	$0.6D_s + 0.6D_e - 0.7E_eX$
SLS43	$0.6D_s + 0.6D_e + 0.7E_eZ$
SLS44	$0.6D_s + 0.6D_e - 0.7E_eZ$
SLS45	$0.6D_s + 0.6D_o + T_{sp} + 0.7E_oX$
SLS46	$0.6D_s + 0.6D_o + T_{sp} - 0.7E_oX$
SLS47	$0.6D_s + 0.6D_o + T_{sp} + 0.7E_oZ$
SLS48	$0.6D_s + 0.6D_o + T_{sp} - 0.7E_oZ$

1.15 Ultimate Load Combinations (BS 8110)

Comb No	Combination
ULS1	$1.4D_s + 1.4D_o + 1.2T_{sp}$
ULS2	$1.4D_s + 1.4D_t$
ULS3	$1.2D_s + 1.2D_o + 1.2T_{sp} + 1.6L$
ULS4	$1.2D_s + 1.2D_t + 1.6L$
ULS5	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5L$
ULS6	$1.2D_s + 1.2D_t + 0.5L$
ULS7	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5W_X$
ULS8	$1.2D_s + 1.2D_o + 1.2T_{sp} - 0.5W_X$
ULS9	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5W_Z$
ULS10	$1.2D_s + 1.2D_o + 1.2T_{sp} - 0.5W_Z$
ULS11	$1.2D_s + 1.2D_t + 0.5W_X$

1.15 Ultimate Load Combinations (BS 8110)

Comb No	Combination
ULS12	$1.2D_s + 1.2D_t - 0.5W_X$
ULS13	$1.2D_s + 1.2D_t + 0.5W_Z$
ULS14	$1.2D_s + 1.2D_t - 0.5W_Z$
ULS15	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5L + W_X$
ULS16	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5L - W_X$
ULS17	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5L + W_Z$
ULS18	$1.2D_s + 1.2D_o + 1.2T_{sp} + 0.5L - W_Z$
ULS19	$1.2D_s + 1.2D_t + 0.5L + 0.75W_X$
ULS20	$1.2D_s + 1.2D_t + 0.5L - 0.75W_X$
ULS21	$1.2D_s + 1.2D_t + 0.5L + 0.75W_Z$
ULS22	$1.2D_s + 1.2D_t + 0.5L - 0.75W_Z$
ULS23	$1.2D_s + D_o + T_{sp} + 0.5L + E_oX$
ULS24	$1.2D_s + D_o + T_{sp} + 0.5L - E_oX$
ULS25	$1.2D_s + D_o + T_{sp} + 0.5L + E_oZ$
ULS26	$1.2D_s + D_o + T_{sp} + 0.5L - E_oZ$
ULS27	$0.9D_s + 0.9D_f + 0.75W_X$
ULS28	$0.9D_s + 0.9D_f - 0.75W_X$
ULS29	$0.9D_s + 0.9D_f + 0.75W_Z$
ULS30	$0.9D_s + 0.9D_f - 0.75W_Z$
ULS31	$0.9D_s + 0.9D_e + W_X$
ULS32	$0.9D_s + 0.9D_e - W_X$
ULS33	$0.9D_s + 0.9D_e + W_Z$
ULS34	$0.9D_s + 0.9D_e - W_Z$
ULS35	$0.9D_s + 0.9D_o + 1.2T_{sp} + W_X$
ULS36	$0.9D_s + 0.9D_o + 1.2T_{sp} - W_X$
ULS37	$0.9D_s + 0.9D_o + 1.2T_{sp} + W_Z$
ULS38	$0.9D_s + 0.9D_o + 1.2T_{sp} - W_Z$
ULS39	$0.9D_s + 0.9D_e + E_eX$
ULS40	$0.9D_s + 0.9D_e - E_eX$
ULS41	$0.9D_s + 0.9D_e + E_eZ$
ULS42	$0.9D_s + 0.9D_e - E_eZ$
ULS43	$0.9D_s + 0.9D_o + 1.2T_{sp} + E_oX$
ULS44	$0.9D_s + 0.9D_o + 1.2T_{sp} - E_oX$
ULS45	$0.9D_s + 0.9D_o + 1.2T_{sp} + E_oZ$
ULS46	$0.9D_s + 0.9D_o + 1.2T_{sp} - E_oZ$

2.0 OUTPUT

2.1 Location of Pedestals

Location No	Pedestal Type	Location (mm)		Rotation (deg)
		X	Z	

2.1 Location of Pedestals

Location No	Pedestal Type	Location (mm)		Rotation (deg)
		X	Z	
L1	PT1	3000	3000	0

2.2 Wind Load Calculation - Program(ASCE-7 2005)

Description	Formulae	Trans.	Clause
Importance Factor	I	1	Table 6-1
Wind Directionality Factor	K_d	0.95	Table 6-4
Topographic Factor (K_1)	K_1	5.8	Fig 6-4
Topographic Factor (K_2)	$K_2 = 1 - \left(\frac{ x }{\mu * L_h} \right)$	0.867	
Topographic Factor (K_3)	$K_3 = e^{\left(\frac{-V * H_{eff}}{L_h} \right)}$	0.698	
Topographic Factor	$K_{zt} = (1 + K_1 * K_2 * K_3)^2$	20.313	Fig 6 - 4
Gust Effect Factor	$G = 0.925 * \left(\frac{1 + 1.7 * I_z * \sqrt{g_q^2 * Q^2 + g_r^2 * R^2}}{1 + 1.7 * g_v * I_z} \right)$	0.85	Cl. 6.5.8
Velocity pressure Exposure Coefficient	K_z	0.85	Cl. 6.5.6.6
Force Coefficient	C_f	0.717	Fig 6 - 21
Wind Pressure(N/m ²)	$q_z = 0.613 * K_z * K_{zt} * K_e * K_d * V^2$	6284.102	Cl. 6.5.10

2.2.1 Wind Load from Pressure

Direction	Shear			Moment	
	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kN.m)	M_z (kN.m)
Trans.	18.722	0	0	0	-28.082
Long.	0	0	18.722	28.082	0

2.3 Seismic Load Calculation - Program(ASCE-7 2005)

2.3.1 Seismic Shear

Component Amplification Factor	a_p	= 2.500	Table 13.6-1
Component Response Modification Factor	R_p	= 2.500	Table 13.6-1
Spectral Response Accel.at 0.2 sec	S_{Ds}	= 0.000	Table 11.4-3
Seismic Shear	V_s	= 21.888 kN	Eq 13.3-1

2.3.2 Seismic Load from Shear

Description	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kN.m)	M_z (kN.m)
Seismic Load (Equipment - Operating)					
Trans.	21.888	0.000	0.000	0.000	-229.824

Description	F _x (kN)	F _y (kN)	F _z (kN)	M _x (kN.m)	M _z (kN.m)
Longi.	0.000	0.000	21.888	229.824	0.000
Seismic Load(Equipment - Empty)					
Trans.	15.048	0.000	0.000	0.000	-158.004
Longi.	0.000	0.000	15.048	158.004	0.000

2.4 Loads on Pedestal

Load Cases	Horizontal F _x (kN)	Vertical F _y (kN)	Horizontal F _z (kN)	Moment M _x (kN.m)	Moment M _z (kN.m)
Erection	0	12	0	0	0
Empty	21	22	23	24	25
Operating	0	32	0	0	0
Test	0	42	0	0	0
Piping Thermal	0	0	0	0	0
Live	0	52	0	0	0
Snow	0	0	0	0	0
Wind - trans	18.722	0	0	0	-28.082
Wind - Long	0	0	18.722	28.082	0
Seismic - Trans (Oper)	21.888	0	0	0	-229.824
Seismic - Long (Oper)	0	0	21.888	229.824	0
Seismic - Trans (Emp)	15.048	0	0	0	-158.004
Seismic - Long (Emp)	0	0	21.888	229.824	0

2.5 Service Loads on Pedestal

2.5.1 Unfactored Load on Pedestal - 1

Load Comb.	Horizontal F _x (kN)	Vertical F _y (kN)	Horizontal F _z (kN)	Moment M _x (kN.m)	Moment M _y (kN.m)	Moment M _z (kN.m)
SLS1	0.000	32.000	0.000	0.000	0.000	0.000
SLS2	0.000	42.000	0.000	0.000	0.000	0.000
SLS3	0.000	84.000	0.000	0.000	0.000	0.000
SLS4	0.000	94.000	0.000	0.000	0.000	0.000
SLS5	0.000	71.000	0.000	0.000	0.000	0.000
SLS6	0.000	81.000	0.000	0.000	0.000	0.000
SLS7	11.233	32.000	0.000	0.000	0.000	-16.849
SLS8	-11.233	32.000	0.000	0.000	0.000	16.849
SLS9	0.000	32.000	11.233	16.849	0.000	0.000
SLS10	0.000	32.000	-11.233	-16.849	0.000	0.000
SLS11	15.322	32.000	0.000	0.000	0.000	-160.877
SLS12	-15.322	32.000	0.000	0.000	0.000	160.877
SLS13	0.000	32.000	15.322	160.877	0.000	0.000
SLS14	0.000	32.000	-15.322	-160.877	0.000	0.000
SLS15	8.425	42.000	0.000	0.000	0.000	-12.637

Load Comb.	Horizontal F_x (kN)	Vertical F_y (kN)	Horizontal F_z (kN)	Moment M_x (kN.m)	Moment M_y (kN.m)	Moment M_z (kN.m)
SLS16	-8.425	42.000	0.000	0.000	0.000	12.637
SLS17	0.000	42.000	8.425	12.637	0.000	0.000
SLS18	0.000	42.000	-8.425	-12.637	0.000	0.000
SLS19	8.425	71.000	0.000	0.000	0.000	-12.637
SLS20	-8.425	71.000	0.000	0.000	0.000	12.637
SLS21	0.000	71.000	8.425	12.637	0.000	0.000
SLS22	0.000	71.000	-8.425	-12.637	0.000	0.000
SLS23	6.319	81.000	0.000	0.000	0.000	-9.478
SLS24	-6.319	81.000	0.000	0.000	0.000	9.478
SLS25	0.000	81.000	6.319	9.478	0.000	0.000
SLS26	0.000	81.000	-6.319	-9.478	0.000	0.000
SLS27	11.601	71.000	0.000	0.000	0.000	-121.807
SLS28	-11.601	71.000	0.000	0.000	0.000	121.807
SLS29	0.000	71.000	11.601	121.807	0.000	0.000
SLS30	0.000	71.000	-11.601	-121.807	0.000	0.000
SLS31	8.425	7.200	0.000	0.000	0.000	-12.637
SLS32	-8.425	7.200	0.000	0.000	0.000	12.637
SLS33	0.000	7.200	8.425	12.637	0.000	0.000
SLS34	0.000	7.200	-8.425	-12.637	0.000	0.000
SLS35	23.833	13.200	13.800	14.400	0.000	-1.849
SLS36	1.367	13.200	13.800	14.400	0.000	31.849
SLS37	12.600	13.200	25.033	31.249	0.000	15.000
SLS38	12.600	13.200	2.567	-2.449	0.000	15.000
SLS39	11.233	19.200	0.000	0.000	0.000	-16.849
SLS40	-11.233	19.200	0.000	0.000	0.000	16.849
SLS41	23.134	13.200	13.800	14.400	0.000	-95.603
SLS42	2.066	13.200	13.800	14.400	0.000	125.603
SLS43	12.600	13.200	29.122	175.277	0.000	15.000
SLS44	12.600	13.200	-1.522	-146.477	0.000	15.000
SLS45	15.322	19.200	0.000	0.000	0.000	-160.877
SLS46	-15.322	19.200	0.000	0.000	0.000	160.877
SLS47	0.000	19.200	15.322	160.877	0.000	0.000
SLS48	0.000	19.200	-15.322	-160.877	0.000	0.000

2.6 Factored Loads on Pedestal

2.6.1 Factored Load on Pedestal 1

Load Comb.	Horizontal F_x (kN)	Vertical F_y (kN)	Horizontal F_z (kN)	Moment M_x (kN.m)	Moment M_y (kN.m)	Moment M_z (kN.m)
ULS1	0.000	44.800	0.000	0.000	0.000	0.000
ULS2	0.000	58.800	0.000	0.000	0.000	0.000
ULS3	0.000	121.600	0.000	0.000	0.000	0.000
ULS4	0.000	133.600	0.000	0.000	0.000	0.000
ULS5	0.000	64.400	0.000	0.000	0.000	0.000

Load Comb.	Horizontal F_x (kN)	Vertical F_y (kN)	Horizontal F_z (kN)	Moment M_x (kN.m)	Moment M_y (kN.m)	Moment M_z (kN.m)
ULS6	0.000	76.400	0.000	0.000	0.000	0.000
ULS7	9.361	38.400	0.000	0.000	0.000	-14.041
ULS8	-9.361	38.400	0.000	0.000	0.000	14.041
ULS9	0.000	38.400	9.361	14.041	0.000	0.000
ULS10	0.000	38.400	-9.361	-14.041	0.000	0.000
ULS11	9.361	50.400	0.000	0.000	0.000	-14.041
ULS12	-9.361	50.400	0.000	0.000	0.000	14.041
ULS13	0.000	50.400	9.361	14.041	0.000	0.000
ULS14	0.000	50.400	-9.361	-14.041	0.000	0.000
ULS15	18.722	64.400	0.000	0.000	0.000	-28.082
ULS16	-18.722	64.400	0.000	0.000	0.000	28.082
ULS17	0.000	64.400	18.722	28.082	0.000	0.000
ULS18	0.000	64.400	-18.722	-28.082	0.000	0.000
ULS19	14.041	76.400	0.000	0.000	0.000	-21.062
ULS20	-14.041	76.400	0.000	0.000	0.000	21.062
ULS21	0.000	76.400	14.041	21.062	0.000	0.000
ULS22	0.000	76.400	-14.041	-21.062	0.000	0.000
ULS23	21.888	58.000	0.000	0.000	0.000	-229.824
ULS24	-21.888	58.000	0.000	0.000	0.000	229.824
ULS25	0.000	58.000	21.888	229.824	0.000	0.000
ULS26	0.000	58.000	-21.888	-229.824	0.000	0.000
ULS27	14.041	10.800	0.000	0.000	0.000	-21.062
ULS28	-14.041	10.800	0.000	0.000	0.000	21.062
ULS29	0.000	10.800	14.041	21.062	0.000	0.000
ULS30	0.000	10.800	-14.041	-21.062	0.000	0.000
ULS31	37.622	19.800	20.700	21.600	0.000	-5.582
ULS32	0.178	19.800	20.700	21.600	0.000	50.582
ULS33	18.900	19.800	39.422	49.682	0.000	22.500
ULS34	18.900	19.800	1.978	-6.482	0.000	22.500
ULS35	18.722	28.800	0.000	0.000	0.000	-28.082
ULS36	-18.722	28.800	0.000	0.000	0.000	28.082
ULS37	0.000	28.800	18.722	28.082	0.000	0.000
ULS38	0.000	28.800	-18.722	-28.082	0.000	0.000
ULS39	33.948	19.800	20.700	21.600	0.000	-135.504
ULS40	3.852	19.800	20.700	21.600	0.000	180.504
ULS41	18.900	19.800	42.588	251.424	0.000	22.500
ULS42	18.900	19.800	-1.188	-208.224	0.000	22.500
ULS43	21.888	28.800	0.000	0.000	0.000	-229.824
ULS44	-21.888	28.800	0.000	0.000	0.000	229.824
ULS45	0.000	28.800	21.888	229.824	0.000	0.000
ULS46	0.000	28.800	-21.888	-229.824	0.000	0.000

2.7 Soil and Self-Weight of Foundation

Self-Weight of Pad

$$S_{wf} = 432.0 \text{ kN}$$

Self-Weight of Pedestals	$S_{wpd} = 180.2 \text{ kN}$
Minimum Soil Overburden	$SIM_{nWt} = 332.9 \text{ kN}$
Maximum Soil Overburden	$SIM_{xWt} = 388.4 \text{ kN}$
Water Weight above Pad	$W_{rfp} = 72.6 \text{ kN}$
Deduction Weight of Suspended Soil	$SID_{nWt} = 72.6 \text{ kN}$
Buoyancy Deduction Load	$B_{fuf} = 261.3 \text{ kN}$
Total Weight under Min.Soil Condition	$M_{nCwt} = S_{wf} + S_{wpd} + W_{rfp} + SIM_{nWt} - SID_{nWt} - B_{fuf} = 683.7 \text{ kN}$
Total Weight under Max. Soil Condition	$M_{xCwt} = S_{wf} + S_{wpd} + SIM_{xWt} = 1000.5 \text{ kN}$

2.8 Serviceability Check for SLS combinations

2.8.1 Stability Resistance

Load Comb.	Sliding Resistance (kN)			Overturning Resisting Moment (kN.m)					
	Frictional	Passive	Total	Self - X	Self - Z	Passive - X	Passive - Z	Total - X	Total-Z
SLS1	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS2	290.3	0.0	290.3	2177.2	2177.2	0.0	0.0	2177.2	2177.2
SLS3	307.1	0.0	307.1	2303.2	2303.2	0.0	0.0	2303.2	2303.2
SLS4	311.1	0.0	311.1	2333.2	2333.2	0.0	0.0	2333.2	2333.2
SLS5	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS6	305.9	0.0	305.9	2294.2	2294.2	0.0	0.0	2294.2	2294.2
SLS7	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS8	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS9	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS10	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS11	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS12	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS13	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS14	286.3	0.0	286.3	2147.2	2147.2	0.0	0.0	2147.2	2147.2
SLS15	290.3	0.0	290.3	2177.2	2177.2	0.0	0.0	2177.2	2177.2
SLS16	290.3	0.0	290.3	2177.2	2177.2	0.0	0.0	2177.2	2177.2
SLS17	290.3	0.0	290.3	2177.2	2177.2	0.0	0.0	2177.2	2177.2
SLS18	290.3	0.0	290.3	2177.2	2177.2	0.0	0.0	2177.2	2177.2
SLS19	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS20	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS21	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS22	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS23	305.9	0.0	305.9	2294.2	2294.2	0.0	0.0	2294.2	2294.2
SLS24	305.9	0.0	305.9	2294.2	2294.2	0.0	0.0	2294.2	2294.2
SLS25	305.9	0.0	305.9	2294.2	2294.2	0.0	0.0	2294.2	2294.2
SLS26	305.9	0.0	305.9	2294.2	2294.2	0.0	0.0	2294.2	2294.2
SLS27	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS28	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS29	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS30	301.9	0.0	301.9	2264.2	2264.2	0.0	0.0	2264.2	2264.2
SLS31	167.0	0.0	167.0	1252.3	1252.3	0.0	0.0	1252.3	1252.3
SLS32	167.0	0.0	167.0	1252.3	1252.3	0.0	0.0	1252.3	1252.3

Load Comb.	Sliding Resistance (kN)			Overturning Resisting Moment (kN.m)					
	Frictional	Passive	Total	Self - X	Self - Z	Passive - X	Passive - Z	Total - X	Total-Z
SLS33	167.0	0.0	167.0	1252.3	1252.3	0.0	0.0	1252.3	1252.3
SLS34	167.0	0.0	167.0	1252.3	1252.3	0.0	0.0	1252.3	1252.3
SLS35	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS36	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS37	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS38	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS39	171.8	0.0	171.8	1288.3	1288.3	0.0	0.0	1288.3	1288.3
SLS40	171.8	0.0	171.8	1288.3	1288.3	0.0	0.0	1288.3	1288.3
SLS41	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS42	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS43	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS44	169.4	0.0	169.4	1270.3	1270.3	0.0	0.0	1270.3	1270.3
SLS45	171.8	0.0	171.8	1288.3	1288.3	0.0	0.0	1288.3	1288.3
SLS46	171.8	0.0	171.8	1288.3	1288.3	0.0	0.0	1288.3	1288.3
SLS47	171.8	0.0	171.8	1288.3	1288.3	0.0	0.0	1288.3	1288.3
SLS48	171.8	0.0	171.8	1288.3	1288.3	0.0	0.0	1288.3	1288.3

2.8.2 Overturning Check

Load Comb.	Overturning(kN.m)		Resisting(kN.m)		FOS Overturning		
	Moment X	Moment Z	Moment X	Moment Z	Actual X	Actual Z	Allowable
SLS1	0.0	0.0	2147.2	2147.2	100.00	100.00	1.50
SLS2	0.0	0.0	2177.2	2177.2	100.00	100.00	1.50
SLS3	0.0	0.0	2303.2	2303.2	100.00	100.00	1.50
SLS4	0.0	0.0	2333.2	2333.2	100.00	100.00	1.50
SLS5	0.0	0.0	2264.2	2264.2	100.00	100.00	1.50
SLS6	0.0	0.0	2294.2	2294.2	100.00	100.00	1.50
SLS7	0.0	-38.8	2147.2	2147.2	100.00	55.41	1.50
SLS8	0.0	38.8	2147.2	2147.2	100.00	55.41	1.50
SLS9	38.8	0.0	2147.2	2147.2	55.41	100.00	1.50
SLS10	-38.8	0.0	2147.2	2147.2	55.41	100.00	1.50
SLS11	0.0	-190.8	2147.2	2147.2	100.00	11.26	1.50
SLS12	0.0	190.8	2147.2	2147.2	100.00	11.26	1.50
SLS13	190.8	0.0	2147.2	2147.2	11.26	100.00	1.50
SLS14	-190.8	0.0	2147.2	2147.2	11.26	100.00	1.50
SLS15	0.0	-29.1	2177.2	2177.2	100.00	74.91	1.50
SLS16	0.0	29.1	2177.2	2177.2	100.00	74.91	1.50
SLS17	29.1	0.0	2177.2	2177.2	74.91	100.00	1.50
SLS18	-29.1	0.0	2177.2	2177.2	74.91	100.00	1.50
SLS19	0.0	-29.1	2264.2	2264.2	100.00	77.90	1.50
SLS20	0.0	29.1	2264.2	2264.2	100.00	77.90	1.50
SLS21	29.1	0.0	2264.2	2264.2	77.90	100.00	1.50
SLS22	-29.1	0.0	2264.2	2264.2	77.90	100.00	1.50
SLS23	0.0	-21.8	2294.2	2294.2	100.00	100.00	1.50
SLS24	0.0	21.8	2294.2	2294.2	100.00	100.00	1.50

Load Comb.	Overturning(kN.m)		Resisting(kN.m)		FOS Overturning		
	Moment X	Moment Z	Moment X	Moment Z	Actual X	Actual Z	Allowable
SLS25	21.8	0.0	2294.2	2294.2	100.00	100.00	1.50
SLS26	-21.8	0.0	2294.2	2294.2	100.00	100.00	1.50
SLS27	0.0	-144.4	2264.2	2264.2	100.00	15.68	1.50
SLS28	0.0	144.4	2264.2	2264.2	100.00	15.68	1.50
SLS29	144.4	0.0	2264.2	2264.2	15.68	100.00	1.50
SLS30	-144.4	0.0	2264.2	2264.2	15.68	100.00	1.50
SLS31	0.0	-29.1	1252.3	1252.3	100.00	43.09	1.50
SLS32	0.0	29.1	1252.3	1252.3	100.00	43.09	1.50
SLS33	29.1	0.0	1252.3	1252.3	43.09	100.00	1.50
SLS34	-29.1	0.0	1252.3	1252.3	43.09	100.00	1.50
SLS35	41.3	-48.3	1270.3	1270.3	30.75	26.29	1.50
SLS36	41.3	29.2	1270.3	1270.3	30.75	43.53	1.50
SLS37	80.1	-9.6	1270.3	1270.3	15.87	100.00	1.50
SLS38	2.6	-9.6	1270.3	1270.3	100.00	100.00	1.50
SLS39	0.0	-38.8	1288.3	1288.3	100.00	33.24	1.50
SLS40	0.0	38.8	1288.3	1288.3	100.00	33.24	1.50
SLS41	41.3	-140.7	1270.3	1270.3	30.75	9.03	1.50
SLS42	41.3	121.6	1270.3	1270.3	30.75	10.45	1.50
SLS43	232.1	-9.6	1270.3	1270.3	5.47	100.00	1.50
SLS44	-149.4	-9.6	1270.3	1270.3	8.50	100.00	1.50
SLS45	0.0	-190.8	1288.3	1288.3	100.00	6.75	1.50
SLS46	0.0	190.8	1288.3	1288.3	100.00	6.75	1.50
SLS47	190.8	0.0	1288.3	1288.3	6.75	100.00	1.50
SLS48	-190.8	0.0	1288.3	1288.3	6.75	100.00	1.50

2.8.3 Sliding and Uplift Check

Load Comb.	Resultant Shear (kN)	Resisting Force (kN)	FOS Sliding		FOS Uplift			
			Actual	Allowable	Uplift Force (kN)	Resisting Force (kN)	Actual	Allowable
SLS1	0.0	286.3	100.00	1.50	0.0	683.7	100.00	1.2
SLS2	0.0	290.3	100.00	1.50	0.0	683.7	100.00	1.2
SLS3	0.0	307.1	100.00	1.50	0.0	683.7	100.00	1.2
SLS4	0.0	311.1	100.00	1.50	0.0	683.7	100.00	1.2
SLS5	0.0	301.9	100.00	1.50	0.0	683.7	100.00	1.2
SLS6	0.0	305.9	100.00	1.50	0.0	683.7	100.00	1.2
SLS7	11.2	286.3	25.49	1.50	0.0	683.7	100.00	1.2
SLS8	11.2	286.3	25.49	1.50	0.0	683.7	100.00	1.2
SLS9	11.2	286.3	25.49	1.50	0.0	683.7	100.00	1.2
SLS10	11.2	286.3	25.49	1.50	0.0	683.7	100.00	1.2
SLS11	15.3	286.3	18.69	1.50	0.0	683.7	100.00	1.2
SLS12	15.3	286.3	18.69	1.50	0.0	683.7	100.00	1.2
SLS13	15.3	286.3	18.69	1.50	0.0	683.7	100.00	1.2
SLS14	15.3	286.3	18.69	1.50	0.0	683.7	100.00	1.2
SLS15	8.4	290.3	34.46	1.50	0.0	683.7	100.00	1.2

Load Comb.	Resultant Shear (kN)	Resisting Force (kN)	FOS Sliding		FOS Uplift			
			Actual	Allowable	Uplift Force (kN)	Resisting Force (kN)	Actual	Allowable
SLS16	8.4	290.3	34.46	1.50	0.0	683.7	100.00	1.2
SLS17	8.4	290.3	34.46	1.50	0.0	683.7	100.00	1.2
SLS18	8.4	290.3	34.46	1.50	0.0	683.7	100.00	1.2
SLS19	8.4	301.9	35.83	1.50	0.0	683.7	100.00	1.2
SLS20	8.4	301.9	35.83	1.50	0.0	683.7	100.00	1.2
SLS21	8.4	301.9	35.83	1.50	0.0	683.7	100.00	1.2
SLS22	8.4	301.9	35.83	1.50	0.0	683.7	100.00	1.2
SLS23	6.3	305.9	48.41	1.50	0.0	683.7	100.00	1.2
SLS24	6.3	305.9	48.41	1.50	0.0	683.7	100.00	1.2
SLS25	6.3	305.9	48.41	1.50	0.0	683.7	100.00	1.2
SLS26	6.3	305.9	48.41	1.50	0.0	683.7	100.00	1.2
SLS27	11.6	301.9	26.02	1.50	0.0	683.7	100.00	1.2
SLS28	11.6	301.9	26.02	1.50	0.0	683.7	100.00	1.2
SLS29	11.6	301.9	26.02	1.50	0.0	683.7	100.00	1.2
SLS30	11.6	301.9	26.02	1.50	0.0	683.7	100.00	1.2
SLS31	8.4	167.0	19.82	1.50	0.0	410.2	100.00	1.2
SLS32	8.4	167.0	19.82	1.50	0.0	410.2	100.00	1.2
SLS33	8.4	167.0	19.82	1.50	0.0	410.2	100.00	1.2
SLS34	8.4	167.0	19.82	1.50	0.0	410.2	100.00	1.2
SLS35	27.5	169.4	6.15	1.50	0.0	410.2	100.00	1.2
SLS36	13.9	169.4	12.21	1.50	0.0	410.2	100.00	1.2
SLS37	28.0	169.4	6.04	1.50	0.0	410.2	100.00	1.2
SLS38	12.9	169.4	13.17	1.50	0.0	410.2	100.00	1.2
SLS39	11.2	171.8	15.29	1.50	0.0	410.2	100.00	1.2
SLS40	11.2	171.8	15.29	1.50	0.0	410.2	100.00	1.2
SLS41	26.9	169.4	6.29	1.50	0.0	410.2	100.00	1.2
SLS42	14.0	169.4	12.14	1.50	0.0	410.2	100.00	1.2
SLS43	31.7	169.4	5.34	1.50	0.0	410.2	100.00	1.2
SLS44	12.7	169.4	13.35	1.50	0.0	410.2	100.00	1.2
SLS45	15.3	171.8	11.21	1.50	0.0	410.2	100.00	1.2
SLS46	15.3	171.8	11.21	1.50	0.0	410.2	100.00	1.2
SLS47	15.3	171.8	11.21	1.50	0.0	410.2	100.00	1.2
SLS48	15.3	171.8	11.21	1.50	0.0	410.2	100.00	1.2

2.8.4 Bearing Pressure Check

Load Comb.	Minimum Soil Condition			Maximum Soil Condition			Bearing Pressure		
	Axial Force (kN)	Moment X (kN.m)	Moment Z (kN.m)	Axial Force (kN)	Moment X (kN.m)	Moment Z (kN.m)	Actual(kN/m ²)	Allowable(kN/m ²)	Contact %
SLS1	715.7	0.0	0.0	1032.5	0.0	0.0	28.68	321.60	100.0
SLS2	725.7	0.0	0.0	1042.5	0.0	0.0	28.96	381.60	100.0
SLS3	767.7	0.0	0.0	1084.5	0.0	0.0	30.13	321.60	100.0
SLS4	777.7	0.0	0.0	1094.5	0.0	0.0	30.40	381.60	100.0

Load Comb.	Minimum Soil Condition			Maximum Soil Condition			Bearing Pressure		
	Axial Force (kN)	Moment X (kN.m)	Moment Z (kN.m)	Axial Force (kN)	Moment X (kN.m)	Moment Z (kN.m)	Actual(kN/m²)	Allowable(kN/m²)	Contact %
SLS5	754.7	0.0	0.0	1071.5	0.0	0.0	29.77	321.60	100.0
SLS6	764.7	0.0	0.0	1081.5	0.0	0.0	30.04	381.60	100.0
SLS7	715.7	0.0	-38.8	1032.5	0.0	-38.8	29.76	420.60	100.0
SLS8	715.7	0.0	38.8	1032.5	0.0	38.8	29.76	420.60	100.0
SLS9	715.7	38.8	0.0	1032.5	38.8	0.0	29.76	420.60	100.0
SLS10	715.7	-38.8	0.0	1032.5	-38.8	0.0	29.76	420.60	100.0
SLS11	715.7	0.0	-190.8	1032.5	0.0	-190.8	33.98	420.60	100.0
SLS12	715.7	0.0	190.8	1032.5	0.0	190.8	33.98	420.60	100.0
SLS13	715.7	190.8	0.0	1032.5	190.8	0.0	33.98	420.60	100.0
SLS14	715.7	-190.8	0.0	1032.5	-190.8	0.0	33.98	420.60	100.0
SLS15	725.7	0.0	-29.1	1042.5	0.0	-29.1	29.77	420.60	100.0
SLS16	725.7	0.0	29.1	1042.5	0.0	29.1	29.77	420.60	100.0
SLS17	725.7	29.1	0.0	1042.5	29.1	0.0	29.77	420.60	100.0
SLS18	725.7	-29.1	0.0	1042.5	-29.1	0.0	29.77	420.60	100.0
SLS19	754.7	0.0	-29.1	1071.5	0.0	-29.1	30.57	420.60	100.0
SLS20	754.7	0.0	29.1	1071.5	0.0	29.1	30.57	420.60	100.0
SLS21	754.7	29.1	0.0	1071.5	29.1	0.0	30.57	420.60	100.0
SLS22	754.7	-29.1	0.0	1071.5	-29.1	0.0	30.57	420.60	100.0
SLS23	764.7	0.0	-21.8	1081.5	0.0	-21.8	30.65	420.60	100.0
SLS24	764.7	0.0	21.8	1081.5	0.0	21.8	30.65	420.60	100.0
SLS25	764.7	21.8	0.0	1081.5	21.8	0.0	30.65	420.60	100.0
SLS26	764.7	-21.8	0.0	1081.5	-21.8	0.0	30.65	420.60	100.0
SLS27	754.7	0.0	-144.4	1071.5	0.0	-144.4	33.78	420.60	100.0
SLS28	754.7	0.0	144.4	1071.5	0.0	144.4	33.78	420.60	100.0
SLS29	754.7	144.4	0.0	1071.5	144.4	0.0	33.78	420.60	100.0
SLS30	754.7	-144.4	0.0	1071.5	-144.4	0.0	33.78	420.60	100.0
SLS31	417.4	0.0	-29.1	607.5	0.0	-29.1	17.68	420.60	100.0
SLS32	417.4	0.0	29.1	607.5	0.0	29.1	17.68	420.60	100.0
SLS33	417.4	29.1	0.0	607.5	29.1	0.0	17.68	420.60	100.0
SLS34	417.4	-29.1	0.0	607.5	-29.1	0.0	17.68	420.60	100.0
SLS35	423.4	41.3	-48.3	613.5	41.3	-48.3	19.53	420.60	100.0
SLS36	423.4	41.3	29.2	613.5	41.3	29.2	19.00	420.60	100.0
SLS37	423.4	80.1	-9.6	613.5	80.1	-9.6	19.53	420.60	100.0
SLS38	423.4	2.6	-9.6	613.5	2.6	-9.6	17.38	420.60	100.0
SLS39	429.4	0.0	-38.8	619.5	0.0	-38.8	18.29	420.60	100.0
SLS40	429.4	0.0	38.8	619.5	0.0	38.8	18.29	420.60	100.0
SLS41	423.4	41.3	-140.7	613.5	41.3	-140.7	22.10	420.60	100.0
SLS42	423.4	41.3	121.6	613.5	41.3	121.6	21.57	420.60	100.0
SLS43	423.4	232.1	-9.6	613.5	232.1	-9.6	23.75	420.60	100.0
SLS44	423.4	-149.4	-9.6	613.5	-149.4	-9.6	21.46	420.60	100.0
SLS45	429.4	0.0	-190.8	619.5	0.0	-190.8	22.51	420.60	100.0
SLS46	429.4	0.0	190.8	619.5	0.0	190.8	22.51	420.60	100.0
SLS47	429.4	190.8	0.0	619.5	190.8	0.0	22.51	420.60	100.0

Load Comb.	Minimum Soil Condition			Maximum Soil Condition			Bearing Pressure		
	Axial Force (kN)	Moment X (kN.m)	Moment Z (kN.m)	Axial Force (kN)	Moment X (kN.m)	Moment Z (kN.m)	Actual(kN/m ²)	Allowable(kN/m ²)	Contact %
SLS48	429.4	-190.8	0.0	619.5	-190.8	0.0	22.51	420.60	100.0

2.8.5 Crack Width Check

Position	Combination	Location (m)	Moment (kN.m/m)	Crack Width (mm)	
				Actual	Allowable
Bottom - X	SLS28	1.75	13.25	0.0000	0.2
Top - X	SLS45	1.75	2.79	0.0000	0.2
Bottom - Z	SLS29	1.75	13.25	0.0000	0.20
Top - Z	SLS43	4.25	4.46	0.0000	0.20

2.9 Ultimate Design

2.9.1 Pad - Check for Bending Moment

- X Direction - Bottom -----
 - Critical Ultimate Load Combination = **ULS24**
 - Critical Moment Location = **1.75 m**
 - Design Moment = **18.2 kN.m**
 - Moment Capacity (for given Reinforcement) = **248.7 kN.m**
 - Reinforcement Provided = **0.268 %**
 - Min. Reinforcement Required = **0.24 %**
 - Provided Rebar Spacing = **150 mm**
 - Allowed Maximum Rebar Spacing = **300.0 mm**
- X Direction - Top -----
 - Critical Ultimate Load Combination = **ULS43**
 - Critical Moment Location = **1.75 m**
 - Design Moment = **3.7 kN.m**
 - Moment Capacity (for given Reinforcement) = **248.7 kN.m**
 - Reinforcement Provided = **0.268 %**
 - Min. Reinforcement Required = **0.24 %**
 - Provided Rebar Spacing = **150 mm**
 - Allowed Maximum Rebar Spacing = **300.0 mm**
- Z Direction - Bottom -----
 - Critical Ultimate Load Combination = **ULS25**
 - Critical Moment Location = **1.75 m**
 - Design Moment = **18.2 kN.m**
 - Moment Capacity (for given Reinforcement) = **115.1 kN.m**
 - Reinforcement Provided = **0.113 %**
 - Min. Reinforcement Required = **0.24 %**
 - Provided Rebar Spacing = **200 mm**
 - Allowed Maximum Rebar Spacing = **300.0 mm**
- Z Direction - Top -----
 - Critical Ultimate Load Combination = **ULS41**
 - Critical Moment Location = **4.25 m**

Design Moment = **6.2 kN.m**
 Moment Capacity (for given Reinforcement) = **115.1 kN.m**
 Reinforcement Provided = **0.113 %**
 Min. Reinforcement Required = **0.24 %**
 Provided Rebar Spacing = **200 mm**
 Allowed Maximum Rebar Spacing = **300.0 mm**

2.9.2 Pad - Check for Shear

Position	Critical Combination	Location (m)	Shear Force (kN/m)	Design Stress (N/mm ²)	Strength (N/mm ²)
Bottom - X	ULS23	4.68	15.3	0.035	0.475
Top - X	ULS43	1.32	2.9	0.007	0.475
Bottom - Z	ULS25	1.32	15.3	0.036	0.376
Top - Z	ULS41	4.68	5.0	0.012	0.376

2.10 Check for Punching Shear

Pedestal	Load Comb.	Punching at	Punch. Force (kN)	Tension Face	Punch. Stress (N/mm ²)	Strength (N/mm ²)
L1	ULS4	Face	233.6	Bottom	0.054	4.733
	ULS4	1.5 d	169.0	Bottom	0.026	0.376

2.10.1 Pedestal Design

○ Pedestal - PT1 (1035.53 Size Octagon) Design Check {L1}

- Design Check - Bending Moment
 - Design Pedestal Location = **L1**
 - Design Load Combination = **ULS41**
 - Design Axial Load (+ve Compression) = **182.0 kN**
 - Design Moment (Resultant) = **313.2 kN.m**
 - Axial Compression Load Capacity = **83050.5 kN**
 - Axial Tension Load Capacity = **2185.5 kN**
 - Moment Capacity = **2828.5 kN.m**
 - Design Ratio for Bending Moment = **0.111**
 - Reinforcement Provided = **0.1 %**
 - Min. Reinforcement Required = **0.4 %**
 - Vertical Rebar Spacing = **449.8 mm**
- Design Check for Shear
 - Design Pedestal Location = **L1**
 - Design Load Combination = **ULS41**
 - Design Axial Load (+ve Compression) = **182.0 kN**
 - Design Moment (Resultant) = **313.2 kN.m**
 - Design Shear (Resultant) = **46.6 kN**
 - Maximum Shear Stress = **0.015 N/mm²**
 - Maximum Allowable Shear Stress = **4.733 N/mm²**
 - Design Ties Spacing = **Not Required**
 - Provided Ties Spacing = **150 mm**

- Maximum Allowed Ties Spacing

= **320 mm**

2.10.2 Steel Material Strength

Effective Cross Sectional Area of Anchor	$A_{se} = \pi / 4 * (d - 0.9743 / 8)^2 = \mathbf{343.286 \text{ mm}^2}$	ASME B1.1
Bolt Tension Strength	$P_t = \mathbf{160 \text{ N/mm}^2}$	Table 34
Bolt Shear Strength	$P_s = \mathbf{240 \text{ N/mm}^2}$	Table 30
Design Steel Tension Strength of Bolt	$P_b = P_t * A_{se} = \mathbf{82.389 \text{ kN}}$	cl 6.3.4.3
Design Steel Shear Strength of Bolt	$P_v = P_s * A_{se} = \mathbf{54.926 \text{ kN}}$	cl 6.3.2.1
Anchorage Tension Capacity	$T_c = \min(P_b , C_t) = \mathbf{50 \text{ kN}}$	
Anchorage Shear Capacity	$S_c = \min(P_v , C_s) = \mathbf{50 \text{ kN}}$	

2.10.3 Anchor Bolt Check

Sl. No	Tension in Anchor Bolt T_{ab} (kN)	Bolt Tension Capacity T_c (kN)	Shear per bolt V_{ab} (kN)	Bolt Shear Capacity S_c (kN)	Anchorage Interaction $(T_{ab} / T_c) + (V_{ab} / S_c)$	Status
ULS 1	No Tension	50	0	50	0	Pass
ULS 2	No Tension	50	0	50	0	Pass
ULS 3	No Tension	50	0	50	0	Pass
ULS 4	No Tension	50	0	50	0	Pass
ULS 5	No Tension	50	0	50	0	Pass
ULS 6	No Tension	50	0	50	0	Pass
ULS 7	No Tension	50	2.34	50	0.047	Pass
ULS 8	No Tension	50	2.34	50	0.047	Pass
ULS 9	No Tension	50	2.34	50	0.047	Pass
ULS 10	No Tension	50	2.34	50	0.047	Pass
ULS 11	No Tension	50	2.34	50	0.047	Pass
ULS 12	No Tension	50	2.34	50	0.047	Pass
ULS 13	No Tension	50	2.34	50	0.047	Pass
ULS 14	No Tension	50	2.34	50	0.047	Pass
ULS 15	No Tension	50	4.68	50	0.094	Pass
ULS 16	No Tension	50	4.68	50	0.094	Pass
ULS 17	No Tension	50	4.68	50	0.094	Pass
ULS 18	No Tension	50	4.68	50	0.094	Pass
ULS 19	No Tension	50	3.51	50	0.07	Pass
ULS 20	No Tension	50	3.51	50	0.07	Pass
ULS 21	No Tension	50	3.51	50	0.07	Pass
ULS 22	No Tension	50	3.51	50	0.07	Pass
ULS 23	14.228	50	5.472	50	0.394	Pass
ULS 24	14.228	50	5.472	50	0.394	Pass
ULS 25	14.228	50	5.472	50	0.394	Pass
ULS 26	14.228	50	5.472	50	0.394	Pass
ULS 27	No Tension	50	3.51	50	0.07	Pass
ULS 28	No Tension	50	3.51	50	0.07	Pass
ULS 29	No Tension	50	3.51	50	0.07	Pass

Sl. No	Tension in Anchor Bolt T_{ab} (kN)	Bolt Tension Capacity T_c (kN)	Shear per bolt V_{ab} (kN)	Bolt Shear Capacity S_c (kN)	Anchorage Interaction $(T_{ab} / T_c) + (V_{ab} / S_c)$	Status
ULS 30	No Tension	50	3.51	50	0.07	Pass
ULS 31	No Tension	50	10.735	50	0.215	Pass
ULS 32	1.925	50	5.175	50	0.142	Pass
ULS 33	1.867	50	10.93	50	0.256	Pass
ULS 34	No Tension	50	4.751	50	0.095	Pass
ULS 35	No Tension	50	4.68	50	0.094	Pass
ULS 36	No Tension	50	4.68	50	0.094	Pass
ULS 37	No Tension	50	4.68	50	0.094	Pass
ULS 38	No Tension	50	4.68	50	0.094	Pass
ULS 39	12.202	50	9.94	50	0.443	Pass
ULS 40	17.774	50	5.264	50	0.461	Pass
ULS 41	26.604	50	11.648	50	0.765	Pass
ULS 42	21.23	50	4.734	50	0.519	Pass
ULS 43	21.528	50	5.472	50	0.54	Pass
ULS 44	21.528	50	5.472	50	0.54	Pass
ULS 45	21.528	50	5.472	50	0.54	Pass
ULS 46	21.528	50	5.472	50	0.54	Pass

3.0 SUMMARY

3.1 Stability Checks(SLS)

Stability Condition	Critical Combination	Actual	Allowable	Status
FOS Overturning X	SLS43	5.474	1.500	Pass
FOS Overturning Z	SLS45	6.754	1.500	Pass
FOS Sliding (Resultant)	SLS43	5.338	1.500	Pass
FOS Uplift	SLS1	100.0	1.200	Pass
Bearing Pressure (kN/m ²)	SLS3	30.1	321.6	Pass
Contact (%)	SLS1	100.0	85.0	Pass

3.2 Crackwidth Check

Stability Condition	Critical Combination	Actual(mm)	Allowable(mm)	Status
Bottom - X	SLS28	0.0000	0.200	Pass
Top - X	SLS45	0.0000	0.200	Pass
Bottom - Z	SLS29	0.0000	0.200	Pass
Top - Z	SLS43	0.0000	0.200	Pass

3.3 Pad Design

3.3.1 Pad Minimum Reinforcement

Position	Provided	Min. Percentage	Max. Spacing	Status
Bottom - X	16Φ at 150 c/c (0.27%)	0.13 %	300.0	Pass
Bottom - Z	12Φ at 200 c/c (0.11%)	0.13 %	300.0	Fail
Top- X	16Φ at 150 c/c (0.27%)	0.13 %	300.0	Pass
Top- Z	12Φ at 200 c/c (0.11%)	0.13 %	300.0	Fail

3.3.2 Pad Moment Capacity

Position	Combination	Required (kN.m/m)	Capacity (kN.m/m)	Status
Bottom - X	ULS24	18.15	248.71	Pass
Top - X	ULS43	3.71	248.71	Pass
Bottom - Z	ULS25	18.15	115.14	Pass
Top - Z	ULS41	6.22	115.14	Pass

3.3.3 Pad Shear Capacity

Position	Combination	Required (kN/m)	Capacity (kN/m)	Status
Bottom - X	ULS23	15.3	210.0	Pass
Top - X	ULS43	2.9	210.0	Pass
Bottom - Z	ULS25	15.3	160.8	Pass
Top - Z	ULS41	5.0	160.8	Pass

3.3.4 Punching Shear

Location	Combination	Punching at	Face	Actual(N/mm ²)	Strength(N/mm ²)	Status
L1	ULS4	Face	Bottom	0.054	4.733	Pass
L1	ULS4	1.5d	Bottom	0.026	0.376	Pass

3.4 Pedestal Design

3.4.1 Pedestal Bending Moment

Type	Applicable Locations	Critical Location	Combination	Design Ratio	Status
PT1	L1	L1	ULS41	0.111	Pass

3.4.2 Pedestal Shear

Type	Applicable Locations	Critical Location	Combination	Provided Spacing(mm)	Max. Spacing (mm)	Status
PT1	L1	L1	ULS41	150.0	320.0	Pass

3.5 Anchorage Bolts Check

3.5.1 Anchorage in Tension and Shear

Description	Combination	Actual (kN)	Capacity (kN)	Status
Tension	ULS41	26.604	50	Pass
Shear	ULS41	11.648	50	Pass

3.5.2 Interaction in Tension and Shear

Description	Combination	Actual Tension (kN)	Tension Capacity (kN)	Actual Shear (kN)	Shear Capacity (kN)	Interaction	Status
Anchorage	ULS41	26.604	50	11.648	50	0.765	Pass