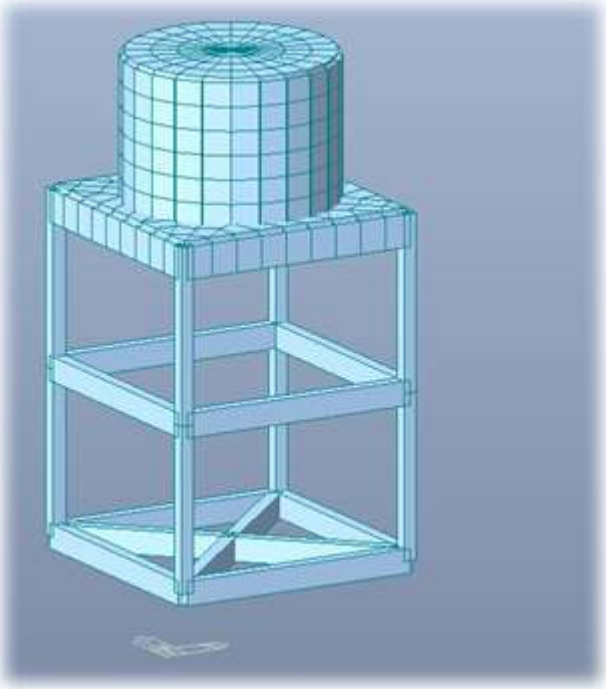


20 M^3 ELEVATED STORAGE WATER TANK DESIGN REPORT

2nd September 2023

Prepared by:
Sheilla Constance Apio

ANALYSIS MODEL

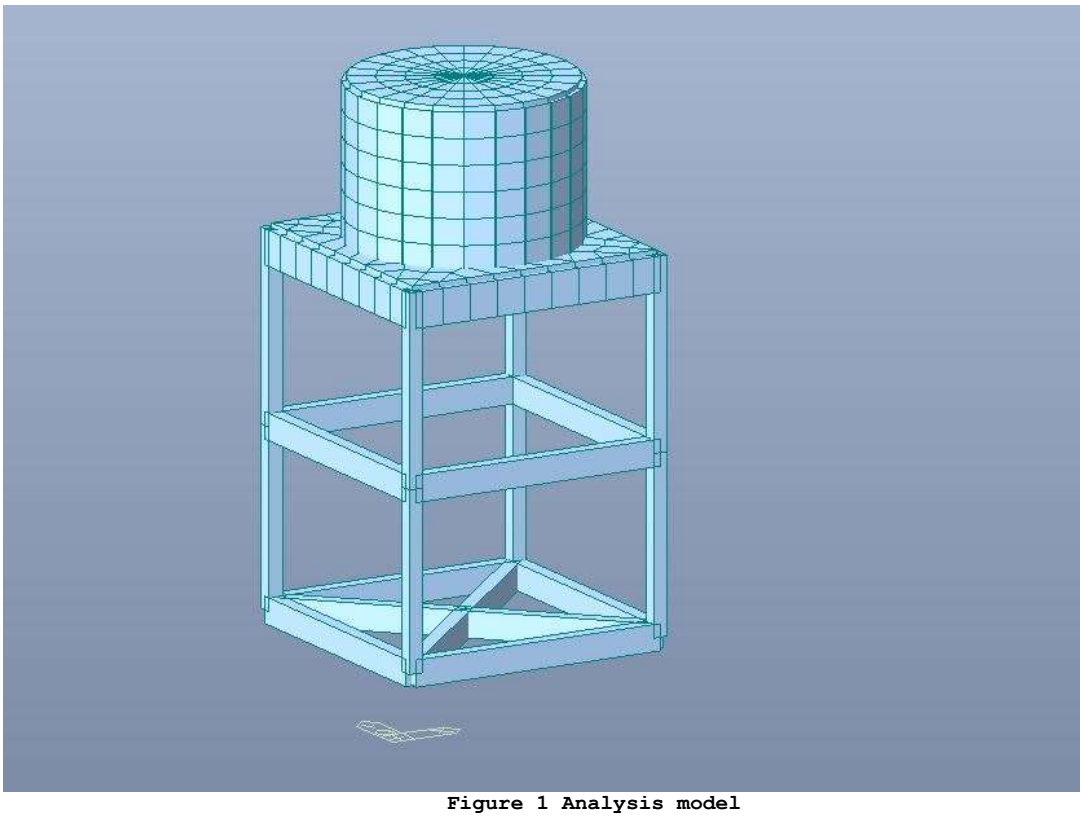


Figure 1 Analysis model

MODAL DISPLACEMENT

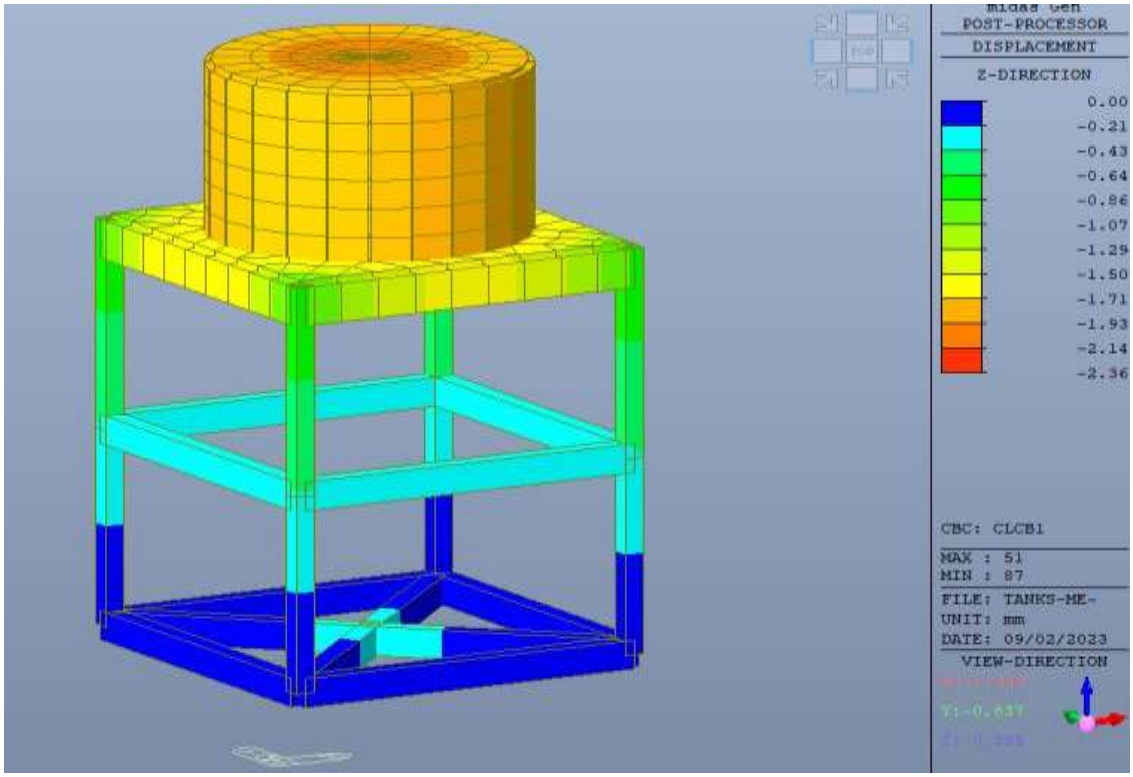


Figure 2 Modal displacement

LOAD CASES AND COMBINATIONS

No.	Name	Combination
1	cLCB1	1.35D + 1.5(1.0LL)
2	cLCB2	1.35D + 1.5(1.0LL) + 1.5(0.6)WL
3	cLCB3	1.35D + 1.5(0.7LL) + 1.5WL
4	cLCB4	1.35D + 1.5(1.0LL) - 1.5(0.6)WL
5	cLCB5	1.35D + 1.5(0.7LL) - 1.5WL
6	cLCB6	1.0D + 1.0(0.3L) + 1.0E
7	cLCB7	1.0D + 1.0(0.3L) - 1.0E
8	cLCB8	SERV :1.0D + (1.0LL)
9	cLCB9	SERV :1.0D + (1.0LL) + (0.6)WL
10	cLCB10	SERV :1.0D + (1.0LL) - (0.6)WL
11	cLCB12	SERV :1.0D + (0.7LL) - 1.0WL
12	cLCB13	SERV :1.0D + (0.5LL)
13	cLCB14	SERV :1.0D + (0.3LL) + (0.2)WL
14	cLCB15	SERV :1.0D + (0.3LL) - (0.2)WL
15	cLCB16	SERV :1.0D + (0.3LL)

D – DEAD LOAD

LL -LIVELOAD

WL – WIND LOAD (based on wind speed of 35 m/s)

E - EARTHQUAKE (based on a PGA of 0.064g)

SERV - Serviceability

LOADS

No.	Section	DEAD LOAD (kN/m2)	LIVE LOAD (kN/m2)
1.	Roof load	-1.2	-1.5

Pressure on the tank walls is based on water density of 10kN/m^3

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
--------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
============================================================================================


================================================================================
    [[[*]]]   SLAB CHECKING MAXIMUM RESULT DATA  : DOMAIN Water tank-Bottom slab, Dir 1.
================================================================================
 ------------------------------------------------------------------
     Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 ------------------------------------------------------------------
  150.00    467 BOT 0.4060 0.5655 | 18.2685(   1) 26.1139 0.700  OK
            533 TOP 0.2032 0.5655 | 9.14531(   1) 26.1139 0.350  OK
 ------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 467
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  16.797 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.2240 kN.
    M_Rd     = Cc*(d-a/2)  =      26.1139  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P12 @200
    As_req =       0.4060 mm^2/mm.  (     405.9673 mm^2/m.)
    M_Ed   =      18.2685  kN-mm./mm.
    M_Rd   =      26.1139  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.700  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.170

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 533
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
--------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
============================================================================================

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  16.797 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.2240 kN.
    M_Rd     = Cc*(d-a/2)  =      26.1139  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P12 @200
    As_req =       0.2032 mm^2/mm.  (     203.2291 mm^2/m.)
    M_Ed   =       9.1453  kN-mm./mm.
    M_Rd   =      26.1139  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.350  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.170
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
==========================================================================================


============================================================================
    [[[*]]]   SLAB CHECKING MAXIMUM RESULT DATA  : DOMAIN Water tank-Bottom slab, Dir 2.
============================================================================
 ---------------------------------------------------------------------
     Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 ---------------------------------------------------------------------
  150.00    453 BOT 0.4060 0.5655 | 18.2703(   1) 26.1139 0.700  OK
            561 TOP 0.2032 0.5655 | 9.14198(   1) 26.1139 0.350  OK
 ---------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 453
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  16.797 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.2240 kN.
    M_Rd     = Cc*(d-a/2)  =      26.1139  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P12 @200
    As_req =       0.4060 mm^2/mm.  (     406.0060 mm^2/m.)
    M_Ed   =      18.2703  kN-mm./mm.
    M_Rd   =      26.1139  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.700  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.170

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 561
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
---------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
=============================================================================================

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  16.797 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.2240 kN.
    M_Rd     = Cc*(d-a/2)  =      26.1139  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P12 @200
    As_req =       0.2032 mm^2/mm.  (     203.1551 mm^2/m.)
    M_Ed   =       9.1420  kN-mm./mm.
    M_Rd   =      26.1139  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.350  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.170
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
==========================================================================================


============================================================================
    [[[*]]]   SLAB CHECKING MAXIMUM RESULT DATA  : DOMAIN Water tank-Top slab, Dir 1.
============================================================================
 ---------------------------------------------------------------------
     Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 ---------------------------------------------------------------------
  150.00   3911 BOT 0.1625 0.3927 | 3.17944(   1) 18.6157 0.171  OK
           3930 TOP 0.1625 0.3927 | 4.25689(   1) 18.6157 0.229  OK
 ---------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 3911
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  11.719 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1562 kN.
    M_Rd     = Cc*(d-a/2)  =      18.6157  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.1625 mm^2/mm.  (     162.5000 mm^2/m.)
    M_Ed   =       3.1794  kN-mm./mm.
    M_Rd   =      18.6157  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.171  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.118

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 3930
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
---------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
=============================================================================================

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  11.719 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1562 kN.
    M_Rd     = Cc*(d-a/2)  =      18.6157  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.1625 mm^2/mm.  (     162.5000 mm^2/m.)
    M_Ed   =       4.2569  kN-mm./mm.
    M_Rd   =      18.6157  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.229  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.118
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
==========================================================================================


============================================================================
    [[[*]]]   SLAB CHECKING MAXIMUM RESULT DATA  : DOMAIN Water tank-Top slab, Dir 2.
============================================================================
 ---------------------------------------------------------------------
     Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 ---------------------------------------------------------------------
  150.00   3963 BOT 0.1625 0.3927 | 3.17934(   1) 18.6157 0.171  OK
           3893 TOP 0.1625 0.3927 | 4.25666(   1) 18.6157 0.229  OK
 ---------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 3963
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  11.719 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1562 kN.
    M_Rd     = Cc*(d-a/2)  =      18.6157  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.1625 mm^2/mm.  (     162.5000 mm^2/m.)
    M_Ed   =       3.1793  kN-mm./mm.
    M_Rd   =      18.6157  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.171  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.118

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 3893
    Thickness :  150.0000 mm.
    Materials :  fck =      0.0200 kN/mm^2.
                 fcd =      0.0133 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Covering  :  dB  =  25.0000 mm.
                 dT  =  25.0000 mm.
    LCB No.   :    1
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

```
---------------------------------------------------------------------------------------------
 midas Gen - RC-Slab Flexural Checking   [ Eurocode2:04 & Eurocode8:04 ]    Gen 2019
=============================================================================================

 -. Information of Design.
    b        =   1.0000 mm.  (by Code Unit Length).
    d        = 125.0000 mm.
    lambda   =   0.800
    a        = lambda * x  =  11.719 mm.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1562 kN.
    M_Rd     = Cc*(d-a/2)  =      18.6157  kN-mm./mm.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.1625 mm^2/mm.  (     162.5000 mm^2/m.)
    M_Ed   =       4.2567  kN-mm./mm.
    M_Rd   =      18.6157  kN-mm./mm.
    RatM   = M_Ed / M_Rd =   0.229  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.118
```

RC Beam Strength Checking Result

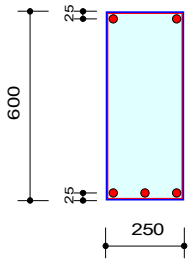
	Company		**Project Title**	20 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, mm
Material Data : fck = 0.02, fyk = 0.46, fyw = 0.25 kN/mm^2
Section Property: 600x250 loading beams (No : 5)
Beam Span : 6363.96 mm

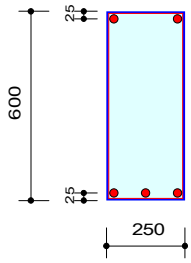
2. Section Diagram

[END-I]



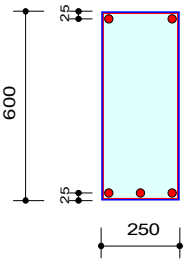
TOP : 2-P16
BOT : 3-P16
STIRRUPS : 2-P10 @100

[MID]



TOP : 2-P16
BOT : 3-P16
STIRRUPS : 2-P10 @100

[END-J]



TOP : 2-P16
BOT : 3-P16
STIRRUPS : 2-P10 @100

3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	4	4	4
Moment (M_Ed)	15547.76	3886.94	15339.53
Factored Strength (M_Rd)	88980.14	88980.14	88980.14
Check Ratio (M_Ed/M_Rd)	0.1747	0.0437	0.1724
Neutral Axis (x/d)	0.0533	0.0533	0.0533
(+) Load Combination No.	4	4	4
Moment (M_Ed)	36901.39	47349.33	36781.43
Factored Strength (M_Rd)	132436.44	132436.44	132436.44
Check Ratio (M_Ed/M_Rd)	0.2786	0.3575	0.2777
Neutral Axis (x/d)	0.0781	0.0781	0.0781
Using Rebar Top (As_top)	402.1200	402.1200	402.1200
Using Rebar Bot (As_bot)	603.1800	603.1800	603.1800

4. Shear Capacity

	END-I	MID	END-J
Load Combination No.	4	4	4
Factored Shear Force (V_Ed)	90.08	39.85	89.96
Shear Strength by Conc.(V_Rdc)	55.73	55.73	55.73
Shear Strength by Rebar.(V_Rds)	176.72	176.72	176.72
Shear Strength by Rebar.(V_Rdmax)	476.10	476.10	476.10
Using Shear Reinf. (Asw)	1570.8000	1570.8000	1570.8000
Using Stirrups Spacing	2-P10 @100	2-P10 @100	2-P10 @100
Shear Ratio by Conc	1.6164	0.7150	1.6143
Shear Ratio by (V_Rds ; V_Rdmax)	0.5098	0.2255	0.5091
Check Ratio	0.5098	0.7150	0.5091

RC Beam Strength Checking Result

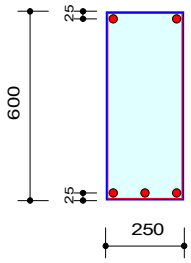
	Company		**Project Title**	20 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, mm
Material Data : fck = 0.02, fyk = 0.46, fyw = 0.25 kN/mm^2
Section Property: 600x250 tie beams (No : 4)
Beam Span : 4500 mm

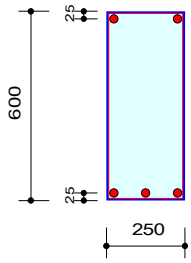
2. Section Diagram

[END-I]



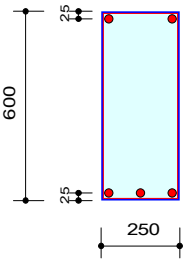
TOP : 2-P16
BOT : 3-P16
STIRRUPS : 2-P10 @100

[MID]



TOP : 2-P16
BOT : 3-P16
STIRRUPS : 2-P10 @100

[END-J]



TOP : 2-P16
BOT : 3-P16
STIRRUPS : 2-P10 @100

3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	7	7	7
Moment (M_Ed)	673.46	168.54	674.17
Factored Strength (M_Rd)	88980.14	88980.14	88980.14
Check Ratio (M_Ed/M_Rd)	0.0076	0.0019	0.0076
Neutral Axis (x/d)	0.0533	0.0533	0.0533
(+) Load Combination No.	4	4	4
Moment (M_Ed)	31029.48	46053.87	30941.81
Factored Strength (M_Rd)	132436.44	132436.44	132436.44
Check Ratio (M_Ed/M_Rd)	0.2343	0.3477	0.2336
Neutral Axis (x/d)	0.0781	0.0781	0.0781
Using Rebar Top (As_top)	402.1200	402.1200	402.1200
Using Rebar Bot (As_bot)	603.1800	603.1800	603.1800

4. Shear Capacity

	END-I	MID	END-J
Load Combination No.	5	7	5
Factored Shear Force (V_Ed)	55.72	50.83	55.70
Shear Strength by Conc.(V_Rdc)	55.73	55.73	55.73
Shear Strength by Rebar.(V_Rds)	176.72	176.72	176.72
Shear Strength by Rebar.(V_Rdmax)	476.10	476.10	476.10
Using Shear Reinf. (Asw)	1570.8000	1570.8000	1570.8000
Using Stirrups Spacing	2-P10 @100	2-P10 @100	2-P10 @100
Shear Ratio by Conc	0.9998	0.9121	0.9995
Shear Ratio by (V_Rds ; V_Rdmax)	0.3153	0.2876	0.3152
Check Ratio	0.9998	0.9121	0.9995

RC Beam Strength Checking Result

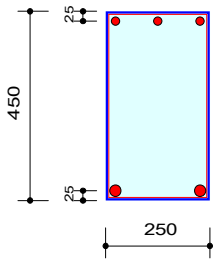
	Company		**Project Title**	20 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, mm
Material Data : fck = 0.02, fyk = 0.46, fyw = 0.25 kN/mm^2
Section Property: 450x250 tie beams (No : 6)
Beam Span : 4500 mm

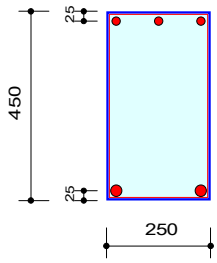
2. Section Diagram

[END-I]



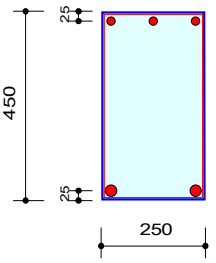
TOP : 3-P12
BOT : 2-P16
STIRRUPS : 2-P10 @100

[MID]



TOP : 3-P12
BOT : 2-P16
STIRRUPS : 2-P10 @100

[END-J]



TOP : 3-P12
BOT : 2-P16
STIRRUPS : 2-P10 @100

3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	4	4	4
Moment (M_Ed)	4499.19	1125.29	4501.17
Factored Strength (M_Rd)	55164.63	55164.63	55164.63
Check Ratio (M_Ed/M_Rd)	0.0816	0.0204	0.0816
Neutral Axis (x/d)	0.0725	0.0725	0.0725
(+) Load Combination No.	5	5	5
Moment (M_Ed)	2916.16	5318.32	2915.26
Factored Strength (M_Rd)	65137.57	65137.57	65137.57
Check Ratio (M_Ed/M_Rd)	0.0448	0.0816	0.0448
Neutral Axis (x/d)	0.0835	0.0835	0.0835
Using Rebar Top (As_top)	339.3000	339.3000	339.3000
Using Rebar Bot (As_bot)	402.1200	402.1200	402.1200

4. Shear Capacity

	END-I	MID	END-J
Load Combination No.	7	7	7
Factored Shear Force (V_Ed)	33.06	26.73	33.06
Shear Strength by Conc.(V_Rdc)	42.21	42.21	42.21
Shear Strength by Rebar.(V_Rds)	130.62	130.62	130.62
Shear Strength by Rebar.(V_Rdmax)	351.90	351.90	351.90
Using Shear Reinf. (Asw)	1570.8000	1570.8000	1570.8000
Using Stirrups Spacing	2-P10 @100	2-P10 @100	2-P10 @100
Shear Ratio by Conc	0.7833	0.6334	0.7833
Shear Ratio by (V_Rds ; V_Rdmax)	0.2531	0.2047	0.2531
Check Ratio	0.7833	0.6334	0.7833

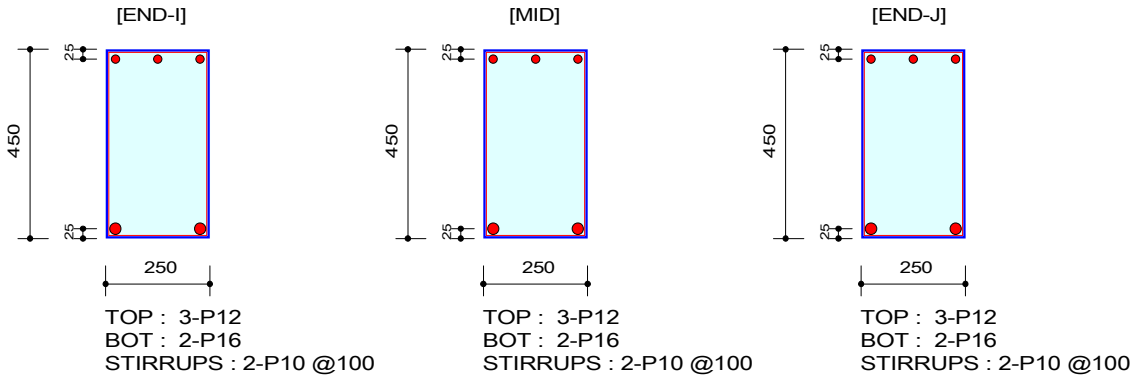
RC Beam Strength Checking Result

	Company		**Project Title**	20 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, mm
Material Data : fck = 0.02, fyk = 0.46, fyw = 0.25 kN/mm^2
Section Property: 450x250 ground beams (No : 7)
Beam Span : 6363.96 mm

2. Section Diagram



3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	5	7	5
Moment (M_Ed)	12814.45	0.00	12814.45
Factored Strength (M_Rd)	55164.63	55164.63	55164.63
Check Ratio (M_Ed/M_Rd)	0.2323	0.0000	0.2323
Neutral Axis (x/d)	0.0725	0.0725	0.0725
(+) Load Combination No.	5	5	5
Moment (M_Ed)	1601.81	6407.23	1601.81
Factored Strength (M_Rd)	65137.57	65137.57	65137.57
Check Ratio (M_Ed/M_Rd)	0.0246	0.0984	0.0246
Neutral Axis (x/d)	0.0835	0.0835	0.0835
Using Rebar Top (As_top)	339.3000	339.3000	339.3000
Using Rebar Bot (As_bot)	402.1200	402.1200	402.1200

4. Shear Capacity

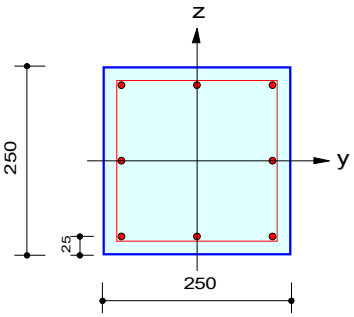
	END-I	MID	END-J
Load Combination No.	5	5	5
Factored Shear Force (V_Ed)	12.08	6.04	12.08
Shear Strength by Conc.(V_Rdc)	42.21	42.21	42.21
Shear Strength by Rebar.(V_Rds)	130.62	130.62	130.62
Shear Strength by Rebar.(V_Rdmax)	351.90	351.90	351.90
Using Shear Reinf. (Asw)	1570.8000	1570.8000	1570.8000
Using Stirrups Spacing	2-P10 @100	2-P10 @100	2-P10 @100
Shear Ratio by Conc	0.2862	0.1431	0.2862
Shear Ratio by (V_Rds ; V_Rdmax)	0.0925	0.0462	0.0925
Check Ratio	0.2862	0.1431	0.2862

RC Column Checking Result

	Company		**Project Title**	20 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Condition

Design Code : Eurocode2:04 UNIT SYSTEM kN, mm
Member Number : 71 (PM), 73 (Shear)
Material Data : fck = 0.02, fyk = 0.46, fyw = 0.25 kN/mm^2
Column Height : 3050 mm
Section Property : 250x250 columns (No : 1)
Rebar Pattern : 8 - 3 - P12 Ast = 904.8 mm^2 (Rhost = 0.014)



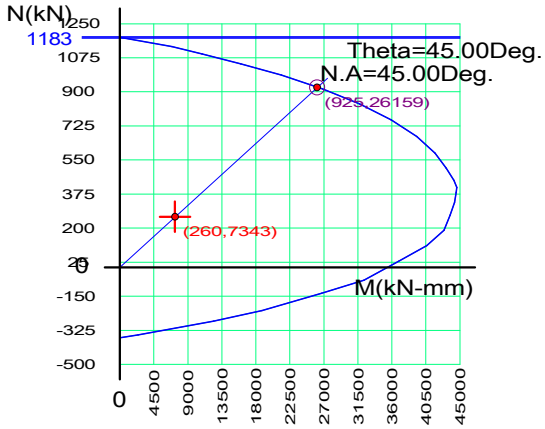
2. Applied Loads

Load Combination : 4 AT (I) Point
N_Ed = 259.630 kN M_Edy = 5192.60 kN-mm M_Edz = 5192.60 kN-mm
M_Ed = SQRT(M_Edy^2+ M_Edz^2) = 7343.44 kN-mm

3. Axial Forces and Moments Capacity Check

Concentric Max. Axial Load	N_Rdmax	= 1183.19 kN	
Axial Load Ratio	N_Ed/N_Rd	= 259.630 / 925.173	= 0.281 < 1.000 ..... O.K
Moment Ratio	M_Ed/M_Rd	= 7343.44 / 26159.1	= 0.281 < 1.000 ..... O.K
	M_Edy/M_Rdy	= 5192.60 / 18497.3	= 0.281 < 1.000 ..... O.K
	M_Edz/M_Rdz	= 5192.60 / 18497.3	= 0.281 < 1.000 ..... O.K
Normalized Axial Load Ratio	Nu_d / 0.65	= 0.164 / 0.650	= 0.252 < 1.000 ..... O.K

4. M-N Interaction Diagram



N_Rd(kN)	M_Rd(kN-mm)
1183.19	0.00
1096.75	10965.09
985.78	21479.71
838.76	31724.89
674.23	39381.86
508.92	43268.04
410.20	44681.28
333.93	44321.67
189.66	42915.43
30.28	36957.42
-131.99	26786.89
-275.25	12447.55
-361.92	0.00

5. Shear Force Capacity Check (End)

Applied Shear Force	V_Ed	= 28.8658 kN (Load Combination : 7)
Shear Ratio by Conc	V_Ed/V_Rdc	= 28.8658 / 50.8972 = 0.567
Shear Ratio by (V_Rds ; V_Rdmax)	V_Ed/V_Rds	= 28.8658 / 29.5063 = 0.978
Shear Ratio	V_Ed/V_Rd	= 0.567 < 1.000 ..... O.K
		(Asw-H_use = 670.26667 mm^2/m, 2-P8 @150)
Joint Shear Ratio	Vjhd/Vjs	= 0.00000 / 0.00000 = 0.000 < 1.000 ..... O.K
		(Ash = 268.10667 mm^2, 2-3 P8)

6. Shear Force Capacity Check (Middle)

Applied Shear Force	V_Ed	= 28.8658 kN (Load Combination : 7)
Shear Ratio by Conc	V_Ed/V_Rdc	= 28.8658 / 51.2189 = 0.564
Shear Ratio by (V_Rds ; V_Rdmax)	V_Ed/V_Rds	= 28.8658 / 29.5063 = 0.978
Shear Ratio	V_Ed/V_Rd	= 0.564 < 1.000 ..... O.K
		(Asw-H_use = 670.26667 mm^2/m, 2-P8 @150)

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

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--------------------------------------------------------------------------------------------
 midas Gen - RC-Mesh Flexural Wall Checking  [ Eurocode2:04 & Eurocode8:04 ]Gen 2019
============================================================================================


============================================================================================
    [[[*]]]   MESHED WALL CHECKING MAXIMUM RESULT DATA : DOMAIN Water tank-Walls. (Vertical)
============================================================================================


 -. Information of Parameters.
    Elem No.  : 2571
    LCB No.   :    4
    Materials :  fck =      0.0200 kN/mm^2.
                 fyk =      0.4600 kN/mm^2.
    Thickness :  t   = 150.0000 mm.
    Covering  :  Dw  =  25.0000 mm.

 -. Information of Design.
    Alpha_cc =   1.000  (Default or User Defined).
    gamma_c  =   1.500  (for Concrete)
    gamma_s  =   1.150  (for Reinforcement)
    fcd      = Alpha_cc *fck / gamma_c =      0.0133 kN/mm^2.
    fyd      = fyk / gamma_s           =      0.4000 kN/mm^2.
    Nu       = 0.6*(1-fck/250) =      0.5520 (fck in MPa)

 -. Design Forces.
    Sig_Edx  =      0.0007 kN/mm^2.
    Sig_Edy  =      0.0001 kN/mm^2.
    Tau_Edxy =      0.0004 kN/mm^2.

    Sig_Ed_max =      0.0007 kN/mm^2. (x-dir)
    Sig_Ed_min =      0.0001 kN/mm^2. (y-dir)
    Tau_Edxy   =      0.0004 kN/mm^2.

    (Sig_Ed_min in Tension or Sig_Ed_max*Sig_Ed_min <= Tau_Edxy^2 --> Rebar Required!)
    ftd_max  =      0.0000 kN/mm^2. (x-dir)
    ftd_min  = Tau_Edxy^2/Sig_Ed_max - Sig_Ed_min        =      0.0001 kN/mm^2. (y-dir)

    f'tdx    =      0.0000 kN/mm^2.
    f'tdy    =      0.0001 kN/mm^2.
    Sig_cd   = Sig_Ed_max*[1 + (Tau_Edxy/Sig_Ed_max)^2 ] =      0.0010 kN/mm^2.

    rhoy_req = max(f'tdy/fyd, 0.002)                =  0.0020
    rhox_req = max(f'tdx/fyd, 0.001, 0.25*rhoy_req) =  0.0010

    b        = 1.0 mm.  (by Unit Length).
    Asx_Req  =       0.1500 mm^2/mm.  (     150.0000 mm^2/m.)
    Asy_Req  =       0.3000 mm^2/mm.  (     300.0000 mm^2/m.)
    Asx_use  =       0.3927 mm^2/mm.  (     392.7000 mm^2/m.)
    Asy_use  =       0.5655 mm^2/mm.  (     565.5000 mm^2/m.)
    ftnx     = Asx_use/(b*t)*fyd =      0.0010 kN/mm^2.
    ftny     = Asy_use/(b*t)*fyd =      0.0015 kN/mm^2.
```

PROJECT TITLE : 20 cum tank

	Company		Client	
	Author	Sheilla C A	File Name	tanks-meshed-loaded-analysis.rcs

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--------------------------------------------------------------------------------------------
 midas Gen - RC-Mesh Flexural Wall Checking  [ Eurocode2:04 & Eurocode8:04 ]Gen 2019
============================================================================================


 -. Information of Result.
    Rein. Bar_x :  P10 @200 (Hor.)
    Rein. Bar_y :  P12 @200 (Ver.)
    Rat_x   = f'tdx/ftnx       =   0.000
    Rat_y   = f'tdy/ftny       =   0.096
    Rat_cd  = Sig_cd/(Nu*fcd)  =   0.134
    Rat     = Rat_y =   0.096  <  1.0  --->  O.K !
```
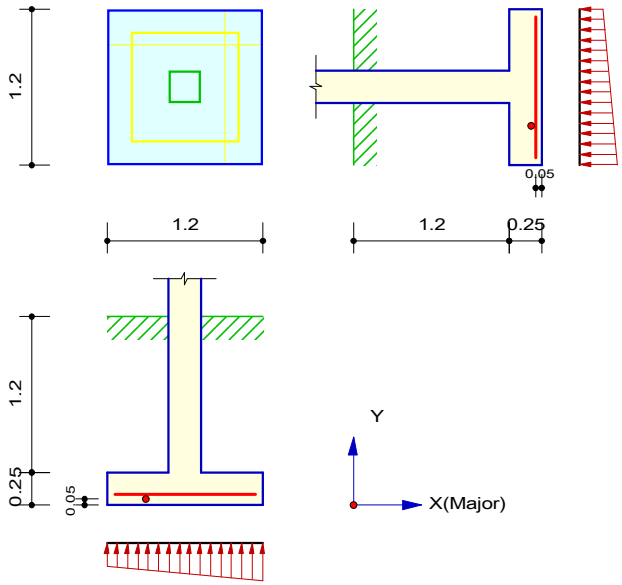

	Company		**Project Title**	20 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Geometry and Materials

Material : fcu = 20594, fy = 392266 kN/m^2
Dim. : 1.2 * 1.2 * 0.25 m (Dc = 0.05 m)
Allow. Soil Qe = 350 kN/m^2
Soil Depth H = 1.2 m (Density = 18 kN/m^3)



2. Design Condition

Design Code : BS8110-97
Selected Node No : 51
Design Node No : 51 (Column Size: 0.25*0.25 m)
Design Load Combination
Service : 2 [fLCB2 : 1.0D + (1.0LL)]
Factored : 1 [fLCB1 : 1.35D + 1.5(1.0LL)]
Applied Loads
Ns = 206.311, Nu = 288.797 kN
Msx = -11.098, Mux = -15.000 kN-m
Msy = 11.0986, Muy = 14.9998 kN-m

3. Soil Bearing Pressure Check

Actual Pressure
Qs(max) = 247.945 kN/m^2 < Qe = 350.000 kN/m^2 ..... O.K
Qs(min) = 93.7985 kN/m^2 > 0.00 kN/m^2 ..... O.K
Design Pressure
Qu(max) = 304.719 kN/m^2
Qu(min) = 96.3889 kN/m^2

4. Bending Moment Check (Gammamc= 1.50, Gammams= 1.05)

X-X Axis (Y Direction)

	Required Space	Max. Space
Mux = 26.9500 kN-m/m		
As = 0.00038 m^2/m	P12 @ 290	P12 @ 270
As(min) = 0.0017*D = 0.00041 m^2/m	P13 @ 340	P13 @ 320

Y-Y Axis (X Direction)

	Required Space	Max. Space
Muy = 26.9501 kN-m/m		
As = 0.00040 m^2/m	P12 @ 270	P12 @ 270
As(min) = 0.0017*D = 0.00041 m^2/m	P13 @ 320	P13 @ 320

5. Shear Check (Gammam= 1.25)

Vertical Shear
Vy_d = 330.963 kN/m^2 < 2*Vcy = 864.629 kN/m^2 ..... O.K
Vy_2d = 93.5177 kN/m^2 < Vcy = 432.314 kN/m^2 ..... O.K
Vx_d = 366.658 kN/m^2 < 2*Vcx = 915.088 kN/m^2 ..... O.K
Vx_2d = 130.775 kN/m^2 < Vcx = 457.544 kN/m^2 ..... O.K

Punching Shear
V = 466.287 kN/m^2 < Vc = 741.162 kN/m^2 ..... O.K
Vcf = 1424.03 kN/m^2 < Vmax = 3631.08 kN/m^2 ..... O.K

REQUIRED REINFORCEMENTAND CONCRETE STRENGTH

SECTION	**Dimensions**	**REINFORCEMENT**	**CONCRETE STRENGTH**
Tank roof slab	150mm thick	T10 @ 200 (All bars)	C20/25
Tank floor slab	150 mm thick	T12 @ 200 (All bars)	C20/25
Tank walls	150 mm thick	T12 @ 200 (Vertical) T10 @ 200 (Horizontal)	C20/25
Footing	1.2x1.2x0.25m	T12 @ 200 (All bars)	C20/25