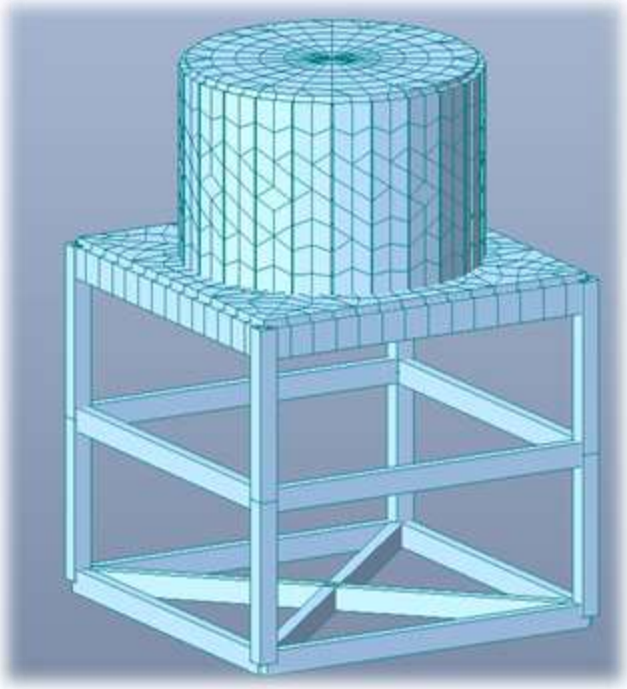


60 M^3 ELEVATED STORAGE WATER TANK DESIGN REPORT

2nd September 2023

Prepared by:
Sheilla Constance Apio

ANALYSIS MODEL

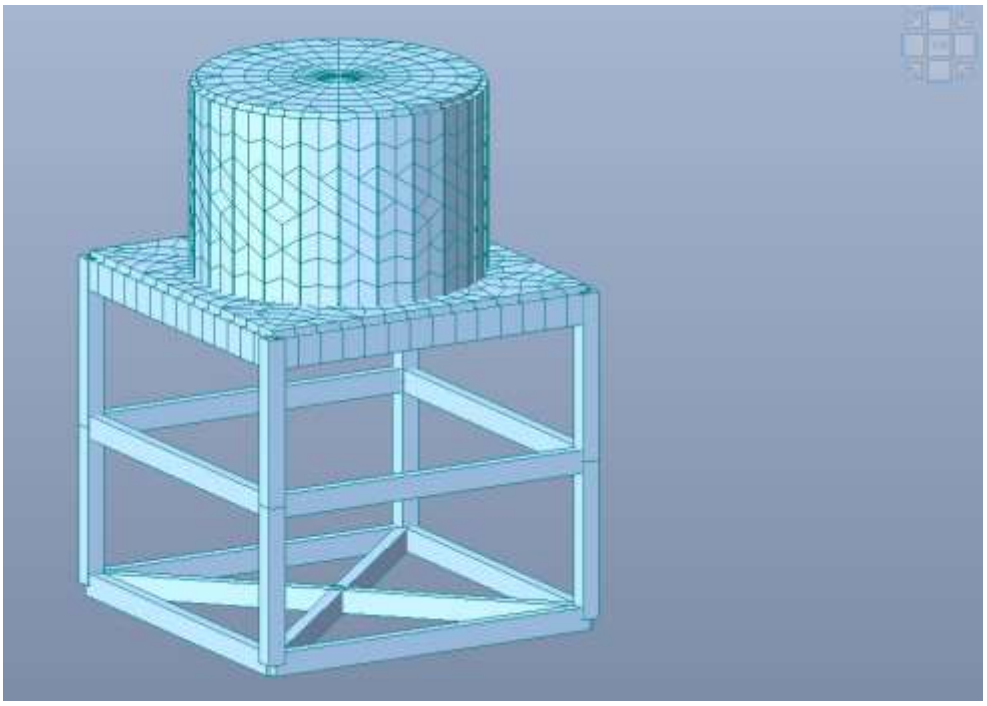


Figure 1 Analysis model

MODAL DISPLACEMENT

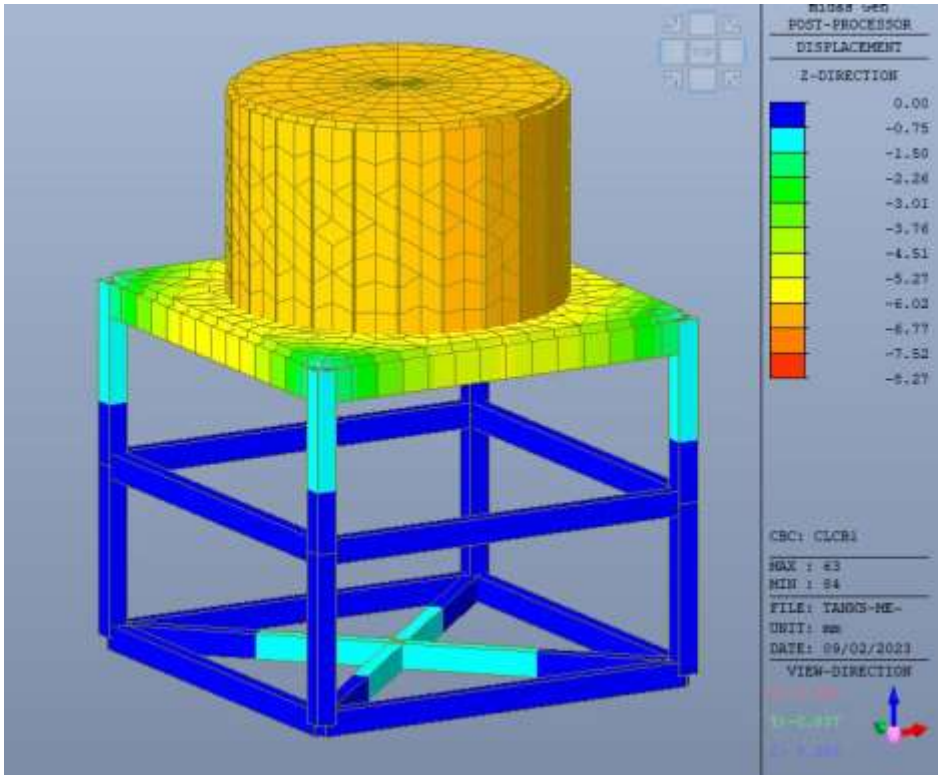


Figure 2 Modal displacement

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

PROJECT TITLE : 60 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
 ------------------------------------------------------------------
  0.2500   1479 BOT 0.0012 0.0020 | 99.7026(   1) 155.484 0.641  OK
           1513 TOP 0.0003 0.0020 | 24.3879(   1) 155.484 0.157  OK
 ------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 1479
    Thickness :    0.2500 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1

 -. Information of Design.
    b        =   0.0010 m.  (by Code Unit Length).
    d        =   0.2250 m.
    lambda   =   0.800
    a        = lambda * x  =   0.060 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.7969 kN.
    M_Rd     = Cc*(d-a/2)  =     155.4840  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P16 @100
    As_req =       0.0012 m^2/m.  (       0.0012 m^2/m.)
    M_Ed   =      99.7026  kN-m./m.
    M_Rd   =     155.4840  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.641  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.335

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 1513
    Thickness :    0.2500 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1
```

PROJECT TITLE : 60 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        =   0.0010 m.  (by Code Unit Length).
    d        =   0.2250 m.
    lambda   =   0.800
    a        = lambda * x  =   0.060 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.7969 kN.
    M_Rd     = Cc*(d-a/2)  =     155.4840  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P16 @100
    As_req =       0.0003 m^2/m.  (       0.0003 m^2/m.)
    M_Ed   =      24.3879  kN-m./m.
    M_Rd   =     155.4840  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.157  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.335
```

PROJECT TITLE : 60 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
 ---------------------------------------------------------------------
  0.2500   1534 BOT 0.0012 0.0020 | 99.7879(   1) 155.484 0.642  OK
           1475 TOP 0.0003 0.0020 | 24.3726(   1) 155.484 0.157  OK
 ---------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 1534
    Thickness :    0.2500 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1

 -. Information of Design.
    b        =   0.0010 m.  (by Code Unit Length).
    d        =   0.2250 m.
    lambda   =   0.800
    a        = lambda * x  =   0.060 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.7969 kN.
    M_Rd     = Cc*(d-a/2)  =     155.4840  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P16 @100
    As_req =       0.0012 m^2/m.  (       0.0012 m^2/m.)
    M_Ed   =      99.7879  kN-m./m.
    M_Rd   =     155.4840  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.642  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.335

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 1475
    Thickness :    0.2500 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1
```

PROJECT TITLE : 60 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        =   0.0010 m.  (by Code Unit Length).
    d        =   0.2250 m.
    lambda   =   0.800
    a        = lambda * x  =   0.060 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.7969 kN.
    M_Rd     = Cc*(d-a/2)  =     155.4840  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P16 @100
    As_req =       0.0003 m^2/m.  (       0.0003 m^2/m.)
    M_Ed   =      24.3726  kN-m./m.
    M_Rd   =     155.4840  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.157  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.335
```

PROJECT TITLE : 60 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
 ------------------------------------------------------------------
  0.2000   4353 BOT 0.0002 0.0004 | 6.79819(   1) 26.5133 0.256  OK
           4318 TOP 0.0002 0.0004 | 10.8976(   1) 26.5133 0.411  OK
 ------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 4353
    Thickness :    0.2000 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1

 -. Information of Design.
    b        =   0.0010 m.  (by Code Unit Length).
    d        =   0.1750 m.
    lambda   =   0.800
    a        = lambda * x  =   0.012 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1568 kN.
    M_Rd     = Cc*(d-a/2)  =      26.5133  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.0002 m^2/m.  (       0.0002 m^2/m.)
    M_Ed   =       6.7982  kN-m./m.
    M_Rd   =      26.5133  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.256  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.084

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 4318
    Thickness :    0.2000 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1
```

PROJECT TITLE : 60 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        =   0.0010 m.  (by Code Unit Length).
    d        =   0.1750 m.
    lambda   =   0.800
    a        = lambda * x  =   0.012 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1568 kN.
    M_Rd     = Cc*(d-a/2)  =      26.5133  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.0002 m^2/m.  (       0.0002 m^2/m.)
    M_Ed   =      10.8976  kN-m./m.
    M_Rd   =      26.5133  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.411  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.084
```

PROJECT TITLE : 60 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
 ------------------------------------------------------------------
  0.2000   4305 BOT 0.0002 0.0004 | 6.80093(   1) 26.5133 0.257  OK
           4249 TOP 0.0002 0.0004 | 10.7783(   1) 26.5133 0.407  OK
 ------------------------------------------------------------------


 << BOTTOM >>

 -. Information of Parameters.
    Elem No.  : 4305
    Thickness :    0.2000 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1

 -. Information of Design.
    b        =   0.0010 m.  (by Code Unit Length).
    d        =   0.1750 m.
    lambda   =   0.800
    a        = lambda * x  =   0.012 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1568 kN.
    M_Rd     = Cc*(d-a/2)  =      26.5133  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.0002 m^2/m.  (       0.0002 m^2/m.)
    M_Ed   =       6.8009  kN-m./m.
    M_Rd   =      26.5133  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.257  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.084

 << TOP >>

 -. Information of Parameters.
    Elem No.  : 4249
    Thickness :    0.2000 m.
    Materials :  fck =  20000.0000 KPa.
                 fcd =  13333.3333 KPa.
                 fyk = 460000.0000 KPa.
    Covering  :  dB  =   0.0250 m.
                 dT  =   0.0250 m.
    LCB No.   :    1
```

PROJECT TITLE : 60 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        =   0.0010 m.  (by Code Unit Length).
    d        =   0.1750 m.
    lambda   =   0.800
    a        = lambda * x  =   0.012 m.
    eta      =   1.000
    Cc       = eta*fcd*b*a =      0.1568 kN.
    M_Rd     = Cc*(d-a/2)  =      26.5133  kN-m./m.

 -. Information of Moments and Result.
    Rein. Bar :  P10 @200
    As_req =       0.0002 m^2/m.  (       0.0002 m^2/m.)
    M_Ed   =      10.7783  kN-m./m.
    M_Rd   =      26.5133  kN-m./m.
    RatM   = M_Ed / M_Rd =   0.407  <  1.0  --->  O.K !

 -. Check ratio of neutral axis depth to effective depth.
    x/d         =    0.084
```

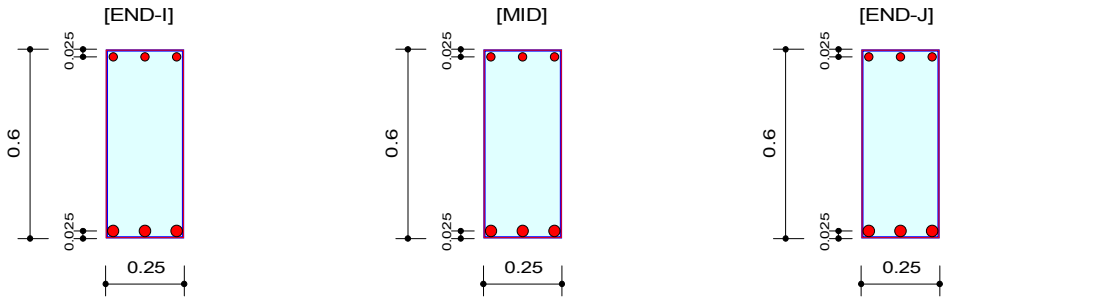
RC Beam Strength Checking Result

	Company		**Project Title**	60 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, m
Material Data : fck = 20000, fyk = 460000, fyw = 250000 KPa
Section Property: 600x250 loading beams (No : 10)
Beam Span : 9.54594 m

2. Section Diagram



TOP : 3-P16
BOT : 3-P20
STIRRUPS : 2-P10 @50

TOP : 3-P16
BOT : 3-P20
STIRRUPS : 2-P10 @50

TOP : 3-P16
BOT : 3-P20
STIRRUPS : 2-P10 @50

3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	4	4	4
Moment (M_Ed)	39.86	9.97	39.89
Factored Strength (M_Rd)	133.12	133.12	133.12
Check Ratio (M_Ed/M_Rd)	0.2994	0.0749	0.2997
Neutral Axis (x/d)	0.0579	0.0579	0.0579
(+) Load Combination No.	4	4	4
Moment (M_Ed)	75.39	89.81	75.65
Factored Strength (M_Rd)	207.15	207.15	207.15
Check Ratio (M_Ed/M_Rd)	0.3639	0.4336	0.3652
Neutral Axis (x/d)	0.0977	0.0977	0.0977
Using Rebar Top (As_top)	0.0006	0.0006	0.0006
Using Rebar Bot (As_bot)	0.0009	0.0009	0.0009

4. Shear Capacity

	END-I	MID	END-J
Load Combination No.	4	4	4
Factored Shear Force (V_Ed)	187.88	49.30	188.28
Shear Strength by Conc.(V_Rdc)	64.67	64.67	64.67
Shear Strength by Rebar.(V_Rds)	353.43	353.43	353.43
Shear Strength by Rebar.(V_Rdmax)	476.10	476.10	476.10
Using Shear Reinf. (Asw)	0.0031	0.0031	0.0031
Using Stirrups Spacing	2-P10 @50	2-P10 @50	2-P10 @50
Shear Ratio by Conc	2.9054	0.7623	2.9115
Shear Ratio by (V_Rds ; V_Rdmax)	0.5316	0.1395	0.5327
Check Ratio	0.5316	0.7623	0.5327

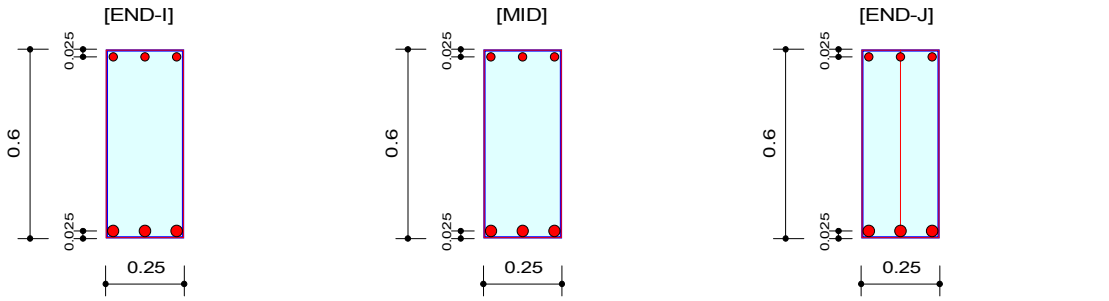
RC Beam Strength Checking Result

	Company		**Project Title**	60 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, m
Material Data : fck = 20000, fyk = 460000, fyw = 250000 KPa
Section Property: 600x250 tie beams (No : 11)
Beam Span : 7.35 m

2. Section Diagram



TOP : 3-P16
BOT : 3-P20
STIRRUPS : 2-P10 @50

TOP : 3-P16
BOT : 3-P20
STIRRUPS : 2-P10 @50

TOP : 3-P16
BOT : 3-P20
STIRRUPS : 3-P10 @50

3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	4	4	4
Moment (M_Ed)	49.84	12.47	49.87
Factored Strength (M_Rd)	133.12	133.12	133.12
Check Ratio (M_Ed/M_Rd)	0.3744	0.0936	0.3746
Neutral Axis (x/d)	0.0579	0.0579	0.0579
(+) Load Combination No.	4	4	4
Moment (M_Ed)	117.05	144.37	117.07
Factored Strength (M_Rd)	207.15	207.15	207.15
Check Ratio (M_Ed/M_Rd)	0.5651	0.6969	0.5651
Neutral Axis (x/d)	0.0977	0.0977	0.0977
Using Rebar Top (As_top)	0.0006	0.0006	0.0006
Using Rebar Bot (As_bot)	0.0009	0.0009	0.0009

4. Shear Capacity

	END-I	MID	END-J
Load Combination No.	4	7	4
Factored Shear Force (V_Ed)	215.29	54.98	215.53
Shear Strength by Conc.(V_Rdc)	64.67	64.67	64.67
Shear Strength by Rebar.(V_Rds)	353.43	353.43	476.10
Shear Strength by Rebar.(V_Rdmax)	476.10	476.10	476.10
Using Shear Reinf. (Asw)	0.0031	0.0031	0.0047
Using Stirrups Spacing	2-P10 @50	2-P10 @50	3-P10 @50
Shear Ratio by Conc	3.3291	0.8502	3.3329
Shear Ratio by (V_Rds ; V_Rdmax)	0.6091	0.1556	0.4527
Check Ratio	0.6091	0.8502	0.4527

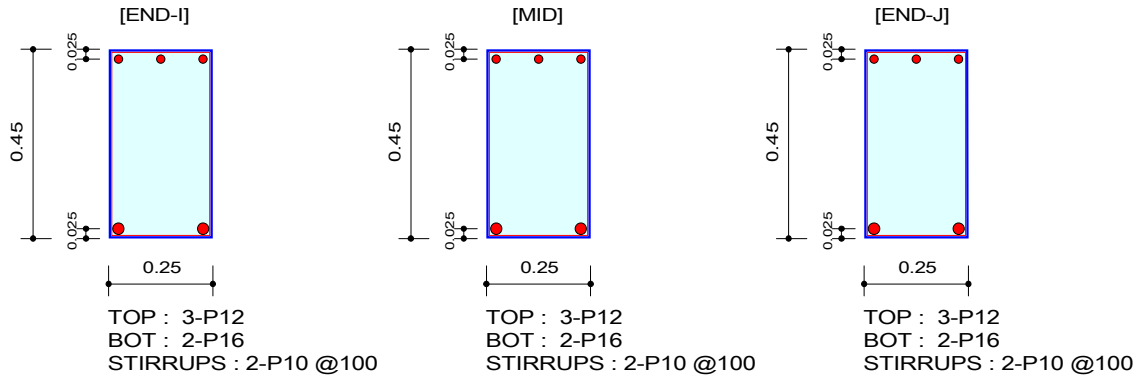
RC Beam Strength Checking Result

	Company		**Project Title**	60 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, m
Material Data : fck = 20000, fyk = 460000, fyw = 250000 KPa
Section Property: 450x250 tie beams (No : 6)
Beam Span : 6.75 m

2. Section Diagram



3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	4	4	4
Moment (M_Ed)	17.85	4.46	17.84
Factored Strength (M_Rd)	55.16	55.16	55.16
Check Ratio (M_Ed/M_Rd)	0.3235	0.0809	0.3235
Neutral Axis (x/d)	0.0725	0.0725	0.0725
(+) Load Combination No.	4	5	4
Moment (M_Ed)	8.92	4.63	8.92
Factored Strength (M_Rd)	65.14	65.14	65.14
Check Ratio (M_Ed/M_Rd)	0.1370	0.0711	0.1370
Neutral Axis (x/d)	0.0835	0.0835	0.0835
Using Rebar Top (As_top)	0.0003	0.0003	0.0003
Using Rebar Bot (As_bot)	0.0004	0.0004	0.0004

4. Shear Capacity

	END-I	MID	END-J
Load Combination No.	7	7	7
Factored Shear Force (V_Ed)	27.31	17.82	27.31
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)	0.0016	0.0016	0.0016
Using Stirrups Spacing	2-P10 @100	2-P10 @100	2-P10 @100
Shear Ratio by Conc	0.6472	0.4223	0.6472
Shear Ratio by (V_Rds ; V_Rdmax)	0.2091	0.1365	0.2091
Check Ratio	0.6472	0.4223	0.6472

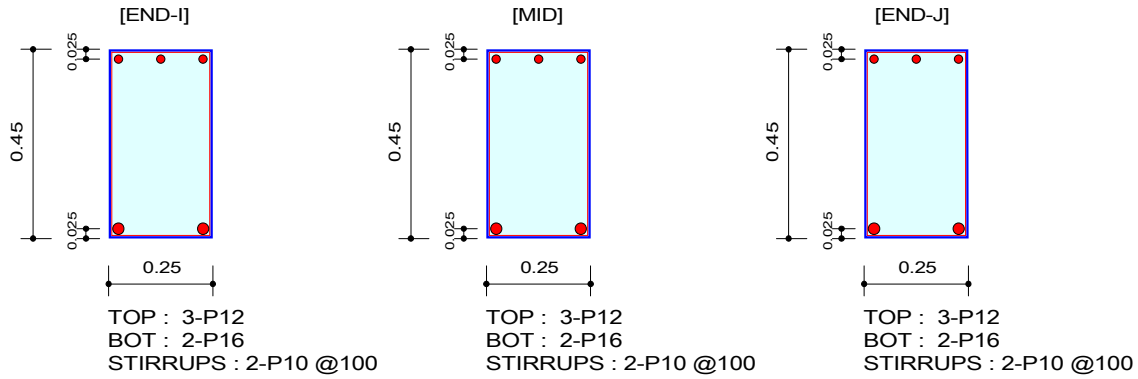
RC Beam Strength Checking Result

	Company		**Project Title**	60 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Information

Design Code : Eurocode2:04
Unit System : kN, m
Material Data : fck = 20000, fyk = 460000, fyw = 250000 KPa
Section Property: 450x250 ground beams (No : 7)
Beam Span : 9.54594 m

2. Section Diagram



3. Bending Moment Capacity

	END-I	MID	END-J
(-) Load Combination No.	5	7	5
Moment (M_Ed)	28.83	0.00	28.83
Factored Strength (M_Rd)	55.16	55.16	55.16
Check Ratio (M_Ed/M_Rd)	0.5227	0.0000	0.5227
Neutral Axis (x/d)	0.0725	0.0725	0.0725
(+) Load Combination No.	5	5	5
Moment (M_Ed)	3.60	14.42	3.60
Factored Strength (M_Rd)	65.14	65.14	65.14
Check Ratio (M_Ed/M_Rd)	0.0553	0.2213	0.0553
Neutral Axis (x/d)	0.0835	0.0835	0.0835
Using Rebar Top (As_top)	0.0003	0.0003	0.0003
Using Rebar Bot (As_bot)	0.0004	0.0004	0.0004

4. Shear Capacity

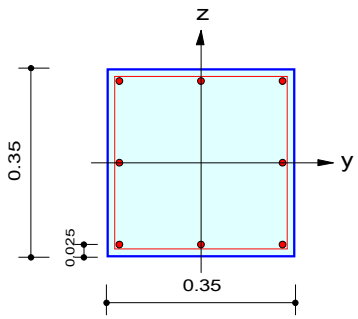
	END-I	MID	END-J
Load Combination No.	5	5	5
Factored Shear Force (V_Ed)	18.12	9.06	18.12
Shear Strength by Conc.(V_Rdc)	42.21	42.21	42.21
Shear Strength by Rebar.(V_Rds)	130.62	130.62	130.62
Shear Strength by Rebar.(V_Rdmax)	351.90	351.90	351.90
Using Shear Reinf. (Asw)	0.0016	0.0016	0.0016
Using Stirrups Spacing	2-P10 @100	2-P10 @100	2-P10 @100
Shear Ratio by Conc	0.4294	0.2147	0.4294
Shear Ratio by (V_Rds ; V_Rdmax)	0.1387	0.0694	0.1387
Check Ratio	0.4294	0.2147	0.4294

RC Column Checking Result

	Company		**Project Title**	60 cum tank
	Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Design Condition

Design Code : Eurocode2:04 UNIT SYSTEM kN, m
Member Number : 98 (PM), 97 (Shear)
Material Data : fck = 20000, fyk = 460000, fyw = 250000 KPa
Column Height : 3.25 m
Section Property : 350x350 columns (No : 3)
Rebar Pattern : 8 - 3 - P16 Ast = 0.00160848 m^2 (Rhost = 0.013)



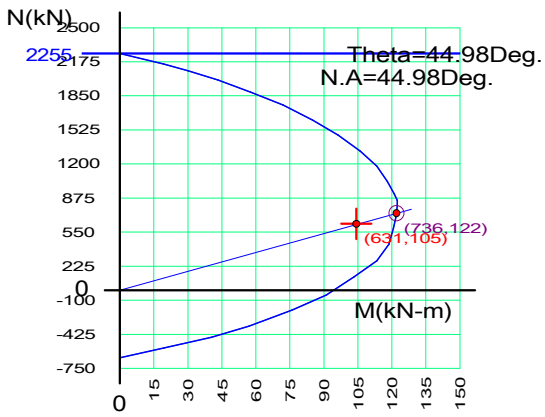
2. Applied Loads

Load Combination : 4 AT (J) Point
N_Ed = 630.914 kN M_Edy = 74.0150 kN-m M_Edz = 73.9733 kN-m
M_Ed = SQRT(M_Edy^2+ M_Edz^2) = 104.644 kN-m

3. Axial Forces and Moments Capacity Check

Concentric Max. Axial Load	N_Rdmax	= 2255.28 kN	
Axial Load Ratio	N_Ed/N_Rd	= 630.914 / 735.784	= 0.857 < 1.000 ..... O.K
Moment Ratio	M_Ed/M_Rd	= 104.644 / 122.250	= 0.856 < 1.000 ..... O.K
	M_Edy/M_Rdy	= 74.0150 / 86.4764	= 0.856 < 1.000 ..... O.K
	M_Edz/M_Rdz	= 73.9733 / 86.4110	= 0.856 < 1.000 ..... O.K
Normalized Axial Load Ratio	Nu_d / 0.65	= 0.214 / 0.650	= 0.329 < 1.000 ..... O.K

4. M-N Interaction Diagram



N_Rd(kN)	M_Rd(kN-m)
2255.28	0.00
2093.75	30.02
1892.21	57.78
1625.33	85.18
1327.76	106.11
1040.45	118.25
859.92	122.57
711.79	122.10
435.70	118.78
128.20	103.44
-187.32	76.10
-451.53	40.62
-643.39	0.00

5. Shear Force Capacity Check (End)

Applied Shear Force	V_Ed	= 58.8340 kN (Load Combination : 7)
Shear Ratio by Conc	V_Ed/V_Rdc	= 58.8340 / 104.402 = 0.564
Shear Ratio by (V_Rds ; V_Rdmax)	V_Ed/V_Rds	= 58.8340 / 42.6202 = 1.380
Shear Ratio	V_Ed/V_Rd	= 0.564 < 1.000 ..... O.K
		(Asw-H_use = 0.00067 m^2/m, 2-P8 @150)
Joint Shear Ratio	Vjhd/Vjs	= 0.00000 / 0.00000 = 0.000 < 1.000 ..... O.K
		(Ash = 0.00027 m^2, 2-3 P8)

6. Shear Force Capacity Check (Middle)

Applied Shear Force	V_Ed	= 58.8340 kN (Load Combination : 7)
Shear Ratio by Conc	V_Ed/V_Rdc	= 58.8340 / 104.402 = 0.564
Shear Ratio by (V_Rds ; V_Rdmax)	V_Ed/V_Rds	= 58.8340 / 42.6202 = 1.380
Shear Ratio	V_Ed/V_Rd	= 0.564 < 1.000 ..... O.K
		(Asw-H_use = 0.00067 m^2/m, 2-P8 @150)

PROJECT TITLE : 60 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 Design    [ Eurocode2:04 & Eurocode8:04 ]Gen 2019
============================================================================================


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


 -. Information of Parameters.
    Elem No.  : 3159
    LCB No.   :    4
    Materials :  fck =  20000.0000 KPa.
                 fyk = 460000.0000 KPa.
    Thickness :  t   =   0.2500 m.
    Covering  :  Dw  =   0.0250 m.

 -. 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 =  13333.3333 KPa.
    fyd      = fyk / gamma_s           = 400000.0000 KPa.
    Nu       = 0.6*(1-fck/250) =      0.5520 (fck in MPa)

 -. Design Forces.
    Sig_Edx  =    473.1683 KPa.
    Sig_Edy  =   -425.6683 KPa.
    Tau_Edxy =    476.4071 KPa.

    Sig_Ed_max =    473.1683 KPa. (x-dir)
    Sig_Ed_min =   -425.6683 KPa. (y-dir)
    Tau_Edxy   =    476.4071 KPa.

    (Sig_Ed_min in Tension or Sig_Ed_max*Sig_Ed_min <= Tau_Edxy^2 --> Rebar Required!)
    ftd_max  = |Tau_Edxy| - Sig_Ed_max =      3.2389 KPa. (x-dir)
    ftd_min  = |Tau_Edxy| - Sig_Ed_min =    902.0754 KPa. (y-dir)

    f'tdx    =      3.2389 KPa.
    f'tdy    =    902.0754 KPa.
    Sig_cd   = 2*|Tau_Edxy|         =    952.8142 KPa.

    rhoy_req = max(f'tdy/fyd, 0.002)               =  0.0023
    rhox_req = max(f'tdx/fyd, 0.001, 0.25*rhoy_req) =  0.0010

    b        = 1.0 m.  (by Unit Length).
    Asx_Req  =       0.0003 m^2/m.  (       0.0003 m^2/m.)
    Asy_Req  =       0.0006 m^2/m.  (       0.0006 m^2/m.)
    Asx_use  =       0.0004 m^2/m.  (       0.0004 m^2/m.)
    Asy_use  =       0.0006 m^2/m.  (       0.0006 m^2/m.)
    ftnx     = Asx_use/(b*t)*fyd =    628.3200 KPa.
    ftny     = Asy_use/(b*t)*fyd =    904.8000 KPa.
```

PROJECT TITLE : 60 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 Design    [ Eurocode2:04 & Eurocode8:04 ]Gen 2019
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 -. Information of Result.
    Rein. Bar_x :  P10 @200 (Hor.)
    Rein. Bar_y :  P12 @200 (Ver.)
    Rat_x   = f'tdx/ftnx       =   0.005
    Rat_y   = f'tdy/ftny       =   0.997
    Rat_cd  = Sig_cd/(Nu*fcd)  =   0.129
    Rat     = Rat_y =   0.997  <  1.0  --->  O.K !
```
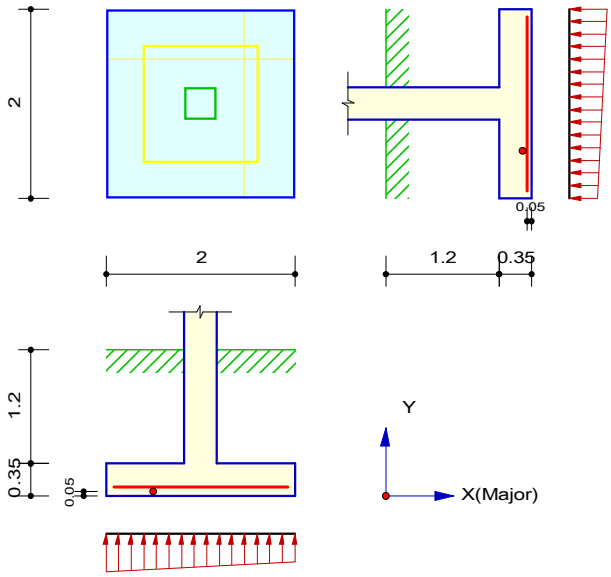

Company		**Project Title**	60 cum tank
Author	Sheilla C A	**File Name**	D:\...s-meshed-loaded-analysis.mgb

1. Geometry and Materials

Material : fcu = 20594, fy = 392266 kN/m^2
Dim. : 2 * 2 * 0.35 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 : 64
Design Node No : 64 (Column Size: 0.35*0.35 m)
Design Load Combination
Service : 2 [fLCB2 : 1.0D + (1.0LL)]
Factored : 1 [fLCB1 : 1.35D + 1.5(1.0LL)]
Applied Loads
Ns = 516.562, Nu = 726.339 kN
Msx = 28.9889, Mux = 39.5225 kN-m
Msy = -28.991, Muy = -39.526 kN-m

3. Soil Bearing Pressure Check

Actual Pressure
Qs(max) = 202.625 kN/m^2 < Qe = 350.000 kN/m^2 ..... O.K
Qs(min) = 115.656 kN/m^2 > 0.00 kN/m^2 ..... O.K
Design Pressure
Qu(max) = 240.871 kN/m^2
Qu(min) = 122.299 kN/m^2

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

X-X Axis (Y Direction)

	Required Space	Max. Space
Mux = 69.1090 kN-m/m		
As = 0.00065 m^2/m	P12 @ 160	P12 @ 190
As(req) = As*Lx*2/3(Cx+3d) = 0.00069 m^2/m	P13 @ 190	P13 @ 220

Y-Y Axis (X Direction)

	Required Space	Max. Space
Muy = 69.1096 kN-m/m		
As = 0.00068 m^2/m	P12 @ 150	P12 @ 190
As(req) = As*Ly*2/3(Cy+3d) = 0.00074 m^2/m	P13 @ 170	P13 @ 220

5. Shear Check (Gammam= 1.25)

Vertical Shear
Vy_d = 356.030 kN/m^2 < 2*Vcy = 816.090 kN/m^2 ..... O.K
Vy_2d = 155.919 kN/m^2 < Vcy = 408.045 kN/m^2 ..... O.K
Vx_d = 379.013 kN/m^2 < 2*Vcx = 847.209 kN/m^2 ..... O.K
Vx_2d = 179.434 kN/m^2 < Vcx = 423.605 kN/m^2 ..... O.K

Punching Shear
V = 513.648 kN/m^2 < Vc = 623.596 kN/m^2 ..... O.K
Vcf = 1710.63 kN/m^2 < Vmax = 3631.08 kN/m^2 ..... O.K

REQUIRED REINFORCEMENTAND CONCRETE STRENGTH

SECTION	**Dimensions**	**REINFORCEMENT**	**CONCRETE STRENGTH**
Tank roof slab	200 mm thick	T10 @ 200 (All bars)	C20/25
Tank floor slab	200 mm thick	T16 @ 100 (All bars)	C20/25
Tank walls	250 mm thick	T12 @ 200 (Vertical) T10 @ 200 (Horizontal)	C20/25
Footing	2.0x2.0x0.35m	T12 @ 150 (All bars)	C20/25