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Design And Analysis of Clear Water Reservoir

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Abstract: **The main theme behind this project is to perform analysis and design of a rectangular clear water reservoir. Water is getting scarce and polluted there is a necessity of construction of clear water reservoir for storage and distribution of pure water for different purposes. Water reservoir include both circular and rectangular .The design is done mainly based on the storage capacity and supply , it may also includes choice of materials of construction, as well as the location, volume, purpose, hydraulic pressures , soil pressures , Wind and Earthquake design considerations etc… We conclude that our project work is based on the goal of constructing the best, economical and safest design of an rectangular clear water reservoir the design is done by limit state method. The analysis and design of rectangular clear water reservoir taking different load cases like Dead load , Live Load, Seismic load in to consideration .**

Keywords: **Clear Water Reservoir, RCC Walls, Footings.**

1. INTRODUCTION

1.1 Water Retaining Structures:

The purposes of retaining structures is to create large bodies of water, or reservoirs, that have a variety of functions, including land irrigation, power generation, water supply and flood control

Fig .1.1: Water Retaining Structure

1.2 Basic Types of Water Retaining Structures:

Classification based on purpose:

Raw Water Reservoir;

Raw water reservoir is a water retaining structure, where the raw water is screened before being pump to the treatment plant. The raw water reservoir is also a flow regulating basin that feeds the treatment plant with a constant flow

Fig .1.2: Raw Water Reservoir

Clear Water Reservoir;

Clear water reservoir is a water retaining structure which is used to store clear water from treatment plant Clear water reservoir should always be closed structures, design to prevent contamination through ingress of surface or ground water.

Fig .1.3: Clear Water Reservoir

Elevated service Reservoir;

Elevated water reservoir is a water retaining structure which is used to balance the fluctuating demand from the distribution system, permitting the source to given study or differently faced output (to give a suitable pressure for the distribution system and reduce pressure fluctuations)

Fig. 1.4: Elevated Service Reservoir

2. CLEAR WATER RESERVOIR

Clear Water Reservoir is mainly classified into two types based upon Shape

1. Rectangular Clear Water Reservoir
2. Circular Clear Water Reservoir

Rectangular Clear Water Reservoir;

The walls of large rectangular reservoirs are sometimes build in discontinuous lengths in order to minimize restraints to the effects of early thermal contraction shrinkage, If the wall basis discontinuous with main floor slab each wall unit is designed to be independently stable, and no slip membrane is provided between the wall base and the blinding concrete alternatively the base to each unit to each wall unit can be tide into the adjacent panel of floor slab. Roof slabs can be connected to the perimeter walls are simply supported with a sliding joint between the top of the wall and the underside of the slab. In such forms of construction, except for the effect of any corner junctions, the walls pan vertically, lighter as a cantilever, or with ends that are simply supported are restrain, depending on the particular details.

Fig .2.1: Rectangular Clear Water Reservoir

Circular Clear Water reservoir

The walls of circular reservoir is primarily designed to resist ring tension due to the horizontal pressures of the contain liquid. If the wall free end the at top and free to slide at bottom then, when tank is full, the intention depth is z is given by n=Yzr, where Y is the unit weight of liquid, and r is the internal radius of the tank. In this condition when the tank is full, no vertical bending or radial share exits

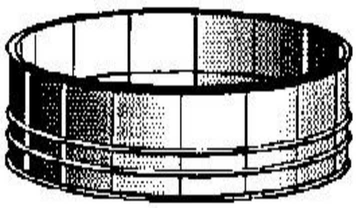

Fig .2.2: Circular Clear Water Reservoir

Design procedure for rectangular clear water reservoir and its requirement:

Ground or partly underground liquid containing structures shall be designed for the following conditions:

- liquid depth up to full height of wall : no relief due to soil pressure from outside to be considered;
- structure empty (i.e. empty of liquid, any material, etc.): full earth pressure and surcharge pressure wherever applicable, to be considered;
- structures shall be designed for uplift in empty conditions with the water table as indicated in geo-technical report & due care should be taken for seasonal variation on higher side.
- walls shall be designed under operating conditions to resist earthquake forces from earth pressure mobilization and dynamic water loads;

- Ground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/uplift pressures from below to base slab. The design shall be such that the minimum gravity weight exceeds the uplift pressure at least by 20%.
- An increase cover of 15 mm is recommended for walls and roof bottom to account for contract with chlorinated water in side the reservoir. The increase cover is not proposed for the base slab as a cement concrete screed topping is proposed to provide protection to the RCC Structure.

Foundations:

The minimum depth of foundations for the structures, frame foundations and load bearing walls shall be as per IS 1904.

Bearing capacity of soil shall be determined as per IS: 6403.

Care shall be taken to avoid the foundations of adjacent buildings or structure foundations, either existing or not within the scope of this contract. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. No extra claims for such adjustments shall be accepted by the Employer.

A structure subjected to groundwater pressure shall be designed to resist floatation. The dead weight of empty structure shall provide a factor of safety of 1.2 against uplift during construction and service.

Where there is level difference between the natural ground level and the foundations of structure or floor slabs, this difference shall be filled up in the following ways

In case of liquid retaining structures, the natural top soil shall be removed as described above and the level difference shall be made up with Plain Cement Concrete not weaker than M 10.

Design Requirements:

The following are the design requirements for all reinforced or plain concrete structures.

a) All blinding and leveling concrete shall be a minimum 100 mm thick in concrete grade M10 unless otherwise

Liquid Retaining Structures:

All structural reinforced concrete shall be of a minimum M25 grade with a maximum 40 mm aggregate size for footings and base slabs and with a maximum 20 mm aggregate size for all other structural members.

The reinforced concrete for water retaining structures shall have a minimum cement content of 300 kg/m^3 with a maximum 20 mm size aggregate and 330 kg/m^3 with a maximum 40 mm size aggregate.

The minimum reinforcement in walls, floors and roofs in each of two directions of right angles within each surface zone shall be as per 7.1 of IS: 3370 part 2.

a) The nominal cover of concrete for all steel, including stirrups, links, sheathing and spacers shall be as per 7.2 of IS : 3370 Part 2.

b) Structure shall be provided with damp proofing for basement and floors and water proofing for roofs.

Any structure or pipeline crossing below roads shall be designed for Class A of IRC loading.

All pipes and conduits laid below the structural plinth and roadwork's shall be embedded in reinforced concrete of grade M20 of minimum thickness 150 mm.

Construction of floors and walls of Liquid Retaining structures shall be as per 9.4 & 9.5 of IS: 3370 Part 1.

DESIGN LIFE & DESIGN LOADINGS:

The design life of all structures and buildings shall be 60 years. The structure shall be designed to resist the worst combination of the following loads/ stresses under test and working conditions; these include dead load, live load, wind load, seismic load, and stresses due to temperature changes, shrinkage and creep in materials, dynamic loads:

1. DEAD LOADING:

This shall comprises all permanent construction including walls, floors, roofs, partitions, stairways, fixed service equipment's and other items of machinery. In estimating the loads of process equipment all fixtures and attached piping shall be included.

2. LIVE LOADING:

Live loads shall be in general as per I.S. 875. However, the following minimum loads shall be considered in the design of structures:

i) Live load on roofs =4.00 Kn/m2 : 4.00 Kn/m^2
ii) Live load on all other floors walkways, stairways and platforms = 2.00Kn/m2 : 2.00 Kn/m^2

In the absence of any suitable provisions for live loads in I.S. Codes or as given above for any particular type of floor or structure, assumptions made must receive the approval of the Engineer-in-charge prior to starting the design work. Apart from the specified live loads or any other load due to material stored, any other equipment load or possible overloading during maintenance or erection/ construction shall be considered and shall be partial or full whichever causes the most critical condition

3. WIND LOAD:

Wind loads shall be as per I.S. 875. Part 3

4. EARTHQUAKE LOAD:

This shall be computed as per I.S. 1893 taking into consideration soil foundation system, importance factor appropriate to the type of structure basic horizontal seismic coefficient/ seismic zone factor & average acceleration coefficient.

5. DYNAMIC LOAD:

Dynamic loads due to working of plant items such as pumps, blowers, compressors, switch gears, travelling cranes, etc. shall be considered in the design of structures

2.1 Description and data of Rectangular Clear Water Reservoir:

The Clear Water Reservoir (CWR) has the capacity of 1750 cum. It is provided with two compartments and each compartment of size 14m x 14m. One common inlet chamber is provided to draw water from filters to CWR. A free board of 800mm is considered in each compartment. Water from each compartment is conveyed to a common sump for pumping water to adjacent pump house. The Size of the common sump is 28.6m x 1.5m. A cover slab to CWR is provided

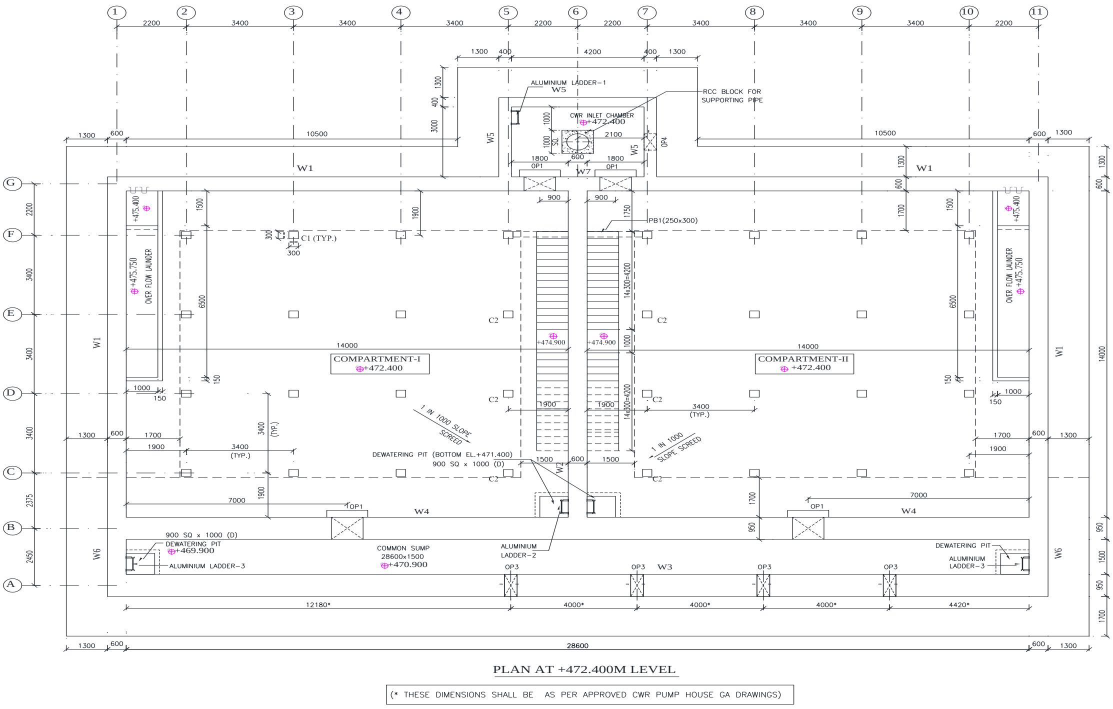

Fig .2.3: Description of Rectangular Clear Water Reservoir

Clear Water Reservoir Levels and data :

Finished Ground level (FGL) =473.40 m

Natural Ground level (NGL) = 473.40 m

Lowest water level (L.W.L) = 472.40 m

Maximum water level (M.W.L) = 476.40 m

Common Sump Bottom Level=470.90 m

Design Constants

Unit weight of water =10 Kn/m2

Unit weight of Concrete=25 Kn/m2

Unit weight of Soil=20kn/m2

Unit weight of surcharge=20 Kn/m2

Grade of Concrete=M25

Grade of Steel=Fe500

For cracked sections:

Permissible stress in concrete in bending compression, $\sigma_{cbc = 8.5 N/mm2}$

Permissible stress in concrete in direct compression, $\sigma_{cc = 6.0 N/mm2}$

Permissible stress in steel in tension, $\sigma_{st =230 N/mm2}$

Modular ratio m=10.98

k=0.29

j=0.904

Q=1.109

For uncracked sections:

Permissible stress in concrete in direct tension, $\sigma_{cc=1.3 N/mm2}$

Permissible stress in concrete in tension due to bending, σbc=1.8 N/mm2

Permissible stress in steel in tension, $\sigma_{st = 130 N/mm2}$

Modular ratio m=10.98

k=0.42

j=0.861

IS Codes/ Documents

a.IS:456- 2000 - Plain & reinforced concrete - Code of Practice (Fourth revision)

b. SP: 16: Design Aids for reinforced concrete to IS 456

c. SP: 34 -1987 Hand Book on Concrete Reinforcement and Detailing.

d.IS:3370 - 2009 - Code of practice for concrete structures for the Storage of Liquids

Part-I: General Requirements

Part-II: Reinforced Concrete Structures

Material Specifications for Design Purpose:

a. Grade of Concrete M25

b. Grade of steel - High Yield Strength Deformed bars with yield stress of 500 N/mm^2

Material	Property	Value	Units	Remarks
Concrete, M25	Density	25	kN/m^3	IS:875 (Part 1) - 1987
	Characteristic Strength	25	N/ Sq mm	IS: 456-2000
	Modulus of Elasticity	25000	N/ sq mm	IS: 456-2000
	Coefficient of Thermal Expansion	10×10^{-6}	Per °C	IS: 456-2000
High yield strength Reinforcement bars	Density	78.5	kN/m^3	IS: 1786
	Characteristic Strength	500	N/ sq mm	
	Modulus of Elasticity	200000	N/ sq mm	
Brick	Density	20	kN/m^3	IS: 875 (Part 1) - 1987
Structural Steel	Density	78.5	kN/m^3	IS: 875 (Part 1) - 1987
	Yield Strength	250	Mpa	IS: 2062 – 1999
	Modulus of Elasticity	2×10^5	Mpa	IS: 800-1984
	Poission's ratio	0.3		IS: 800-1984
	Coefficient of Thermal Expansion	12×10^{-6}	Per °C	IS: 800-1984

Fig. 2.4: Material Properties of Rectangular Clear Water Reservoir

Plant Site Information:

Location of the Site: Haripura Chaurah

Basic Wind speed: 47 m/s (considered)

Seismic Zone: Zone II

Soil Properties:

Net Safe Bearing capacity considered for design = 200 Kn/m^2

2.2 Design of Reservoir Walls:

Design Data:

Length of the each compartments = 14 m

Width of the each compartment =14 m

Depth of water in each compartment =4 m

Free Board (excluding slab thickness) = 0.8 m

Height of water pressure including free board =4.8 m

Height of the wall below FGL = 1 m

Height of wall above the FGL = 4 m

Total height of the wall =5 m

Thickness of wall footing =0.45 m

Design Philosophy:

The reservoir walls are designed as propped cantilever wall considering prop action at top cover slab level, Fixed at base slab at +472.40m level. The liquid retaining face of the wall is designed as uncraked section and soil face is designed as cracked section.

Wall is designed for following two conditions:

i) Tank Full with water and no soil pressure from outside

ii) Tank empty and soil pressure from outside

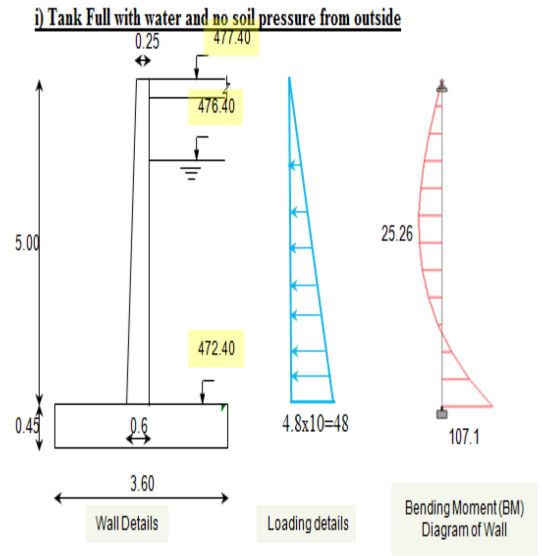

Fig. 2.5: Tank Full with Water and no Soil Pressure from Outside

width of the wall, a=14.6 m

Height of the wall, b =5 m

Ratio of a and b =3

Since the ratio (a/b) is greater than 3, the wall behaves as propped cantilever, with the top cover slab providing prop action to the Wall

Water Pressure on the wall at the base = 48kn/m2

Max. BM causing tension on water face (from staad) =107.147 Kn-m/m

Max. BM causing tension on Soil face (from staad) =25.268 Kn-m/m

Thickness of wall required for uncracked section, D =

$$\sqrt{\frac{6\ M}{b\ \sigma_{bt}}} = \sqrt{\frac{6 \text{ x } 107.147 \text{ x } 10\text{\^{}}6}{1000 \text{ x } 1.8}} = 598 \text{ mm}$$

Thickness of wall provided at the base = **600** mm

Thickness of wall required for soil side moment, d =

$$\sqrt{\frac{M}{bQ}} = \sqrt{\frac{25.268 \text{ x } 10\text{\^{}}6}{1000 \text{ x } 1.109}} = 151 \text{ mm}$$

D = 191 mm

Thickness of wall provided at the top = **250** mm

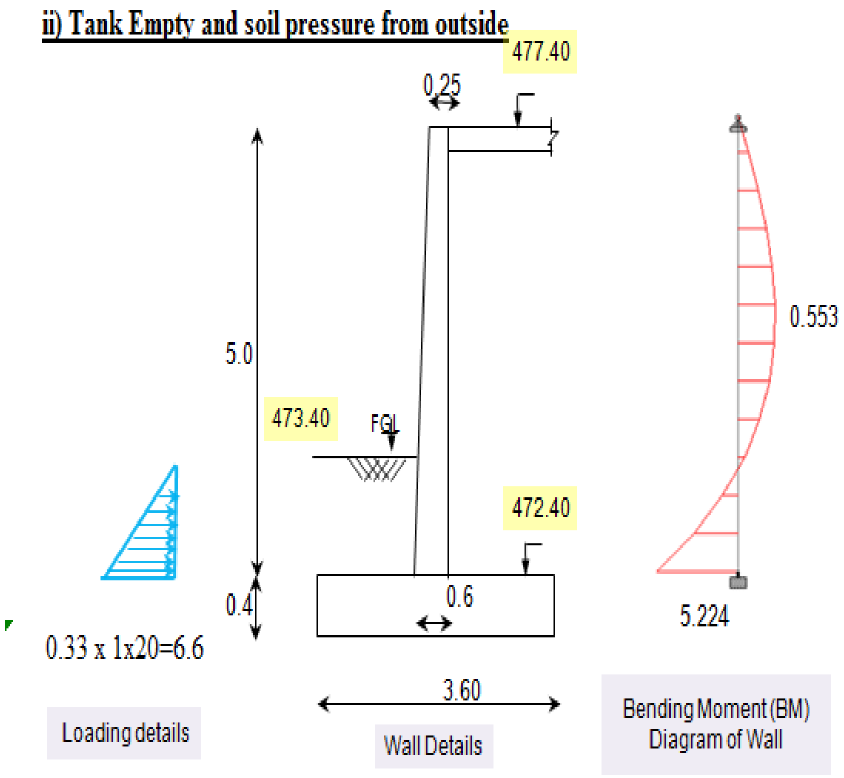

Fig-3: Case-II Tank Empty and soil pressure from outside

Fig .2.6: Tank Full with Water and Soil Pressure from Outside

Coefficient of active earth pressure=0.33

Soil Pressure on the wall at the base, ka g h, =6.6 Kn/m2

Surcharge Pressure on the wall at the base, ka q, =6.6 Kn/m2

Maximum BM causing tension on water face (from staad) =0.553 Kn-m/m

Maximum BM causing tension on soil face (from staad) = 5.224 Kn-m/m

Thickness of wall required for cracked section, d =

$$\sqrt{\frac{M}{bQ}} = \sqrt{\frac{5.224 \times 10^6}{1000 \times 1.109}} = 69 \text{ mm} < \text{d provided}$$

Reinforcement Calculations

Thickness of the wall =600 mm

Clear cover to all reinforcement on water face=45 mm

Clear cover to all reinforcement on soil face=40 mm

Vertical reinforcement:

Diameter of vertical reinforcement on water face=16 mm

Diameter of vertical reinforcement on soil face=12 mm

Effective depth of the wall on water face=547mm

Effective depth of the wall on soil face=554mm

Area of steel required on **Water face**

$$\left(\frac{M}{\sigma_{st} j d}\right) = \frac{107.147 \times 10^6}{(130 \times 0.861 \times 547)} = 1751 \text{ mm}^2$$

(As Per IS 3370:2009 For D > 500mm, assume each reinforcement face controls 250mm depth of concrete)

Minimum percentage of steel required in each direction on each face =0.35%

Minimum area of steel required =875 mm2

Spacing of reinforcement required= 114 mm

Spacing of reinforcement provided=100mm

Y16 @ 100c/c on water face in vertical direction and Y16 @ 200mm provide from mid -height of the wall

Area of steel required on **Soil face**

$$\left(\frac{M}{\sigma_{st} j d}\right) = \frac{25.268 \times 10^6}{(230 \times 0.904 \times 554)} = 220 \text{ mm}^2$$

(As Per IS 3370:2009 For D > 500mm, assume each reinforcement face controls 250mm depth of concrete)

Minimum percentage of steel required in each direction on each face =0.35%

Minimum area of steel required = 875 mm2

Spacing of reinforcement required =129 mm

Spacing of reinforcement provided =125 mm

Y12 @ 125c/c on soil face in vertical direction

Horizontal Reinforcement

Dia of horizontal reinforcement bar=12 mm

Minimum percentage of steel required in each direction on each face = 0.35 %

Minimum area of steel required = 875 mm2

Spacing of reinforcement required =129 mm

Spacing of reinforcement provided= 125 mm

Y12 @ 125c/c on each face in horizontal direction

Stability check for Wall- W1 (Case I: Tank Full and No Soil outside)

Width of wall at the base t_b=0.6 m

Width of wall at the top t_t=0.25 m

Width of footing near water face L_1 =1.7 m

Width of footing near soil face L_2 =1.3m

Total Height of wall (H_1) =5m

Height of straight portion of wall (H_2) =0 m

Height of taper portion of wall (H_4) =5 m

Height of water level =4.8 m

Depth of footing below the GL (H_3) =1.5m

Thickness of footing at the water edge (t_1) =0.45m

Thickness of footing at soil edge (t_2) =0.45m

Thickness of footing at face of wall (t_3) =0.45m

Base width, b =3.6 m

Net safe bearing capacity of soil = 200 kn/m2

Gross safe bearing capacity of soil = 226.1kn/m2

Span of top slab between supports = 3.775 kn/m

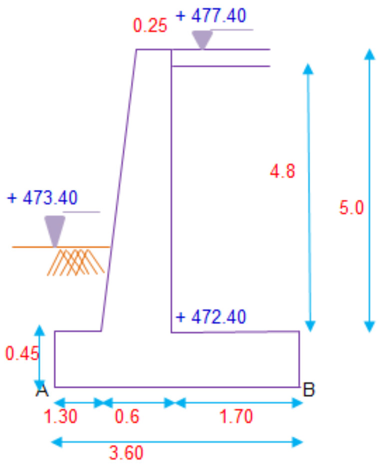

Fig .2.7: Tank Full with Water and no Soil Pressure from Outside

S.No	Length (m)	Breadth (m)	Depth (m)	Dens. kN/m³	Tri/ Rec	Load (kN)	Dist. from origin(m)	Moment (kN-m)	Location
1	1	1.89	0.18	25		8.258	1.78	14.7	Load from top slab
2	1	1.89	0.075	24		3.398	1.78	6.05	Floor finishes on top slab
3	1	0.25	5.00	25		31.25	1.78	55.63	Wall (straight)
4	1	0.35	5.00	25	1	21.88	1.53	33.47	Wall (triangular)
5	1	3.60	0.45	25		40.50	1.8	72.90	Footing
6	1	1.70	4.80	10		81.60	2.75	224.40	Water weight on footing
					P =	**186.88**	RM =	**407.14**	

Over turning moment acting at the base =161.209 Kn- m (from staad)

Total Moment acting at the base = 245.9 Kn-m

x = (RM-OTM)/P = 1.32 m

Eccentricity, e = (b/2)-x = 0.484 m

b\6 = 0.6 m

Check for Tension = safe

Factor of safety against overturning = (RM)/(OTM) = 2.53

Length of footing in contact with soil = 3x(b/2-e) = 3.6 m

Length of footing not in contact with soil = b-3x(b/2-e) = 0

% Loss of contact = 0 %

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Max. Pressure at the base =$(P/A+6Pe/b^2)$ =93.79 Kn/m2

Min pressure at the base = $(P/A-6Pe/b^2)$ =10.04 Kn/m2

Design of footing for Reservoir Wall:

Case-I : Tank Full with water inside and no soil from out side

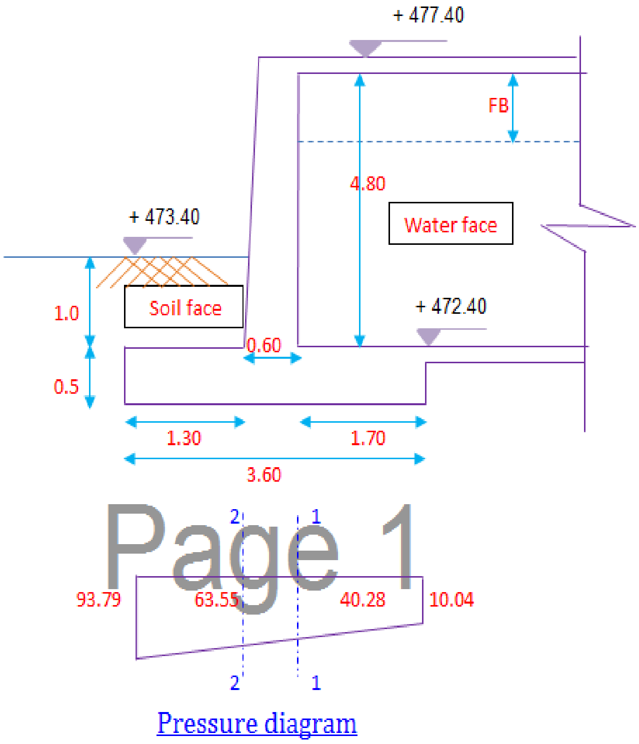

Fig .2.8: Pressure Distribution Diagram for Footing

Design data:

Grade of Concrete=M25

Grade of Steel=Fe500

Density of concrete=25 kn/m2

Density of Soil =18 kn/m2

Density of Water =10 kn/m2

Width of footing near the water face =1700 mm

Width of footing near the soil face =1300 mm

Overall width of footing= 3600 mm

Footing not in contact with soil=0 mm

Footing in contact with soil=3600 mm

Width of wall at the base =600 mm

Depth of soil up to top of footing (Below tank base slab) = 0 mm

Assume thickness of footing provided = 450 mm

Clear cover to reinforcement on soil face= 30 mm

Clear cover to reinforcement on water face=50 mm

Design for Top Slab:

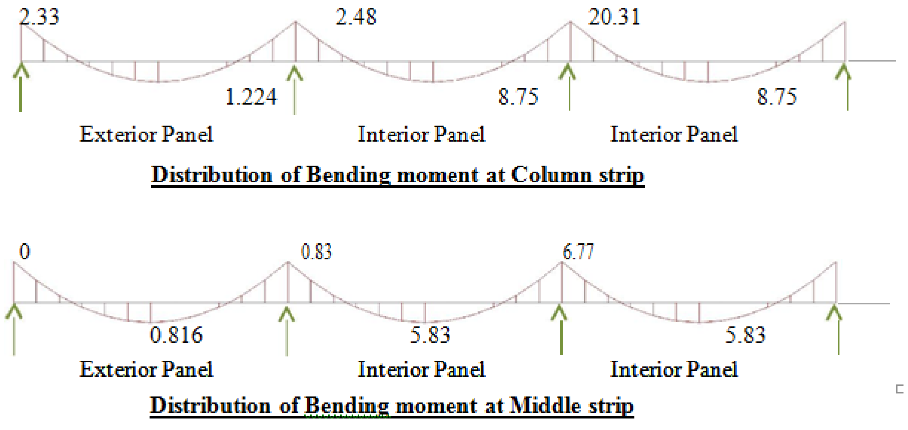

Fig .2.9: Bending Moment Distribution @ Top Slab

Design for Base Slab:

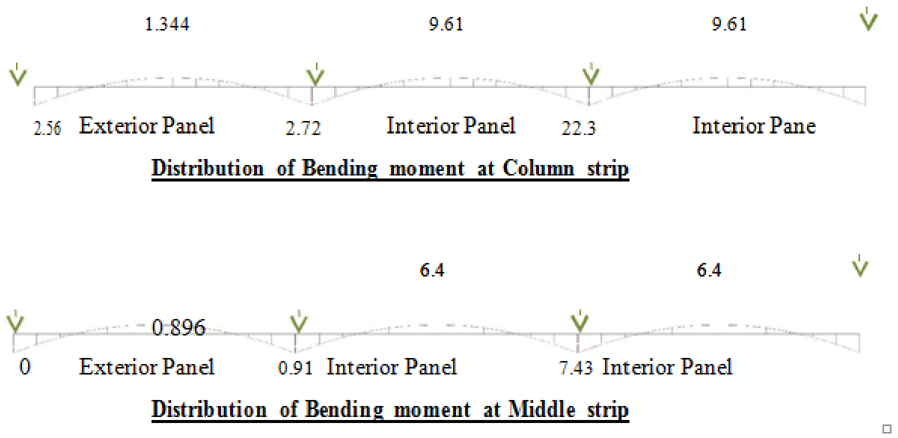

Fig .2.10: Bending Moment Distribution @ Base Slab

2.3 Specifications for Clear Water Reservoir:

Standards: The Indian standards & code of practice shall be adhered to for the design, workmanship, testing of material, structure and commissioning etc.

Reinforced cement concrete

Ordinary Portland Cement (OPC)/ Pozzolanic Portland cement conforming to relevant IS shall be used. Cement manufactured in mini-cement plants shall not be used.

All reinforcement used shall be of Thermo Mechanically Treated steel bars only conforming to IS: 1786 latest revision with up-to-date amendments. All steel shall be procured from main/ primary producers, who make their own ingots/ billets. No re rolled steel shall be incorporated in the work. Also, the steel shall not be procured from the producers who make pencil ingots/ billets from scrap. The reinforcement bars shall have ISI mark and shall be clean and free from loose mill scales, rust and coating of oil or other coatings which may destroy or reduce bond

Testing for water tightness:

In addition to the structural test of structures, the tanks shall also be tested for water tightness test at full supply level as described in 10.1.1,10.1.2 and 10.1.3 of latest revision of IS 3370 (Part I).

On completion of the Service Reservoir works and before its commissioning, the contractor shall carry out a water tightness test for the maximum water head condition i.e. with the water standing at Full Supply Level (FSL).

Puddle collar:

Puddle collars shall be used the connecting the inlet, outlet, and wash out pipes to the reservoir. All puddle shall be fixed at right angle to the RCC wall during the casting of wall .All puddle collar shall be of MS. The minimum length shall be at least 100 mm more than the total finished thickness of wall and size of puddles shall be equal to the size of the respective pipe

Stairs:

Stairs shall be insitu of RCC and also incorporated while designing the structure

Pipes and specials:

The MS Puddles shall be fabricated using 12 mm thick MS sheets conforming to IS-2062 for inlet and over flow. For outlet MS Pipes shall be of 8mm thick MS sheet.

Steel flanges:

The flanges and their dimensions of drilling, whatever not specified, shall be in accordance with IS: 6392-1971 or its latest revision. The flanges shall be slip on boss type NP I.0 N/mm^2.

Railings:

Hand railing around the walkway, stairs and landing shall be fixed on a side requiring safety. Railing to consist of 32 mm diameter Class B GI pipes in two rows (one at the top and other 550mm above finished floor level) and 1000 mm high, 40mm GI, class B pipe vertical post at a maximum distance of 1500 mm centers (at least two vertical pipes are to be provided whenever distance is less) with all accessories like elbows, tees etc. including welding, threading and fixing in cement concrete floor. Railing shall be painted after welding to protect it against corrosion.

Hand railing and vertical posts fabricated from galvanized mild steel pipes and fittings shall conform to the following requirements

Vertical posts shall be made of GI mild steel tubes (Class-B) of 40 mm nominal bore and fittings such as tees, bends, crosses etc. of heavy class conforming to IS 1239.

Vertical posts shall be spaced at a maximum distance of 1.5 m centers and shall be built into the concrete or bolted to the MS plate embedded in concrete

Hand railing and vertical posts shall be painted with 3 coats of approved paint.

Hand Railing inside the tank shall be made up of RCC

Ventilators:

Size of ventilator shall be calculated as per design requirement, Wire mesh should be of 24 gauge square mesh of SS wire around the periphery and the top shall be cast insitu

Rubber sheets and nut bolts:

The nuts and bolts shall be of best quality carbon steel, machined on the shank and electro-galvanized. Rubber gasket shall be as per IS 5382. Dimensions and drilling of flat gasket will be as per IS 1538: 1993, suitable for making flanged joint.

PVC water stopper:

The water stop shall be of plastic compound, the basic resin of which shall be polyvinyl chloride. The compound shall contain additional resins, plasticizers, inhibitors or other materials such that when the material is compounded, it shall meet the requirements given in IS 15058:2001

GI water stop:

GI Water stop consisting of 150 mm wide GI strip of 18 gauges (with 150 mm overlap at the ends) shall be provided at construction joints in walls of water retaining structures

In lining and outside coating:

The coating of the pipe & puddle shall be smooth, dense and hard. The coating shall be free from excessive surface irregularities. Projection exceeding 3 mm. measured from the general surface shall be removed. For inside coating of epoxy paint, the inside surface of the pipe & puddle should be sand or shot blasted. The surface should be thoroughly rubbed down with rough sand paper or wire brush so that surface will be uniformly rough. Mixed paint should be used within 30 to 60 minutes of mixing and fresh mixing shall be taken for every new application. The epoxy paint should be of food grade quality as per IS.

Epoxy primer and epoxy paint of approved quality shall be used for external and internal painting. No primer shall be applied without prior approval of the EIC. The mix of zinc rich epoxy primer shall be prepared at works site not earlier than 15 min. before applying the same on pipes and special surfaces. One coat of epoxy primer shall be applied along with 2 coats of epoxy paint. No thinner shall be added to ready mix paints without previous approval of the owner and the finishing coats on top of the primer coat shall only be applied after allowing the film to cure for at least 48 hours.

After application of epoxy primer, the surface should be cleaned by duster and inspected. If during inspection any portion is found rusting the same shall be removed by emery paper and coated with epoxy primer.

The painting shall be done by cross brushing, i.e. one coat shall be given vertically and another coat shall be given horizontally so as to get required thickness, a good looking surface and also to avoid sagging of paint. Every successive coat of paint shall be given only after 48 hrs. of painting the previous coat. Before applying the next coat, the surface shall be properly cleaned by duster.

The laying, jointing and testing of welded steel pipe puddle shall conform to latest and relevant IS: 5822.

The welded joints shall be tested as per IS 3600 of 1966

3. CONCLUSION

Water is a chemical compound and may occur in a liquid form or in a solid form or in a gaseous form .All these three forms of water are extremely useful to man , providing him the luxuries and comforts , in addition to fulfilling his basic necessities of life , Storage of water in the form of tanks for drinking and washing purposes , industrial use , swimming purpose for exercise and enjoyment . Thus the reservoirs or tanks are gaining importance in the present day of life . Safe and economic design is required for effective maintenance of clear water reservoir taking safety and serviceability into consideration .Design of water tank is tedious method particularly design of underground water tanks involves a lot of mathematical formulas and this project by designing clear water reservoir gives the solution for all those problems.

REFERENCES

[1] K.C. Jain, "Design for RCC Slabs - A Ready Reckoner", lakshmi publications, new delhi- 2002.

[2] S. S. Bhavikatti, "Design Of R.C.C. Structural Elements, Volume 1", new age international publications, new Delhi, 2005

[3] Design of RCC Structures – By Ashok Kumar Jain

[4] IS: 456, Indian Standard code of practice for Reinforced Concrete Design (Bureau of Indian Standards, New Delhi ,(under print).

[5] IS: 3370-2009, Code of practice for Concrete Structures for the storage of Liquids(Bureau of Indian Standards, New Delhi ,(under print).

[6] Part-I: General Requirements

[7] Part-II: Reinforced Concrete Structures

[8] Dayaratnam.P .Design of Reinforced Concrete Structures. New Delhi. Oxford & IBH Publication. 2000

[9] Vazirani & Ratwani Concrete Structures. New Delhi. Khanna Publications.1990

[10] Sayal & Goel. Reinforced Concrete Structures. New Delhi. S.chand Publications.2004

[11] SP: 16: Design Aids for reinforced concrete to IS 456

[12] SP: 34 -1987 Hand Book on Concrete Reinforcement and Detailing