Comparative Analysis of Design of An Intze Tank By Working Stress Method Using IS:3370(1965) And IS: 3370(2009)

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Abstract- *This thesis gives in detail, the theory behind the design of liquid retaining structure*

i.e. an INTZE TANK by adopting following method.

1. *Working stress method IS 3370-1965*
2. *Working state method IS3370-2009*

Objective of the study was to :

To compare the design of an INTZE TANK done by WSM in reference to IS 3370 – 1965 and IS 3370 – 2009 (new version).

For designing, Intze water tank with top and bottom dome having effective depth 7.5 metres of capacity 5,00,000 liters of water has been designed .For design, M30 grade concrete and Fe-415 grade steel has been used. The graphs are included to show the comparison of outcomes.

The following outcome has been observed that :The size of members remained same for working stress method by IS:3370(1965) and IS:3370 (2009) except in Top Ring Beam which shows little increment of size in IS:3370(2009). However, the requirement of area of steel increased in IS:3370 (1965).

Keywords- Working Stress Method, Intze Water tank,Top Ring Beam

I. INTRODUCTION

For large diameter cylindrical tanks , even the tanks with domed spherical bottom are not stasifactory and result into an uneconomical design. For such a scenario, intze type water tank are recommended.

This is a special type of overhead tank used for very large capacities. Circular tanks for large volume proves to be uneconomical when flat bottom slab is constructed.

The forces in conical dome is calculated in such a way that the outward thrust levied in the bottom spherical dome is balanced by the inward thrust induced by the conical dome.

The resultant thrust is then neutralised by the bottom ring beam constructed at the junction of conical dome and bottom spherical dome. This geometrical arrangement gives a more economical and inexpensive design and results in a lesser hoop tension and other subjected loads.

II. LITREATURE REVIEW

[i]An effort has been taken to provide a design of elevated circular water tank which is more economical, simple and having a better serviceability using IS 3370-2009 in WORKING STATE METHOD. Design of water tank manually is a tediousjob ,in this project circular INTZE WATER TANK is analysed using membrane theory , separate continuity analysis has not done . [ii]Cost estimation is carried out using Schedule Of Rates of Gujarat Water Supply and Sewerage Board (GWSSB SOR 2011– 2012), for overhead intze water tank of predefined volume, for IS (3370:1965) and IS (3370:2009).

Variation of cost (in Rs.) with d/h for LSM and WSM of design using M30 concrete and Fe415 steel for 1000m3 capacity. The primary elements affecting the design of the tank are the diameter (D) and the height (H) of the water tank. The non-dimensional elememt, D/H, gives a useful measure for reaching at optimal proportioning of the tank. [iii]In this research water tanks are designed by both WSM and LSM.

Circular and square water tank are designed. Detailed analysis and design is carried out. Detailed drawings are made for all the cases. For better understanding the capital implications , cross-sectional area of concrete and steel were calculated. Exact amount of reinforcement required is estimated for each case as per deatiled drawings. It was noted that in case of LSM investment needed is less. Obviously

circular water tank is more economical as compared to square tank.

[iv]This report gives the detailed analysis of the design of liquid retaining structure using working stress method. The report takes into consideration the design of reservoir for the following cases: 1) Underground Tank, 2) Tank Resting on ground and 3) Overhead water tank. The analytical design has been made with Microsoft Excel sheet. The report gives idea for safe design with lesser cost of the tank and give the designer relationship curve between design variable. Thus design of tank can be more economical, reliable and simple. The report helps in understanding the design philosophy for the safe and economical design of water tank. [v]*This study is carried out to know the importance of continuity analysis for practical consideration. In this paper analysis of Intze type water tank is carried out by both procedures by using conventional method and finite element method. In conventional method, the analysis of Intze type tank carried out in two parts as under,*

i. *Taking into consideration only membrane forces, and*
ii. *Taking into consideartion effect of continuity with membrane forces.*

III. METHODOLOGY

The Working, Allowable or Permissible stress method is an elastic design method. In this design method, components are designed restricted to their elastic range. The service loads or working loads acting on the structure are calculated and components are designed on the basis of certain permissible stresses in concrete and reinforcement.

For WSM, service loads are used in the design and the strength of construction material is not taken into account. In fact, the complete structure during the service bears loading stresses under the ultimate state and i.e. why this method is called WSM. Under such condition, the structure becomes too expensive.

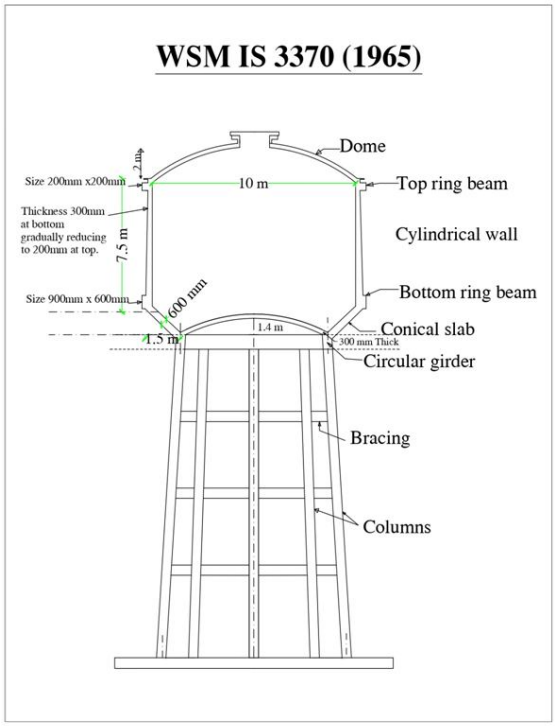
- The Stresses in members is obtained from the sevice loads and equated with allowable stresses.
- The method follows proportional stress-strain procedure for both the materials..
- Factor of safety is considered..
- Ultimate load carrying capacity cannot be calculated precisely.

PROBLEM FORMULATION

- Grade of concrete :M30
- Grade of steel: Fe-415 High Strength Deformed Bars.
- Capacity of the tank = 5, 00,000.00 Ltrs.
- Unit wt of water = 10 N/m^3.
- f_{ck} (Characteristic compressive strength of concrete) = 30Mpa
- f_y (Yield strength of steel) = 415Mpa

IV. RESULT AND DISCUSSION

The size of members remained same for working stress method by IS:3370 (1965) and IS:3370 (2009) except in Top Ring Beam. However, the requirement of area of steel increased in IS:3370 (2009) in Cylindrical portion and conical dome. However, the change in the clause of requirement of minimum steel decreased the steel required in bottom and Top spherical dome ,Top and Bottom Ring Beam



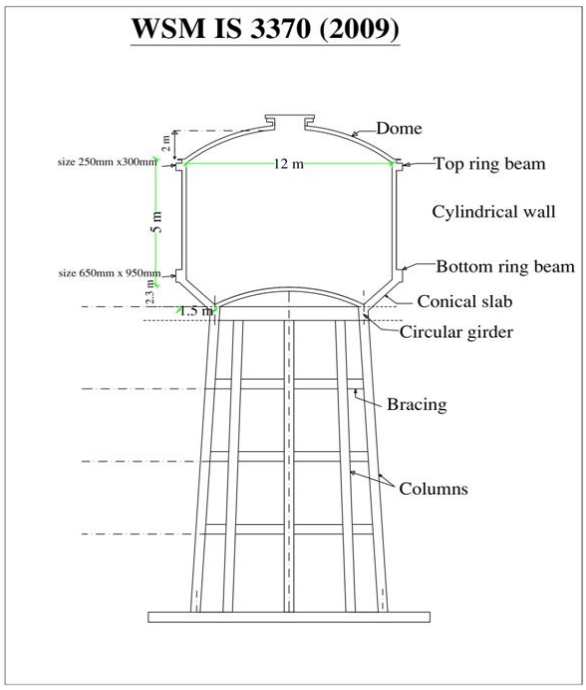


Fig. 4.1 DRAWING SHOWING THE CROSS-SECTION BY WSM IS 3370(1965)

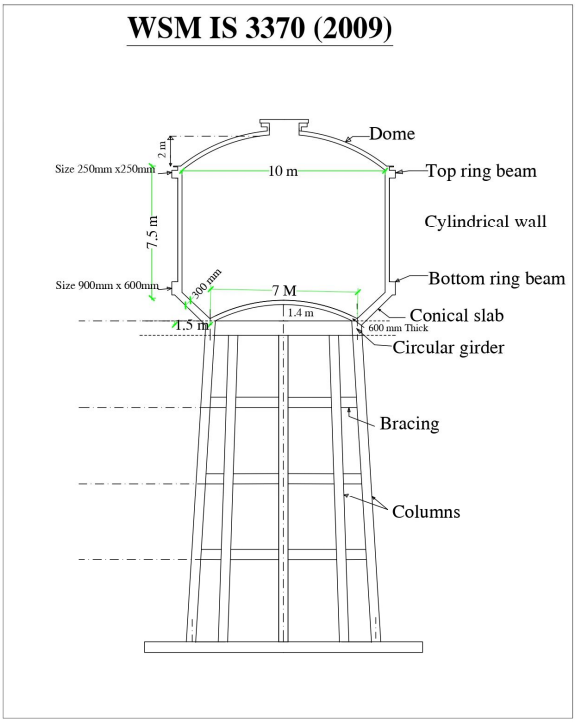


Fig. 4.3 DRAWING SHOWING THW CROSS-SECTION BY WSM IS 3370(2009)

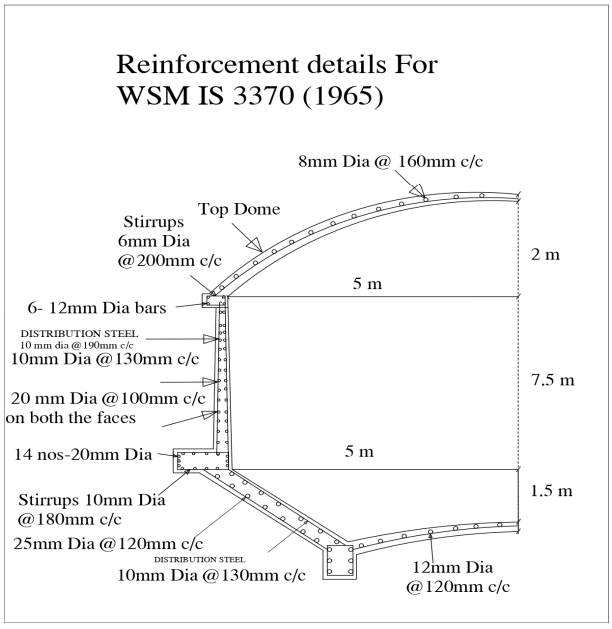


FIG. 4.2 : DETAILING OF REINFORCEMENT IN INTZE TANK BY WSM IS 3370(1965)

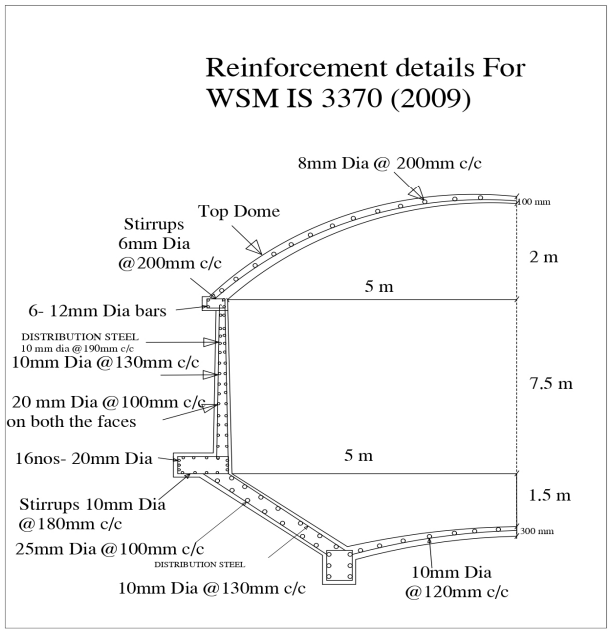
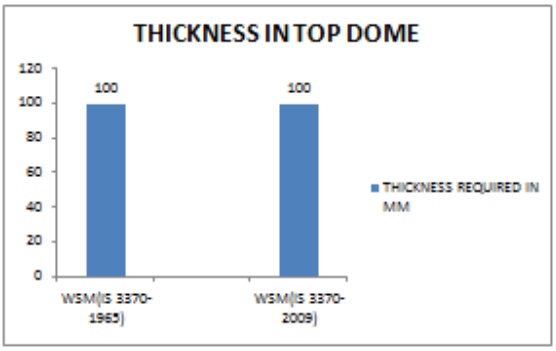
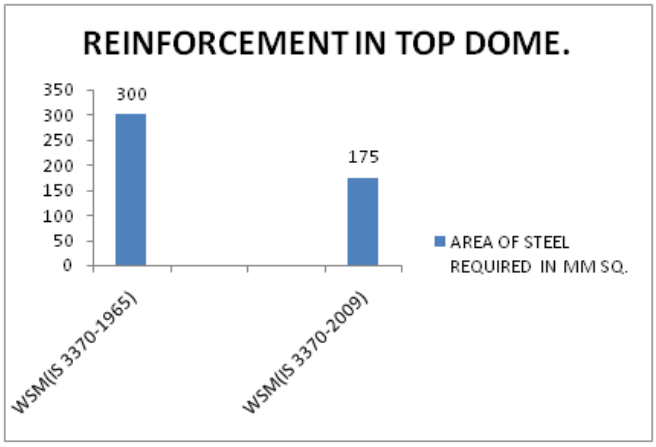
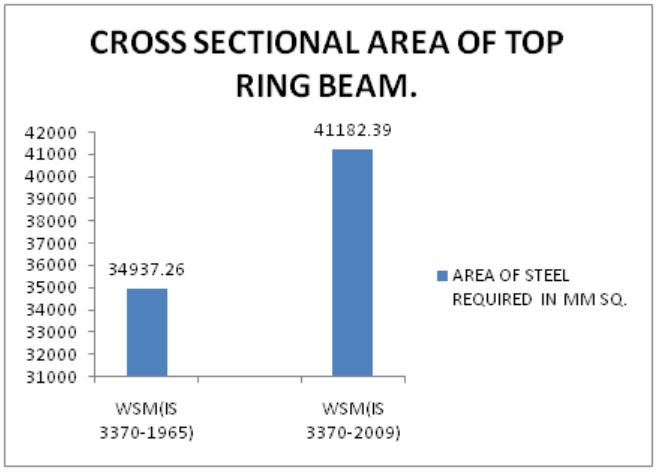


FIG. 4.4 DETAILING OF REINFORCEMENT IN INTZE TANK BY WSM IS 3370(2009)







V. CONCLUSION

The size of members remained same for working stress method by IS:3370 (1965) and IS:3370 (2009) except in Top Ring Beam. However, the requirement of area of steel increased in IS:3370 (2009) in Cylindrical portion and conical dome. However, the change in the clause of requirement of minimum steel decreased the steel required in bottom and Top spherical dome ,Top and Bottom Ring Beam.

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