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# Comparative Analysis of Overhead Water Tank

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***Abstract:** Water tanks are important public utility and industrial structure. The design and construction methods used in reinforced concrete are influenced by the prevailing construction practices, the physical property of the material and the climatic conditions. Before taking up the design, the most suitable type of staging of tanks and correct estimation of loads including statically equilibrium of structure particularly in regards to overturning of overhanging members are made. The work presented in the research paper consists of the comparative analysis of the overhead water tank in terms of the shear force, bending moment and other parameters.*

***Keywords:** Hydrodynamic Pressure, Elevated Water Tank, STAAD Pro V8i.*

## I. INTRODUCTION

Storage reservoirs and overhead tank are used to store water, liquid petroleum, petroleum products and similar liquids. These structures are made of masonry, steel, reinforced concrete and pre stressed concrete. Out of these, masonry and steel tanks are used for smaller capacities.

The cost of steel tanks is high and hence they are rarely used for water storages. Reinforced concrete tank is high and hence they are rarely used for water storages. Reinforced concrete tanks are very popular because, besides the construction and designs being simple, they are cheap, monolithic in nature and can be made leak proof. Generally no cracks are allowed to take place in any part of the structure of liquid retaining R.C.C tanks and they made water tight by using richer mix (not less than M20) of concrete. In addition sometimes water proofing materials are also used to make tanks water tight. Permeability of concrete is directly proportional to water cement ratio.

Proper compaction using vibrators should be done to achieve imperviousness. Cement content ranging from 330 Kg/$m3$ to 530 Kg/$m3$is recommended in order to keep shrinkage low.

## II. REVIEW OF LITERATURE

Manjare, S.A. et al [1] studied that for same capacity, same geometry, same height, with same staging system, in the same Zone, with same Importance Factor & response reduction factor; response by Equivalent Static Method to Dynamic method differ considerably.

Simpi, B., et al [2] studied Static analysis water- structure interaction shows that both water and structure achieve a pick at the same time due to the assumption that water is stuck to the container and acts as a structure itself and both structure and water has same stiffness, while in Dynamic analysis we considered two mass model.

Solé, C., et al [3] studied that Column moment in bracing increases by increasing height of staging of water tank. Column moment is minimum for radial bracing. Shear force in bracing increases by increasing height of staging. Shear force in bracing is minimum for radial bracing.

## III. MODELING

The modeling is carried out in the STAAD software, mentioned as follows.

The following models are prepared in the project

1) *Model-I:* Rectangular water tank-6m height by IS code
2) *Model-II:* Rectangular water tank-9m height by IS code
3) *Model-III:* Rectangular water tank-12m height by IS code
4) *Model-IV:* Rectangular water tank-6m height by ACI code
5) *Model-V:* Rectangular water tank-9m height by ACI code

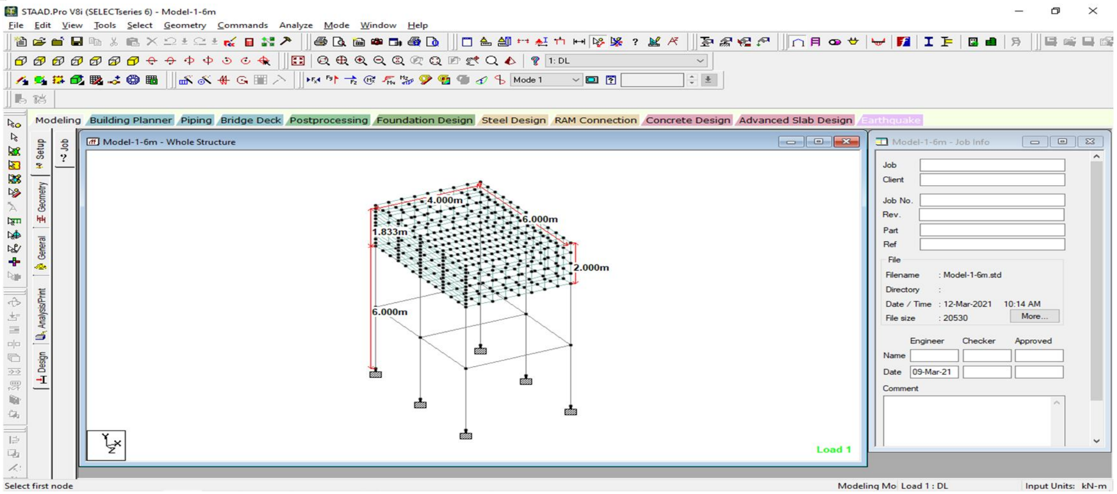


Fig. No.1: Model-I: Rectangular water tank-6m height by IS code

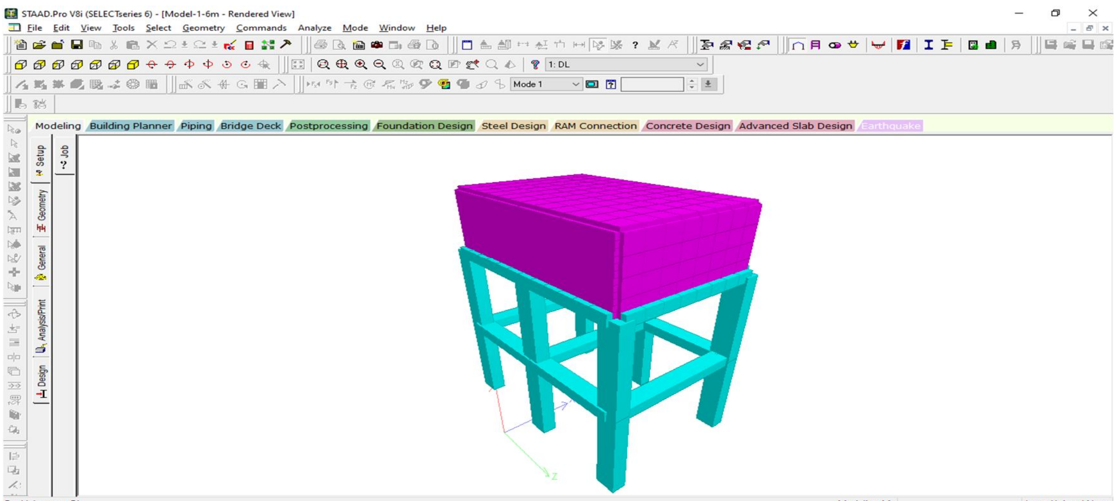


Fig. No.2: Elevation of Model-I

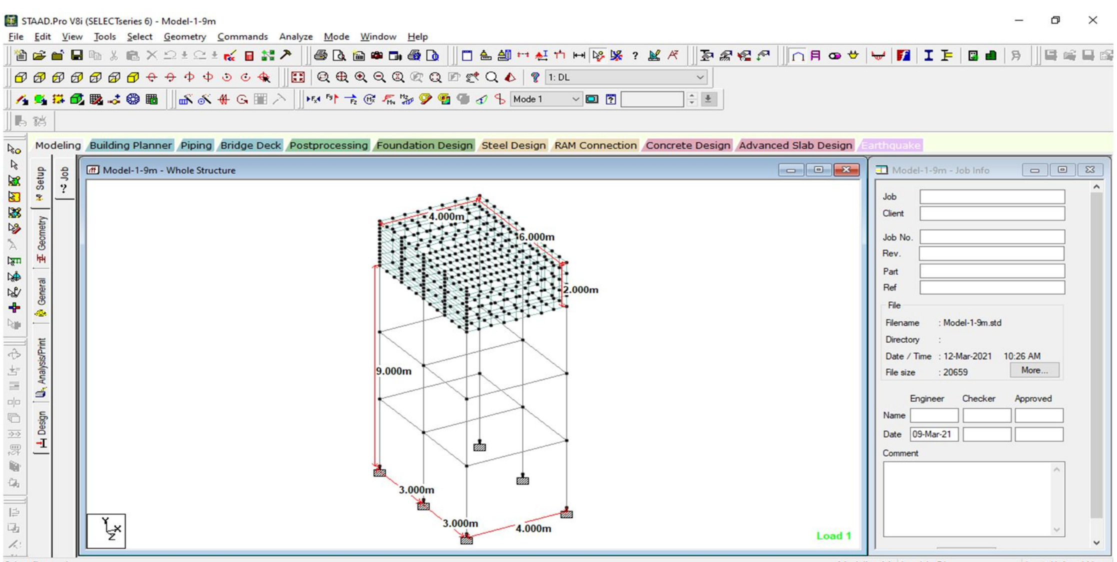


Fig. No.3: Model-II: Rectangular water tank-9m height by IS code

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Table No.1: Properties of Model-I & IV

| Particulars | Dimension |
|---|---|
| Plan dimension of water tank | 4.0 m X 6.0 m |
| Depth of water tank | 2.0 m |
| Thickness of water tank | 200 mm |
| Height of Column | 6.0 m |
| Size of Beam | 350 mm X 500 mm |
| Size of Column | 400 mm X 600 mm |

## IV. RESULTS

The analysis is carried out in STAAD software and the results in terms of shear force, bending moment and other parameter is obtained as follows.

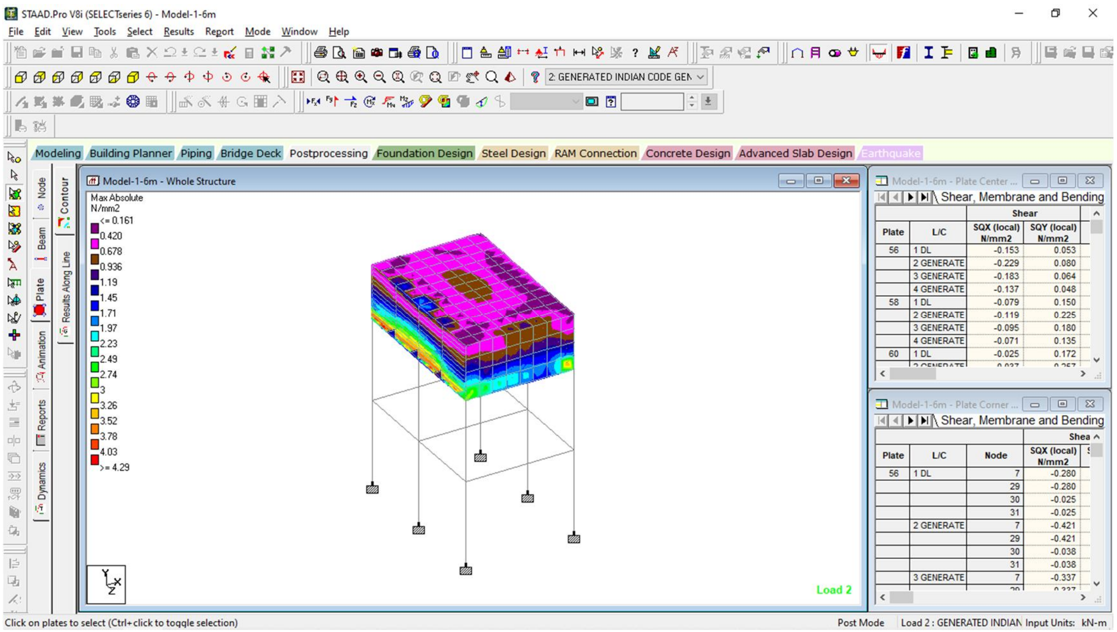


Fig. No. 6.1: Max Absolute stress of Model-I

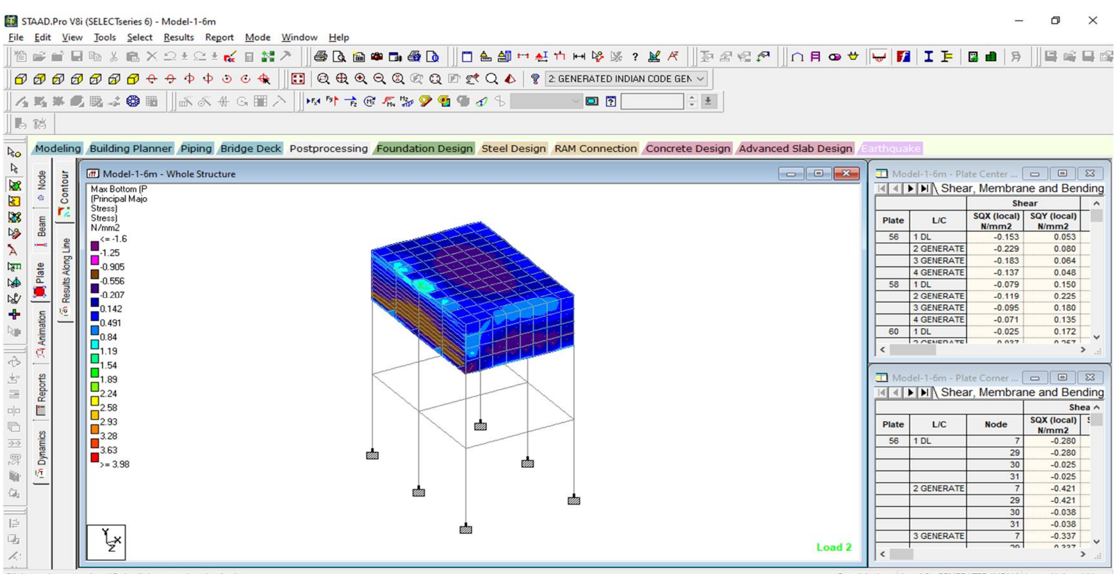


Fig. No. 6.2: Max Bottom Principal stress of model-I

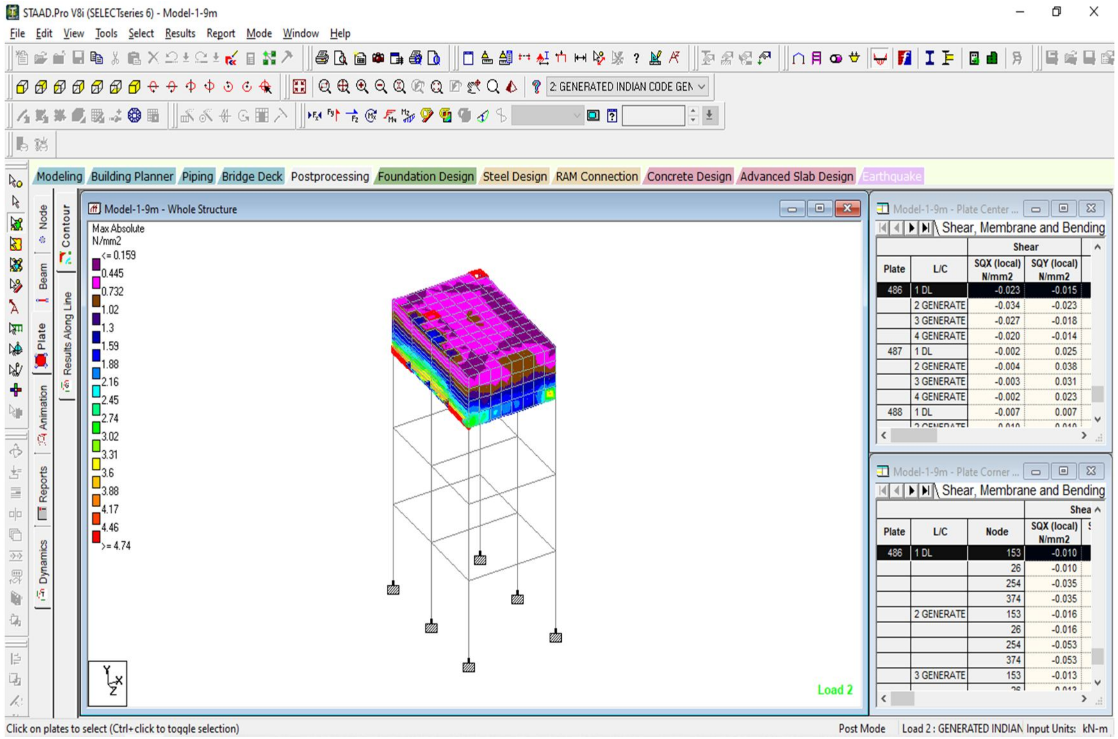


Fig. No. 6.3: Maximum Absolute stresses for model-II

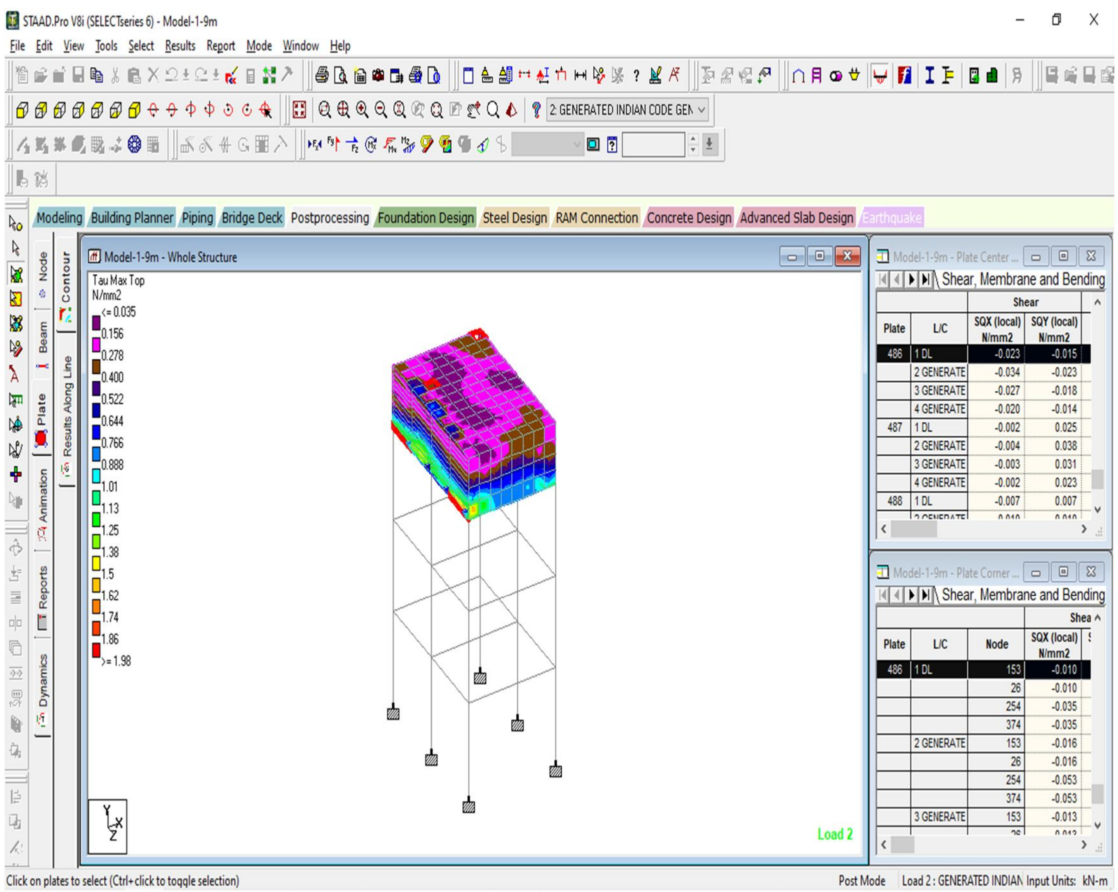


Fig. No.4: Maximum Tau stresses for model-II

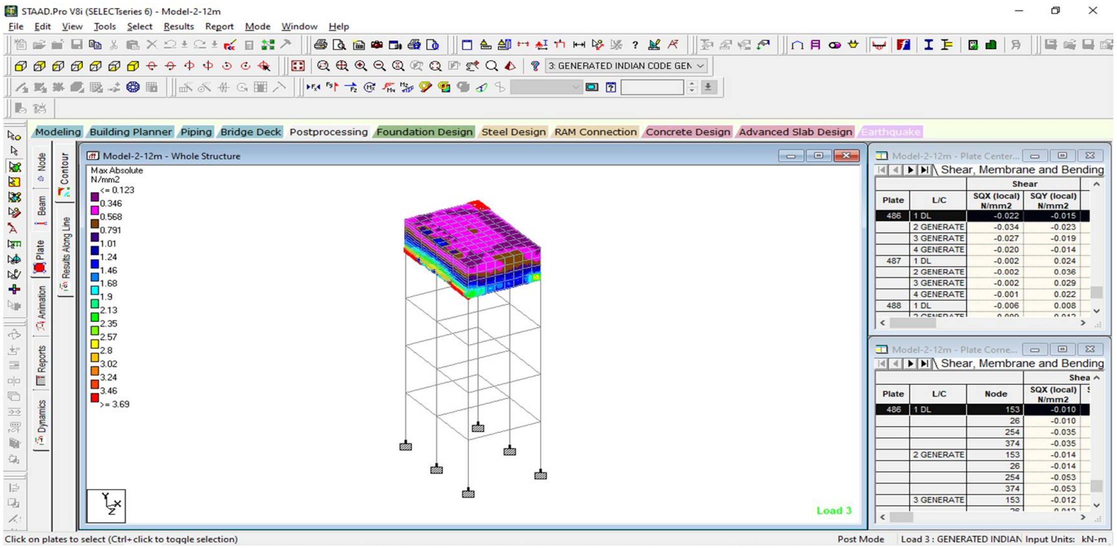


Fig. No.5: Maximum absolute stresses for model-III

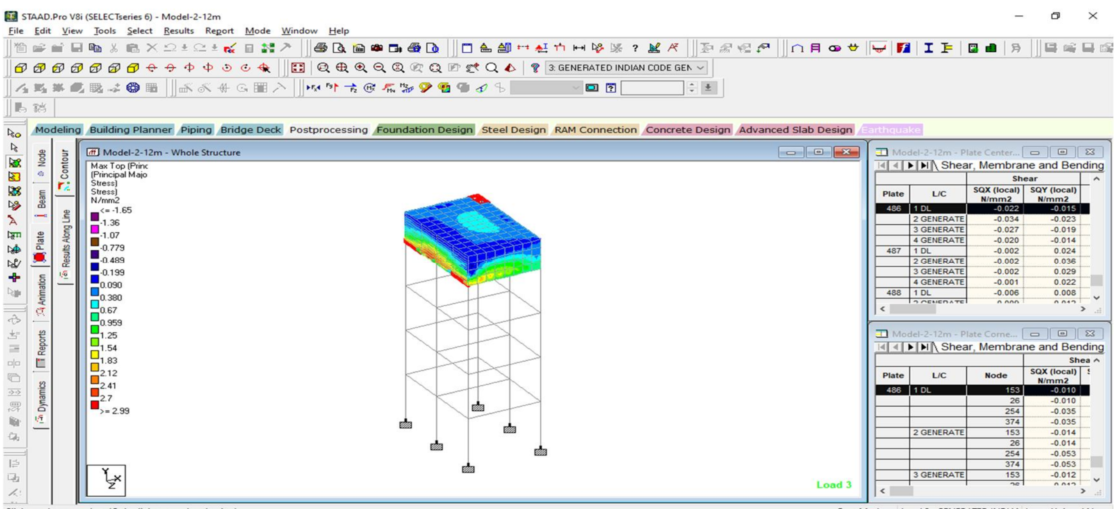


Fig. No.6: Maximum principal stresses for model-III

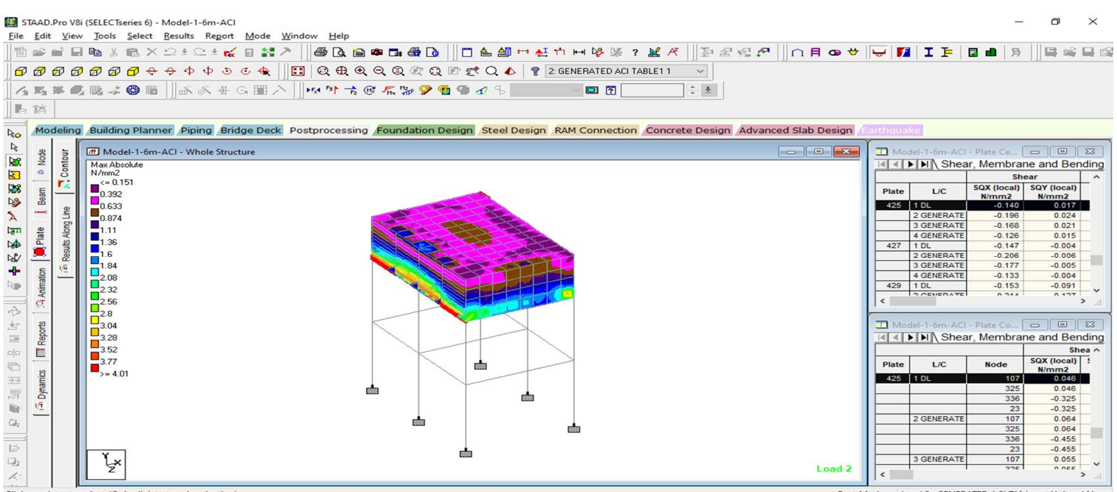


Fig. No.7: Maximum absolute stresses for model-IV

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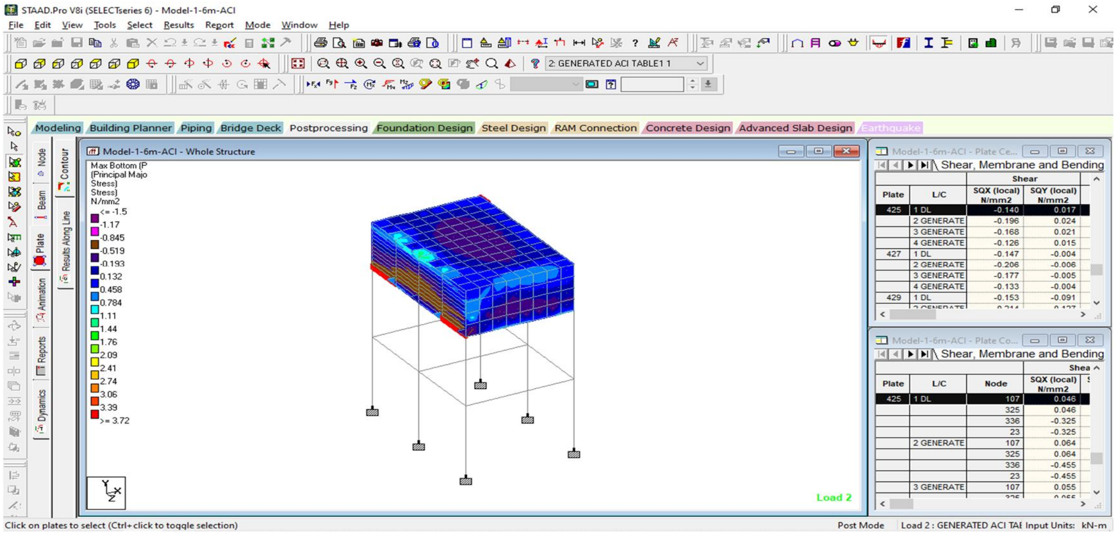


Fig. No.8: Maximum Bottom Principal stresses for model-IV

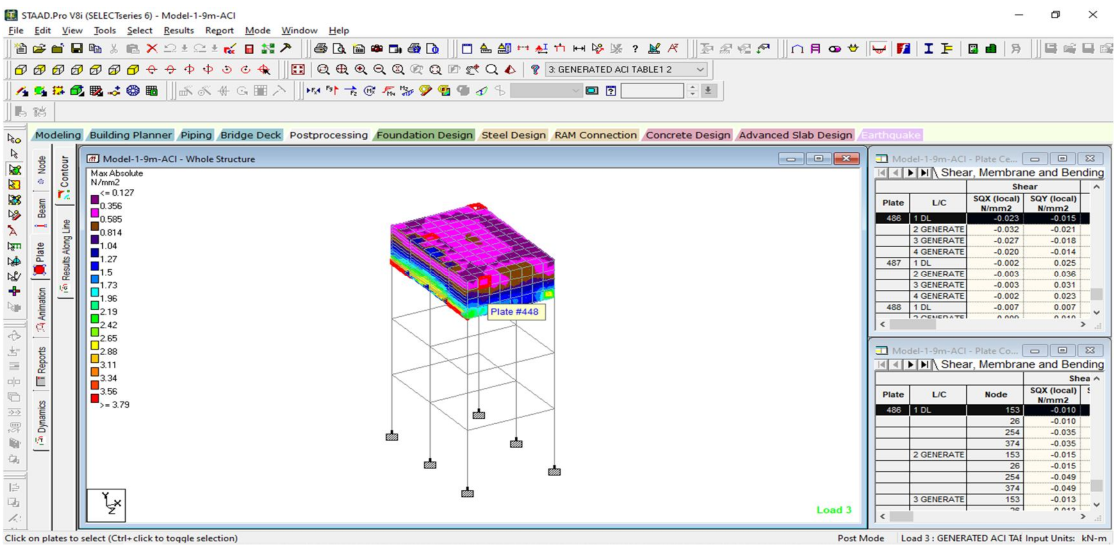


Fig. No.9: Maximum absolute stresses for model-V

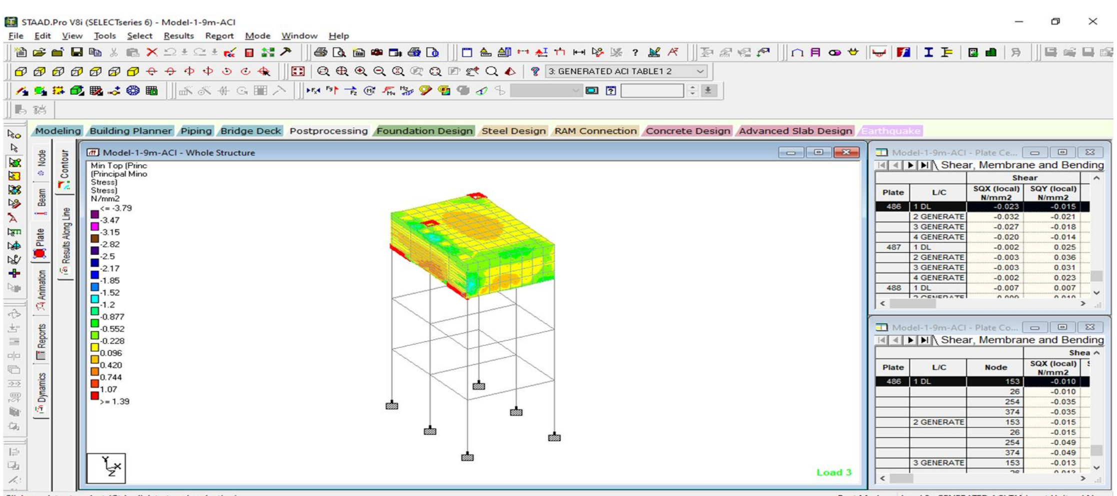


Fig. No.10: Minimum Top principal stresses for model-V

## V. CONCLUSION

The conclusions from the above study are as follows:

*A.* The models are compared for different height and the code
*B.* The nodal displacement and nodal reactions are higher for the higher height water tank
*C.* The calculation of shear stress, membrane stress, principal stress, von mis stress and Tresca stresses are obtained for all the models.
*D.* The stresses are found to be lower for the lower height of water tank
*E.* The storey drift is found to be increasing as the height of the water tank increases.

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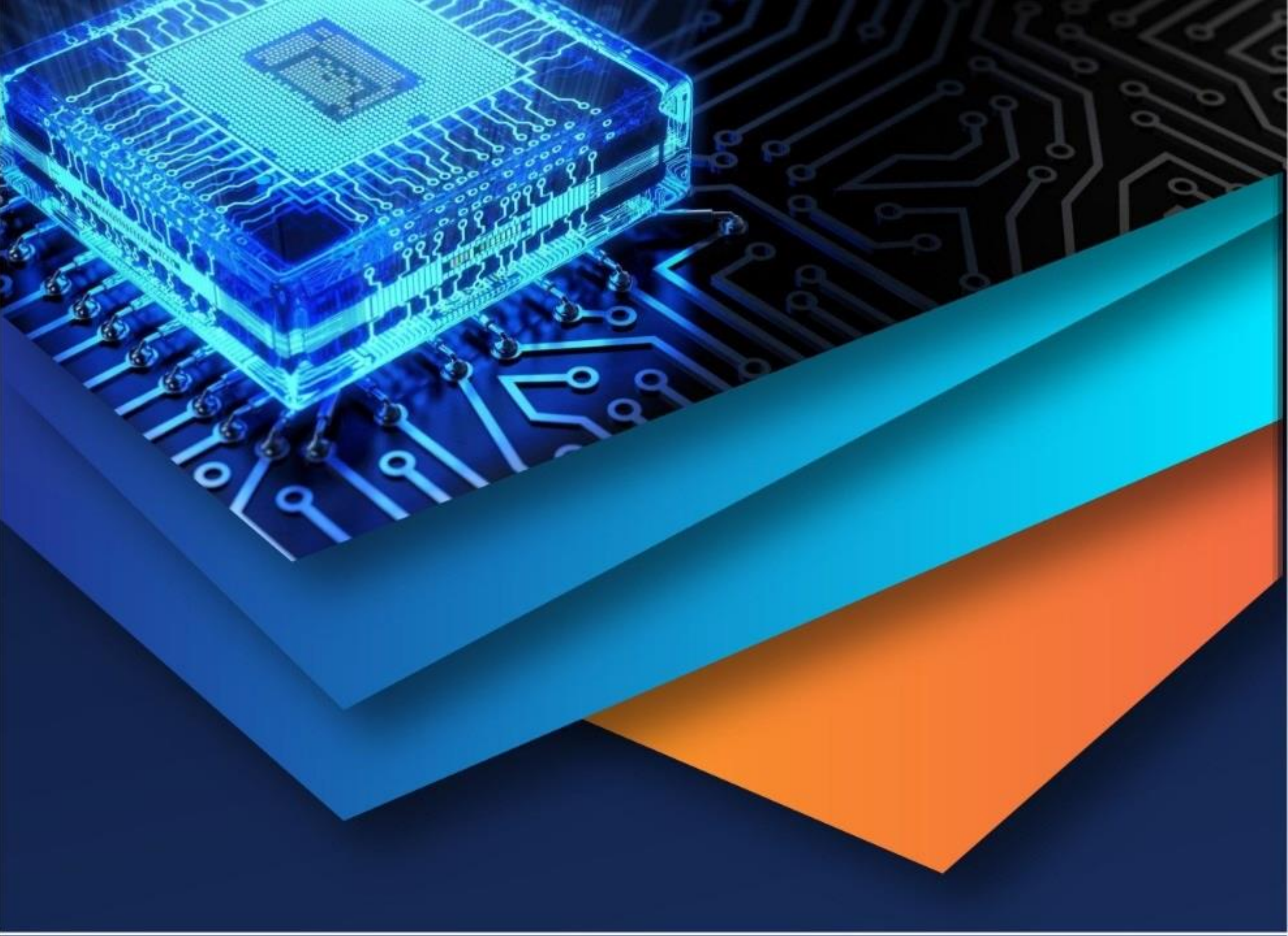


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