"COMPARISON OF ROUND, SQUARE AND RECTANGULAR TANKS WITH THE SAME VOLUME AND THE SAME HEIGHT AS THE PLATFORM"

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Abstract:-Rapid urbanization and urban expansion have led to an increase in demand for water supply. In terms of durability and safety, the water tank is considered an important structure. Water, liquid oil, petroleum products and similar liquids are stored in tanks. All storage tanks are designed as a crack-free structure to avoid leakage. This work is the application of the method in the structural analysis and construction of circular water tanks, rectangular water tanks and square water tanks. Under the same setting height, all three tanks have the same volume, we consider comparing the scenes. All storage tanks are crack-free to avoid leakage. Therefore, the efficiency of rectangular, square or circular water tanks was achieved in the research. Use a capacity of 3 * 3 * 3 (27) cubic meters to draw reasonable conclusions about the financial impact of tank design efficiency, tank type and structural capacity. The basic materials of the tank are steel and concrete. The results of saving materials show that circular troughs use less single material than rectangular troughs. Although there are other factors to consider, this makes round containers more advantageous than rectangular ones.

Key word: Reinforced Concrete, Steel, Water Tank, Form work, Optimization, Tank Capacity, Water Tank.

I. INTRODUCTION

One of the most important development needs of the community is a safe and adequate supply of drinking water. Unfortunately, many rural areas in developing countries do not yet have enough drinking water. The large rural populations in these countries depend on the availability of artificial wells, natural springs and rivers and recent limited projects of water supply from canals.

Storage tank is the common name for liquid storage tanks. The tanks with lower filling levels are generally designed to store large quantities of water, while the suspended tanks are designed to convey the gravity flow directly and usually have a lower capacity.

Seismic analysis of a large number of structures without a body reinforcement system has shown various harmful effects. Therefore, it is necessary to provide an adequate tensioning system for structural safety.

Constantly increasing reservoirs are crucial strategic structures and their damage due to earthquakes can damage the drinking water supply. Since high storage tanks are often used in seismically active areas, their seismic performance must also be verified in detail. Due to the lack of understanding of the transport system, some water tanks have been damaged. Therefore, compared to other transport systems, it is necessary to pay attention to the seismic safety of the lifeline structure by using the safety of the lifeline structure during an earthquake, and greater tectonic strength is also required. The design of new basins and the assessment of the safety of existing reservoirs must be very precise, since the failure of these systems (especially during earthquakes) can be catastrophic.

The hydrodynamic pressure of a tank subjected to seismic forces plays an important role in the design of the tank. An earthquake causes a great horizontal force and the discharge into a high water tank. In their basic configuration, these storage tanks are very easily damaged. When the tank is in good condition, the seismic force almost determines the design of these structures in areas with frequent seismic activity. It is important to ensure that the basic preconditions are not affected by the earthquake. In extreme cases, avoid complete collapse of the tank be avoided.

Type of water tank

- Under ground water Tanks
- Tank resting on ground
- Over head tanks or ELEVATED WATER TANK

II. METHODOLOGY

In this study, 3 types of water tanks are selected and various loadings like dead load, live load, water load, seismic load and wind load are considered on the tank. Geometry selected is rectangular, circular and square. Height of water tank = 3m; Column height = 4m, Beam (bracing) assigned in diagonal as shown in Fig. 1

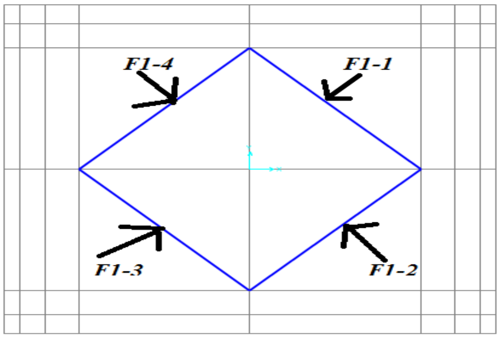

Fig 1 Top View F1 Mean First Floor

Location of column and bracing is same in all type of water tanks. Loading is applied in X and Y direction both. Columns are assigned as names C-11 for first floor fist column. Similarly other columns names are assigned. Bracing name are assigned are F-11 for first floor first bracing.Proposed water tank sketches are shown in Fig. 2

In this study geometry of tanks of same capacity are considered and all parameters are taken same for all shapes i.e. staging height, capacity of tank, column sizes, bracing sizes, and thickness of walls & slabs.

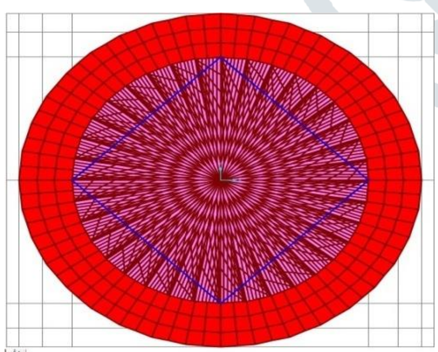

Fig 3 Top View Tank with Applied Load

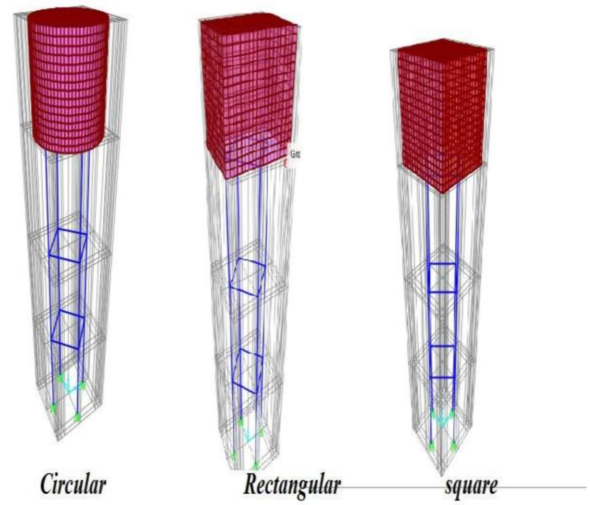

Fig 2 Proposed Water Tank Sketch

Concrete mixer lesser than M20 should not be used for water tank and we use M30 concrete.

Table 1 Section Property

Section Name	Material	Shape	t3	t2	Area	I33	I22
			m	m	m2	m4	m4
Beam	M30	Rect.	0.4	0.4	0.16	0.002133	0.002133
Column	M30	Rect.	0.4	0.4	0.16	0.002133	0.002133

Table 2 Load Pattern Definitions

Load Pattern	Design Type	Self Wt Multiply	Auto Load
DEAD	Dead	1.	
WIND	Wind	0.	IS 875-2015
SEISMIC	Quake	0.	IS 1893-2016
POINT WATER LOAD	Other	0.	

III. RESULT

In this study 3 type different shape of water tanke are considered and bending momnet, shear force, and axial load are calculated and graphically represented below:-

Column-11

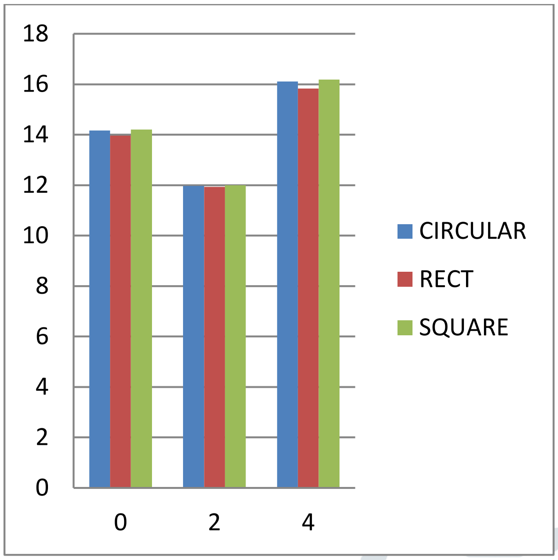

Fig 4 Bending Moment Due To Dead Load and Seismic Load in Column C 11

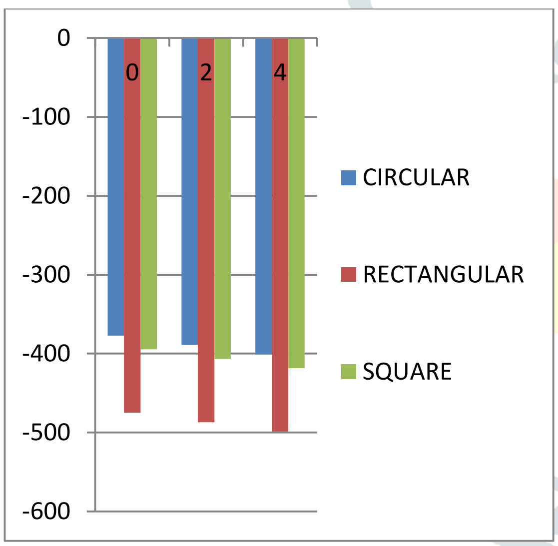

Fig 5 Axial Load Due To Dead Load + Seismic Load Column C11

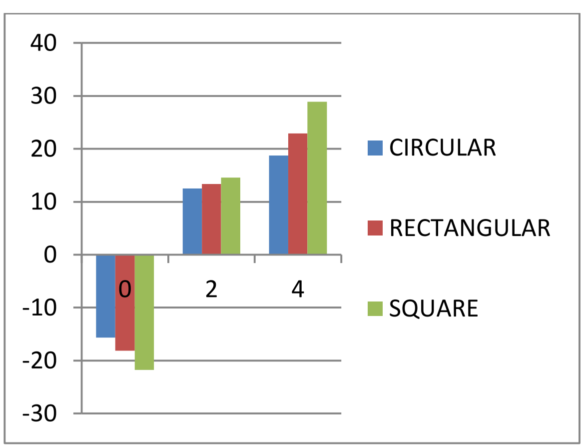

Fig 6 Bending Moment Due To Dead Load and Wind Load

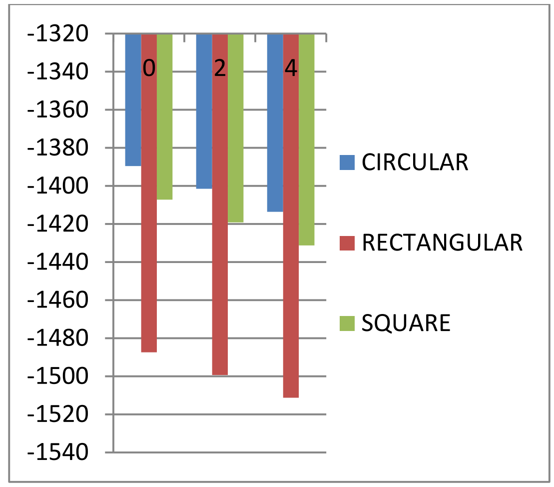

Fig 7 Axial Load in Column C11 Due To DL + WP

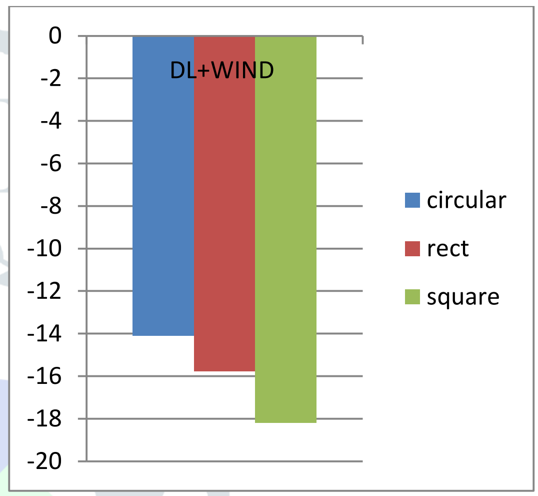

Fig 8 Shear Force Due To DL + Wind Load Column C11

Column-12

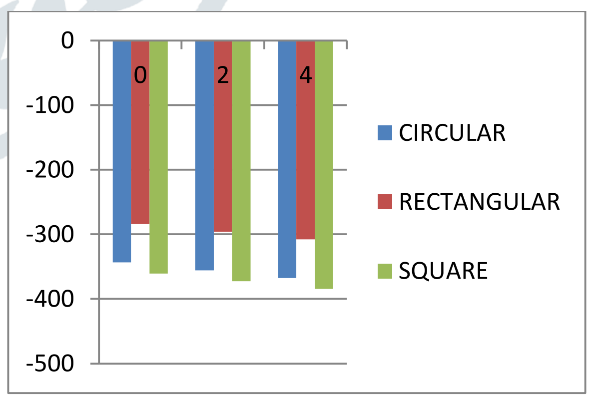

Fig 9 Axial Load Due To Dead Load + Seismic Load C12

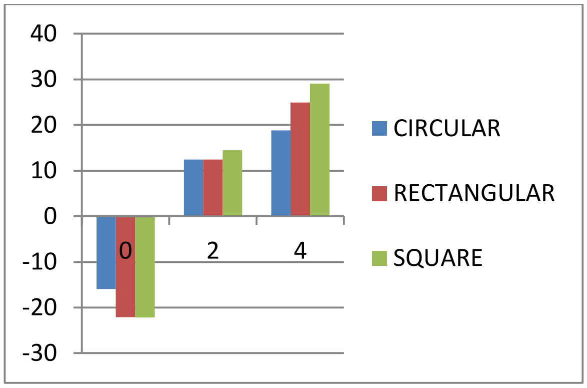

Fig 10 Bending Moment Due To Dead Load and Wind Load

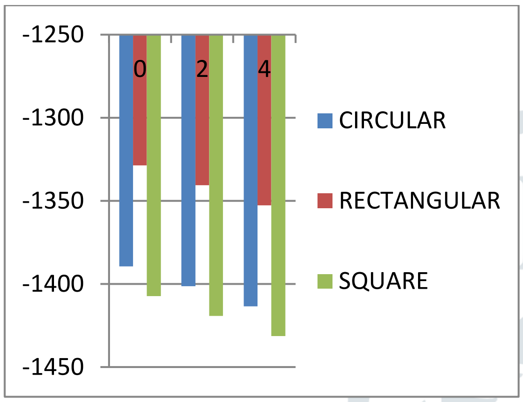

Fig 11 Axial Load in Column C12 Due To DL + WP

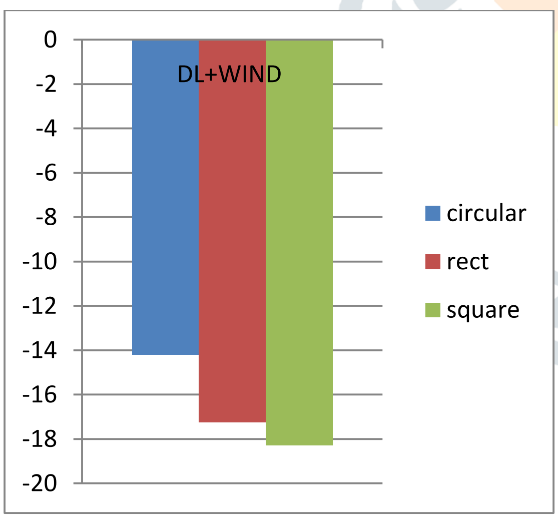

Fig 12 Shear Force Due To DL + Wind Load Column C12

Column-13

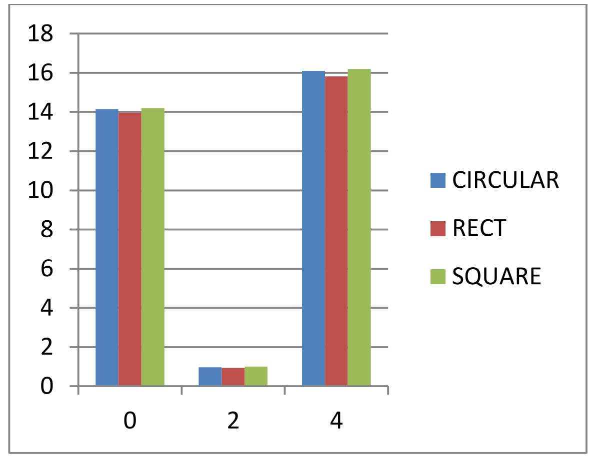

Fig 13 Bending Moment Due To Dead Load and Seismic Load in Column C 13

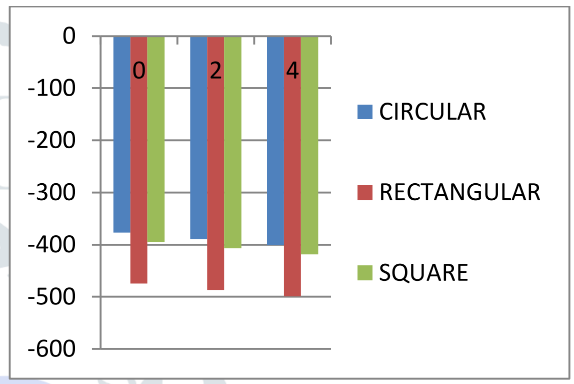

Fig 14 Axial Load Due To Dead Load + Seismic Load Column C13

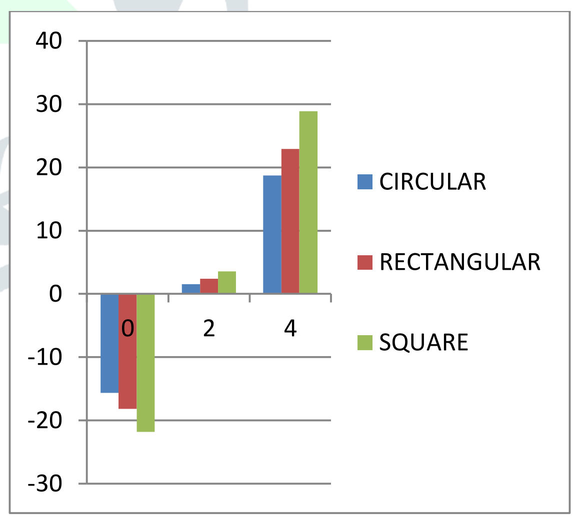

Fig 15 Bending Moment Due To Dead Load and Wind Load

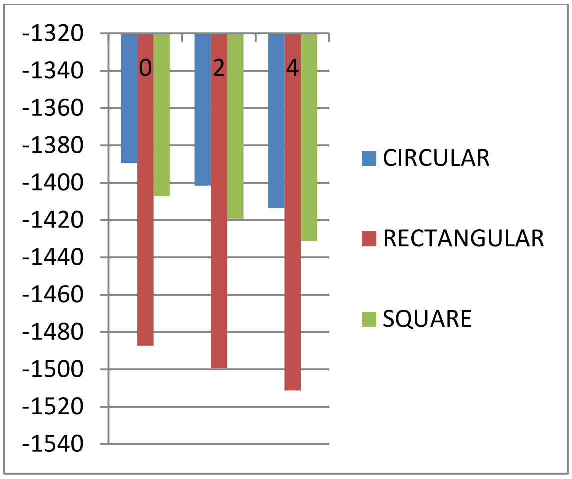

Fig 16 **Axial Load in Column C13 Due To DL + WP**

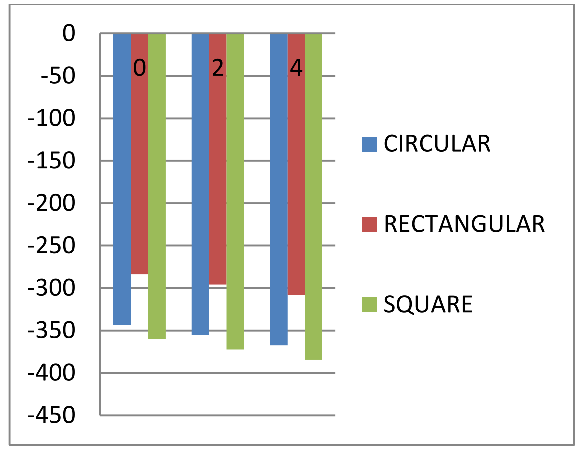

Fig 19 **Axial Load Due To Dead Load + Seismic Load Column C14**

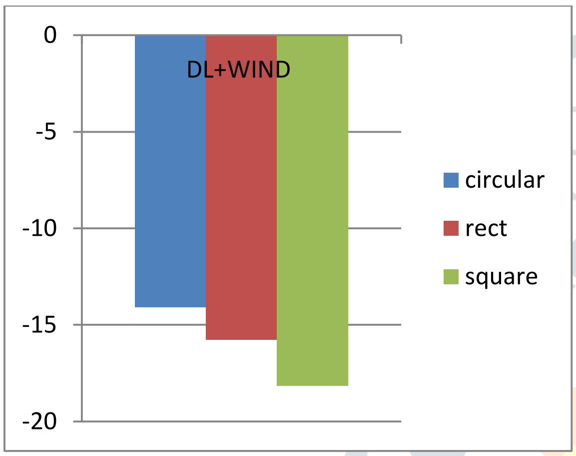

Fig 17 **Shear Force Due To Dl+ Wind Load Column C13**

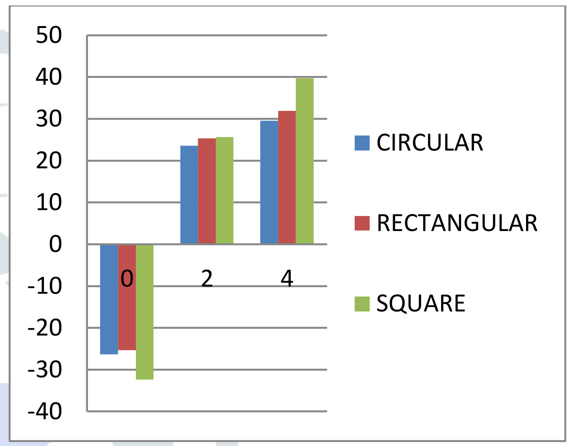

Fig 20 **Bending Moment Due To Dead Load and Wind Load**

Column-14

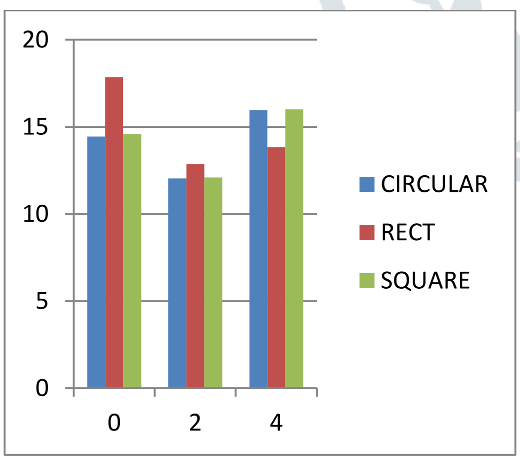

Fig 18 **Bending Moment Due To Dead Load and Seismic Load in Column C 14**

Column-14

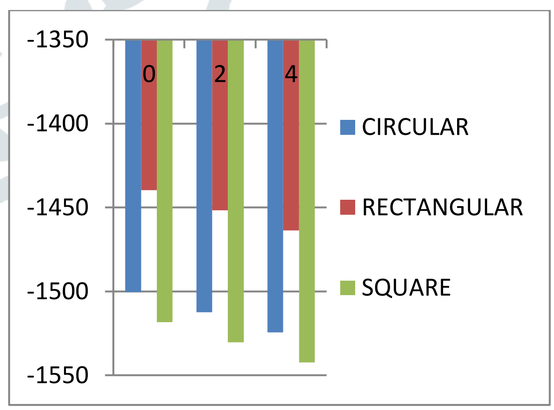

Fig 21 **Axial Load in Column C14 Due To DL + WP**

Column-31

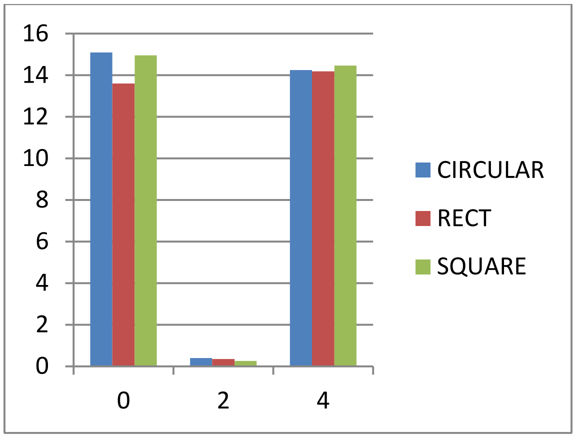

Fig 22 Bending Moment Due To Dead Load and Seismic Load in Column C 31

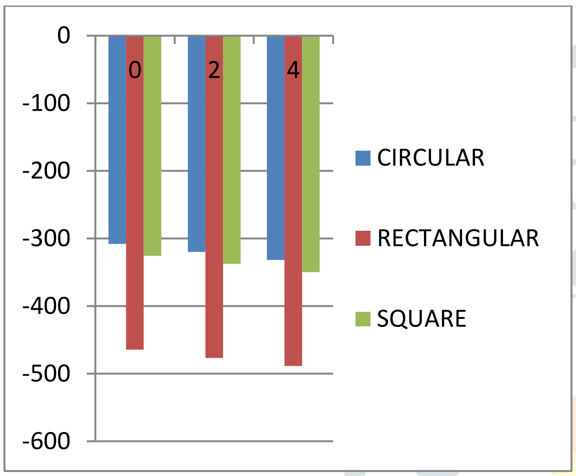

Fig 23 Axial Load Due To Dead Load + Seismic Load Column C31

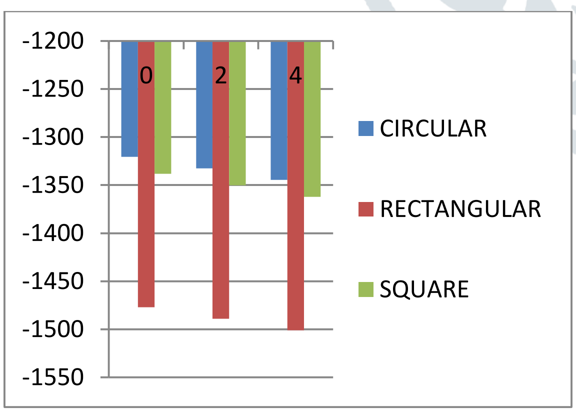

Fig 24 Axial Load in Column C31 Due To DL + WP

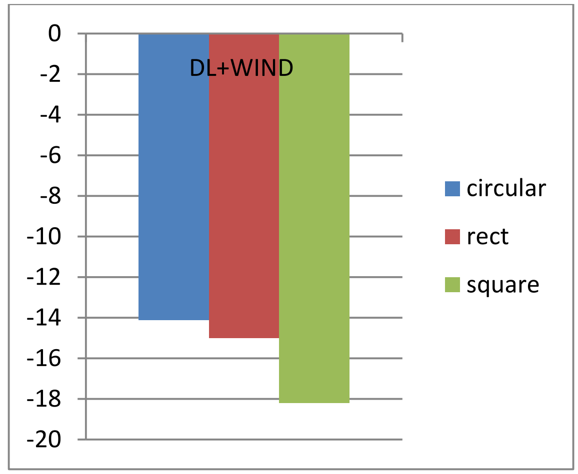

Fig 25 Shear Force Due To Dl + Wind Load Column C31

Column-32

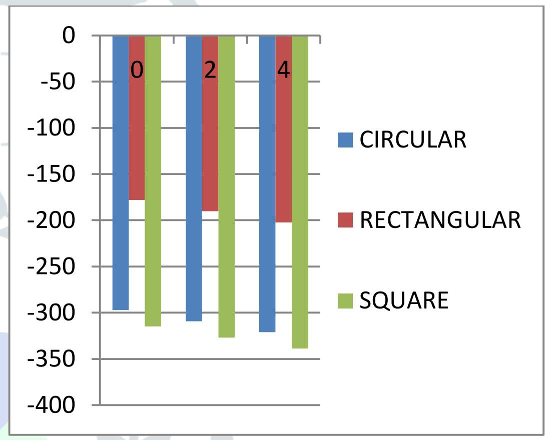

Fig 26 Axial Load Due To Dead Load + Seismic Load Column C32

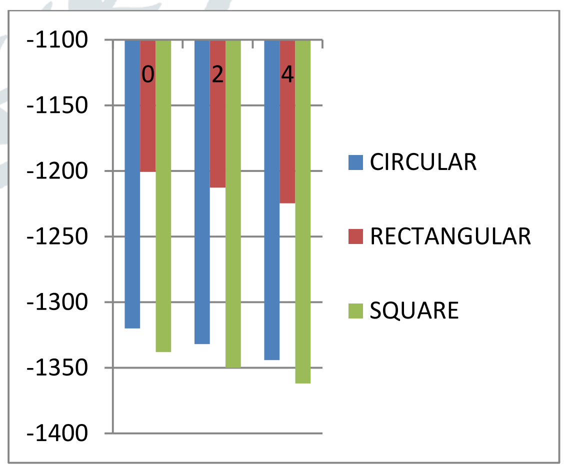

Fig 27 Axial Load in Column C32 Due To DL + WP

Column-33

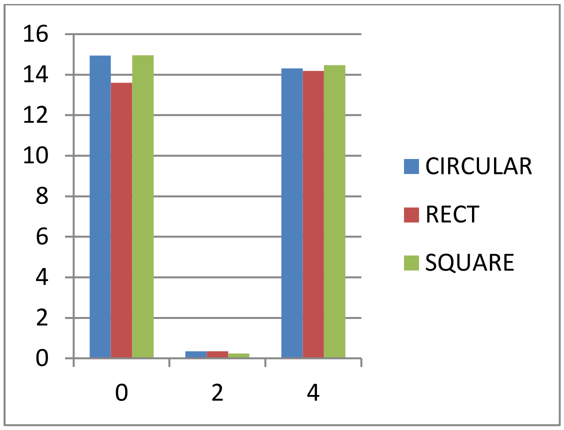

Fig 28 **Bending Moment Due To Dead Load and Seismic Load in Column C 33**

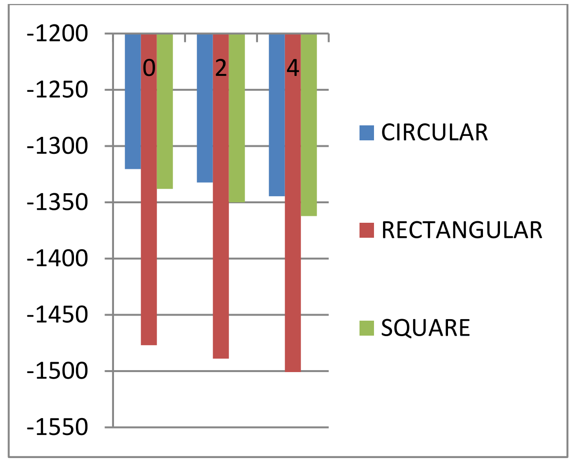

Fig 31 **Axial Load in Column C33 Due To DL + WP**

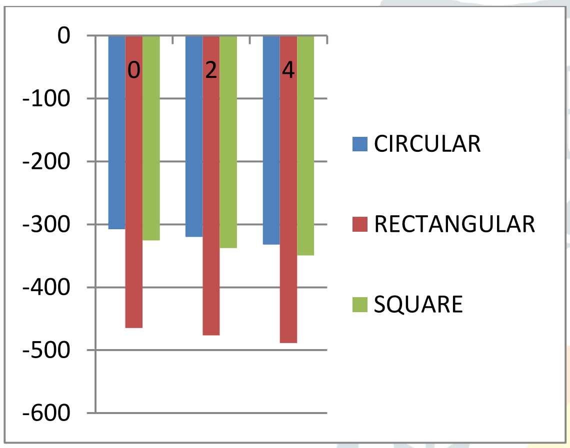

Fig 29 **Axial Load Due To Dead Load + Seismic Load Column C33**

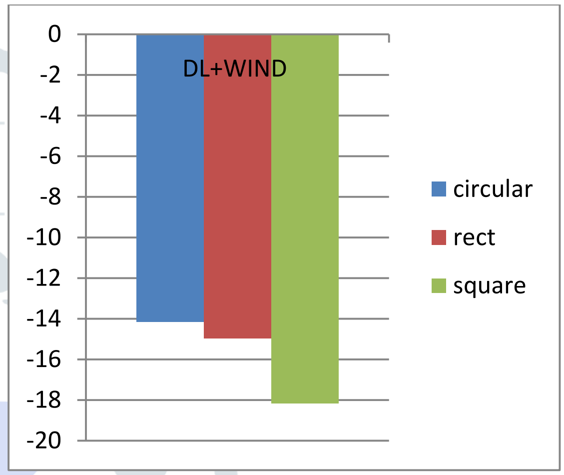

Fig 32 **Shear Force Due To Dl+ Wind Load Column C33**

Column-34

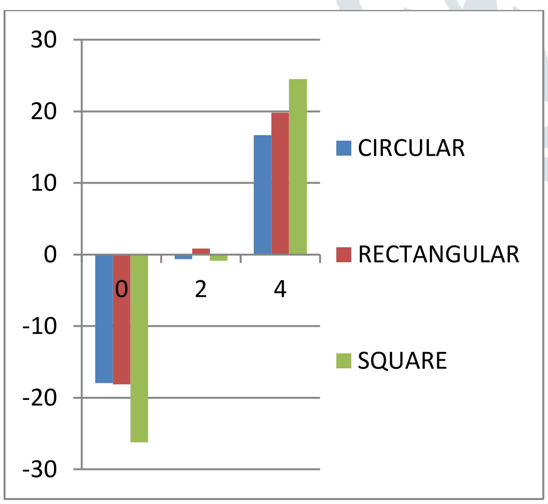

Fig 30 **Bending Moment Due To Dead Load and Wind Load**

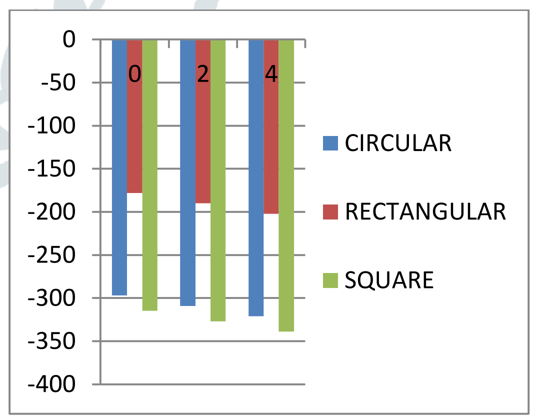

Fig 33 **Axial Load Due To Dead Load + Seismic Load Column C34**

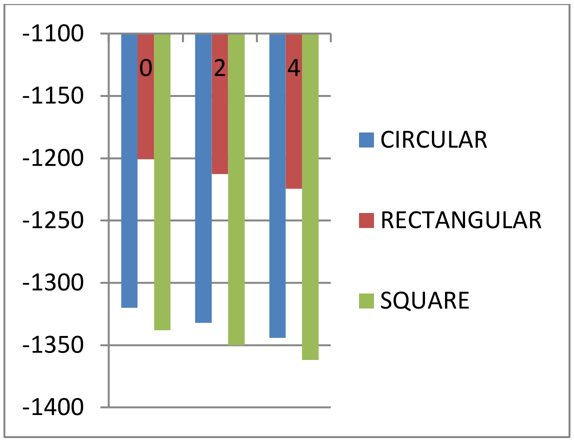

Fig 34 Axial Load in Column C34 Due To DL + WP

Bracing F-11

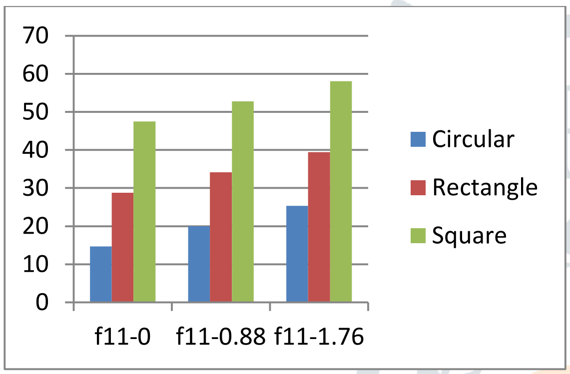

Fig 35 Shear Force Due To Dead Load + Wind Load on Beam F11

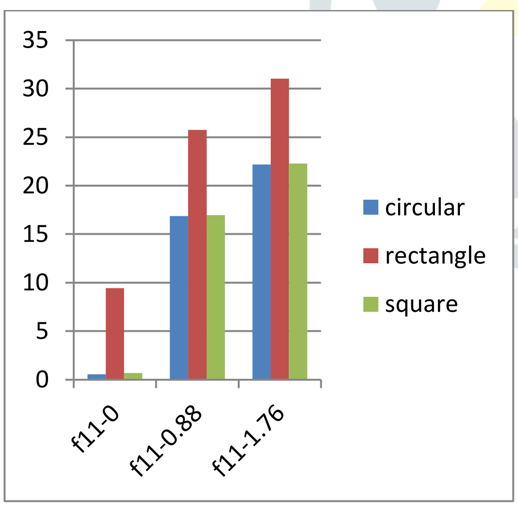

Fig 36 Shear Force Due To Dead Load + Seismic {Max} On Beam F11

Bracing F-12

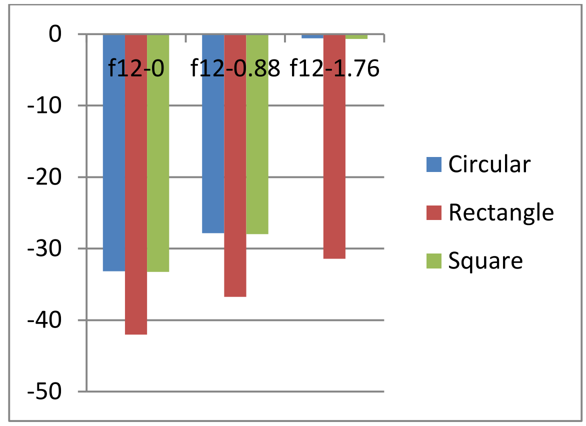

Fig 37 Shear Force Due To Dead Load + Seismic {Min} On Beam F12

Bracing F-13

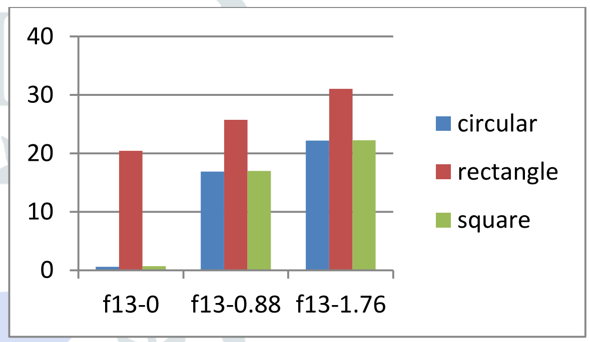

Fig 38 Shear Force Due To Dead Load + Seismic {Max} On Beam F13

Bracing F-14

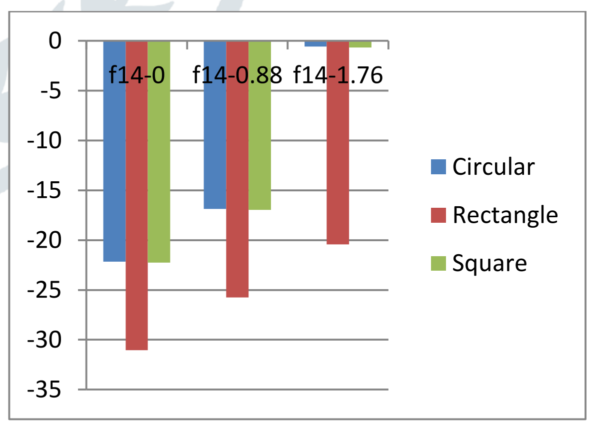

Fig 39 Shear Force Due To Dead Load + Seismic {Min} On Beam F14

Bracing F-21

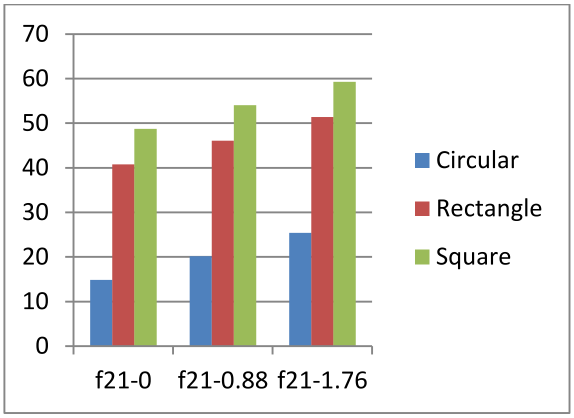

Fig 40 Shear Force Due To Dead Load + Wind Load on Beam F21

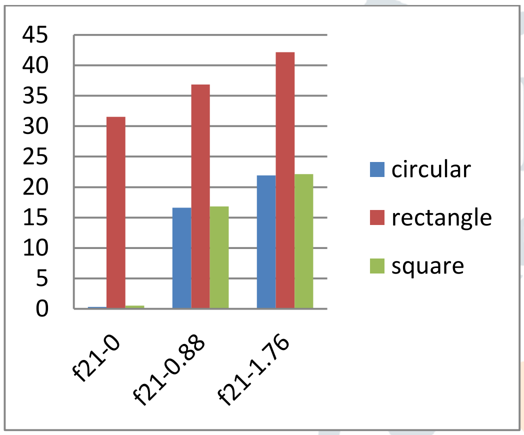

Fig 41 Shear Force Due To Dead Load + Seismic {Max} On Beam F21

Bracing F-22

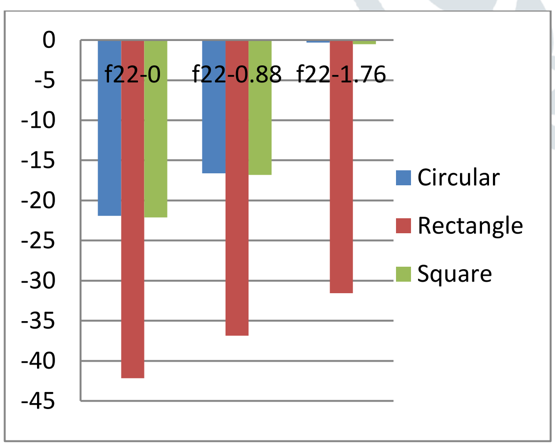

Fig 42 Shear Force Due To Dead Load + Seismic {Min} On Beam F22

Bracing F-23

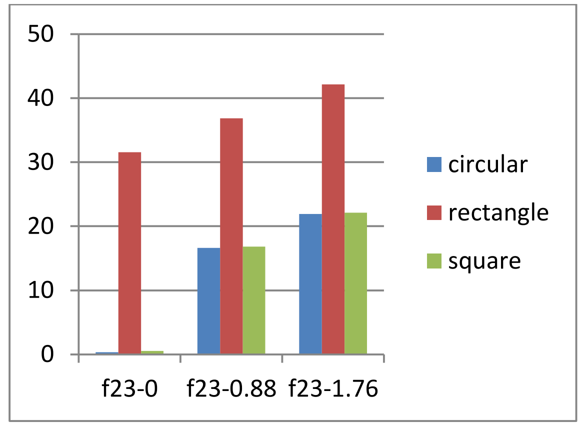

Fig 43 Shear Force Due To Dead Load + Seismic {Max} On Beam F23

Bracing F-24

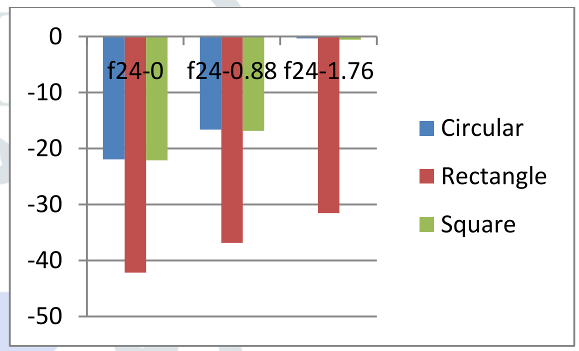

Fig 44 Shear Force Due To Dead Load + Seismic {Min} On Beam F24

IV. CONCLUSIONS

Circular shape has the foremost uniform stress distribution. The strain generated by fluid within the tank distributes equally in all directions. Just in case of rectangular or square shapes, the strain concentration would be too high in corners. This can be the prime reason that most of the large storage tanks are made in circular shape. It are often concluded that circular kind of storage tank is more economical than other shapes of water tank. The number of formwork & material required for circular short of storage tank is additionally less.

For the identical volume of water tanks circular style of water tank has less side wall and base thickness. As per observed results circular storage tank develop less stress on side walls with lower moment of inertia as compare to other shapes. The dimensions of columns in staging just in case of circular tank will be reduced in as compared to other geometry of tanks.

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