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SEISMIC ANALYSIS AND DESIGN OF EXISTING ELEVATED RC INTZE WATER TANK AT PEDANA AS PER LATEST IS PROVISIONS AND STADD PRO

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Abstract: The Existing elevated water tanks in India designed using IS 1893:1984 needs to be checked for safety as per revised code (IS 1893-2002 code) by carrying out static analysis. As known from the very past experiences, elevated water tanks were collapsed or heavily damaged during earth quakes all over the world. So most of the damages are observed during the earthquakes arise from the causes like unsuitable design of supporting system, mistakes on selecting supporting system. The main aim of this project is to understand the seismic behavior of the elevated water tank and comparison of various zones of seismic analysis parameters of the elevated reinforced concrete water tank with consideration and modeling of impulsive and convective water masses inside the container in Two Mass Model as per IS: 1893(part 2)-2007 Draft code and with stadd pro V8i software. The plan, sectional details are collected from Rural Water and Supply (RW&S). In this study Seismic Forces acting on an Intze Type Water tank for Indian conditions are studied. Most of the designers consider the wind effect and neglect the seismic effect on the structure. The comparative study of different zones seismic analysis of existed elevated reinforced Intze tank is done by using the IS codes and andstadd pro. Then finally concluded that in the earlier tank designed reinforcement is heavy, this will leads to uneconomical and it is considered as one of the disadvantage. From the recent code the base shear and overturning moment is less from that the reinforcement is reduced. It is very necessary to design and analyze the water tank as economical as possible. Finally the results have been presented in the form of graphs and tables.

Keywords: component; formatting; style; styling; insert (key words)

I. INTRODUCTION

1.1 EARTHQUAKES

An Earthquake is a wonder that outcomes from and is fueled by the sudden arrival of put away vitality in the outside layer that proliferates seismic waves. At the world's surface, quakes may show themselves by shaking the ground or dislodging of the ground and now and again torrents, which may prompts death toll and demolition of property. The word Earthquake is utilized to portray any seismic occasion whether a characteristic marvel or an occasion created by people that produces seismic waves. The Earth Quakes are happened actually which are identified with the tectonic way of the earth. Such Earth Quakes are called tectonic quakes. The world's lithosphere is an interwoven of plates in moderate however consistent movement brought about by the warmth in the world's mantle and center. Plate limits grind past one another, making frictional anxiety. At the point when the frictional anxiety surpasses a basic quality, called nearby quality, a sudden disappointment happens. The limit of tectonic plates along which disappointment happens is known as the shortcoming plane. At the point when the disappointment at the flaw plane results in a rough relocation of the world's outside, the flexible strain vitality is discharged and seismic waves are emanated, along these lines an earth shudder happens.

1.2 CLASSIFICATION OF ELEVATED TANKS

In light of the limits of the tank, the conceivable order for distinctive sorts of raised tanks may be given as beneath.
a) For tank up to 50 m³ capacity must be square or circular in shape and supported on staging three or four columns.
b) Tanks of capacity above 50 m³ and up to 200 m³ must be square or circular in plan and
Supported on minimum four columns.
c) For capacity above 200 m³ and up to 800 m³ the tank must be square, rectangular, circular or intze type tank. The number of columns to be adopted shall be decided based upon the column spacing which normally lies between 3.6 and 4.5 m.

II. LITERATURE REVIEW

2.1 GENERAL:

A brief survey of past studies with respect to seismic investigation of overhead tanks is given in this segment. These studies are essentially centered around comprehension the conduct of overhead water tanks under seismic loading.

2.2 DESCRIPTION:

Housner [8] in his exploration paper proposed Two Mass Model for raised tanks which is more fitting and is as a rule regularly utilized as a part of the vast majority of the universal codes including Draft code for IS 1893 (Part - II). The weight created within the liquid because of the dynamic movement of the tank can be isolated into rash and convective parts. At the point when a tank containing fluid with a free surface is subjected to even quake ground movement, then the tank divider and fluid are subjected to level quickening. The fluid in the lower area of tank carries on like a mass that is unbending nature associated with tank divider. This mass is termed as hasty fluid mass which quickens alongside the divider and instigates indiscreet hydrodynamic weight on tank divider and comparably on base. Fluid mass in the upper locale of tank experiences sloshing movement. This mass is termed as convective fluid mass and it applies convective hydrodynamic weight on tank divider and base. For these two models and with a specific end goal to incorporate the impact of their hydrodynamic weight in examination.Spring mass model is adopted for Two Mass Model for elevated tanks.

Sudhir Jain K. & M. S. Medhekar [17]The basic information behind in this paper is to modify the suggestion in IS: 1893-1984. The majorrevisions suggested are:

1. No provision for ground supported tanks with rigid and flexible walls in above IS code.This provision must be included in the seismic analysis.
2. The single degree of freedom idealization of tank is to be replaced by two or threedegree of freedom idealization.
3. A performance factor (K) of 3.0 is suggested for all types of tank.
4. The bracing beam flexibility is to be included in the calculation of lateral stiffness ofsupporting system of tank.
5. In the seismic analysis, the effect of Convective hydrodynamic pressure is to beincluded.
6. A simplified hydrodynamic pressure distribution is suggested for stress analysis oftank wall.

O. R. Jaiswal& S. K. Jain [17]O. R. Jaiswal and S. K. Jain [17] Recognizing the impediments and shot comings in the procurement of IS:1893-1984, Jain and Medhekar, Jain and Sameer an arrangement of procurements on a seismic configuration of fluid stockpiling tanks, the creator has given a few proposals –

1. Design horizontal seismic coefficient given in revised IS: 1893(Part-1)-2002 is usedand values of response reduction factor for different types of tanks are proposed.
2. Different spring-mass model for tanks with rigid & flexible wall are done away with;instead, a single spring-mass model for both types of tank is proposed.
3. Expressions for convective hydrodynamic pressure are corrected.

III. PROVISIONS OF INDIAN CODE

3.1 GENERAL DESIGN REQUIREMENTS (I.S)

3.1.1 Plain Concrete Structures:

Plain concrete member of reinforced concrete liquid retaining structure may be designed against structural failure by allowing tension in plain concrete as per the permissible limits for tension in bending. This will automatically take care of failure due to cracking. However, nominal reinforcement shall be provided, for plain concrete structural members.

3.1.2. Permissible Stresses in Concrete:

(a) For resistance to cracking: For calculations relating to the resistance of members to cracking, the permissible stresses in tension (direct and due to bending) and shear shall confirm to the values specified in Table 1. The permissible tensile stresses due to bending apply to the face of the member in contact with the liquid. In members less than 225mm. thick and in contact with liquid on one side these permissible stresses in bending apply also to the face remote from the liquid.

(b) For strength calculations: In strength calculations the permissible concrete stresses shall be in accordance with Table 1. Where the calculated shear stress in concrete alone exceeds the permissible value, reinforcement acting in conjunction with diagonal compression in the concrete shall be provided to take the whole of the shear.

Table 1: Permissible concrete stresses in calculations relating to resistance to cracking

Grade of concrete	Permissible stresses (N/mm2)		
	Direct Tension, σtd	Tension due to Bending σtb	Shear τsh (Q / b jd)
M 15	1.1	1.5	1.5
M 20	1.2	1.7	1.7
M 25	1.3	1.8	1.9
M 30	1.5	2.0	2.2
M 35	1.6	2.2	2.5
M 40	1.7	2.4	2.7

3.1.3 Permissible Stresses in Steel:

(a) For resistance to cracking: When steel and concrete are assumed to act together for checking thetensile stress in concrete for avoidance of crack, the tensile stress in steelwill be limited by the requirement that the permissible tensile stress in theconcrete is not exceeded so the tensile stress in steel shall be equal to theproduct of modular ratio of steel and concrete, and the correspondingallowable tensile stress in concrete.

(b) For strength calculations: In strength calculations the permissible stress shall be as follows:

(i) Tensile stress in member in direct tension 1000 kg/cm^2

(ii) Tensile stress in member in bending on liquid retaining face of members or face away from liquid for members less than 225mm thick 1000 kg/cm^2

(iii) On face away from liquid for members 225mm or more in thickness 1250 kg/cm^2

(iv) Tensile stress in shear reinforcement, For members less than 225mm thickness 1000 kg/cm^2.

For members 225mm or more in thickness 1250 kg/cm^2

IV. SEISMIC ANALYSIS

DESIGN OFINTZE TANK WITH FRAME STAGING

The design will be collected from the Rural Water and Supply (RW&S) and is given below.

Preliminary data:-

Table: 2 Sizes of various components

S.NO	Component	Size(mm)
1	Top dome	80 thick
2	Top ring beam	350x650
3	Cylindrical wall	120
4	Bottom ring beam	400 x 1100
5	Circular ring beam	480x700

6	Bottom dome	140
7	Conical dome	140
8	Braces	400x480 and 300x480
9	Columns	480x480

4.1.2. Weight calculations:-
i).Top dome:-
Effective span=19.92M.
Rise (h) =2.54M.
Bottom radius of the dome(r) =9.96 M.
Thickness of the dome (t) =80mm.
Radius of the dome (R) = $((r^2+h^2)/(2*h)) = ((9.96^2+2.54^2)/(2*2.54))$ =20.8m.
Weight of the top dome =2xπx20.8x2.54x (0.08x25)
=663.90KN.
ii).Weight of the top ring beam= πx (19.8+0.35) x0.35x0.65x25=360.036KN
iii).Cylindrical wall =πx (19.92x0.12x2.65x25)
=497.51KN.
iv).Bottom ring beam=πx (19.8+0.40) x0.4x1.10x25=698.06KN.
v).Circular ring beam=πx (15.4x0.48x0.7x25)
=406.39KN.
vi).Bottom dome:-
Radius of the dome (r2) = $((15.4/2)^2/2.07)+2.07)/2$
=15.35M.
Weight of the bottom dome
=2xπ15.35x2.07x0.14x25= 698.75 KN.
vii).conical dome:-
Length of cone, (Lc) = $(1.85^2+2.2^2)^{1/2}$ =2.87M.
Weight of the conical dome = πx ((19.92+15.4)/2)x2.87x0.465x25 =1851.038KN.
viii). Water = $((\pi x19.8^2x2.65/4) + (\pi x1.5 (19.8^2+15.4^2+(19.8x15.4))/12-(\pi x2^2x(15.35x3-1.5)/3))x9.81$=9772.329KN.
ix).columns =0.48x0.48x20x25x18.26 = 2103.552KN.
x). Braces = (2xπx15.4x0.4x0.48x25)+
(πx15.4x0.3x0.4x25) = 609.62KN.
4.2. Parameters of spring mass model:-
Total weight of water = 9772.39KN.
Volume of water = 9773/9.81=996.22 m^3.
Mass of water (m) =996220 KG.
Inner diameter of tank (D) =19.8M.
Let h be the height of equivalent circular cylinder,
$\pi (D/2)^2 h = 996.22$
h = 996.22 / (πx $(19.8/2)^2$) = 3.23m.
For h / D = 3.23 / 19.8 =0.163,
m_i / m = 0.25;
m_i = 0.25 x 996220 = 149433kg.
m_c / m =0.75;
m_c =0.75 x996220 =747165kg.
h_i / h = 0.375; h_i = 0.375 x 3.23 =1.21m.
h^*_I / h = 2.5; h^*_I =2.5 x 3.23 = 8.075m.
h_c / h = 0.51; h_c = 0.51 x 3.23 =1.64m.
h^*_c / h = 2.5; h^*_c =2.5 x 3.23 = 8.075m.
Mass of empty container + one third mass of staging,
M_s = (5175.68+2713.17/3) x (1000 / 9.81)
= 619778.79 kg.
i). Time period:-
Time period of impulsive mode
$T_i = 2\pi\sqrt{(m_i+m_s)/K_s}$
$=2\pi\sqrt{(149433+697354)/44434.98}$ = 0.86 sec.
Time period of convective mode,
$T_c = C_c\sqrt{(D)/g}$
For h /D = 0.163 C_c = 4.50
Thus, $T_c = 4.5 x\sqrt{(19.8/9.81)}$ = 6.39sec.
ii).Design of horizontal seismic coefficient:-
At zone-3:-
Design of horizontal seismic coefficient for impulsive mode,
$(A_{h)i}$ = (0.16/2) x (1.5/2.5)x1.5 = 0.072
Design horizontal seismic coefficient for convective mode,
$(A_h)_c$ = (0.16/2) x (1.5/2.5)x0.58= 0.027
At zone-4:-
Design of horizontal seismic coefficient for impulsive mode,
$(A_{h)i}$ = (0.24/2) x (1.5/2.5)x1.5 = 0.108
Design horizontal seismic coefficient for convective mode,
$(A_h)_c$ = (0.24/2) x (1.5/2.5)x0.58= 0.041
At zone-5:-
Design of horizontal seismic coefficient for impulsive mode,
$(A_{h)i}$ = (0.36/2) x (1.5/2.5)x1.5 = 0.162
Design horizontal seismic coefficient for convective mode,
$(A_h)_c$ = (0.36/2) x (1.5/2.5)x0.58= 0.062
iii). Base shear:-
At zone-3:-
Base shear at the bottom of staging, in impulsive mode,
$V_i = (A_h)_i (m_i + m_s) g$
= 543.309KN.
Similarly, base shear in convective mode,
$V_c = (A_h)_c x\ m_c x\ g$ = 197.91KN.
Total base shear at the bottom of staging,
$V = V_i + V_c$
=543.309+197.91 = 741.219KN. ~741 KN.
At zone-4:-
Base shear at the bottom of staging, in impulsive mode,
$V_i = (A_h)_i (m_i + m_s) g$
= 814.96KN.
Similarly, base shear in convective mode,
$V_c = (A_h)_c x\ m_c x\ g$
= 300.517KN.
Total base shear at the bottom of staging,
$V = V_i + V_c$
=814.96+300.517 = 1115.47KN. ~1116 KN.
At zone-5:-
Base shear at the bottom of staging, in impulsive mode,
$V_i = (A_h)_i (m_i + m_s) g$
= 1222.44KN.
Similarly, base shear in convective mode,
$V_c = (A_h)_c x\ m_c x\ g$
= 454.44KN.
Total base shear at the bottom of staging,
$V = V_i + V_c$
=1222.44+454.44 = 1676.88KN. ~1677 KN.
iv).Base moment:-
At zone-3:-
Overturning moment at the base of staging in impulsive

mode,
$M_i = (A_h)_i\ (m_i(h^*_I + h_s) + m_s h_{cg})\ x\ g$
= 11709.941 KN-M.
Similarly over turning moment in convective mode,
$M_c = (A_h)_c\ (m_c(h^*_c + h_s)\ x\ g$
= 5211.73 KN-M.
Total overturning moment
$M = M_i + M_c$
= 11709.941 + 5211.73 = 16921.67 KN-M.
At zone-4:-
Overturning moment at the base of staging in impulsive mode,
$M_i = (A_h)_i\ (m_i(h^*_I + h_s) + m_s h_{cg})\ x\ g$
= 17564.91 KN-M.
Similarly over turning moment in convective mode,
$M_c = (A_h)_c\ (m_c(h^*_c + h_s)\ x\ g$
= 7914.12 KN-M.
Total overturning moment
$M = M_i + M_c$
= 17564.91 + 7914.12 = 25479.03 KN-M.
At zone-5:-
Overturning moment at the base of staging in impulsive mode,
$M_i = (A_h)_i\ (m_i(h^*_I + h_s) + m_s h_{cg})\ x\ g$
= 26347.36 KN-M.
Similarly over turning moment in convective mode,
$M_c = (A_h)_c\ (m_c(h^*_c + h_s)\ x\ g$
= 11967.69 KN-M.
Total overturning moment
$M = M_i + M_c$
= 26347.36 + 11967.69 = 38315.05 KN-M.

4.3. Impulsive hydrodynamic pressure
At zone-3:-
Impulsive hydrodynamic pressure on wall
$P_{iw}(y) = Q_{iw}(y)\ (A_h)_i \rho g h \cos\phi$
= 0.865 (0.072) 1 x 9.81 x 4.0 x 1
= $2.44 kN/m^2$
At zone-4:-
Impulsive hydrodynamic pressure on wall
$P_{iw}(y) = Q_{iw}(y)\ (A_h)_i \rho g h \cos\phi$
= 0.865 (0.108) 1 x 9.81 x 4.0 x 1 = $3.66 kN/m^2$
At zone-5:-
Impulsive hydrodynamic pressure on wall
$P_{iw}(y) = Q_{iw}(y)\ (A_h)_i \rho g h \cos\phi$
= 0.865 (0.162) 1 x 9.81 x 4.0 x 1
= $5.49 kN/m^2$
Impulsive hydrodynamic pressure on Base Slab
At zone-3:-
Impulsive hydrodynamic pressure on Base Slab
P_{ib}= 0.866$(A_h)_i\rho g h$ [(sin h (0.866) x/h)/(cos h (0.866))l'/h]
= $2.380 kN/m^2$
At zone-4:-
Impulsive hydrodynamic pressure on Base Slab
P_{ib}= 0.866$(A_h)_i\rho g h$ [(sin h (0.866) x/h)/(cos h (0.866))l'/h]= $3.57 kN/m^2$
At zone-5:-
Impulsive hydrodynamic pressure on Base Slab
P_{ib}= 0.866$(A_h)_i\rho g h$ [(sin h (0.866) x/h)/(cos h (0.866))l'/h]= $5.355 kN/m^2$

4.4Convective hydrodynamic pressure:
At zone-3:-
Convective hydrodynamic pressure on the wall
$P_{cw}(y) = Q_{cw}(y)\ (A_h)_c \rho g D\ [1\text{-}1/3\cos^2\phi]\ \cos\phi$
= 0.436 x 0.027 x 9.81 x 19.8 [1-1/3 $(1)^2$] 1
= $1.52 kN/m^2$
At zone-4:-
Convective hydrodynamic pressure on the wall
$P_{cw}(y) = Q_{cw}(y)\ (A_h)_c \rho g D\ [1\text{-}1/3\cos^2\phi]\ \cos\phi$
= 0.436 x 0.041 x 9.81 x 19.8 [1-1/3 $(1)^2$] 1
= $2.314 kN/m^2$
At zone-5:-
Convective hydrodynamic pressure on the wall
$P_{cw}(y) = Q_{cw}(y)\ (A_h)_c \rho g D\ [1\text{-}1/3\cos^2\phi]\ \cos\phi$
= 0.436 x 0.062 x 9.81 x 19.8 [1-1/3 $(1)^2$] 1
= $3.50 kN/m^2$
Convective hydrodynamic pressure on Base Slab
At zone-3:-
Convective hydrodynamic pressure on Base Slab
$P_{cb} = Q_{cb}(x)\ (A_h)_c \rho g D$
P_{cb}= 0.289 x 0.027x 1 x 9.81 x 19.8 = $1.519 kN/m^2$
At zone-4:-
Convective hydrodynamic pressure on Base Slab
$P_{cb} = Q_{cb}(x)\ (A_h)_c \rho g D$
P_{cb}= 0.289 x 0.041x 1 x 9.81 x 19.8 = $2.301 kN/m^2$
At zone-5:-
Convective hydrodynamic pressure on Base Slab
$P_{cb} = Q_{cb}(x)\ (A_h)_c \rho g D$
P_{cb}= 0.289 x 0.062x 1 x 9.81 x 19.8 = $3.480 kN/m^2$

4.5. ANALYSIS FOR TANK EMPTYCONDITION:-Mass of empty container + one third mass of staging, m_s = 619778.79kg.
Stiffness of staging, K_s = 44434.98 KN/M.
i).Time period:-
Time period of impulsive mode,
$T = T_i = 2\pi\ x\ \sqrt{}\ (ms / K_s)$
= 2π x $\sqrt{}$ (619778.79 / 44434.98 KN/M)
= 0.74 sec.
Empty tank will not convective mode of vibration.
ii).Design horizontal seismic coefficient:-
At zone-3:-
Design horizontal seismic coefficient corresponding to impulsive time period T_i,
From the code (IS 1893 (Part 1):)
$(A_h)_i$ = (0.16/2) x (1.5/2.5)x1.7 = 0.08.
At zone-4:-
Design horizontal seismic coefficient corresponding to impulsive time period T_i,
From the code (IS 1893 (Part 1):)
$(A_h)_i$ = (0.24/2) x (1.5/2.5)x1.7 = 0.122.
At zone-5:-
Design horizontal seismic coefficient corresponding to impulsive time period T_i,
From the code (IS 1893 (Part 1):)
$(A_h)_i$ = (0.36/2) x (1.5/2.5)x1.7 = 0.183.
iii).Base shear:-
At zone-3:-
Total base shear,
$V = V_i = (A_h)_i\ x\ m_s x\ \ g$

= 0.08 x 619778.79 x 9.81 = 486.40 KN.

At zone-4:-

Total base shear,

$V = V_i = (A_h)_i \times m_s \times g$

= 0.122 x 619778.79 x 9.81 = 741.76 KN.

At zone-5:-

Total base shear,

$V = V_i = (A_h)_i \times m_s \times g$

= 0.183 x 619778.79 x 9.81 = 1112.64 KN.

iv). Base moment:-

At zone-3:-

Total base moment,

$M^* = (A_h)_i\ (m_s x h_{cg})\times g$

= 0.08 x 619778.7 x 18.26 x 9.81 =8881.70 KN-m.

At zone-4:-

Total base moment,

$M^* = (A_h)_i\ (m_s x h_{cg})\times g$

= 0.12 x619778.7 x18.26 x9.81= 13544.60 KN-m.

At zone-5:-

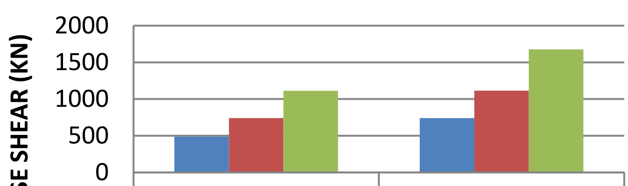
Total base moment,

$M^* = (A_h)_i\ (m_s x h_{cg})\times g$ = 0.183 x 619778.79 x 18.26 x 9.81 = 20316.90 KN-m.

V. RESULTS AND DISCUSSIONS

Comparison of different zones seismic analysis parameters with Indian standard codes of Intze tank supported on frame staging is shown in below tables. In that tables all parameters from the codes IS 1893 (part 2): 2007 draft code for the frame staging are summarized.

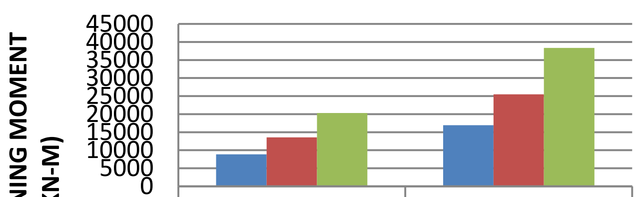
BASE SHEAR:



	tank empty	tank with water
zone-3	486.4	741.21
zone-4	741.76	1115.47
zone-5	1112.64	1676.88

Graph 1: base shear in different zones

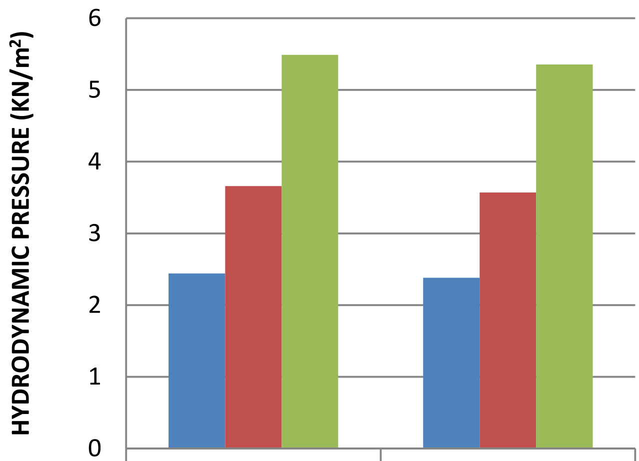
OVER TURNING MOMENTS:



	tank empty	tank with water
zone-3	8881.7	16921.67
zone-4	13544.6	25479.03
zone-5	20316.9	38351.05

Graph 2: overturning moment in different zones

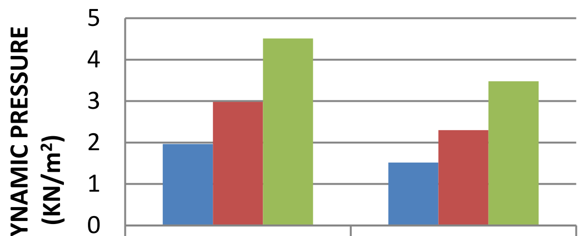
IMPULSIVE HYDRODYNAMIC PRESSURE:



	on wall	on base
zone-3	2.44	2.38
zone-4	3.66	3.57
zone-5	5.49	5.355

Graph 3: impulsive hydrodynamic pressure in different zones

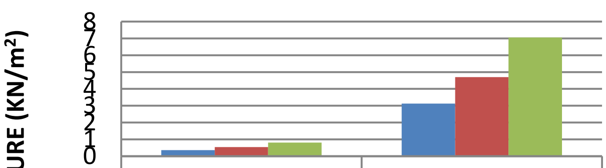
CONVECTIVE HYDRODYNAMIC PRESSURE:



	on wall	on base
zone-3	1.964	1.519
zone-4	2.983	2.301
zone-5	4.512	3.48

Graph 4: Convective hydrodynamic pressure in different zones

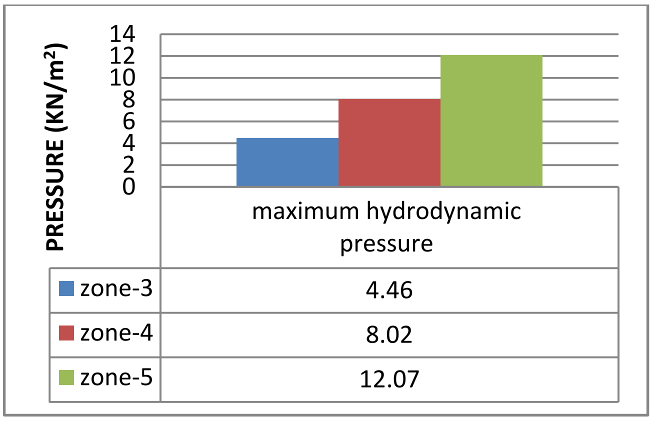
PRESSURE DUE TO WALL INERTIA AND VERTICAL EXCITATION:



	wall inertia	vertical excitation
zone-3	0.36	3.13
zone-4	0.54	4.7
zone-5	0.81	7.06

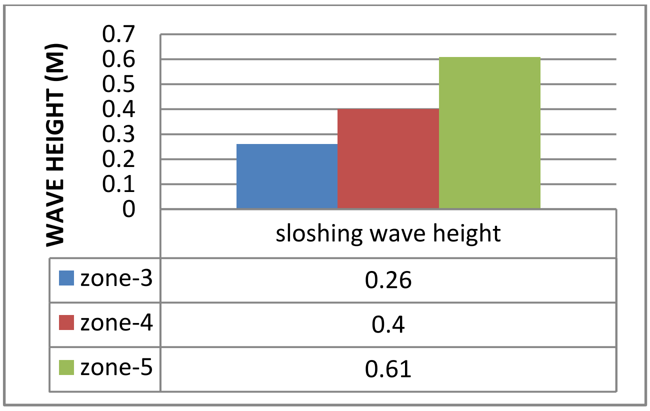
Graph 5: pressure in due to wall inertia and vertical excitation different zones

MAXIMUM HYDRODYNAMIC PRESSURE:



Graph 6: Maximum hydrodynamic pressure in different zones

SLOSHING WAVE HEIGHT:



Graph 7: Sloshing wave height in different zones

VI. CONCLUSIONS

- It can be observed from the earlier code IS 1893: 1984 can used only single degree of freedom and from the later existing tank compared with water code IS 1893 (part 2): 2007 draft code it can follow the Two Mass Modal.
- The distribution of impulsive and convective hydrodynamic pressure is represented graphically for convenience in analysis, the impulsive hydrodynamic pressure on wall and base of existing water tank is lower the values when compared to zone-4 is 33%and with zone-5 is 55% .
- The convective hydrodynamic pressure on wall and base of existing water tank is lower the values when compared to zone-4 is 34%and with zone-5 is 56%.
- Effect of vertical ground acceleration and pressure due to wall inertia on hydrodynamic pressure is also considered while analysis the tank by two mass modal in zone-3 and lower the values when compared to zone-4 is 33% and zone-5 is 55%.
- The Base Shear and Overturning moments obtained from the code IS 1893 (part 2):2007 draft code in zone-3, zone-4 and zone-5, whereas the values of the base shear and over turning moments of existing tank is lower when compared to the zone-4 is 33% and zone-5 is 55%.
- The maximum hydrodynamic pressure of existing water tank is lower the values when compared to zone-4 is 44%and with zone-5 is 63%.
- The sloshing wave height of the existing tank is within the free board and in the zone-4 and zone-5 the sloshing wave height is not with in the free board.
- Then finally concluded that in the earlier code the reinforcement is heavy, this will leads to uneconomical and it is considered as one of the disadvantage. From the recent code the base shear and overturning moment is less from that the reinforcement is reduced. It is very necessary to design and analyze the water tank as economical as possible.

FUTURE SCOPE:

From the design and seismic analysis of Reinforced Concrete Intze water tank using the SAP Software the moments are high and hence they are providing heavy reinforcement and cost is high. By using the SAP Software, the reinforcement which is provided in the elevated structure can be reduced because the moments obtained in the analysis are less. The basic need of any structure is to design as economical as possible, reinforcement in a structure plays an important key role in the elevated water tank and it should not be over-reinforced.

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