International Journal of Research
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 08 Issue 03
March 2021

Design And Analysis Of Shear Walls In Etabs

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ABSTRACT

The standard impartial of this development is to analyze besides scheme a multi-storeyed resedential building construction G+12 (3 dimensional frame)with shear walls by using ETABS software ETABS stands for Extended Three dimensional Analysis of Building Systems.

Now-a-days we are facing some of the major problems because of natural calamities which lead to loss in economy and our valuable life's, one of those disaster is earthquakes to solve the problem we should caught up with earthquake resistance structures one of the technique is Shear walls, shear walls are vertical elements of the horizontal force resisting system. These walls are constructed to counter the effects of lateral load acting on a structure. Shear wall building which differs from the other building is due to the transference of lateral loads, and treated as cantilevers fixed at the basement level and constructed to carry the lateral loads safely by shear and bending. In last two decades, the shear walls become the important part of high rise building and generally lift wells and stair wells are designed as shear walls. This paper addresses the determination of interaction diagram between axial force and bending moment on the section. The interaction diagrams which giving more accurate description about the capacity of shear wall structures. Earthquakes are the most critical loading condition for all land based structures located in the seismically active regions. The reasons were (a) most of the buildings had soft and weak ground storey that provided open space for parking, (b) poor quality of concrete in columns, and (c) poor detailing of the structural design. Therefore, this incident has shown that designers and structural engineers should ensure to offer adequate earthquake resistant provisions with regard to planning, design and detailing in high rise buildings to withstand the effect of an earthquake. As an earthquake resistant system, the use of shear walls is one of the potential options. The use of shear wall buildings is quite common in some earthquake prone regions. Shear walls majorly resist the seismic force, wind forces and even can be built on soils of weak bases by adopting various ground improvement techniques.

The project includes load intention is physically and examining the entire construction through ETABS . The enterprise approaches used in ETABS examination are Limit State Design compatible to Indian Standard Program of Practice. ETABS topographies and advanced operator boundary, visualization tools, influential analysis and project engines with progressive determinate component and dynamic analysis capabilities. From model cohort, analysis and design to conception and result endorsement, ETABS is the best choice. Originally we trendy by the analysis of humble 2 dimensional surrounds and physically checkered the accuracy of the software with our consequences. The consequences exposed to be self-same precise. We examined and intended a G +12storey building primarily aimed at all possible load groupings [Dead, Live, Wind and Seismic Loads].

INTRODUCTION

1.1. General

Prominence of Seismic Project Cryptograms Pulverized atmospheres during shakings grounds marines and distortions in constructions. Assemblie esessential to be intended to endure such forces and distortions. Seismic codes help to recover the behavior of constructions consequently that they may endure the shaking effects deprived of important damage of lifecycle and stuff. Republics everywhere the ecosphere obligate measures delineated in seismic cryptograms to benefit design contrives in the arrangement, designing, specifying and creating of buildings. An earthquake-resistant construction has four qualities in it, specifically: (a) Worthy Important Conformation: The afore mentioned scope, outline and organizational scheme loud loads remain such that they safeguard a straight and flat flow of apathy militaries to the crushed. (b) Adjacent Asset: The thorough going adjacent (horizontal) strength that it can struggle is such that the impairment encouraged in it organizes not upshot in breakdown. (c) Satisfactory Difficulty: Its adjacent load fighting scheme is such that the earthquake-induced distortions in it do not injury its substances below low-to reasonable trembling. (d) Respectable Ductility: Its volume to experience large distortions underneath plain quake shaking even after elastic is better-quality by promising design and specifying approaches. Seismic cryptograms concealment all this features. Indian Seismic Cyphers Seismic ciphers are sole to a certain area or nation.

They revenue into explanation the homegrown seismology, acknowledged level of seismic risk, building typologies, and constituents and approaches rummage-sale in building. Additional, they are revealing of the equal of development a republic has complete in the arena of quake manufacturing. The principal official seismic cipher in India, viz. IS 1893, was available in 1962. Nowadays, the Department of Indian Principles (BIS) has the subsequent seismic ciphers: IS 1893 (Part I), 2002, Indian Regular Standards for Earthquake Resistant Design of Constructions (5th Revision) IS 4326, 1993, Indian Regular Cipher of Preparation for Shaking Hardy Project and Building of (2nd Revision) IS 13827, 1993, Indian Standard Rules for Refining Shaking Resistance of Stone Constructions IS 13828, 1993, Indian Standard Strategies for Educating Earthquake Resistance of Little Asset Brickwork Constructions IS 13920, 1993, Indian Regular Cypher of Preparation for Yielding Detailing of Reinforced Concrete Constructions Endangered to Seismic Militaries IS 13935, 1993, Indian Standard Strategies for Reparation and Seismic Consolidation of Constructions. The guidelines in these ideals do not guarantee that constructions struggle no damage during shaking of all extents. But, to the degree conceivable, they guarantee that constructions are able to respond to earthquake shakings of moderate intensities without structural injury and of weighty concentrations deprive do fentire failure. IS 1893 IS 1893 is the foremost cypher that delivers the seismic region chart (Figure 1) and stipulates seismic design force. This force depends on the mass and seismic coefficient of the construction; the concluding in gobe contingent on possessions comparable seismic region in which construction lies, position of the construction, its stiffness, the mud on which it breathers, and his ductility. For illustration, a building in Bhuj will have 2.25 times the seismic project strength of an indistinguishable construction in Bombay. Congruently, the seismic continuous for a single-storey construction might have 2.5 times that of a 15-storey construction.

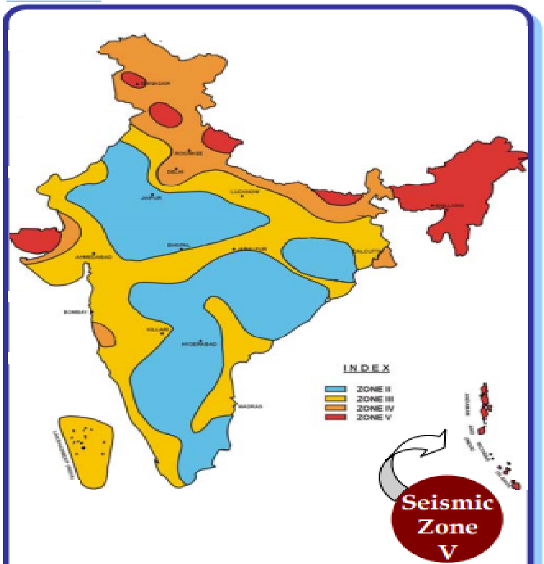


Figure 1: Seismic Zone Map of India showing *four seismic zones - over 60% of India's land under seismic zones III, IV and V.*

The studied 2002 publication, Part 1 of IS1893, comprises requirements that are universal in landscape and persons pertinent for constructions. The supplementary four parts of IS 1893 will concealment: Liquid-Retaining Tanks together raised and pulverized maintained (Part 2); Associations and Absorbent Partitions (Part 3); Developed Constructions counting Load Similar Constructions (Part 4); and Barrages and Ridges (Part 5). These four leaflets are underneath groundwork. In difference, the 1984 version of IS1893 had necessities for altogether the overhead constructions in a solitary manuscript. Necessities for Channels Seismic project of bridges in India is enclosed in three codes, specifically IS 1893 (1984) from the BIS, IRC 6 (2000) from the Indian Roads Congress, and Channel Rules (1964) from the Department of Railways. Afterwards the 2001 Bhuj earthquake, in 2002, the IRC unconfined provisional requirements that kind moment out enhancements to the IRC6 (2000) seismic requirements. IS 4326, 1993.

This cipher protections universal ethics for shaking resistant constructions. Hodgepodge of resources and singular topographies of project and building are distributed through for the subsequent categories of buildings: wooden buildings, brickwork buildings using quadrilateral brick work components, and buildings with assemble darmor-plated concrete roofing/flooring elements. IS 13827, 1993 and IS 13828, 1993 Strategies in IS 13827 deal with experimental project and building aspects for refining earthquake confrontation of earthen households, and those in IS 13828 with overall philosophies of project and singular building features for improving shaking confrontation of constructions of low-strength stonework. This stonework comprises burnt clay element or shingle sandstone in weak grouts, like clay-mud. These principles are appropriate in seismic zones III, IV and V.

Assemblies founded on them are baptized non-engineered, and are not entirely free from downfall underneath seismic shaking intensities VIII (MMI) and developed. Presence of topographiescited in these strategies might only improve the seismic resistance and reduce chances of collapse. IS 13920, 1993 In India, armor-plated concrete constructions are planned and thorough as per the Indian Code IS 456 (2002). Though, constructions situated in high seismic parts necessitate yielding project and detailing. Necessities for the yielding detailing of monumental armor-plated concrete frame and shear wall constructions are quantified in IS 13920 (1993). After the 2001 Bhujtremor, this code has been complete obligatory for altogether constructions in zones III, IV and V. Comparable supplies for seismic design and yielding detailing of steel constructions are not yet obtainable in the Indian ciphers. IS 13935, 1993.

These strategies shelter overall values of seismic strengthening, assortment of constituents, and methods for repair/seismic strengthening of masonry and wooden buildings. The code provides a brief attention for separate armor-plated concrete members in such buildings, but does not concealment steel-clad tangible surround or shear wall constructions as entire. Some strategies are also placed depressed for non-structural and architectural apparatuses of constructions.

In Conclusion Republics with an antiquity of shakings have well industrialized tremor cyphers. Thus, republics comparable Japan, New Zealand and the United States of America, have full seismic code provisions. Growth of construction codes in India started rather initial. Today, India has an honestly respectableiversity of seismic ciphers cover a diversity of assemblies, vacillating from muck or short asset stonework communities to contemporary constructions. Though, the key to guaranteeing earthquake safety lies in having a robust mechanism that enforces and apparatuses these enterprise code necessities in actual buildings.

LITERATURE REVIEW

2.1 GENERAL:

Amongst the numerous seismic reaction governor strategies, TMD showed to be productive in plunging the seismic reaction. Unreceptive TMD container is construction, related to the foremost construction by resources of coils and the restrictions of TMD are modified to that of core building such that the self-motivated reaction of chief construction throughout Shaking is summary. In its place of concerning a distinct portion to the foremost construction, practice of water cistern as unreceptive TMD which is an essential part of construction is beneficial. Effort on practice of aquatic cistern as inactive TMD is existence approved and certain identifications are obtainable in which consequences demonstrate to decrease seismic reaction.

2.2 DANGEROUSASSESSMENT OF LITERATURE

Sadek*et al.* (1997) [1], the optimal limits of Modified Form Discouragement (TMD) that result in substantial decrease in the reaction of constructions to seismic stacking are obtainable. The standard rummage-sale to get limits is to excellent, for a assumed mass relation, the occurrence (tuning) and restraining relations that would consequence in equivalent and great modal restraining in the chief two styles of shaking. The limits are rummage-sale to calculate the answer of numerous solitary and multi-degree of liberty constructions with TMDs to dissimilar tremor excitations. The consequences designate that the procedure of the projected strictures decreases the movement and hastening meaningfully. The procedure can also be rummage-sale in shaking controller of tall constructions by the so called 'mega represent–construction configuration', anywhere infra constructions attend as quivering absorbers for the foremost construction. It is exposed that by choosing the optimal TMD limitations as planned in this red-top, noteworthy discount in the reaction of tall constructions can be accomplished. It was originate that the equivalent restrictive ratios in the principal two methods are superior to the typical of damping ratios of flippantly checked construction and deeply checked TMD. Consequently, the essential modes of vibrations are heavily damped. The consequences designate that using the proposed TMD parameters reduces the displacement and acceleration responses significantly (Up to 50percent).The outcomes expression that in order for TMDs to be effective, large mass ratios must be used, especially for constructions with high damping ratios. The top floor with appropriate stiffness and damping can act as a vibration absorber for the lower floors. The safety and functionality of top floors, however, may present problems since the top floor may experience large displacements.

Nawrotzki(2006) [4], Submissive seismic controller approaches are created on the discount of liveliness, which touches a construction in circumstance of tremor proceedings. Particular well-known methods make usage of frictional, elastic or additional vitality dispelling behaviour of unusual strategies. These projects contemporary certain unusual thoughts for the increase damping in instruction to advance the seismic performance of buildings. Aimed at this determination additional-mass schemes are future and their presentation is examinedhypothetically as healthy as on the shivering counter. Usually these systems are considered as not appropriate for seismic applications, but this paper is no more valid as a general rule, if certain design approaches are kept. Tuned-Mass Controller Organizations (TMCS) can be rummage-sale to regulator the movements, speeding up and interior stress variables of a construction in circumstance of quakes. The protection in contradiction of failure and distinct situations of serviceability of the constructions can be attained. This scheme can likewise be hand-me-down for the seismic retrofit of present constructions as the confidential of the construction is frequently not impartial to adjustment. Hence, the usual operation inside the building may go on during the upgrade activities. Appropriately calculated tuned-mass control systems can be characterized as follows:

They reduce seismically induced responses in terms of displacements, accelerations, internal stresses and strains as well as subsoil demands.

- They increase the structural safety. The collapse of a building becomes less probable and hence, human life is protected.
- They improve the serviceability of constructions. Damage and corresponding repair cost in case of seismic events are reduced significantly.
- In judgment to conservative strengthening methods, the building can usually be under operation during the installation of the TMCS (if no additional measures are required).
- Regarding the overall procedure and required material for the installation of a tuned mass system this strategy container be confidential as 'cost effective‘

RESULTS & DISCUSSIONS

In this chapter, modeling of liquid sloshing in TLDs is presented. The first approach is aimed at understanding the underlying physics of the problem based on a "Sloshing-Slamming (*S2*)" analogy which describes the behavior of the TLD as a linear sloshing model augmented with an impact subsystem. The second model utilizes certain nonlinear functions known as impact characteristic functions, which clearly describe the nonlinear behavior of TLDs in the form of a mechanical model. The models are supported by numerical simulations which highlight the nonlinear characteristics of TLDs.

4.1. Introduction

The motion of liquids in rigid containers has been the subject of many studies in the past few decades because of its frequent application in several engineering disciplines. The need for accurate evaluation of the sloshing loads is required for aerospace vehicles where violent motions of the liquid fuel in the tanks can affect the construction adversely

Liquid sloshing in tanks has also received considerable attention in transportation engineering (Bauer, 1972). This is important for problems relating to safety, including tank trucks on highways and liquid tank cars on railroads. In maritime applications, the effect of sloshing of liquids present on board, e.g., liquid cargo or liquid fuel, can cause loss of stability of the ship as well as structural damage (Bass *et al.* 1980). In structural applications, the effects of earthquake induced loads on storage tanks need to be evaluated for design (Ibrahim *et al.* 1988). Recently however, the popularity of TLDs as viable devices for structural control has prompted study of sloshing for structural applications (Modi and Welt 1987; Kareem and Sun 1987; Fujino*et al.* 1988).

4.1.1. Numerical Modeling of TLDs

The first approach in the modeling of sloshing liquids involves using numerical schemes based on linear and/or non-linear potential flow theory. These types of models represent extensions of the classical theories by Airy and Boussinesq for shallow water tanks. Faltinson (1978) introduced a fictitious term to artificially include the effect of viscous dissipation.

For large motion amplitudes, additional studies have been conducted by Lepelletierand Raichlen (1988); Okamoto and Kawahara (1990); Chen *et al.* (1996) among others. Numerical simulation of sloshing waves in a 3-D tank has been conducted by Wu *et al.* (1998).

The model presented by Lepelletier and Raichlen (1988) recognized the fact that a rational approximation of viscous liquid damping has to be introduced in order to model sloshing at higher amplitudes. Following this approach, a semi-analytical model was presented by Sun and Fujino (1994) to account for wave breaking in which the linear model was modified to account for breaking waves. Two experimentally derived empirical constants were included to account for the increase in liquid damping due to breaking waves and the changes in sloshing frequency, respectively. The attenuation of the waves in the mathematical model due to the presence of dissipation devices is also possible through a combination of experimentally derived drag coefficients of screens to be used in a numerical model (Hsieh *et al.* 1988). Additional models of liquid sloshing in the presence of flow dampening devices are reported, e.g., Warnitchai and Pinkaew (1998). The main disadvantage of such numerical models is the intensive computational time needed to solve the system of finite difference equations.

Numerical techniques for modeling sloshing fail to capture the nonlinear behavior of TLDs. This is due to the inability of theoretical models to achieve long time simulations due to numerical loss of fluid mass (Faltinsen and Rognebakke, 1999). Moreover, it is very difficult to incorporate slamming impact in a direct numerical method. Accurate predictions of impact pressures over the walls of the tanks require the introduction of local physical compressibility in the governing equations. The rapid change in time and space require special treatment which is currently unavailable in existing literature. However, recent work in numerical simulation of violent sloshing flows in deep water tanks are encouraging and represent the state-of-the-art in this area, e.g, Kim (2001). However, until the numerical schemes are more developed, one has to resort to mechanical models for predicting the sloshing behavior. The chief advantages of a mechanical model are savings in computational time and a good basis for design of TLDs.

4.1.2. Mechanical Modeling of TLDs

For convenient implementation in design practice, a better model for liquid sloshing would be to represent it using a mechanical model. This is helpful in combining a TLD system with a given structural system and analyzing the overall system dynamics. Some of the earliest works in this regard are presented in Abramson (1966). Most of these are linear models based on the potential formulation of the velocity field. For shallow water TLDs, various mechanisms associated with the free liquid surface come into play to cause energy dissipation. These include hydraulic jumps, bores, breaking waves, turbulence and impact on the walls (Lou *et al.* 1980). The linear models fail to address the effects of such phenomena on the behavior of the TLD.

Sun *et al.* (1995) presented a tuned mass damper analogy for non-linear sloshing TLDs. The interface force between the damper and the construction was represented as a force induced by a virtual mass and dashpot. The analytical values for the equivalent mass, frequency and damping were derived from a series of experiments. The data was curve-fitted and the resulting quality of the fit was mixed due to the effects of higher harmonics.

Other non-linear models have been formulated as an equivalent mass damper system with non-linear stiffness and damping (e.g., Yu *et al.* 1999). These models can compensate for the increase in sloshing frequency with the increase in amplitude of excitation. This hardening effect is derived from experimental data in terms of a stiffness hardening ratio. However, none of these models explain the physics behind the sloshing phenomenon at high amplitudes.

In contrast with the preceding models, Yalla and Kareem (1999) presented an analogy which attempts to explain the metamorphosis of linear sloshing to a nonlinear hardening sloshing system and the observed increase in the damping currently not fully accounted for by the empirical correction for wave breaking. At high amplitudes, the sloshing phenomenon resembles a rolling convective liquid mass slamming/impacting on the container walls periodically. This is similar to the impact of breaking waves on bulkheads observed in ocean engineering. None of the existing numerical and mechanical models for TLDs account for this impact effect on the walls of the container. The sloshing slamming (*S2*) is described in detail in the following section.

Sloshing-Slamming (*S2*) Damper Analogy

The sloshing-slamming (*S2*) analogy is a combination of two types of models: the linear sloshing model and the impact damper model.

Modeling of Tuned Liquid Column Dampers

Figure 3.1 shows the schematic of the TLCD mounted on a construction represented as a SDOF system.

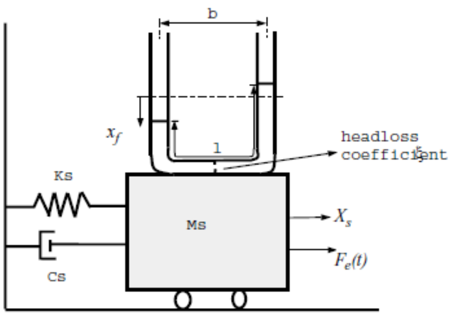


Figure 4.1 Schematic of the Construction-TLCD system

4.2 BUILDING SPECIFICATION:

An existing OGS framed building located at Guwahati, India (Seismic Zone V) is selected for the present study. The building is fairly symmetric in plan and in elevation.

- No. of Floors of Building – G+12
- Slab Thickness – 150 m
- Each Floor Height – 3 m
- Total Height of the Building – 36 m
- External Wall Thick – 230 mm
- Internal Thickness – 120 mm
- For Live Load – 3 kN/m
- Column Sizes – 400 x 450 mm

- Beam Sizes – 300 x 450 mm

The cross sections of the structural members (columns 400 mm×450 mm and beams 300 x 450 mm) are equal in all frames and all stories. Storey masses to 295 and 237 tonnes in the bottom storeyes and at the roof level, respectively. The design base shear was equal to 0.15 times the total weight.

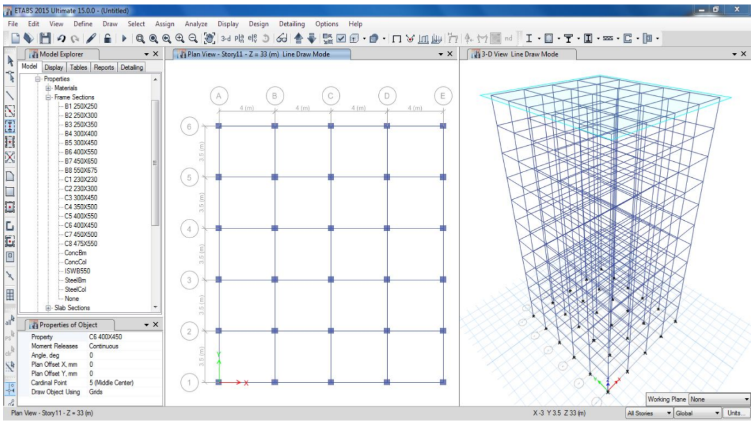


Fig 4.2.Maximum Storey Displacement of G+12 Building

a)For Calculation of Dead Load:

Self- weight- 1 kn/Sq.m

Floor load -2 kN/Sq.m

External wall Thickness – 230mm

For Density of Brick Wall = 20 kN/ m^2

= 20 x 0.23 x 3

= 13.8 kN/m^3

Internal wall Thickness – 120mm

For Density of Brick Wall = 20 kN/ m^2

= 20 x 0.12 x 3

= 7.2 kN/m^3

For Considering of Floor Load -1.8 kN/m^2

Live Load – 3kN/ m

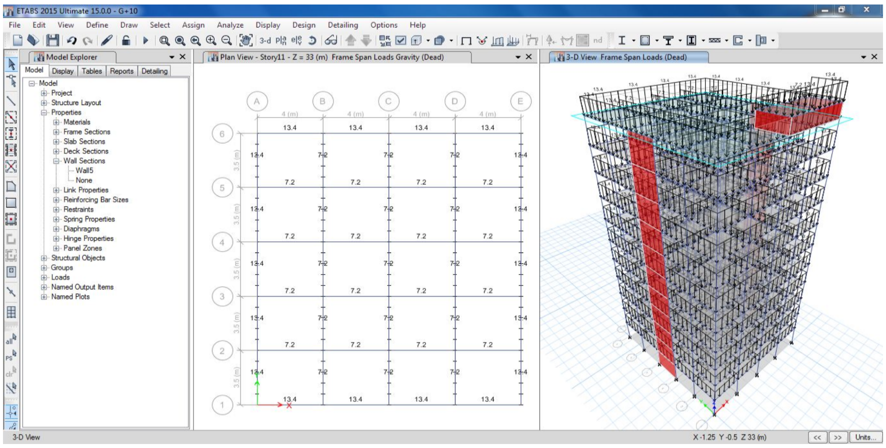


Fig .4.3.Dead Load on G+12 Building

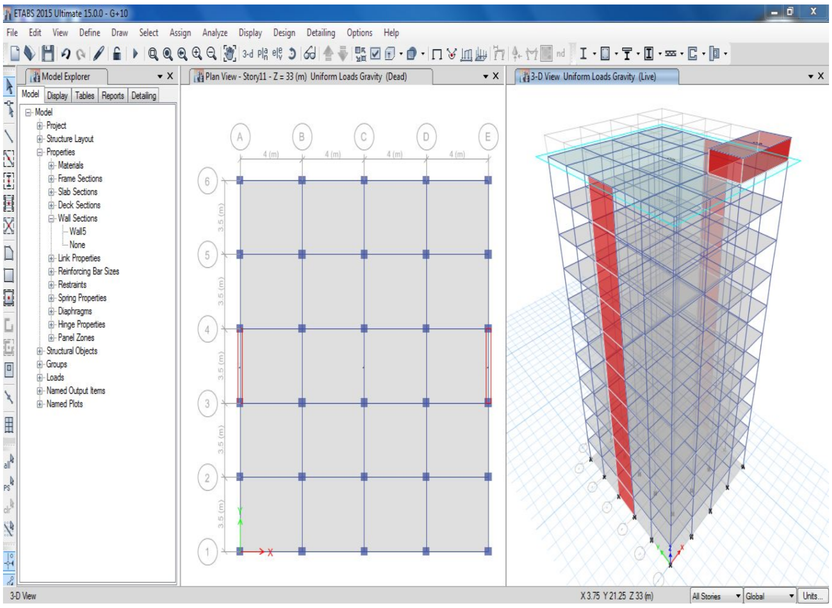


Fig 4.4.Self -Weight of G+12 Building

Table 3.1: Longitudinal reinforcement details of frame sections

Column ID	Longitudinal Reinforcement	Beam ID	Top steel	Bottom steel
C1	12Y16	B1	4Y16	3Y16
C2(a)	8Y20	B4	3Y16	2Y16
C2(b)	8Y20	B5	2Y16, 1Y12	2Y16
C3	8Y16	B7	3Y16	3Y16
		B8	3Y16	3Y16
		B12	3Y16	2Y16, 1Y12
		Roof Beams	2Y16	2Y16

a) Live Load (IS875-PART-2

1.1 This standard (Part 2) covers imposed loads* (live loads) to be assumed in the design of buildings.

The imposed loads, specified herein, are minimum loads which should be taken into consideration for the purpose of structural safety of buildings.

1.2 This Code does not cover detailed provisions for loads incidental to construction and special cases of vibration, such as moving machinery, heavy acceleration from cranes, hoists and the like. Such loads shall be dealt with individually in each case.

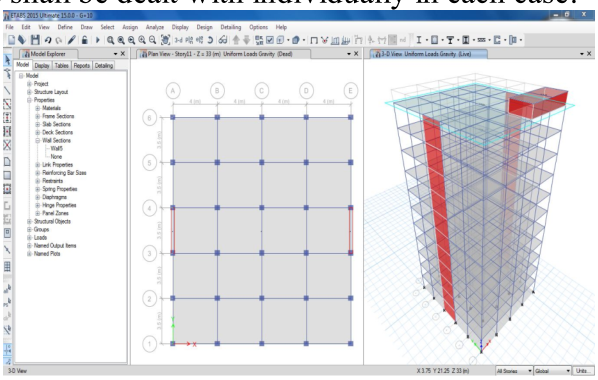


Fig4.5.Live Load on G+12 Building

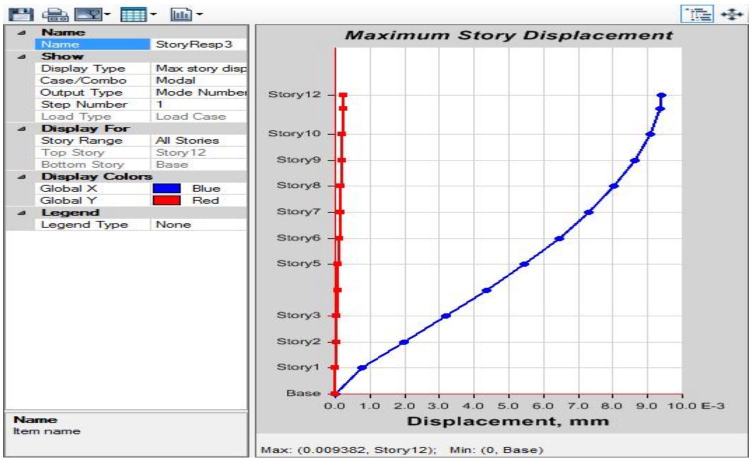


Fig.4.6.Max Storey displacement G+12 Building

4.3. Analysis Results

This chapter provides analysis results.Storey Response - Maximum Storey Displacement

1. Summary Description

This is storey response output for a specified range of stories and a selected load case or load combination.

This is storey response output for a specified range of stories and a selected load case or load combination.

2. Input Data

Name	StoreyResp1		
Display Type	Storey shears	Storey Range	All Stories
Modal Case	Modal	Top Storey	Storey12
Mode Number	1	Bottom Storey	Base

Plot

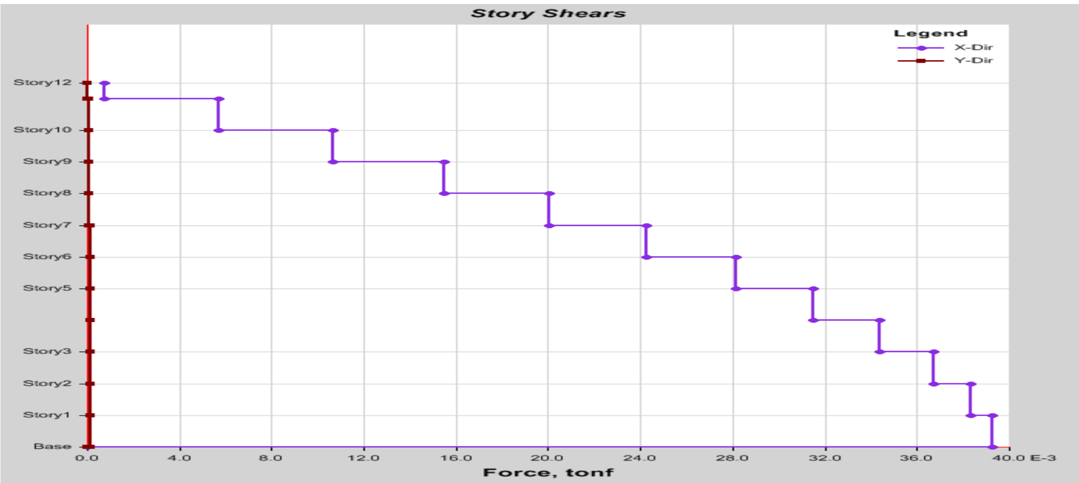


Fig. Shear Force on G+12 Building

3. Tabulated Plot Coordinates

Storey Response Values

Storey	Elevation	Location	X-Dir	Y-Dir

	m		tonf	tonf
Storey12	34.5	Top	0.0008	1.111E-05
		Bottom	0.0008	1.111E-05
Storey11	33	Top	0.0057	3.427E-05
		Bottom	0.0057	3.427E-05
Storey10	30	Top	0.0107	0.0001
		Bottom	0.0107	0.0001
Storey9	27	Top	0.0155	0.0001
		Bottom	0.0155	0.0001
Storey8	24	Top	0.02	0.0001
		Bottom	0.02	0.0001
Storey7	21	Top	0.0243	0.0001
		Bottom	0.0243	0.0001
Storey6	18	Top	0.0281	0.0001
		Bottom	0.0281	0.0001
Storey5	15	Top	0.0315	0.0001
		Bottom	0.0315	0.0001
Storey4	12	Top	0.0344	0.0001
		Bottom	0.0344	0.0001
Storey3	9	Top	0.0367	0.0001
		Bottom	0.0367	0.0001
Storey2	6	Top	0.0383	0.0001
		Bottom	0.0383	0.0001
Storey1	3	Top	0.0393	0.0001
		Bottom	0.0393	0.0001
Base	0	Top	0	0
		Bottom	0	0

Storey Response - Drifts for Diaphragm D1

4. Summary Description

This is storey response output for a specified range of stories and a selected load case or load combination.

5. Input Data

Name	StoreyResp1		
Display Type	Diaph drifts	Storey Range	All Stories
Modal Case	Modal	Top Storey	Storey12
Mode Number	1	Bottom Storey	Base

6. Plot

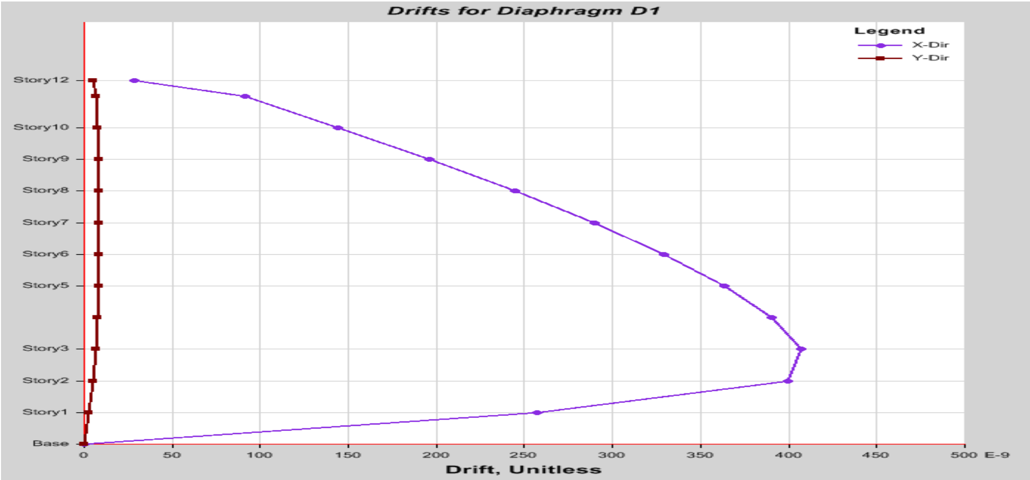


Fig. Drifts Units of Diaphragm

7. Tabulated Plot Coordinates

Storey Response Values

Storey	Elevation m	Location	X-Dir	Y-Dir
Storey12	34.5	Top	2.828E-08	5.113E-09
Storey11	33	Top	9.151E-08	6.768E-09
Storey10	30	Top	1.445E-07	7.533E-09
Storey9	27	Top	1.962E-07	8.026E-09
Storey8	24	Top	2.448E-07	8.436E-09
Storey7	21	Top	2.895E-07	8.683E-09
Storey6	18	Top	3.294E-07	8.712E-09
Storey5	15	Top	3.634E-07	8.453E-09
Storey4	12	Top	3.905E-07	7.82E-09
Storey3	9	Top	4.074E-07	6.697E-09
Storey2	6	Top	3.991E-07	0
Storey1	3	Top	2.568E-07	0
Base	0	Top	0	0

8. Tabulated Plot Coordinates

Storey Response Values

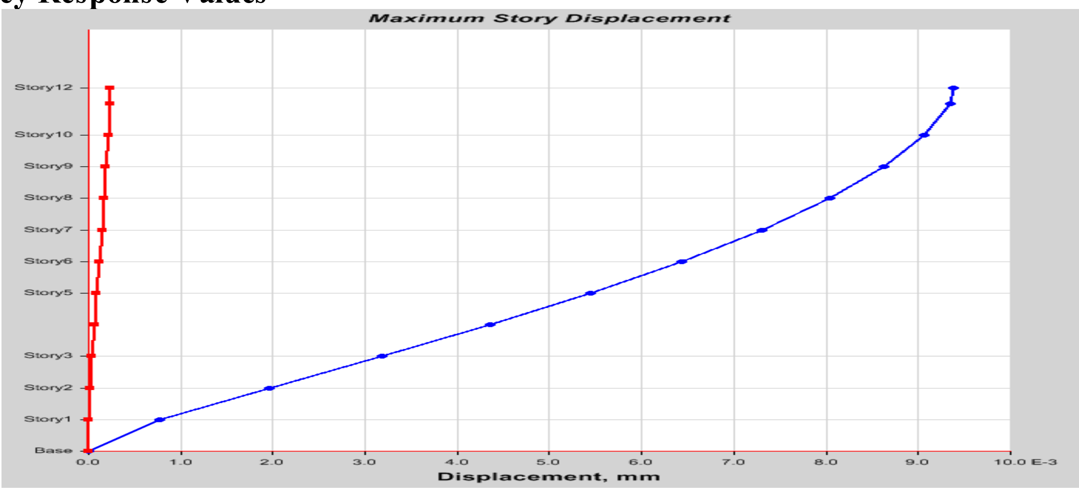


Fig 3.6.Displacement of G+12 Building

Name	StoreyResp2
Display Type	Max storeydispl
Modal Case	Modal
Mode Number	1

Storey Response - Storey Overturning Bending Moment

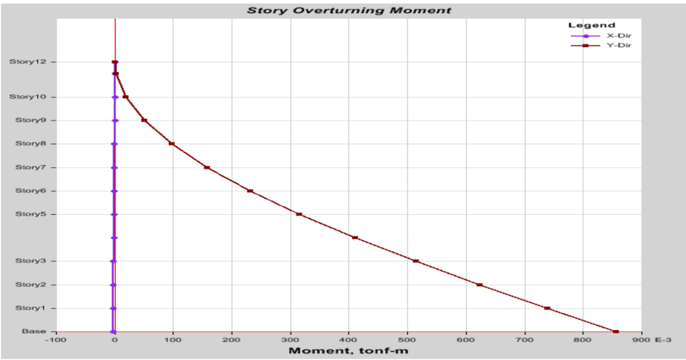
9. Summary Description

This is storey response output for a specified range of stories and a selected load case or load combination.

10. Input Data

Name	StoreyResp1		
Display Type	Overturning Bending Moments	Storey Range	All Stories
Modal Case	Modal	Top Storey	Storey12
Mode Number	1	Bottom Storey	Base

11. Plot



12. Tabulated Plot Coordinates

Storey Response Values of Bending moment

Storey	Elevation	Location	X-Dir	Y-Dir
	m		tonf-m	tonf-m
Storey12	34.5	Top	-1.068E-05	0.0001
Storey11	33	Top	-2.949E-05	0.0015
Storey10	30	Top	-0.0001	0.0189
Storey9	27	Top	-0.0003	0.0513
Storey8	24	Top	-0.0005	0.0979
Storey7	21	Top	-0.0008	0.1583
Storey6	18	Top	-0.0011	0.2314
Storey5	15	Top	-0.0015	0.3159
Storey4	12	Top	-0.0019	0.4107
Storey3	9	Top	-0.0023	0.514
Storey2	6	Top	-0.0027	0.6242
Storey1	3	Top	-0.0032	0.7393
Base	0	Top	-0.0036	0.8571

Storey Response - Storey Stiffness

13. Summary Description

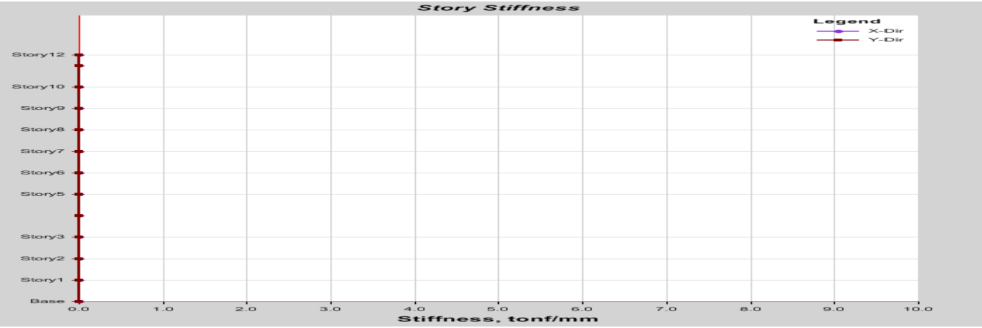
This is storey response output for a specified range of stories and a selected load case or load combination.

14. Input Data

Name	StoreyResp1		

Display Type	Storey stiffness	Storey Range	All Stories
Modal Case	Modal	Top Storey	Storey12
Mode Number	1	Bottom Storey	Base

15. Plot



16. Tabulated Plot Coordinates

Storey Response Values of stiffness Displacement

Storey	Elevation	Location	X-Dir	Y-Dir
	m		tonf/mm	tonf/mm
Storey12	34.5	Top	0	0
Storey11	33	Top	0	0
Storey10	30	Top	0	0
Storey9	27	Top	0	0
Storey8	24	Top	0	0
Storey7	21	Top	0	0
Storey6	18	Top	0	0
Storey5	15	Top	0	0
Storey4	12	Top	0	0
Storey3	9	Top	0	0
Storey2	6	Top	0	0
Storey1	3	Top	0	0
Base	0	Top	0	0

Seismic Weight of Floors

The seismic weight of each floor is its full dead load plus appropriate amount of imposed load, as specified in 7.3.1 and 7.3.2. While computing the seismic weight of each floor, the weight of columns and walls in any storey shall be equally distributed to the floors above and below the storey.

Seismic Weight of Building

The seismic weight of the whole building is the sum of the seismic weights of all the floors. Any weight supported in between storeys shall be distributed to the floors above and below in inverse proportion to its distance from the floors.

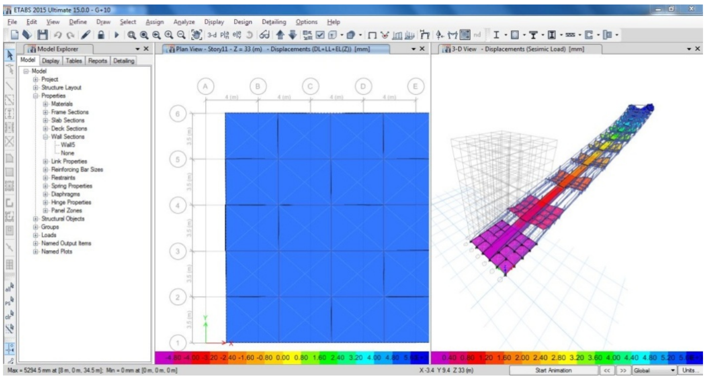


Fig 3.7.Displacement of Seismic Load on G+12 Building

Distribution of Design Force

Vertical Distribution of Base Shear to Differ Floor Level

The design base shear (*V~)* computed in 7.5.3 shall be distributed along the height of the building as per the following

Table 3 Multiplying Factors for Obtaining Values for Other Damping
(*Clause* 6.4.2)

Damping, percent	0	2	5	7	10	15	20	25	30
Factors	3.20	1.40	1.00	0.90	0.80	0.70	0.60	0.55	0.50

expression:

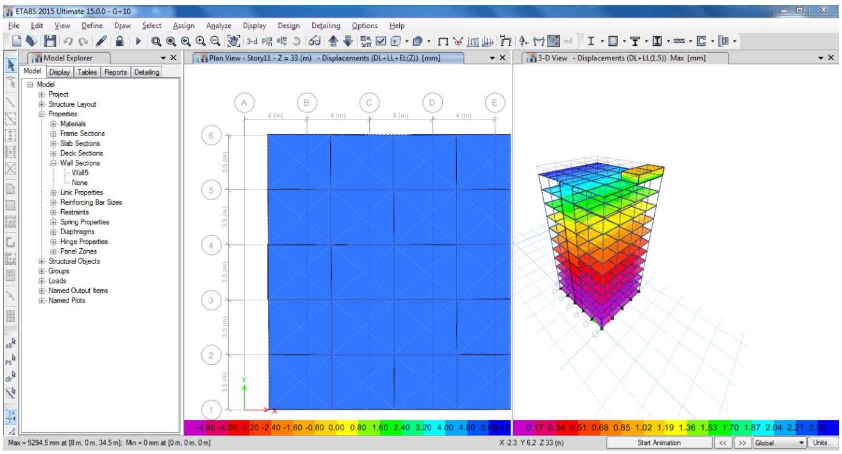


Fig 3.8.Load Combination of G+12 Building

$$Q_i = V_B \frac{W_i h_i^2}{\sum_{j=1}^{n} W_j h_j^2}$$

where

Q_i = Design lateral force at floor *i*,

W_i = Seismic weight of floor *i*,

h_i = Height of floor *i* measured from base, and

n = Number of storeys in the building is the number of levels at which the masses are located.

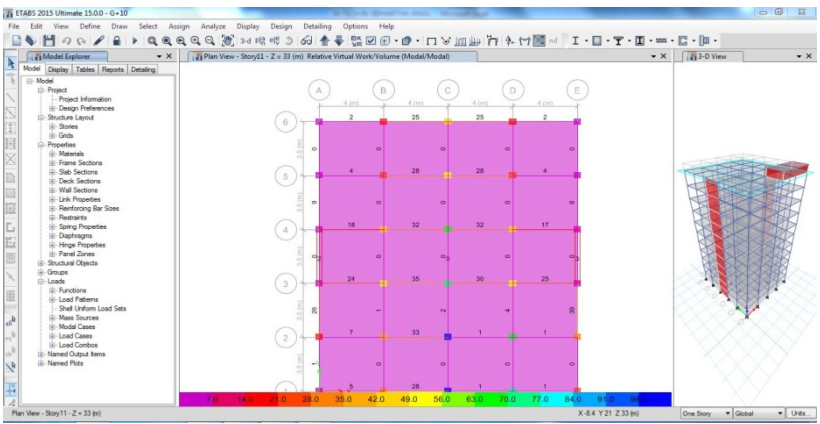


Fig Earthquake Load on G+12 Building

Input Data

17. Name	**18. StoreyResp2**	**19.**	**20.**
21. Display Type	**22. Max storeydispl**	**23. Storey Range**	**24. All Storey's**
25. Modal Case	**26. Modal**	**27. Top Storey**	**28. Storey12**
29. Mode Number	**30. 1**	**31. Bottom Storey**	**32. Base**

Plot

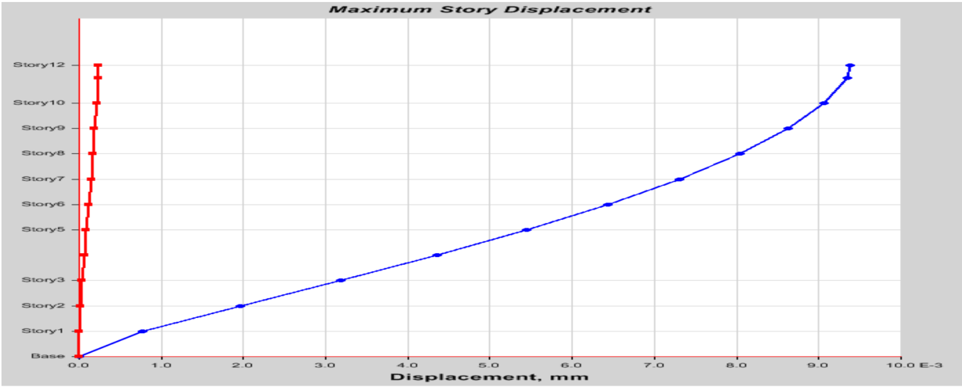


Fig.4.7.Displacement of Storey Response

4.4. DESIGN OF WATER TANK

Introduction: A water tank is used to store water to tide over the daily requirements. In general water tank can be classified under three heads:

- Tanks resting on ground.
- Elevated tanks supported on staging.
- Underground water tanks.

From the shape point of view, water tanks may be several types ,such as

- Circular water tanks.
- Rectangular water tanks.
- Spherical water tanks.
- Intzetank.
- Circular tank with conical bottom.

Design of rectangular tank

Number of flats= 4x4 = 16
Number of members in a family = 6
Water demand per capita=135lits/day
Water requirement = 16x6x135 = 12960 lits
Reserve = 12960 lits
Total Water Storage= 25920 (Say 30,000 lits)
Therefore, V = 30 m3
Height of the water tank H= 1.75m
Freeboard = 0.15m
Therefore, height of water = 1.6m
Area of tank required = 30/1.6 = 18.75 m2
Assume thickness of wall = 100 mm
Provide 2 tanks: (3.75x2.5x1.6)
a= 1.6m b=3.75m c=2.5m
b/a= 2.5 c/a= 2
B.M. COEFFICIENTS
LONG WALL SHORT WALL

International Journal of Research
IJR
International Journal of Research
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 08 Issue 03
March 2021

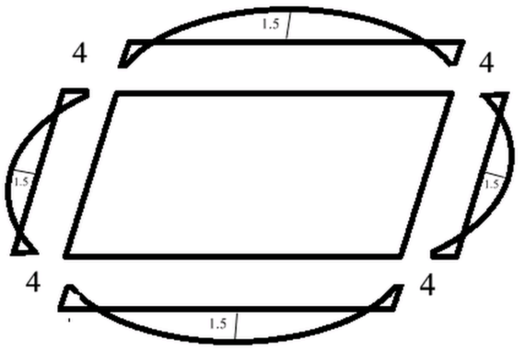
Mx My Mx
Mz

+αx= +0.012		+ αy = +0.027				+ αx = +0.015		+ αz= +0.027
- αx= - 0.013		- αy = - 0.074				- αx = - 0.100		- αz = - 0.06

BM =αγa3 (γ=10 a=1.6)

B.M.

+ Mx = +0.643		+ My = +1.5				+ Mx = +0.80		+Mz= +1.5
- Mx = - 0.7		-My = -4				- Mx = - 5.36		- Mz= - 3.21



Design of Long Wall

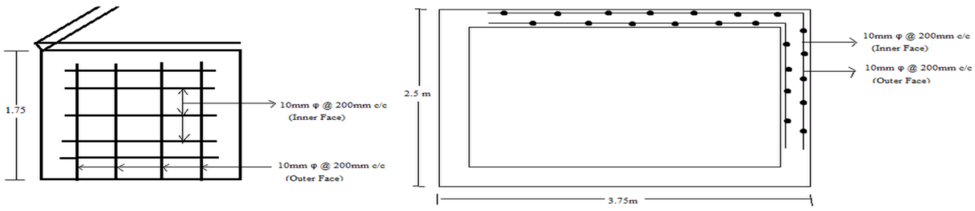
$$d = \sqrt{\frac{M}{QB}} = \sqrt{\frac{3.03 \times 10^6}{1.12 \times 1000}} = 52.01\text{mm}$$

Providing D= 200mm
d = 100-25-(16/2) = 67 mm > 52.01 mm
Vertical Reinforcement
Outer Face: M= 0.49 KN-m
Ast = M/c =>Ast=(0.49x106)/(150x0.87x67)= 56.04 mm2
For t=100, p= 0.24%
Ast.min = 0.24%x1000x100= 240mm2
Provide 10mm φ @ 200mm c/c
Inner Face: M= 0.7x106 N-mm
Ast = M/(σstd) =>Ast=(0.7x106)/(150x0.87x67)= 80.05 mm2
Provide 10mm φ @ 200mm c/c

Design of Short Wall (x-y)

Vertical Reinforcement
Outer Face: M= 5.36 KN-m but Mmin=9.38 KN-m
Provide 10mm φ @ 200mm c/c
Inner Face: M= 0.8x106 N-mm
Provide 10mm φ @ 200mm c/c
Horizontal Reinforcement
Outer Face: M= 1.5 KN-m
Provide 10mm φ @ 200mm c/c
Inner Face: M= 4x106 N-mm =>Ast= 457.48 mm2
Provide 10mm φ @ 200mm c/c(y-z)

Inner Face: M= 4 KN-m Provide 10mm φ @ 200mm c/c
Outer Face: M= 1.5 KN-m Provide 10mm φ @ 200mm c/c



CONCLUSIONS & SUMMARY

CONCLUSIONS

The responsibilities filled seismic care for the inhabitants living the most ground earthquake disposed to areas are far from existence resolved. Though in current time we have new regulations in place for construction that greatly contribute to earthquake disaster mitigation and are being in applied in accordance with world practice. In the procedures adopted for implementation in India the following factors have been found to be critically important in the project and construction of seismic resistant buildings:

Sites selection for construction that are the most favorable in terms of the occurrence of existence and the likely harshness of ground quaking besides pulverized let down; Great superiority of construction to be if compatible to associate IS codes such as IS 1893, IS 13920 to guarantee good presentation through future tremors. To contrivance the project of construction rudiments and joins amongst them in agreement with investigation .i.e. ductility design must be completed. Structural-spatial explanations must be practical that deliver regularity and orderliness in the delivery of form and difficulty in strategy and in promotion.

Investigators designate that amenability with the aforementioned necessities will underwrite meaningfully to tragedy extenuation, irrespective of the strength of the seismic loads and exact features of the shakings. These adjustments in construction and project can be presented which as a consequence has upsurge seismic dependability of the constructions and seismic protection for anthropoid lifespan.

Lastly it is concluded that control systems are classified as unreceptive control, active control, semi active control, and amalgamation of unreceptive and energetic or semi-active control. The unreceptive control system are very stumpy price liken to other regulator scheme and also works (absorbs vibrations) deprived of outside power feastings. Active control systems use computer controlled actuators to produce the best performance. Active form discouragements are very actual in regulatory fluctuations in tall winds and in average sized tremors. Semi-active strategies syndicate the best topographies of together unreceptive and active switch schemes and offer particular flexibility, alike to active switch systems, but without the obligation of great authority foundations for their controller exploit. The hybrid control uses active control with a unreceptive control to supplement and improve the performance of the unreceptive control system and to decrease the energy requirement of the active control system. Organizational regulator establishments will allow seismic fighting and safer design of construction of domestic industrial constructions.

SCOPE FOR THE FURTHER INVESTIGATION

- Studying the seismic comportment of constructions by placing water tanks at various positions.
- Reviewing the seismic behavior of unsymmetrical building, placing water tank at a location such that seismic response is reduced.
- Studying the seismic behavior of constructions with and without water tank subjected to different types of Earthquake data.

SUMMARY

In this expansion, the deductions drawn from the contemporary revision are given. Also the scope for additional investigation based on the contemporary revision was deliberated.

RESULTS

1. Research was carried mainly on application of load tests and behaviour of shear walls in cyclic application of loads.
2. Researchers studied various parameters like enhancement of stiffness, drift, development forces in buildings and also to observe perfect location of shear wall location in building frame for construction.
3. It was seen that any type of building which is tall and can be affected with lateral forces like earthquake and wind forces can be constructed with shear walls.
4. Shear walls can be used as lateral load resisting systems and also retrofitting of structures.
5. Internal shear walls are more efficient than external shear walls when compared with cyclic load tests by researchers.
6. From the above study it can be concluded that, different researchers had studied different type of problems related to earthquake and addressed that shear wall are more prominent to resist lateral force due to earthquakes.
7. Analysis by software's such as ETABS. are also combined along with manual studies. By using ETABS software it is easy to save time and money and easy to calculate the accurate shear forces and bending moments of any structures.

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