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Multi Storey Residential Building Construction Of G+12 With Shear Walls By Using Etabs

H.MD.HASHIM [1] **, S. SUDHEER**[2],
[1]P.G. Scholar, [2]Head of the Department
[1,2]**Branch** : Structural Engineering
[1,2]**Department :** Civil Engineering
[1,2,3] **DR. K.V.SUBBA REDDY INSTITUTE OF TECHNOLOGY**
Email: [1]hmdhashim128@gmail.com, [2]chinna.sudheer10@gmail.com

Abstract:

The standard impartial of this development is to analyse besides scheme a multi-storeyed residential 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. 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

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+12storey building primarily aimed at all possible load groupings [Dead, Live, Wind and Seismic Loads].

Keywords :- ETABS software, building systems, designed and analyzed

INTRODUCTION

Prominence of Seismic Project Cryptograms Pulverized atmospheres during shakings grounds marines and distortions in constructions. Assembly essential to be intended to endure such forces and distortions. Seismic codes help to recover the behaviour 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.

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 cipher that delivers the seismic region chart (Figure 1) and stipulates seismic design force. 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.

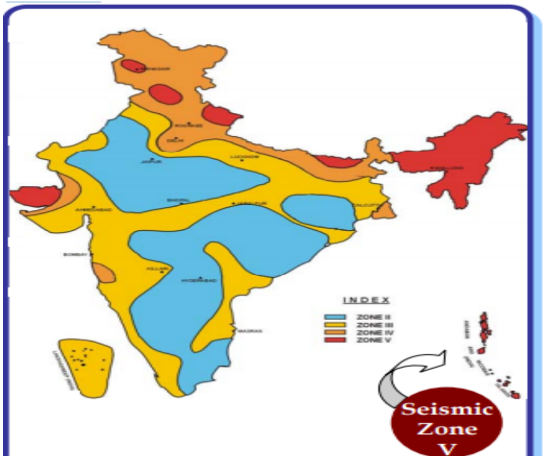

Figure 1: Seismic Zone Map of India showing ***four seismic zones - over 60% of India's land under seismic zones III, IV and V.***

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);

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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.

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 topographies cited in these strategies might only improve the seismic resistance and reduce chances of collapse. IS 13920, 1993 In India, amour-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 armors-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 armour-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.

COMPONENTS OF BUILDING

A construction is definite as any construction built for humanoid occupancy and any other determination. It has three major mechanisms, specifically:

- Foundation
- Plinth
- Super construction

FOUNDATION

It is the lower most in sincerely ready part, underneath the superficial of the ground which is in straight contact with bedrocks and conveys the weight to the subsoil

PLINTH

It is the dominant fragment of the building, above the insincere of the crushed and awake to the apparent of the pulverized

SUPERCONSTRUCTION

The portion of the construction upstairs the pedestal level is named building.

CLASSIFICATION OF BUILDINGS:
Rendering to the Nationwide Construction Cipher (1983), constructions are confidential founded on:

- Residence
- Category of Building

CLASSIFICATION BASED ON RESIDENCE:

RESIDENTIAL BUILDINGS:

Constructions in which slum bearing lodging is providing for residing permanently or temporarily with/without cooling or dining amenities are called as housing constructions. E.g.: Apartments, bungalows, dormitories, private households, hostels, hostels, etc.

EDUCATIONAL BUILDINGS:

All those buildings which are meant for education from primary school to the university are included in this group. E.g.: Schools, Colleges, Universities, training institutes, etc.

INSTITUTIONAL BUILDINGS:

This group includes any building or a portion thereof which is cast-off for determinations such as medical, health, physical or mental disease, care of children or ripened persons, panel detention, etc. These buildings provide ordinary sleeping accommodation for the occupants. It encompasses sanatoriums, hospitals, protective organizations or punishing organizations like custodial/institutions.

INDUSTRIAL BUILDINGS:

This group includes any building or a part of it which produces material of numerous types and possessions which are constructs, assembled or treated similar get-together plants, power plants, refineries, gas plants, mills, diaries, factories, workshops, etc.

ASSEMBLY BUILDINGS:

This grouping comprises any construction or a fragment of it anywhere assemblages of individuals accumulate for pleasure, recreation, social, religious, patriotic or similar meeting purposes. E.g.: Auditoriums, Cinema Halls, etc.

BUSINESS BUILDINGS:

This type includes any building or a part of it which is rummage-sale for determinations such as business of occupational or custody of explanations and annals for comparable drives. E.g.: Offices, Groups, Specialized formations, Libraries, etc.

MERCANTILE BUILDINGS:

This group contains any construction or a part of it which is rummage-sale as a shop, store, market for sales and display of products.

STORAGE BUILDINGS:

This group includes those building constructions which are primarily used for the storage of hiding of properties, wares or produce. E.g.: Granaries, Emotionless Loadings, Garages, etc.

DWELLINGS:

This type includes a building or a part occupied by members of single multifamily units with independent cooking facilities. A dwelling unit may be of following types:

- Detached house
- Semi -detached house
- Terrace Housing Unit
- Flats
- Duplex Apartments

DETACHED HOUSE

A detached house is the choice of every individual wherein pleasing effect is achieved if the approach from the main road is kept open and it permits light an fresh air flow up without any interruption by fences and walls. The main disadvantage of any isolated dwelling is the cost.

SEMI DETACHED HOUSE

This type of construction has the advantage of separate unit as well as reduction in cost of construction as two dwelling units have a common entrance and staircase. An additional advantage of the sense of security is felt by the dwellers.

TERRACE HOUSING UNIT

The main advantage of terrace is the saving in space. This type of construction is an improvement over the semi -detached unit. A promenade component is a noise of three or more house components in steadiness.

FLATS

It is a residence unit separated from another unit by a horizontal division. In the circumstance of conservative collection housing, the separation is achieved by vertical divisions or partitions. This type of dwelling unit gives the community a living complex with common garden, play area, bathing pond, etc. However it is felt that those who occupy flats have additional advantage in respect of the welfare sulking after common services.

DUPLEX APARTMENTS

These are living spaces at two or additional heights. They can be detached, semi -detached or multi storied buildings where corridors can be provided in alternate floors.

CLASSIFICATION BASED ON TYPE OF CONSTRUCTION:

Based on the type of construction, buildings maybe classified as:

- Load bearing construction type buildings
- Composite construction

In case of load bearing construction, the building can be economical if it is up to two or three stories whereas in case of framed type construction, any number of stories can be built. With composite construction technique, economy can be achieved if the number of floor goes up to five. A building with six or more floors has to be dealt with framed construction.

DAMPERS IN CONSTRUCTIONS AND TIME HISTORY ANALYSIS

GENERAL

Seismic activity is unique of the foremost catastrophic events for destroying cities and its inhabitants. Throughout the last insufficient period' s investigators since every where the sphere put widespread labours to accomplish maintainable answer to reduce the direct belongings produced by shakings, which have led to the novelty of various control devices. Submissive live lines indulgence method is unique of the generally approved notions to engross shaking liveliness deprived of producing important compensations to the foremost structural elements. Unreceptive liveliness debauchery strategies are usually humble; easy-to- rehabilitate, economical and ensure not trust on external power, which could be a foremost concern throughout a shaking.

A great quantity of liveliness is communicated hooked on a construction throughout shaking pulverized edge structures. Conservative project attitude pursues to avert failure by permitting organizational memberships to absorb and dispel the communicated shaking energy by inflexible cyclic distortions in particularly thorough counties.

Unreceptive liveliness debauchery schemes include a variety of resources and strategies for ornamental restraining, difficulty and forte and can be rummage-sale both for usual hazard extenuation and for reintegration of aging or lacking constructions. In current years, thoughtful-bore have been assumed to grow the idea of vigor debauchery or additional checking into a practical knowledge and an amount of these diplomacies have been fitted in buildings during the world. In over-all, such arrangements are pigeonholed by an aptitude to enhance vigour understanding in organizational classifications in which they are mounted. In the past two decades, special protective organizations have been established to improve care and reduce damage of constructions during earthquakes. These substitute methods aim to controller the organizational seismic reply and vigour dissipation request on the organizational memberships by adapting the lively possessions of the system. Currently, the most applied and reliable method of reducing seismic structural response is the usage of inert response control schemes. They can be confidential rendering to the methods working to achieve the contribution shaking liveliness as (1) seismic separation organizations and, (2) unreceptive vigour indulgence schemes.

The seismic separation schemes bounce or sieve out the tremor vigor by interrupting a covering with low flat stiffness among the construction and the substance. These arrangements are suitable for a great lesson of constructions that are short to medium height, and whose dominant modes are within a certain frequency range. Several building and bridges have now been installed with base isolation systems. The unreceptive liveliness debauchery schemes on the additional hand liveliness indulgence organizations, on the additional indicator, act as live lines bowls and engross particular of the quivering dynamism so that less is accessible to cause distortion of organizational rudiments. They contain of deliberately located discouragements (viscous, viscos-elastic or friction dampers) or expendable yielding rudiments that connection many shares of the enclosing organization. Self-motivated shaking absorbers also fit to this grouping. The decrease in the mechanical reply is accomplished by transporting certain of the organizational quivering get-up-and-go to auxiliary oscillators friendly to the foremost construction.

1.1. 3.2 DAMPERS

Restraining is unique of countless dissimilar approaches that have been planned aimed at letting a construction to attain best presentation after it is exposed to seismic, wind storm, blast or additional categories of passing shockwave and tremor conflicts. Conservative slant would decree that the building obligation characteristically reduce or disintegrate the effects of temporary inputs finished a recipe of strength, elasticity and deformability. The equal of checking in a conservative flexible construction is actual little. Throughout robust gestures such as tremors conservative constructions typically distort well beyond their flexible bounds and finally fail or failure. Consequently, greatest of the vigour dissolute is engrossed by the construction himself over localized injury as it bombs.

Dampers tinnier mounted in the functioning pedestal of a shop to captivate particular of the liveliness profitable into the construction from the shaky crushed during a trembling. The discouragements decrease the vigour obtainable for trembling the building. This profits that the construction distorts less, so the accidental of injury is summary.

The idea of additional dampers added to a construction carries that key of the contribution vigour to the building will be occupied not by the construction themselves, but rather by supplemental damping fundamentals. A flawless damper would of a form such that the force being shaped by the discouragement is of such a greatness and purpose that the damper forces do not increase overall stress in the construction. Properly applied, an ideal discouragement should be able to concurrently decrease both stress and refraction in the construction.

Expedient that have greatest usually been rummage-sale for seismic defence of assemblies include sticky unsolidified dampers, viscos-elastic solid dampers, rubbing dampers, and copper impediments. Supplementary operations that could be confidential as unreceptive energy dissipation devices or, more generally, submissive governor strategies take account of regulated mass and tweak runny dampers, both of which are primarily appropriate to wind vibration control, re-entering dampers, and phase transformation discouragements. In calculation, there is a class of discouragements, known as semi active dampers, which may be gazed as well-behaved inert plans in the intelligence that they unreceptively fight the comparative motion between their ends but have manageable mechanical possessions. Examples of such dampers include variable-orifice discouragements, magneto rheological discouragements, and electro rheological discouragements.

3.2.1 Tuned Systems

Tuned organizations are added devices friendly to constructions to lessen ambiances due to wind, upheavals or other go-ahead stacking settings. Since the accepted frequencies of these policies are equal or close to those of the buildings to which they are involved, they are so-called tweaked systems. This type of unreceptive devices includes tuned mass dampers and tuned liquid discouragements. Tuned plans are relatively easy to implement in new constructions and in the retrofit of existing ones. They do not require any outside power foundation to purpose and do not interfere in flat and vertical load paths.

3.2.1.1 Tuned Mass Dampers

Altered mass inhibition, also known as a vocal absorber, is a device mounted in constructions to reduce the amplitude of mechanical vibrations. Their application can prevent discomfort, damage, or outright working failure. They are frequently used in power transmission, automobiles, and buildings. Tuned mass dampers (TMDs) comprises a mass, spring attached to the construction and are used for vibration control of constructions when exposed to earthquake excitations. It is a occurrence dependent device. A Tuned mass damper (TMD) is a unreceptive checking system which utilizes a secondary mass attached to a main construction ordinarily through spring and dashpot to reduce the dynamic response of the construction. It is widely used for vibration control in mechanical engineering systems. TMD theory has been adopted to reduce vibrations of tall constructions and other civil engineering constructions. The secondary mass system is designed to have the natural frequency, which is be contingent on its mass and stiffness, tuned to that of the primary construction. Mass of the secondary system varies from 1-10% of the structural mass. As a particular earthquake comprises a large number of frequency content now a days multiple tuned mass dampers (MTMD) has been used to control earthquake induced motion of high rise construction. Often for better response control multiple-damper configurations (MDCs) which consist of several dampers placed in parallel with distributed natural frequencies around the control tuning frequency is used. For the same total mass, a multiple mass damper can significantly increase the equivalent damping introduced to the system.

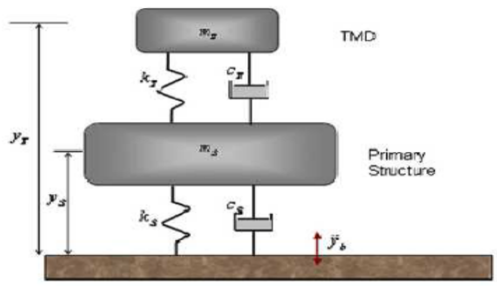

Fig.3.1 Tuned mass damper

3.2.1.2 Tuned Liquid Dampers

Tuned liquid dampers which have been extensively used in marine vessels and space satellites are being implemented in construction for earthquake vibration control. Tuned liquid dampers consists of rigid tanks filled with shallow fluid where the sloshing motion absorbs the energy and dissipates through viscous action of the fluid, wave breaking and auxiliary damping appurtenances such as nets or floating beads. The principle of absorbing the kinetic energy of the construction is similar to TMD's where the fluid functions as moving mass and the restoring force is generated by gravity. TLD's have several advantages over TMD's such as reducing the motion in two directions simultaneously and not requiring large stroke lengths. On the other hand, the relatively small mass of water or other fluids compared to the large mass of TMD's necessitates larger spaces to achieve greater damping effect.

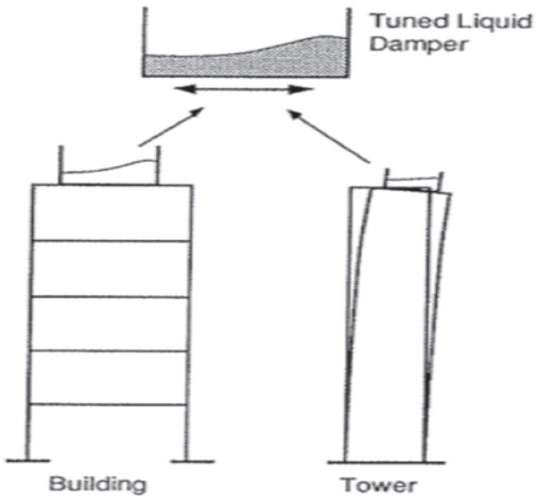

Fig.3.2 Tuned liquid damper

3.2.2 Viscous Fluid Dampers

Fluid viscous dampers which operate on the principle of fluid flow through orifices have been used for many years in automobiles, aerospace and defence industries. They are beginning to emerge in structural applications. These dampers possess linear viscous behaviour and are relatively insensitive to temperature changes. The Taylor's device which has been filled with silicone oil consists of a stainless steel piston with a bronze orifice head and an accumulator. The flow through the orifice is compensated by a unreceptive bimetallic thermostat that allows the operation of device over a temperature range of -40 to 70^0c. The force in the damper is generated by a pressure difference across the piston head. The fluid volume is reduced by the product of travel distance and piston rod area. Since the fluid is compressible, the reduction in volume causes a restoring force which is prevented by accumulator.

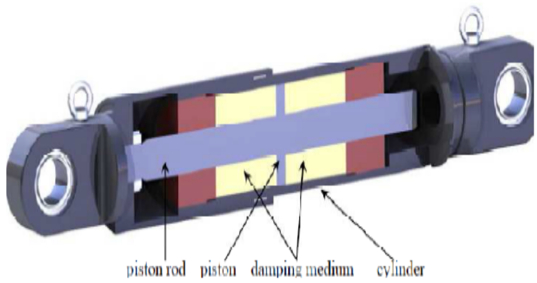

Fig.3.3 Viscous damper

Fluid viscous dampers which operate on the principle of fluid flow through orifices have been used for many years in automobiles, aerospace and defence industries. They are beginning to emerge in structural applications. These dampers possess linear viscous behaviour and are relatively insensitive to temperature changes. The Taylor's device which has been filled with silicone oil consists of a stainless steel piston with a bronze orifice head and an accumulator. The flow through the orifice is compensated by a unreceptive bimetallic thermostat that allows the operation of device over a temperature range of -40 to 70^0c. Viscous fluid dampers are commonly used as unreceptive energy dissipation devices for seismic protection of constructions. Such dampers consist of a hollow cylinder filled with fluid, the fluid typically being silicone based. As the damper piston rod and piston head are stroked, fluid is forced to flow through orifices either around or through the piston head.

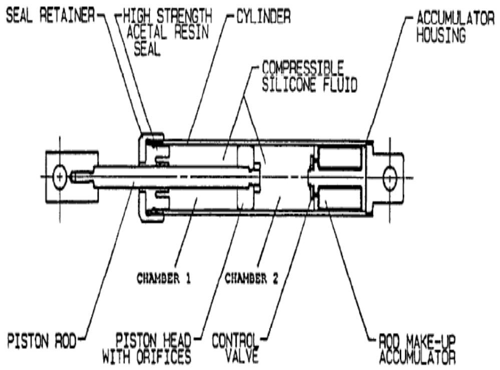

Fig 3.3.1 Main parts of fluid viscous damper

3.2.3 Viscous-Elastic Solid Dampers

Viscous-elastic solid dampers generally consist of solid elastomeric pads (visco-elastic material) bonded to steel plates. The steel plates are attached to the construction within chevron or diagonal bracing. As one end of the damper displaces with respect to the other, the visco-elastic material is sheared resulting in the development of heat which is dissipated to the environment. By their very nature, visco-elastic solids exhibit both elasticity and viscosity i.e., they are displacement and velocity dependent.

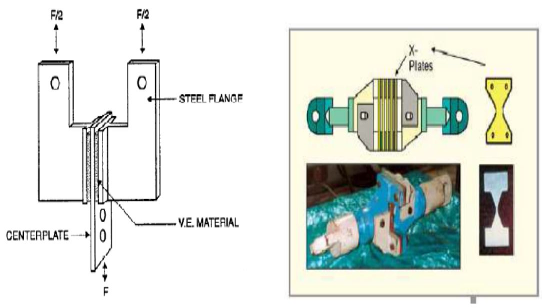

Fig 3.4 Viscos elastic damper

Experimental testing has shown that, under certain conditions, the behaviour of viscos-elastic dampers can be modeled using the Kelvin model of viscous elasticity.

$$P(t)=K(t)+Cu(t)$$

Where K is the storage stiffness of the damper and C is the damping coefficient which is equal to the ratio of loss stiffness to the frequency of motion.

For viscos-elastic materials, the mechanical behaviour is typically presented in terms of shear stresses and strains rather than forces and displacements. The mechanical properties then become the storage and loss moduli that define the properties of the viscos-elastic material rather than properties of the damper. In general, the storage and loss moduli are dependent on frequency of motion, strain amplitude, and temperature. At a given frequency and shear strain amplitude, the storage and loss moduli have similar values that increase with an increase in the frequency of motion. Thus, at low frequencies, viscous-elastic dampers exhibit low stiffness and energy dissipation capacity. Conversely, at high frequencies, stiffness and energy dissipation capacity are increased. Note that increases in temperature, due to cycling of the damper, can significantly reduce the storage and loss moduli, resulting in reduced stiffness and energy dissipation capacity). Thus, temperature dependencies must be considered in the design of such dampers. One approach to considering temperature dependencies, as well as shear strain and frequency dependencies, is to employ a mathematical model that is based on nonlinear regression analysis of experimental cyclic response data. Alternatively, a simplified bounding analysis can be employed wherein lower and upper bound temperatures are used to predict maximum forces and displacements, respectively.

3.2.4 Friction Dampers

Friction dampers dissipate energy via sliding friction across the interface between two solid bodies. Examples of such dampers include slotted-bolted dampers wherein a series of steel plates are bolted together with a specified clamping force. The clamping force is such that slip occurs at a pre specified friction force. At the sliding interface between the steel plates, special materials may be utilized to promote stable coefficients of friction. An alternate configuration, known as the Pall cross-bracing friction damper, consists of cross-bracing that connects in the centre to a rectangular damper. The damper is bolted to the cross-bracing and, under lateral load, the structural frame distorts such that two of the braces are subject to tension and the other two to compression. This force system causes the rectangular damper to deform into a parallelogram, dissipating energy at the bolted joints through sliding friction. Other configurations include a cylindrical friction damper in which the damper dissipates energy via sliding friction between copper friction pads and a steel cylinder. The copper pads are impregnated with graphite to lubricate the sliding surface and ensure a stable coefficient of friction. The physical model corresponding to is a sliding contact. This can be difficult to achieve in practice and thus the damper friction force may change with time. The potential variability in the friction force could be accounted for in design in a manner similar to the way that variability in other structural parameters might be considered.

The hysteresis loops are rectangular, indicating that significant energy can be dissipated per cycle of motion. However, the rectangular shape of the hysteresis loops indicates that the cyclic behaviour of friction dampers is strongly nonlinear. The deformations of the structural framing are largely restricted until the friction force is overcome; thus, the dampers add initial stiffness to the structural system. Note that, if a restoring force mechanism is not provided within the friction damper system, permanent deformation of the construction may exist after an earthquake. To minimize the occurrence of such permanent displacements, some self-centering friction damper systems have been developed.

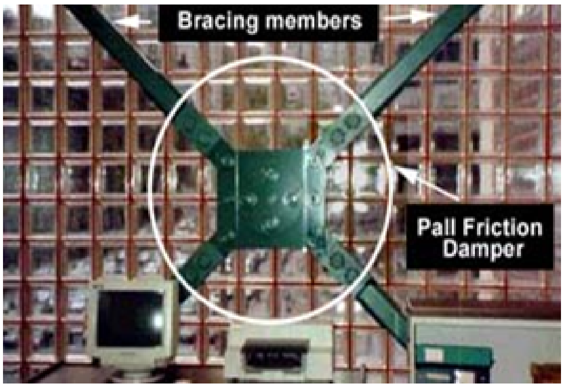

Fig 3.5(c)Friction dampers

3.2.5Metallic Dampers

One of the effective mechanisms available for the dissipation of energy input to a construction from an earthquake is through inelastic deformation of metals. The idea of utilizing added metallic energy dissipaters within a construction to absorb a large portion of seismic energy began with the conceptual and experimental work by Kelly etal. and skinner etal. Several of the devices considered include torsion beams, flexural beams and U-strip energy dissipaters. During ensuing years, a wide variety of such devices have been studied. Many of the devices use mild steel plates with triangular or X - shapes so that yielding is almost spread throughout the material.

The advantages of this type of dampers are their stable behaviour, long term reliability and good resistance to environmental and thermal conditions. Moreover metallic dampers are capable of providing buildings with increased stiffness, strength and energy dissipation capacity. Metal yielding devices are widely used due to their simplicity in both design and implementation and the devices dissipate energy by taking advantage of the material’s stable hysteretic behaviour.

Generally there are three major types of metallic dampers.

BRB dampers
ADAS dampers
TADAS dampers

3.2.5.1 B.R.B. Dampers

A BRB damper consists of a steel brace (usually having low-yield strength) with a cruciform cross section that is surrounded by a stiff steel tube. The region between the tube and brace is filled with a concrete-like material and a special coating is applied to the brace to prevent it from bonding to the concrete. Thus, the brace can slide with respect to the concrete-filled tube.

The confinement provided by the concrete-filled tube allows the brace to be subjected to compressive loads without buckling (i.e., the damper can yield in tension or compression with the tensile and compressive loads being carried entirely by the steel brace).Under compressive loads, the damper behaviour is essentially identical to its behaviour in tension. Since buckling is prevented, significant energy dissipation can occur over a cycle of motion.

In many cases, BRB dampers are installed within a chevron bracing arrangement. In this case, under lateral load, one damper is in compression and the other is in tension, and hence zero vertical loads are applied at the intersection point between the dampers and the beam above. In this regard, the dampers may be regarded as superior to a conventional chevron bracing arrangement where the compression member is expected to buckle elastically, leaving a potentially large unbalanced vertical force component in the tension member that is, in turn, applied to the beam above.

During the initial elastic response of the BRB damper, the device provides stiffness only. As the BRB damper yields, the stiffness reduces and energy dissipation occurs due to inelastic hysteretic response. The hysteretic behaviour of a BRB damper can be represented by various mathematical models that describe yielding behaviour of metals. The behaviour of BRB dampers is quite good in terms of energy dissipation capacity. However, the dissipated energy is the result of inelastic material behaviour and thus the BRB damper is damaged after an earthquake and may need to be replaced. A response modification factor *R*, which accounts for the hysteretic energy dissipation capacity of the BRB, is assigned to constructions that incorporate BRB devices and the design process is similar to that used for other conventional bracing systems. Specifically, *R* values of 7 and 8 are used for BRB frames with non -moment resisting beam-column connections and moment resisting beam column connections, respectively. Proponents of the BRB system have encouraged the classification as a bracing system so as to foster more rapid implementation.

3.2.5.2 ADAS Dampers

This device consists of a series of steel plates wherein the bottom of the plates are attached to the top of a chevron bracing arrangement and the top of the plates are attached to the floor level above the bracing .As the floor level above deforms laterally with respect to the chevron bracing, the steel plates are subjected to a shear force. The shear forces induce bending moments over the height of the plates, with bending occurring about the weak axis of the plate cross section. The geometrical configuration of the plates is such that the bending moments produce a uniform flexural stress distribution over the height of the plates. Thus, inelastic action occurs uniformly over the full height of the plates.

For example, in the case where the plates are fixed-pinned, the geometry is triangular. In the case where the plates are fixed, the geometry is an hourglass shape. To ensure that the relative deformation of the ADAS device is approximately equal to that of the storey in which it is installed, the chevron bracing must be very stiff.

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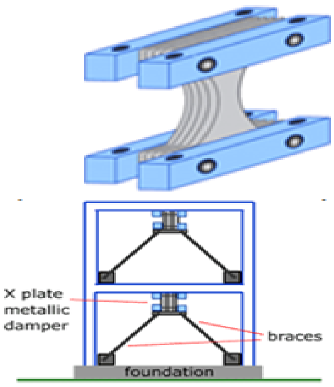

Fig 3.6 Metallic X-plate damper

The hysteretic behaviour of an ADAS damper is similar to that of a BRB damper and can be represented by various mathematical models that describe yielding behavior of metals. As for the BRB dampers, the dissipated energy in an ADAS damper is the result of inelastic material behaviour and thus the ADAS damper will be damaged after an earthquake and may need to be replaced.

3.3 SHEAR YIELDING DAMPERS

Shear panels represent an interesting solution to resist lateral forces and to control the dynamic response of framed buildings. Due to their considerable shear stiffness and strength, they can be favorably used as a seismic resistance system under both moderate and strong earthquake loading. In addition, when designed as dissipative elements, shear panels can be viably used for the seismic protection of the primary construction, due to the large energy dissipation capacity related to the large portion where plastic deformations take place. As far as the stiffening effect is concerned, it has been already recognized that even lightweight metal shear panels may considerably improve the structural performance of the construction at the serviceability limit state.

3.4. TIME HISTORY ANALYSIS

3.4.1 General

Time history analysis is a step by step procedure of the dynamic response of the construction to a specified loading that may vary with time. The analysis may be linear or non- linear. Time history analysis is used to determine the dynamic response to a construction subjected to arbitrary loading. The dynamic equilibrium equations to be solved are given by

$$M\ddot{x} + C\dot{x} + Kx = r(t)$$

Where M is the diagonal mass matrix, C is the damping matrix and K is the stiffness matrix and r(t) is the applied load, $x, \dot{x}, \ddot{x}$ are the displacements, velocities and accelerations of the construction. If the load includes ground accelerations, the displacements, velocities and accelerations are relative to this ground motion.

There are several options that determine the type of time history case to be performed:

- Linear vs. Non -linear.
- Modal vs. Direct-integration
- Transient vs. Periodic

3.4.2. Initial Conditions

The initial conditions that describe the state of construction at the beginning of time history case.

These include

- Displacements and velocities
- Internal forces and stresses
- Internal state variables for non -linear elements
- Energy values for the construction
- External loads

The accelerations are not considered initial conditions, but are computed from the equilibrium equation. For linear transient analyses, zero initial conditions are always assumed. For periodic analyses, the program automatically adjusts the initial conditions at the start of the analysis to be equal to the conditions at the end of the analysis.

3.4.3 Time Steps

Time history analysis is performed at discrete time steps. One may specify the number of output time steps with parameter "nstep" and the size of the time steps with parameter "dt" The time span over which the analysis is given by nstep.dt. Response is also calculated, at every time step of the input time functions in order to accurately capture the full effect of the loading. These time steps are call load steps. For modal time-history analysis, this has little effect on efficiency.

3.4.4 Model Time History Analysis

Modal superposition provides a highly efficient and accurate procedure for performing time-history analysis. Closed-form integration of the modal equations is used to compute the response, assuming linear variation of the time functions, $f\ i(t)$, between the input data time points. Therefore, numerical instability problems are never encountered, and the time increment may be any sampling value that is deemed fine enough to capture the maximum response values. One-tenth of the time period of the highest mode is usually recommended. However, a larger value may give an equally accurate sampling if the contribution of the higher modes is small. The modes used in a time history analysis may be either undamped free vibration modes (Eigen vectors) or the load - dependent Ritz vector modes.

4. 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 behaviour 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.

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 Bossiness 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 Lepelletier and 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.

Numerical techniques for modeling sloshing fail to capture the nonlinear behaviour 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).

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 analysing 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 behaviour 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

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

Modelling of Tuned Liquid Column Dampers

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

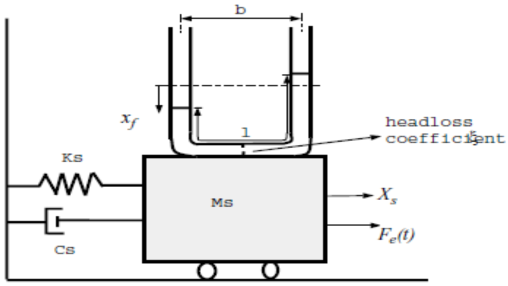

Figure 4.1 Schematic of the Construction-TLCD system

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 storeys and at the roof level, respectively. The design base shear was equal to 0.15 times the total weight.

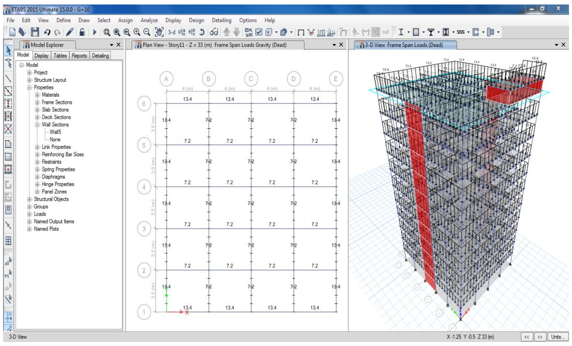

Fig .4.3.Dead Load on G+12 Building

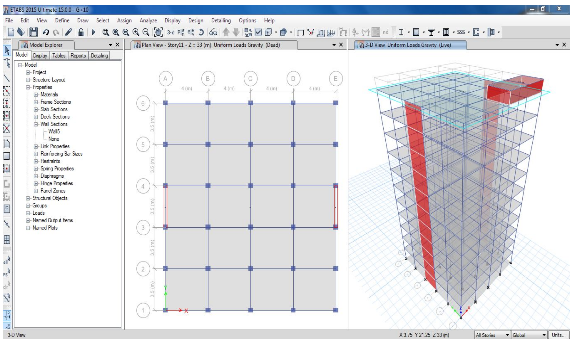

Fig 4.4.Self -Weight of G+12 Building

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.

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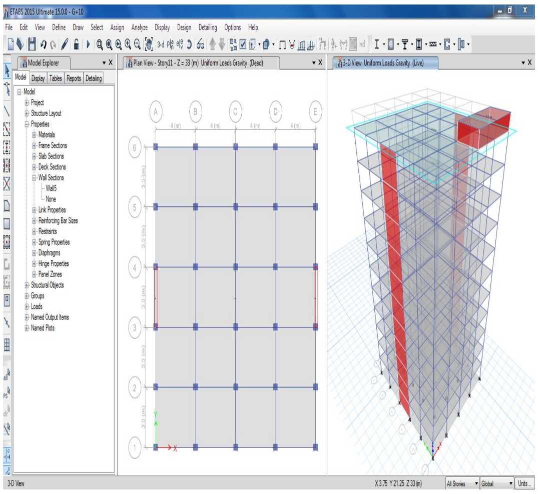

Fig4.5.Live Load on G+12 Building

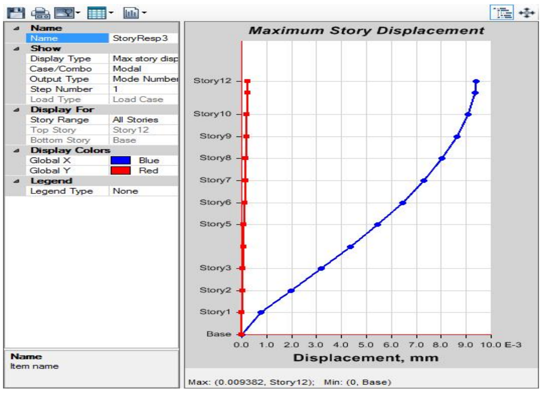

Fig.4.6.Max Storey displacement G+12 Building

4.3. Analysis Results

This chapter provides analysis results.

Storey Response - Maximum Storey Displacement

2. 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.

3. Input Data

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

4. Plot

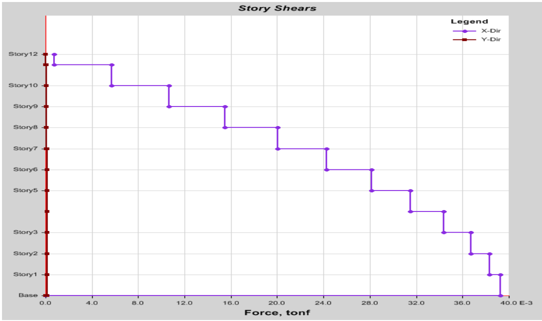

Fig. Shear Force on G+12 Building

5. Tabulated Plot Coordinates

Storey Response Values

Storey	Elevation	Location	X-Direction	Y-Direction
	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

Storey	Elevation	Location	X-Direction	Y-Direction
	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

6. Summary Description

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

7. Input Data

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

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Plot

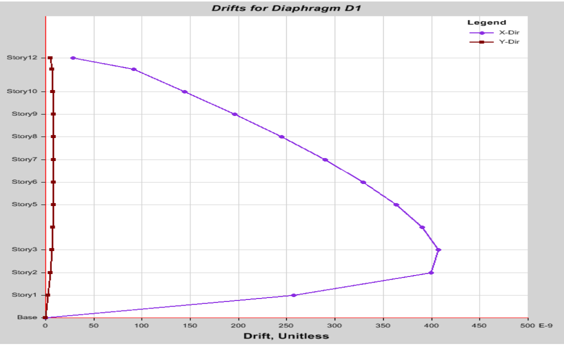


Fig. Drifts Units of Diaphragm

8. Tabulated Plot Coordinates

Storey Response Values

Storey	Elevation	Location	X-Direction	Y-Direction
	m			
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

Tabulated Plot Coordinates

Storey Response Values

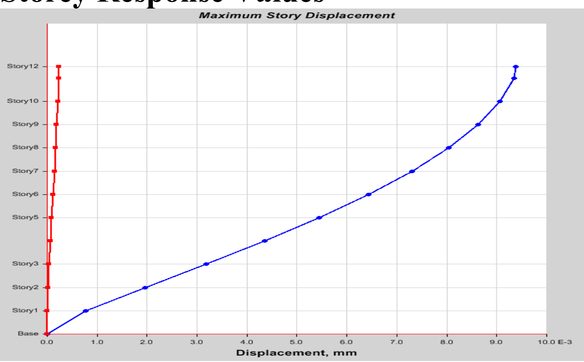


Fig 3.6.Displacement of G+12 Building

Name	StoreyResp2		
Display Type	Max storey displacement	Storey Range	All Stories
Model Case	Model	Top Storey	Storey12
Mode Number	1	Bottom Storey	Base

Storey Response - Storey Overturning Bending Moment

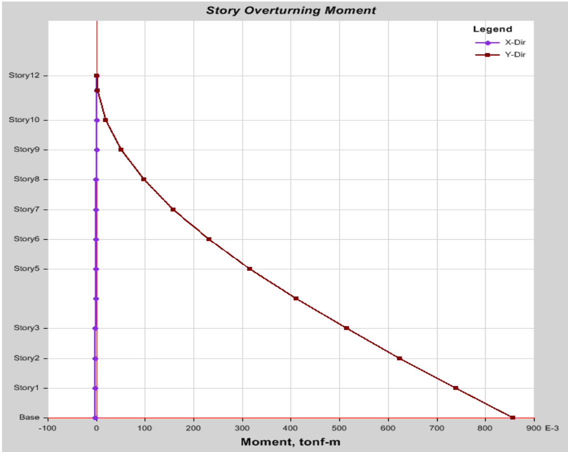
Summary Description

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

9. Input Data

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

10. Plot



11. 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

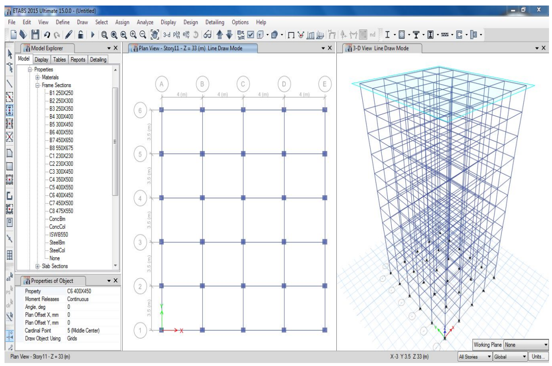


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Fig 4.2.Maximum Storey Displacement of G+12 Building

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

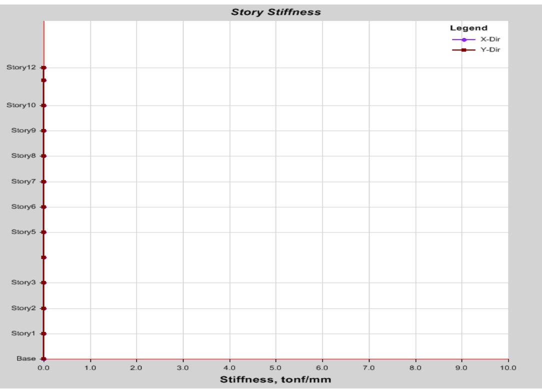
Storey Response - Storey Stiffness Summary Description

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

Input Data

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

Plot



Tabulated Plot Coordinates

Storey Response Values of stiffness Displacement

Storey	Elevation	Location	X-Direction	Y-Direction
	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 storey's shall be distributed to the floors above and below in inverse proportion to its distance from the floors.

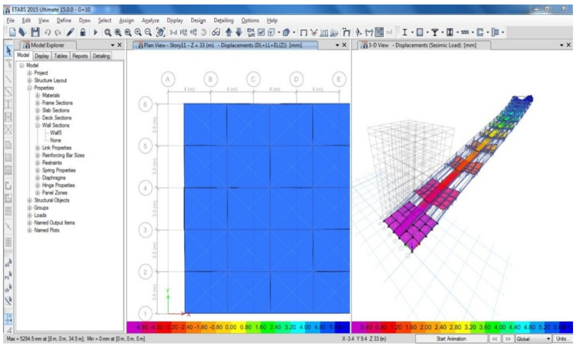


Fig 3.7.Displacement of Seismic Load on G+12 Building

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 expression:

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

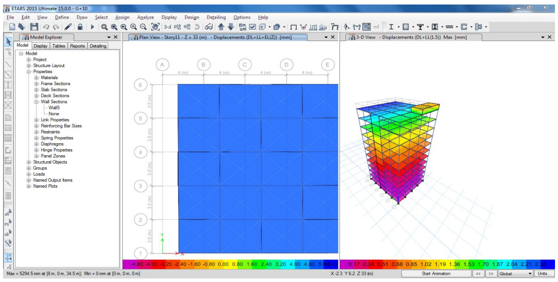


Fig 3.8.Load Combination of G+12 Building

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

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.

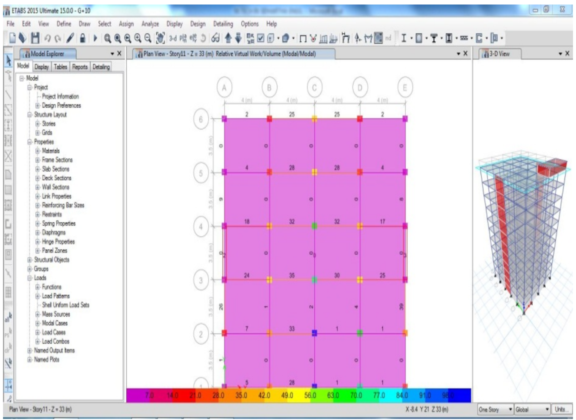


Fig Earthquake Load on G+12 Building

Input Data

Name	StoreyResp2		
Display Type	Max storeydisplacement	Storey Range	All Storey's
Model Case	Model	Top Storey	Storey12
Mode Number	1	Bottom Storey	Base

Plot

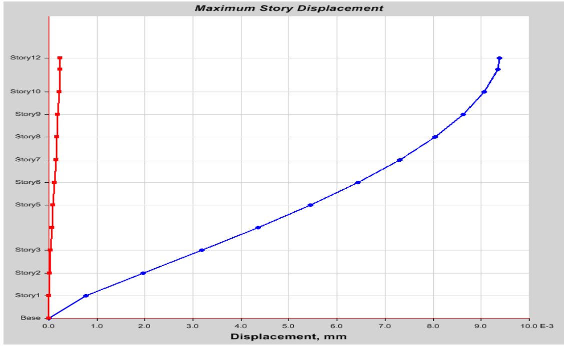


Fig.4.7.Displacement of Storey Response

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.
- Intze tank.
- 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 liters

Reserve = 12960 liters

Total Water Storage= 25920 (Say 30,000 liters)

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

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LONG WALL SHORT WALL

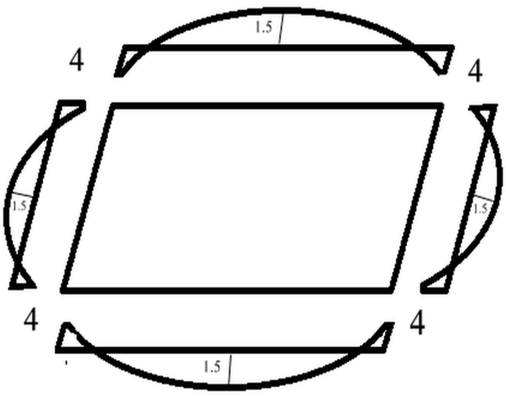
Mx My Mx Mz

+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



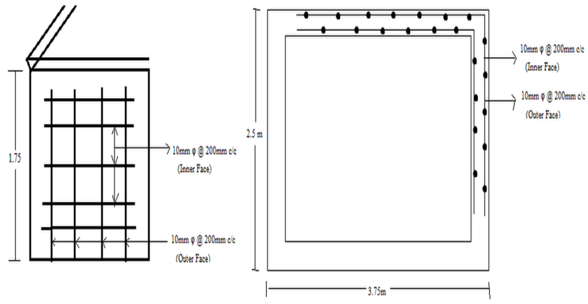
Design of Long Wall

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

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

The responsibilities if filled seismic care for the inhabitants living the most ground earthquake disposed to areas are far from existence solved. 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:

- ites selection for construction that are the most favourable in terms of the occurrence of existence and the likely harshness of ground quaking besides pulverized let down;
- reat superiority of construction to be if compatible to associate IS codes such as

IS 1893, IS 13920 to guarantee good presentation through future tremors.

- ontrivance 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.

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 domesticindustrialconstructions.

SCOPE FOR THE FURTHER INVESTIGATION

- Studying the seismic comportment of constructions by placing water tanks at various positions. C
- Reviewing the seismic behaviour of unsymmetrical building, placing water tank at a location such that seismic response is reduced.
- Studying the seismic behaviour 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.

RESULT

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

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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.
8. 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.

REFERENCES

1. FahimSadek, BijanMohraz, Andrew W. Taylor and Riley M.Chung (1997), "A method of estimating the parameters of tuned mass dampers for seismic applications", *Earthquake Engineering and Structural Dynamics*, **26**:617-635.
2. Dorothy Reed, Jinkyu Yu, Harry Yeh, Sigurdur Gardarsson (1998), "Investigation of tuned liquid dampers under large amplitude excitation", *ASCE, Journal of Engineering Mechanics,* **124:405**-413.
3. Bruno Palazzo, Luigi Petti (1999), "Combined control strategy: Base isolation and Tuned mass damping", *ISET, Journal of earthquake engineering*, **36**:121-137.
4. Peter Nawrotzki (Oct 2006), "Tuned-Mass Systems for the seismic retrofit of buildings", *Seventh International Congress on Advances in Civil Engineering*, Yildiz Technical University, Istanbul, Turkey.
5. AparnaGhosh and BiswajitBasu (2007), "Alternative approach to optimal tuning parameter of liquid column damper for seismic applications", *ASCE, Journal of Structural Engineering,* **133**:1848-1852.

6. P. Nawrotzki(Nov 2008), "Tuned-mass systems for the dynamic upgrade of buildings and other constructions", *Eleventh East Asia-Pacific Conference on Structural Engineering & Construction (EASEC-11)* "Building a Sustainable Environment" , Taipei, Taiwan.