

Study of Lateral Load Resisting Systems of Variable Heights in all Soil Types of High Seismic Zone

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering degree in Civil Engineering

by

MD JISHAN (37200706)



**DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING AND ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MARCH 2021



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of MD JISHAN (Reg.No.37200706) who carried out the project entitled "Study of Lateral Load Resisting Systems of Variable Heights in all Soil Types of High Seismic Zone" under my supervision from December 2020 to March 2021.

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External Examiner

DECLARATION

I, **MD JISHAN (Reg.No.37200706)** hereby declare that the Project Report entitled “**Study of Lateral Load Resisting Systems of Variable Heights in all Soil Types of High Seismic Zone**” done by under the guidance of **Mr. C. Manoj Kumar**, M.E at Sathyabama Institute of Science And Technology, Chennai is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.

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ABSTRACT

The present tall structures are getting increasingly slim, prompting the chance of more influence in examination with prior tall structures. This has carried more difficulties for the architects to cook both gravity stacks just as sidelong loads, prior structures were intended for the gravity stacks however now due to stature and seismic zone the designers has dealt with parallel loads because of tremor and wind Forces. Seismic zone assumes a significant part.

These adaptable structure are delicate to horizontal loads, for example, wind burden and quake load. In such elevated structures as tallness of building expands, the horizontal burden turns out to be more predominant than gravity burden or vertical heap of the structure. Accordingly, to lessen such vibrations and to accomplish better execution against the breeze burdens and seismic tremor loads, there are different parallel burden opposing frameworks embraced for elevated structures. (Baikerikar). Naturally, an appropriate selection of structures shape and engineering adjustments are additionally incredibly huge and successful plan ways to deal with lessen wind and tremor instigated movement by changing the stream design around, thus for this exploration work diverse state of structures are for the most part contemplated. In this writing study, the idea and order of different sidelong burden opposing frameworks are explored in detail for tall building structure. The point of the investigation is to decide the best sidelong burden opposing framework by thinking about different mathematical states of structures.

The examination additionally has been done for the various zones and distinctive soil as determined in IS 1893-2002. Reaction of structures with various statures is introduced in table and charts. Such an examination may assist with giving rules to survey all the more precisely the seismic weakness of building outlines and might be valuable for seismic plan

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CHAPTER 1

1.1 INTRODUCTION

The present tall structures are getting increasingly slim, prompting the chance of more influence in examination with prior tall structures. This has carried more difficulties for the architects to cook both gravity stacks just as sidelong loads, prior structures were intended for the gravity stacks however now due to stature and seismic zone the designers has dealt with parallel loads because of tremor and wind Forces. Seismic zone assumes a significant part.

With more fitting primary structures, for example, shear dividers and Braced designs, and improved material properties, the most extreme tallness of solid structures has expanded in ongoing many years. Quake safe plan of building structures on the grounds that the power to extreme. Significant perspective in plan of quake safe constructions is soil type, as dirt sort changes entire conduct and plan of design changes. So to cook every one of the parallel powers, we need to plan the design particularly so the construction can withstand for the most extreme time span so that there is no damage to the general public.

These adaptable structure are delicate to horizontal loads, for example, wind burden and quake load. In such elevated structures as tallness of building expands, the horizontal burden turns out to be more predominant than gravity burden or vertical heap of the structure. Accordingly, to lessen such vibrations and to accomplish better execution against the breeze burdens and seismic tremor loads, there are different parallel burden opposing frameworks embraced for elevated structures. (Baikerikar). Naturally, an appropriate selection of structures shape and engineering adjustments are additionally incredibly huge and successful plan ways to deal with lessen wind and tremor instigated movement by changing the stream design around, thus for this exploration work diverse state of structures are for the most part contemplated. In this writing study, the idea and order of different sidelong burden opposing frameworks are explored in detail for tall building structure. The point of the investigation is to decide the best sidelong burden opposing framework by thinking about different mathematical states of structures.

CHAPTER 2

2.1 REVIEW OF LITERATURES

“Earthquake Analysis of Building Configuration with Different Position of Shear Wall” (Anuj Chandiwal) December 2016 :-

From past records of tremor, there is expansion popular of seismic tremor is an unexpected movement or shaking of the Earth's outside, brought about by the sudden arrival of gradually aggregated strain put away in the stones underneath the surface. A quake is an oscillatory development created because of arrival of strain energy beneath or inside the outside of earth surface . It produces flexible vibration or waves which development all bearing from the starting place and cause quake. No structure can remain altogether liberated from harm during, even shudder, all houses, enormous or little; can be made to withstand seismic tremors of a specific greatness by playing it safe. Building implodes because of latency powers. gives best outcome. Primary explanation is end bit of spine consistently sway seriously during quake. Here shear divider straightforwardly hinder this end wavering, henceforth lessen generally twisting snapshot of building.

A seismic tremor is an unexpected movement or shaking of the Earth's outside, brought about by the sudden arrival of gradually aggregated strain put away in the stones underneath the surface. A quake is an oscillatory development created because of arrival of strain energy beneath or inside the outside of earth surface . It produces flexible vibration or waves which development all bearing from the starting place and cause quake. No structure can remain altogether liberated from harm during, even shudder, all houses, enormous or little; can be made to withstand seismic tremors of a specific greatness by playing it safe. Building implodes because of latency powers. During a quake the lower segment of a structure will in general vibrate, as it is circuitous contact with ground. The powers of inactivity anyway keep upper position static. There are four essential reasons for quake: -

(I) ground shaking (ii) ground disappointment (iii) tidal waves (iv) fire.

In tall structures parallel burdens are head one which will increment quickly with expansion in stature. The plan deals with the prerequisites of solidarity, unbending nature and strength. The primary framework intended to convey vertical burden might not have the ability to oppose horizontal burden or regardless of whether it has, the plan

for sidelong burden will expand the underlying expense generously with expansion in number of story. To accomplish economy in tall structures exceptional frameworks to oppose parallel burden ought to be embraced.

“SEISMIC ANALYSIS OF RC FRAMED STRUCTURES RETROFITTED WITH STEEL BRACES” (Ciro FAELLA) May 2018.

Existing Reinforced Concrete (RC) structures worked during the most recent a long time in seismic areas (like a wide piece of Italy and the Mediterranean zone) don't by and large follow the further developed seismic codes right now embraced in similar districts and are regularly deprived for retrofitting. A few seismic retrofitting methods are presently accessible and utilized in reasonable applications, despite the fact that issues are as yet open (or not totally settled by similar codes) about the sane plan of these retrofitting intercessions. An exhaustive State-of-the-Art Report gathering the most grounded strategies for seismic retrofitting of RC structure is accessible in. Specifically, a few "part level strategies" (fundamentally pointed toward improving the limit as far as strength as well as pliability of single components of the current constructions) are portrayed and practically recognized by the supposed "structure level methods". The last ones basically target lessening the interest on the current construction by presenting further components (i.e., RC shear dividers) or bases (e.g., steel bracings) ready to oppose the seismic excitation. A levelheaded methodology for a potential synergic use of the two procedures has been additionally imagined and introduced in the logical writing. Propping frameworks are broadly used in steel structures and a few models are presently accessible for portraying their reaction under the cyclic activities instigated by seismic excitation.

Additionally, utilizing steel supporting frameworks in seismic retrofitting of existing RC structures is really an appealing procedure, as it is described by high compositional and utilitarian similarity as for the first reasons for the current construction. This is the critical inspiration for a progression of late examinations pointed toward exploring the conceivable reinforcing of RC outlines through dissipative steel bracings. As an issue of guideline, the plan of steel supporting in RC casings can be drawn closer as per the grounded "limit plan" theory. Also, the vital part of association over strength should be totally returned to on account of steel supports associated with RC joints. Another issue of concern manages the dispersion of steel supports all through the current RC outline

and the meaning of objective underlying plans for propping frameworks to be utilized in seismic retrofitting. Hardly any new examinations really tended to this theme by either proposing exploratory and mathematical outcomes on steel outline with various supports designs, or inspecting diverse propping designs for a given RC structures considered as a contextual investigation, or moving toward the issue of characterizing an ideal propping setup.

The current paper is likewise proposed at exploring the impact of various propping arrangements on the seismic reaction of retrofitted RC outlines. Specifically, the investigation centers around concentric X-supports which are regularly utilized for seismic reinforcing of RC existing constructions. In this manner, Section 2 presents a current RC outline which is considered as a contextual analysis. Also, a similar segment reports the critical strides in the plan methodology of steel supports planned for retrofitting and the different conceivable propping arrangements considered in this examination. At last, Section 3 blueprints the critical parts of mathematical models utilized for reproducing the conduct of both RC edges and steel bracings and sums up the consequences of the seismic examinations completed on those retrofitted structures calling attention to the impact of the propping design on the seismic interest of the current solid individuals. Besides, experiences about the activity esteems at the establishment level are likewise thought of and the fundamental great and negative parts of the different potential arrangements are called attention to.

**“Seismic Analysis of Steel Braced Reinforced Concrete Frames”
(Viswanath K.G, Prakash K.B., Anant Desai) International Journal of
Civil and Structural Engineering, Volume 1, No 1, 2019.**

Steel propped outline is one of the primary frameworks used to oppose tremor stacks in multi-storeyed structures. Many existing built up solid structures need retrofit to defeat lacks to oppose seismic burdens. The utilization of steel supporting frameworks for fortifying or retrofitting seismically insufficient built up solid casings is a practical answer for upgrading quake obstruction. Steel supporting is practical, simple to raise, consumes less space and has adaptability to plan for meeting the necessary strength and solidness. In the current examination, the seismic presentation of supported cement (RC) structures restored utilizing concentric steel propping is researched. The propping is accommodated fringe segments. A four story building is dissected for seismic zone IV according to IS 1893: 2002. The adequacy of different kinds of steel supporting in restoring a four story building is analyzed.

The construction has assumed a significant part in the general plan. Expanding tallness and thinness achieved an adjustment in the primary architects center from static gravity burdens to even powerful loads created by wind and quakes. There was a need to build up the diverse sort of primary framework, one such strategy appeared is by joining steel supports in the construction. The enormous flexibility and high solidarity to weight proportion of underlying steel make it an ideal material for tremor opposition. Steel propped outline is one among the underlying frameworks wont to oppose seismic tremor loads in multistoried structures. Bracings oppose parallel powers dominantly with individuals in pressure or pressure. Supports are exposed to dominantly pivotal anxieties. The structures which are harmed are often retrofitted by utilizing supports. Steel supporting is efficient, simple to raise, consumes less space and has adaptability to plan for meeting the necessary strength and firmness.

“Effect of Internal and External Shear Wall on Performance of Building Frame subjected to Lateral load” (S.V.Venkatesh & H.Sharada Bai) October 2018.

Seismic burdens are infrequent powers that may happen during the existence season of a structure. Structures ought to have the option to withstand seismic loads because of minor quake with no underlying harm and serious tremor without absolute breakdown. Subsequently, it is essential to know the conduct of structures for various Lateral (seismic tremor) Load Resisting Structural frameworks (LLRS). In the current investigation, an endeavor is had to contemplate the effect in underlying conduct of 3-dimensional (3D) single-straight three-narrows 10 story essential second opposing RC outlines when furnished with two unique kinds of shear divider as LLRS. The itemized examinations are completed for zone V of Seismic zones of India according to IS 1893 (section 1):2002, thinking about essential burdens (dead, live and seismic burdens) and their blends with suitable burden factor. Out and out 15 models are broke down which comprise of one essential second opposing RC outline (Bare edge) with three diverse size/direction of segment and other two incorporate fundamental second opposing RC outline with similar sizes/direction of segments as in uncovered edge with inward shear dividers and outer shear mass of two distinct thicknesses. The outcomes got from the straight static examination are completely explored for most extreme estimations of joint relocations, support responses, section powers and bar powers. Alongside these boundaries, the investigation on the head and shear stresses in shear dividers is done. The outcomes demonstrate better protection from parallel burden within the sight of shear dividers with square segments.

The training before 1960s has been to plan structures essentially for gravity loads and check the sufficiency of the construction for wellbeing against sidelong loads. It is set up that the plan of a multi-story building is administered by sidelong loads and it ought to be the superb worry of creator to give satisfactory security to structure against horizontal burdens. Further, the old structures were having generous non-primary brick

work dividers, segments and associated flights of stairs, which gave a critical security edge against horizontal burdens. The advanced structures are having light blind dividers, lightweight adaptable segments alongside high strength cement and steel support, which diminish the security edge given by non-primary parts.

Many existing RC outline structures situated in seismic zones are lacking to withstand tremors. Deficient sidelong protections and helpless specifying of support are the primary purposes behind lacking seismic execution. As of late a lot of exploration has been given for the investigation of different fortifying procedures to improve the seismic exhibition of built up solid edge structures. While a considerable lot of these methods can successfully improve the parallel solidness and opposition of the current design, sufficient seismic conduct will be gotten just if the retrofitted construction can fulfill the strength and pliability requests forced by the quake.

“Response of a 3-Dimensional 2 X 3 Bays Ten Storey RC Frame with Steel Bracings as Lateral Load Resisting Systems Subjected To Seismic Load” (Venkatesh S.V., H. Sharada Bai., Divya S.P.) , May-2017.

A characteristic peril like Earthquake makes harm or breakdown of structures if not intended for parallel burdens coming about because of Earthquake. Subsequently for seismic obstruction for skyscraper structures it is essential to give elite Lateral Load Resisting System (LLRS) which will enhance the conduct of second opposing edges in opposing the horizontal burden. A portion of the LLRS generally utilized are shear dividers, infill edges and steel bracings. In the current examination, an endeavour is had to contemplate the effect in underlying conduct of 3-dimensional (3D) two-coves - three-coves, 10 story essential second opposing RC outlines when furnished with steel bracings as LLRS. The definite examinations are completed for zone V of Seismic zone of India, thinking about essential burdens and their blends. Three models are dissected comprising of one essential second opposing RC outline and other two incorporate fundamental second opposing RC outline with outside and inside steel bracings. The outcomes acquired from the direct powerful examination are altogether explored for most extreme estimations of joint removals, support responses, pillar powers and powers in steel bracings. The outcomes show better protection from parallel heap of the edges within the sight of steel bracings.

Seismic tremors are maybe the most eccentric and wrecking of every single cataclysmic event. They not just aim incredible obliteration as far as human causalities, yet in addition financially affect the influenced region. Many existing structures do not have the seismic strength and specifying necessities according to Indian standard codes of training as of now and hence need to update if the construction was at first not planned and built to oppose a quake for example planned uniquely for gravity stacks yet at the same time has not gone through disappointment. For structures, which have gone through disappointment because of tremor, it is vital for retrofit for sometime later.

“Seismic Behaviour of RCC Shear Wall under Different Soil Conditions” (Anand, N. Mightraj, C., Prince Arulraj, G) December 2016.

Shear divider is a divider made out of propped boards with hard cement encompassing it to counter the impacts of horizontal burdens following up on a design. Despite the fact that constructions are upheld on soil, the majority of the creators don't consider the dirt design cooperation and its ensuing impact on structures during a tremor. At the point when a design is exposed to a design is for the most part built with grade 30 or more grounded concrete. In numerous pieces of Sri Lanka, bed rock can be found at a profundity under 40.0m. The accessibility of fairly more fragile soil with pocket of peat or layers or alluvial soils has urged the underlying architects to depend on both end bearing and skin erosion of heaps instead of just on skin contact or end bearing. Subsequently, the utilization of 1.0m, 1.2m, 1.5m and 1.8m cast in-situ exhausted heaps gave a satisfactory attachment into solid stone is a typical practice. When there is an impressive profundity of in part endured rock (2.0 to 3.0 m), an attachment profundity of equivalent to the heap width would be satisfactory into acceptable quality bed rock giving RQD esteems over 30-40. This is a direct result of high skin rubbing that could be created and planned utilizing the product ETABS and the outcomes from the examination are introduced in this paper.

Shear divider is a solid divider made to oppose sidelong powers following up on tall structures. Shear dividers are vertical components of the even power opposing framework. At the point when shear dividers are planned and built appropriately, they will have the strength and firmness to oppose the even powers. Appropriately planned and itemized structures with shear dividers have displayed generally excellent execution during the past tremors. Actually like supported cement (RC) bars and sections, RC shear dividers additionally perform much better whenever intended to be flexible. By and large mathematical extents of the divider, types and measure of support, and association with different components in the structure help in improving the flexibility of dividers.

“Lateral load analysis of Post tensioned and RCC building using Pushover analysis” Amalu Paul.& Krishnan.M (Sep-2018).

The post-tensioned sections can give higher recentering limit and uncracked portion after seismic quake vibration impacts. In current assessment, the shudder lead of working with and without post-tensioned fragments was surveyed by doing wimp examination. Sucker examination is the nonlinear static assessment which is transforming into a renowned device for seismic execution appraisal of existing and new developments. In this assessment, execution limits of building were evaluated. Vertical supported tendons were likewise circled along four sides of the areas. The shopping complex construction masterminded in Pattambi was picked for assessment which lies in seismic zone III. Here corner areas were compelled by giving extra vertical PT power

up to half of its significant weight limit with most limit support steel up to 4% of the region. The outcomes of the assessment showed that extensions in Performance point, most limit base shear, response decline factor, flexibility factor and over strength factor can be refined by extending PT steel and PT power in tendons.

Ongoing quakes in which many solid constructions have been seriously harmed or fallen, have shown the requirement for assessing the seismic sufficiency of existing structures. About 60% of the land region of our nation is defenseless to harming levels of seismic risk. We can't stay away from future seismic tremors, yet readiness and safe structure development practices can surely diminish the degree of harm and misfortune. To reinforce and oppose the structures for future quakes, a few methodology must be received. One of the methods is the static weakling investigation which is turning into a mainstream instrument for seismic execution assessment of existing and new designs. Specifically, the seismic restoration of more established solid designs in high seismically zones involves developing worry, since structures helpless against harm should be distinguished and a worthy degree of wellbeing should be resolved. To make such evaluation, worked on direct versatile strategies are not sufficient. Sucker examination is performed by exposing a construction to a monotonically expanding example of parallel burdens, addressing the inertial powers which would be capable by the design when exposed to ground shaking. Under gradually expanding loads different primary components may yield consecutively. Utilizing a weakling investigation, a trademark nonlinear power uprooting relationship can be resolved. The post-tensioning strategy is presently a day's expanding broadly, because of its unrivalled exhibition. By utilizing post-tensioning technique one can plan the most financial and the protected plan. Vertical post-tensioning in sections are by and large utilized for precast solid segments. It is additionally utilized for shear dividers in tall structure to get less rebar amount and less clogs. This technique is applied to general structure segments.

“Seismic performance of reinforced concrete moment resisting frames” Sadjadia R., Kianousha M.R.& Talebib S., (August 2018).

The seismic show of two 42-story developed strong designs arranged in Los Angeles, California. Building 1 is a coupled focus divider development and Building 2 is a practically identical coupled focus divider working with line second restricting edges (for instance twofold structure). The plans of the constructions were finished by two celebrated planning firms in the United States using three arrangement moves close. Approach A follows the regular code setup approach (for instance IBC 2006), approach B follows the show based arrangement technique dispersed by the LATBSDC, and approach C follows the redesigned execution notwithstanding design approach disseminated by the Pacific Earthquake Engineering Centre. Nonlinear incredible responses of these designs at five levels of quake shaking powers were taken apart using Perform3D.

Developed strong shear divider systems are typically used as the seismic force restricting structure in the West Coast of the United States. For tall designs, these systems usually go through a mostly discovered assembled strong focus divider to go against an enormous segment of the seismic forces. This results to commonly little gravity systems at the boundary of the design. Seismic response of focus divider structures has been thought by (Yang et al., 2010). Then again, these structures could be arranged as twofold systems by joining focus dividers and upheld strong second restricting edges. To consider the seismic execution of developed strong focus divider structures with and without the second contradicting packaging, a 42-story building arranged in Los Angeles, California were arranged and explored. This paper dissects the seismic display of these two systems to the extent beginning costs, hidden responses, and the typical fix costs at different levels of shudder shaking powers. Building plans were finished by two prominent planning firms in the United States using three arrangement moves close. Approach A follows the regular code plan (International Building Code 2006), except beyond what many would consider possible is outperformed design is for the most part built with grade 30 or more grounded concrete. In numerous pieces of Sri Lanka, bed rock can be found at a profundity under 40.0m. The accessibility of fairly more fragile soil with pocket of peat or layers or alluvial soils has urged the underlying architects to depend on both end bearing and skin erosion of heaps instead of just on skin contact or end bearing. Subsequently, the utilization of 1.0m, 1.2m, 1.5m and 1.8m cast in-situ exhausted heaps gave a satisfactory attachment into solid stone is a typical practice. When there is an impressive profundity of in part endured rock (2.0 to 3.0 m), an attachment profundity of equivalent to the heap width would be satisfactory into acceptable quality bed rock giving RQD esteems over 30-40. This is a direct result of high skin rubbing that could be created.

“Tall Building Structures Analysis and Design” (Bryan Stafford Smith, Alex Coull) 2019.

Tall structures with 20 stories or more would for the most part be arranged with supported solid super construction and insitu cast exhausted heap sub design. Be that as it may, the need to give storm cellars and vehicle leaving offices utilizing not many lower floors represent an impressive test to primary investigation and plan of such structures. This paper features the ordinary highlights that can be considered typical and the available resources accessible for joining such highlights for three dimensional investigation of superstructure thinking of it as alone or consolidating with sub construction. It likewise feature the angle that would require exceptional consideration during the plan of fundamental individuals when opposing burdens coming about. From vertical and even loads.

The super design is for the most part built with grade 30 or more grounded concrete. In numerous pieces of Sri Lanka, bed rock can be found at a profundity under 40.0m . The accessibility of fairly more fragile soil with pocket of peat or layers or alluvial soils has

urged the underlying architects to depend on both end bearing and skin erosion of heaps instead of just on skin contact or end bearing. Subsequently, the utilization of 1.0m, 1.2m, 1.5m and 1.8m cast in-situ exhausted heaps gave a satisfactory attachment into solid stone is a typical practice. When there is an impressive profundity of in part endured rock (2.0 to 3.0 m), an attachment profundity of equivalent to the heap width would be satisfactory into acceptable quality bed rock giving RQD esteems over 30-40. This is a direct result of high skin rubbing that could be created. At the point when the stone is cracked to bring about low RQD esteems (15-25), it very well might be fitting to have more noteworthy attachment profundities like 2.0 m or more. The evaluation of cement utilized for heaps would be around 30, yet by and large would be given 25% additional concrete to take into consideration the way that the solid won't be vibrated. The heaps are given 0.7% to 1.0% support. The arrangement of least sum, for example, 0.4% of support may not be fitting because of creep prompted stresses and disfigurements that happen in heaps. This support of 0.7% or above is relied upon to serve a significant job in case of seismic tremors. To guarantee adequate flexibility at the highest point of the heaps, it is fundamental to have a nearer interface dispersing like 100-150 mm at the top piece of the heap.

“New solutions in seismic isolation for civil structures” (Mikael G. Melkumyan) April 2018.

Earthquake designing is one of the fairly muddled fields of human exercises. There is an excessive amount of vulnerability in this control, from the seismic tremor marvel to the properties of building structures that need to withstand it. Notwithstanding outstanding accomplishments in this field, we need to concede that the mankind is still a long way from settling the riddles of the Nature that it opens to us gradually with each new tremor.

After the December 7, 1988 Spitak quake ($M=7.0$) the seismic peril on the territory of Armenia has been amended and expanded. The quakes are currently expected with a speed increase of 0.4g. Simultaneously, the extraordinary dominant part of structures built before the Spitak quake were intended for seismic activity of about 0.1-0.2g, as per the previous plan codes of the Soviet Union.

Broad deals with looking for new arrangements which could reinforce structures have been dispatched in 1993 by the activity and endeavors of the creator of this paper with the help of the National Survey for Seismic Protection (NSSP) and the American University of Armenia (AUA). Presently, it is protected to say that arrangements prompting progressive changes in the field of tremor designing in the country have been found. These arrangements depend on the utilization of seismic disengagement frameworks.

2.2 LITERATURE REVIEW SUMMARY

From above writing audits, I have a thought regarding how the unique second opposing casing (SMRF) and solid shear wall has better seismic execution because of improved parallel solidness and lateral strength, conduct of shear divider under various soil conditions during the event of quake, the conduct of structures for various Lateral (tremor) Load Resisting Structural frameworks (LLRS), the distinction in underlying behaviour 3-dimensional (3D) two-narrows - three-strights, 10 story essential second opposing RC outlines when given steel supporting as LLRS (Lateral Load Resisting System).

2.3 LATERAL LOAD RESISTING SYSTEMS

2.3.1 INTRODUCTION

Tall structures are getting increasingly slim, prompting the chance of more influence in examination with prior elevated structures. This has carried more difficulties for the architects to provide food both gravity stacks just as sidelong loads, prior structures were intended for the gravity stacks however now in light of stature and seismic zone the designers has dealt with parallel loads because of quake and wind powers. Seismic zone assumes a significant part in the quake safe plan of building structures on the grounds that the zone factor changes as the seismic power changes from low to serious. Another significant viewpoint in the plan of seismic tremor safe constructions is soil type, as the dirt sort changes the entire conduct and plan of the design changes. So to provide food every one of the horizontal powers, we need to plan the construction extraordinarily so the design can withstand for the most extreme time span so that there is no damage to the general public.

2.3.2 STRUCTURAL FORM

From the underlying architect's perspective, the assurance of the primary type of an elevated structure would in a perfect world include just the determination and game plan of the major primary components to oppose all the more productively the different blends of gravity and even stacking. The scope of elements that must be considered in choosing the primary structure incorporates the interior arranging, the material and strategy for development, outside compositional treatment, the arranged area and directing of the assistance frameworks, the nature and size of even stacking, and the stature and extents of the structure. The taller and more slim a structure, the more significant the primary components become, and the more important it is to pick a suitable underlying structure. For structures in excess of 10 stories, anyway the extra material needed for wind obstruction increments nonlinearly with stature so that for working with 50 stories and more the choice of a suitable primary structure might be basic for the economy and undoubtedly the practicality of the structure. The structure design ought to likewise forces satisfactory vertical and parallel solidness to restrict the avoidances.

2.3.3 MOMENT RESISTING FRAMES

Second casings comprise of a network of vertical (i.e., sections) and even (i.e., radiates) individuals (Figure 3.1). They oppose horizontal burdens through pivotal powers, bowing second and shear power created in the two bars and sections. Shaft and segment segments ought to be planned as under-built up segments, and in this way, can be required to go through flexible conduct; weak shear disappointment should be forestalled through limit plan systems. While choosing the underlying setup of the structure, prevalent flexural conduct in pillars and sections ought to be encouraged. This can be accomplished by utilizing moderately long casing Members; short shafts and sections pull in enormous powers and are helpless to fizzle in a weak way.

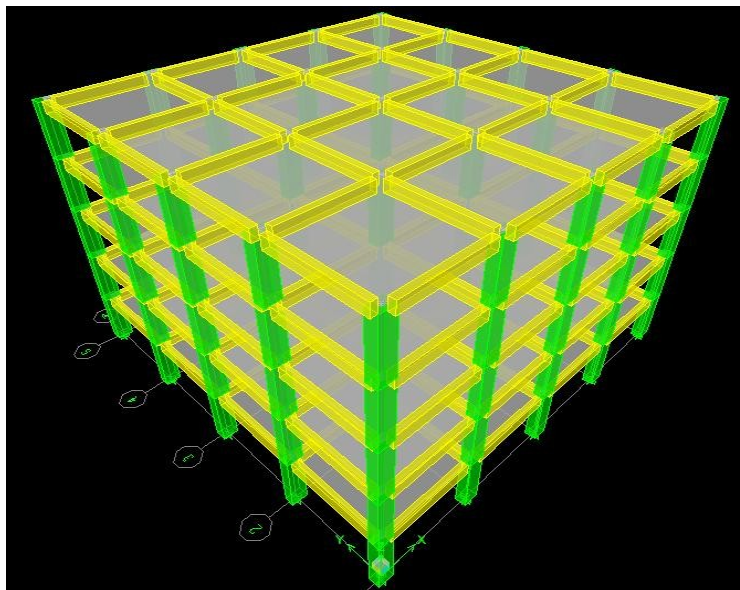


Figure 2.1: Moment Resisting Frame

2.3.4 SHEAR WALLS

Seismic tremor safe structures ought to have, in any event a base sidelong solidness, with the goal that they don't swing a lot during little degrees of shaking. Second casing structures will most likely be unable to offer this consistently. At the point when horizontal dislodging is huge in a structure with second casings just, underlying dividers, regularly normally called shear dividers, can be acquainted with assistance diminish in general uprooting of structures, on the grounds that these vertical plate-like primary

Constant solid vertical divider serve both compositionally as segments and basically to convey gravity and horizontal burdens. Their extremely high in plane firmness and strength makes them ideal for tall structures. In a shear divider structure, such dividers

are completely liable for the parallel burden opposition of the structure. They go about as vertical cantilevers as discrete planar dividers and as non planar congregations of associated dividers around lift, step and administration shafts. Since they are a lot stiffer evenly than inflexible casings, shear divider constructions can be affordable up to around 35 stories. Rather than unbending casings, the shear dividers strong structure will in general limit arranging Seismic tremor safe structures ought to have, in any event a base sidelong solidness, with the goal that they don't swing a lot during little degrees of shaking. Second casing structures will most likely be unable to offer this consistently. At the point when horizontal dislodging is huge in a structure with second casings just, underlying dividers, regularly normally called shear dividers, can be acquainted with assistance diminish in general uprooting of structures, on the grounds that these vertical plate-like primary Shear divider structures have been appeared to perform well in seismic tremor for which flexibility turns into a significant thought in their plan.

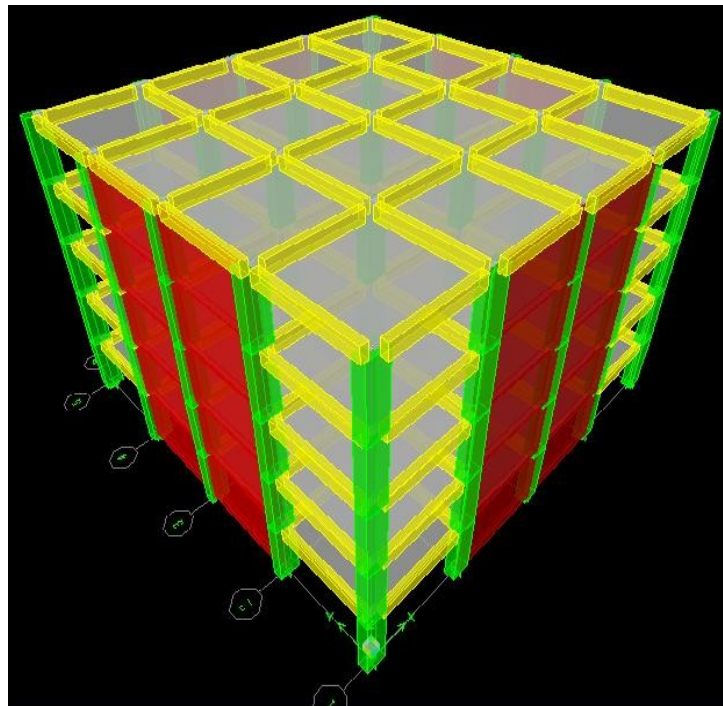


Figure 2.2: Shear Walls

2.3.5 BRACINGS

The primary framework comprises of second casings with explicit narrows gave supports all through the tallness of the structure. Supports are given in both arrangement bearings to such an extent that no winding is prompted in the structure attributable to unsymmetrical solidness in arrangement. Supporting is an underlying framework which is planned principally to oppose wind and tremor powers. Individuals in a supported casing are intended to work in strain and pressure like a bracket. Supports help in lessening in general horizontal removal of structures, and

in diminishing bowing second and shear power requests on shafts and sections in structures. The seismic tremor power is moved as pivotal power in the support individuals. Different kinds of bracings can be utilized including worldwide propping along the structure stature. Consider the five-story benchmark working with three sorts of neighborhood propping frameworks in particular, X-, Chevron and K-supporting frameworks. X-And Chevron supports adequately diminish bowing second, shear power and hub power requests on the shafts and sections of the first casing and are regularly utilized. However, K-supports builds shear interest on segments and can cause weak shear disappointment. Subsequently, some plan codes restrict utilization of K-supports in quake safe plan. Propped outlines are easy to raise nearby, and supporting components can be orientated to oblige flat development across the floor plate. Albeit propped outline frameworks can be fused inside Concrete outlined constructions, they are more qualified to steel outlined structures fusing slanting supporting or potentially unconventionally propped outlines.

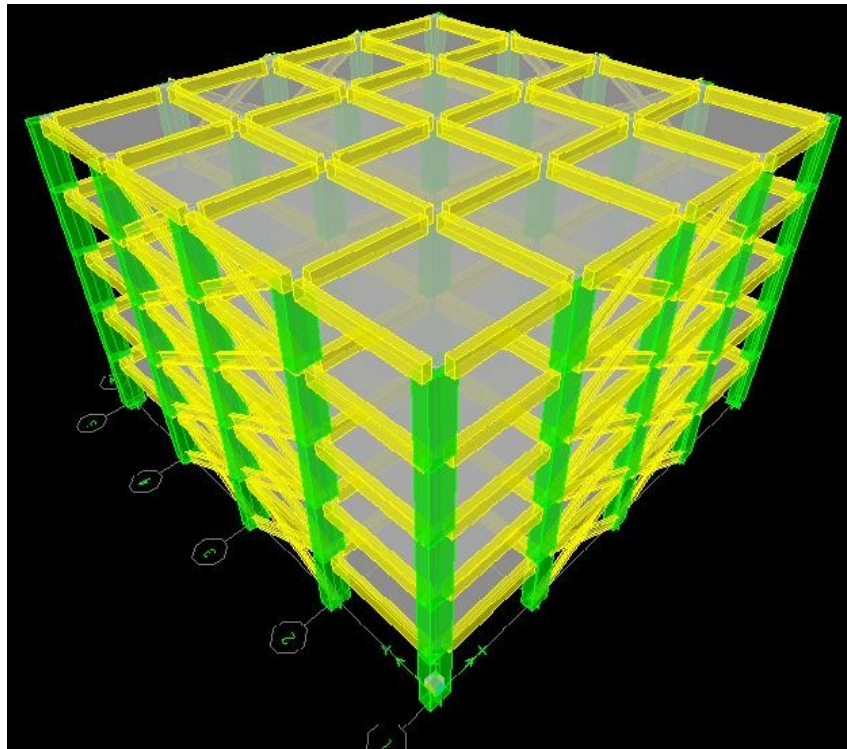


Figure 2.3: Bracings

CHAPTER 3

3.1 OBJECTIVE

1. Determination of Lateral Displacements, Drifts, Base Shear, Time Period at variable statures for exposed edge, outline with Shear Wall and for outline with Bracing utilizing Response Spectrum Method in zone V for a wide range of soils.
2. To study the behaviour of structure in different seismic zones and on different types of soils.
3. To study the Effect of Internal and External Shear Wall on Performance of Building Frame subjected to Lateral load.
4. To study the Seismic Performance Evaluation of Multi-storeyed RC framed buildings with Shear wall.

3.2 SCOPE FOR FURTHER STUDIES

1. Same study can be done by varying the plan size of the building.
2. The study can be extended by inserting staggered shear wall instead of continuous shear wall.
3. The study can be extended by providing different types of bracings.
4. The study can be done by incorporating soil structure interaction.
5. Same study can be done by using other software's.

CHAPTER 4

4.1 METHODOLOGY

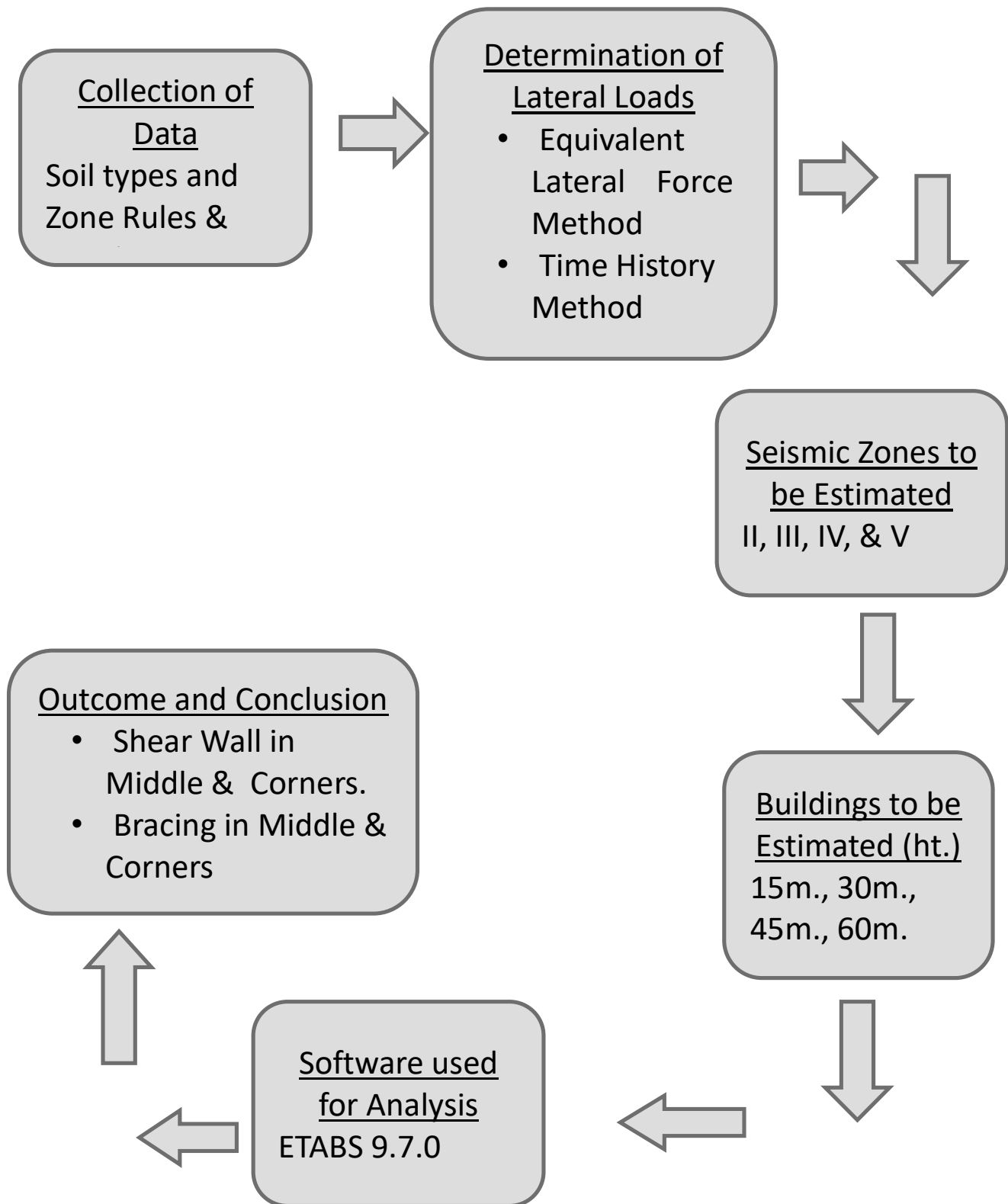


Fig.4.1 Methodology Flow chart

4.2 PLAN OF THE BUILDING

1. Square grid of 20m each in both X and Y direction.
2. Grid contains 4 bays of 5m each in both X and Y direction.
3. Height of each story 3m.
4. Height of building is varied from 15m, 30m, 45m, 60m and 75m.
5. Software used for analysis is ETABS 9.7.0

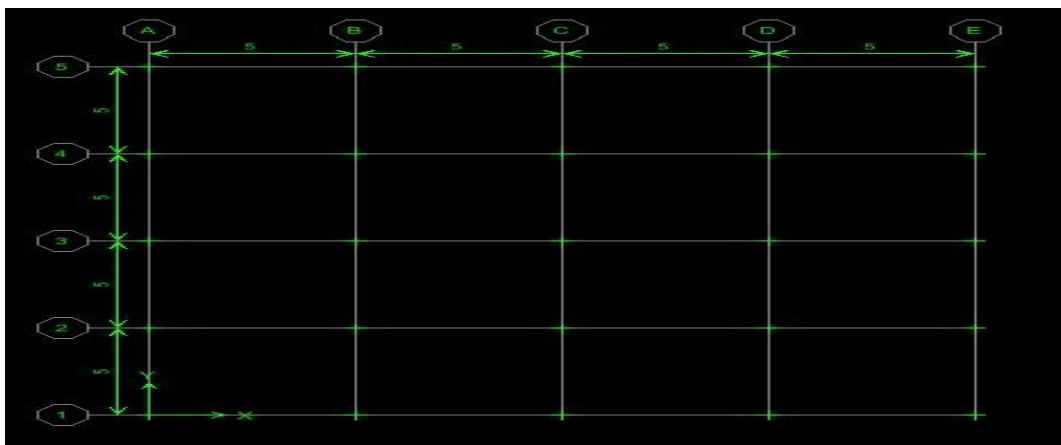


Fig.4.2 Plan of the building

4.3 Details of the Problem

4.3.1 Materials used:

- M50 grade of concrete.
- Fe 415 steel.
- Frame properties :
 - Beams: 0.3m X 0.6m.
 - Columns: 0.5m X 0.9m. (Story 1 to 10) 0.5m X 0.75m. (Story 11 to 20) 0.5m X 0.6m. (Story 21 to 25)
 - Slabs: 0.125m.
 - Shear wall thickness: 0.3m.
 - Bracings ISMB: 500.

- Live load: 3.5 KN/m²
- Dead load of wall as UDL: 14 KN/m²
- Damping: 5%
- The study has been carried out for all the seismic zones and all types of soils

4.4 DIFFERENT CASES OF STUDY

- Case 1: Bare Frame.
- Case 2: Shear Wall in the Middle.
- Case 3: Shear Wall at the Corners.
- Case 4: Bracing in the Middle.
- Case 5: Bracing at the Corner

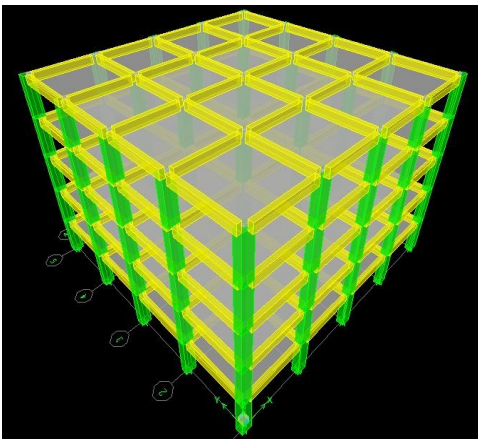


Fig.4.1 Case 1 (bare frame)

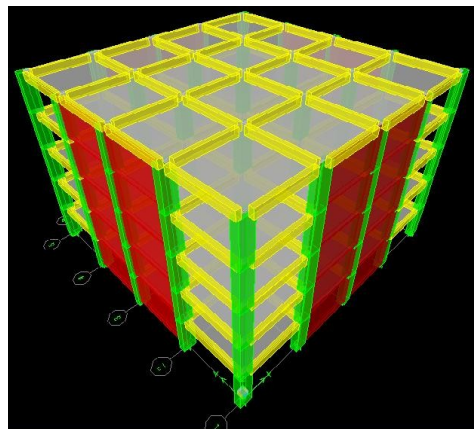


Fig.4.2 case 2 (shear wall in middle)

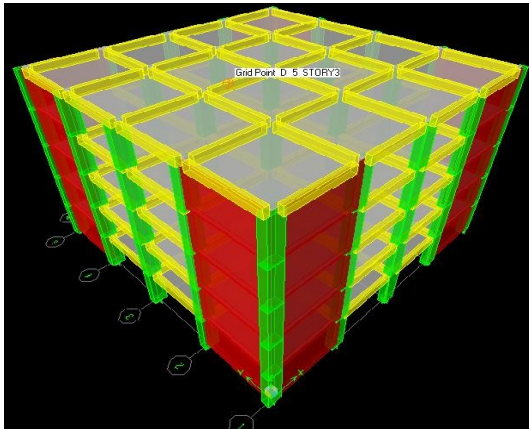


Fig.4.3 Case 3 (shear wall at corners)

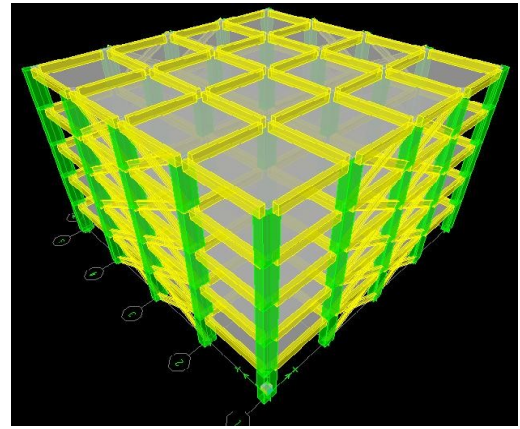


Fig.4.4 case 4 (Bracing in middle)

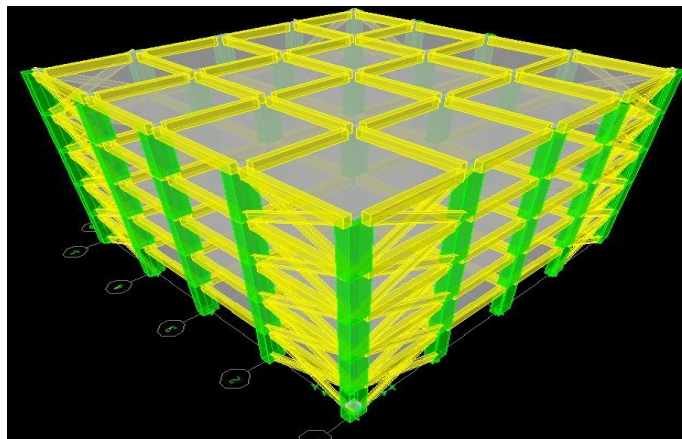


Fig.4.5 Case 5 (Bracing at corner)

CHAPTER 5

RESULTS

5.1 Zone 2 Hard Soil (having N above 30, where N is the standard penetration value.)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	505	0.4113	1.44	0.199
30	555	0.8538	3.06	0.226
45	548	1.2990	4.78	0.242
60	537	1.7703	6.60	0.266
75	525	2.2544	8.67	0.272

Table 5.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	558	0.1156	0.12	0.014
30	1077	0.3249	1.00	0.061
45	1126	0.5989	2.33	0.097
60	1067	0.9216	3.68	0.115
75	1054	1.2759	5.13	0.129

Table 5.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	553	0.1340	0.16	0.019
30	1072	0.3853	1.38	0.087
45	992	0.7061	2.78	0.116
60	955	1.0728	4.23	0.133
75	949	1.4653	5.86	0.148

Table 5.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	535	0.2402	0.49	0.065
30	858	0.5208	1.92	0.118
45	775	0.8367	3.11	0.125
60	770	1.1953	4.54	0.137
75	757	1.5864	6.13	0.150

Table 5.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	527	0.2528	0.55	0.069
30	776	0.5702	2.10	0.126
45	714	0.9326	3.52	0.141
60	712	1.3411	5.15	0.158
75	685	1.7806	6.95	0.171

Table 5.5: Results of Bracings at corners

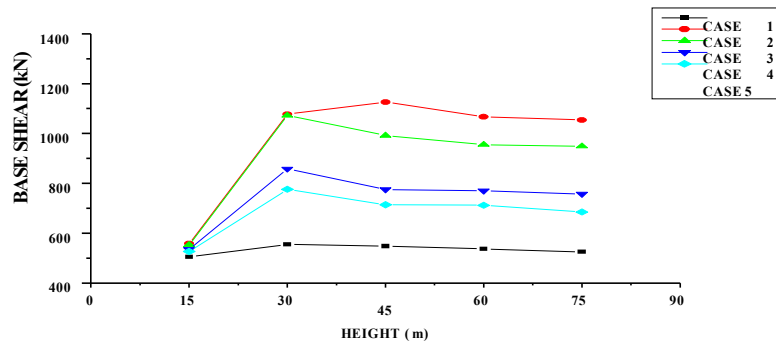


Figure 5.1.1: Height v/s Base Shear for Zone 2 Hard Soil

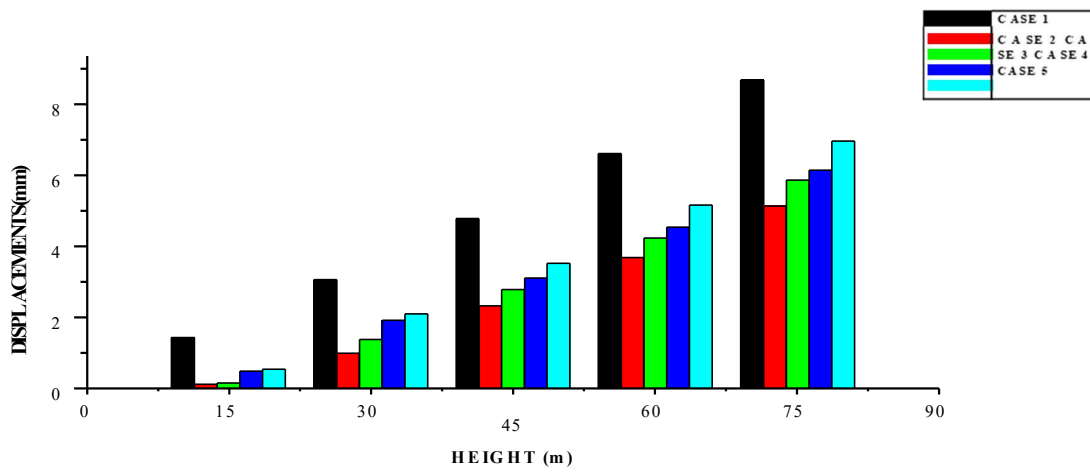


Figure 5.1.2: Displacement Graph for Zone 2 Hard Soil

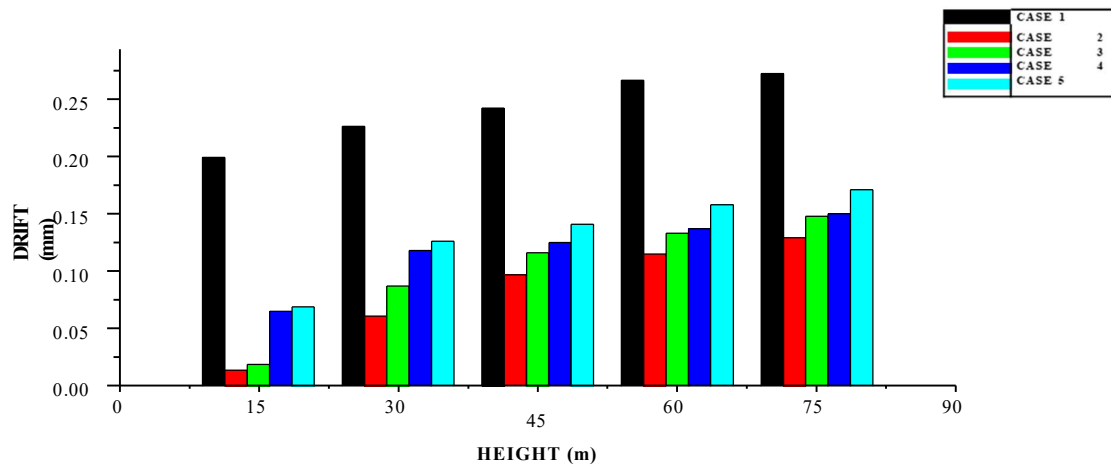


Figure 5.1.3: Drift Graph for Zone 2 Hard Soil

5.1 Zone 2 Hard Soil having N above 30, where N is the standard penetration value

From the respective table for the hard soil in the seismic zone 2, for the bare frames the maximum storey drift is observed for 75 m, with base shear 525 KN, with time period 2.2544 sec the maximum storey displacement is 8.67 mm and maximum story drift is 0.272 mm.

From the respective table for the hard soil in the seismic zone 2, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 5.13 mm and maximum story drift is 0.129 mm.

From the respective table for the hard soil in the seismic zone 2, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 5.86 mm and maximum story drift is 0.148 mm.

From the respective table for the hard soil in the seismic zone 2, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 6.13 mm and maximum story drift is 0.150 mm.

From the respective table for the hard soil in the seismic zone 2, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 6.95 mm and maximum story drift is 0.171 mm.

From the figure 6.1 the case 1 is having the maximum displacement for the case 1, similarly from the figure 6.2 and 6.3 the displacement and drift are maximum for the case 1 respectively.

5.2 Zone 2 Medium Soil (All soils with N between 10 and 30)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	515	0.4113	1.46	0.203
30	749	0.8538	4.10	0.303
45	718	1.2990	6.41	0.319
60	716	1.7703	8.92	0.330
75	705	2.2544	11.71	0.336

Table 5.2.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	558	0.1156	0.12	0.014
30	1077	0.3249	1.00	0.061
45	1505	0.5989	3.25	0.135
60	1350	0.9216	4.96	0.154
75	1282	1.2759	6.83	0.172

Table 5.2.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	553	0.1340	0.16	0.019
30	1072	0.3853	1.38	0.087
45	1319	0.7061	3.81	0.159
60	1196	1.0728	5.72	0.178
75	1141	1.4653	7.87	0.196

Table 5.2.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	535	0.2402	0.49	0.065
30	1030	0.5208	2.41	0.148
45	1021	0.8367	4.20	0.169
60	980	1.1953	6.03	0.182
75	964	1.5864	8.24	0.200

Table 5.2.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	527	0.2528	0.55	0.069
30	996	0.5702	2.85	0.170
45	931	0.9326	4.76	0.191
60	893	1.3411	6.88	0.210
75	889	1.7806	9.36	0.260

Table 5.2.5: Results of Bracings at corners

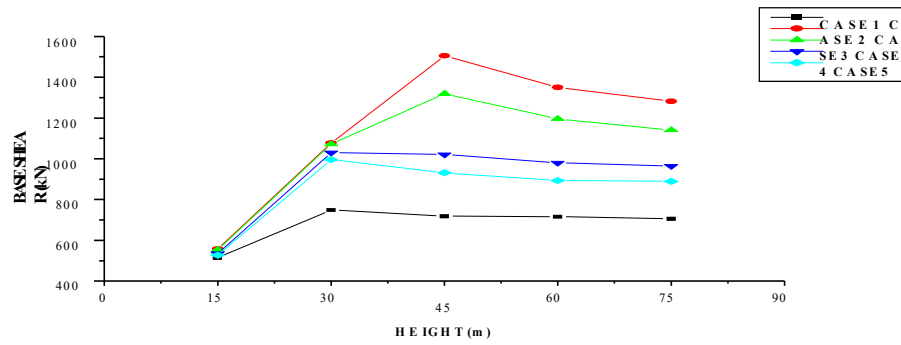


Figure 5.2.1: Height v/s Base Shear for Zone 2 Medium Soil

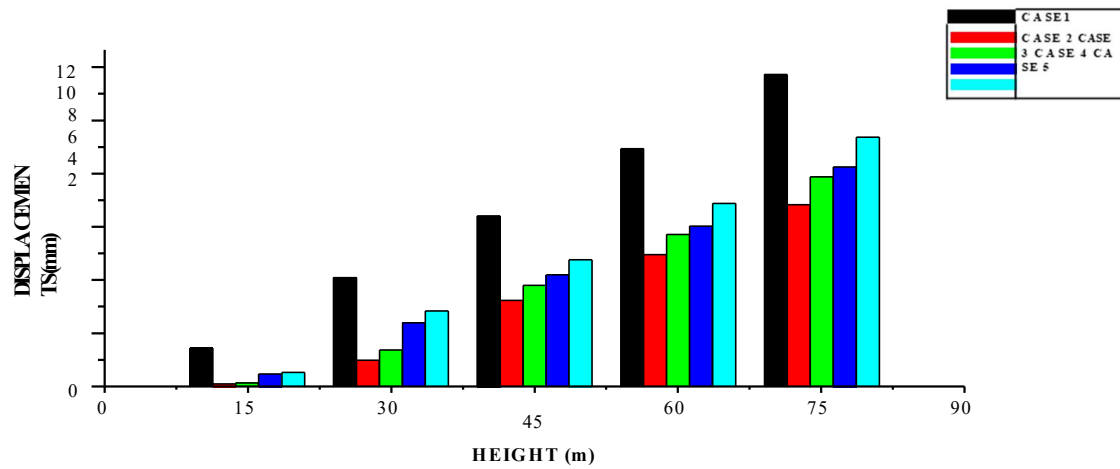


Figure 5.2.2: Displacement Graph for Zone 2 Medium Soil

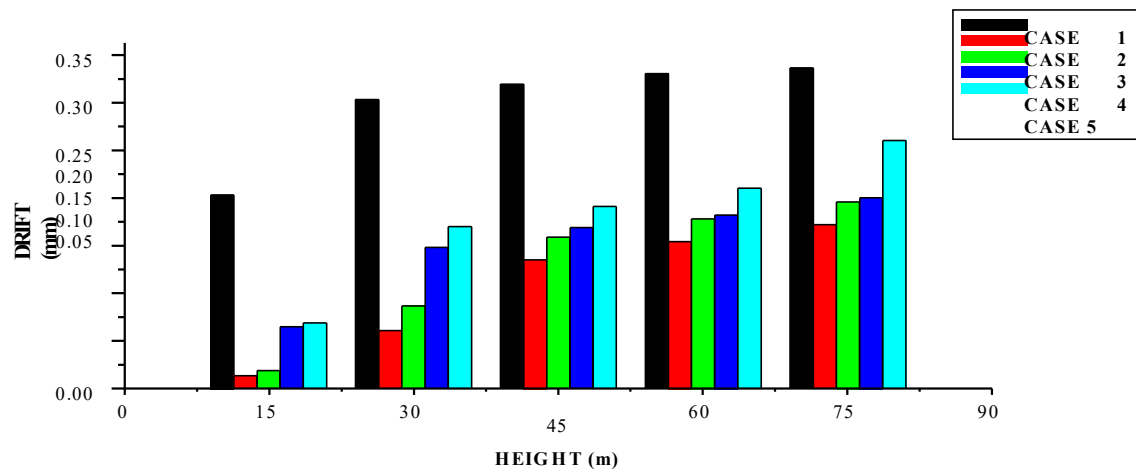


Figure 5.2.3: Drift Graph for Zone 2 Medium Soil

5.2 ZONE 2 (MEDIUM SOIL)

From the respective table for the medium soil in the seismic zone 2, for the bare frames the maximum storey drift is observed for 75 m, with base shear 705 KN, with time period 2.2544 sec the maximum storey displacement is 11.71 mm and maximum story drift is 0.336 mm.

From the respective table for the medium soil in the seismic zone 2, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 6.83 mm and maximum story drift is 0.172 mm.

From the respective table for the medium soil in the seismic zone 2, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 7.87 mm and maximum story drift is 0.196 mm.

From the respective table for the medium soil in the seismic zone 2, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 8.24 mm and maximum story drift is 0.200 mm.

From the respective table for the medium soil in the seismic zone 2, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 9.36 mm and maximum story drift is 0.260 mm.

From the figure 6.4 the case 1 is having the maximum displacement for the case 1, similarly from the figure 6.5 and 6.6 the displacement and drift are maximum for the case 1 respectively.

5.3 Zone 2 Soft Soil (All soils SP with $N < 10$)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	515	0.4113	1.46	0.203
30	898	0.8538	5.00	0.370
45	868	1.2990	7.80	0.384
60	854	1.7703	10.88	0.410
75	840	2.2544	14.22	0.490

Table 5.3.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	558	0.1156	0.12	0.014
30	1077	0.3249	1.00	0.061
45	1578	0.5989	3.76	0.143
60	1606	0.9216	6.06	0.188
75	1496	1.2759	8.40	0.209

Table 5.3.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	553	0.1340	0.16	0.019
30	1072	0.3853	1.38	0.087
45	1542	0.7061	4.56	0.190
60	1415	1.0728	7.00	0.210
75	1348	1.4653	9.58	0.239

Table 5.3.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	535	0.2402	0.49	0.065
30	1030	0.5208	2.41	0.148
45	1237	0.8367	5.14	0.207
60	1169	1.1953	7.40	0.222
75	1125	1.5864	10.20	0.260

Table 5.3.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	527	0.2528	0.55	0.069
30	1010	0.5702	2.92	0.175
45	1123	0.9326	5.80	0.233
60	1058	1.3411	8.43	0.255
75	1029	1.7806	11.40	0.278

Table 5.3.5: Results of Bracings at corners

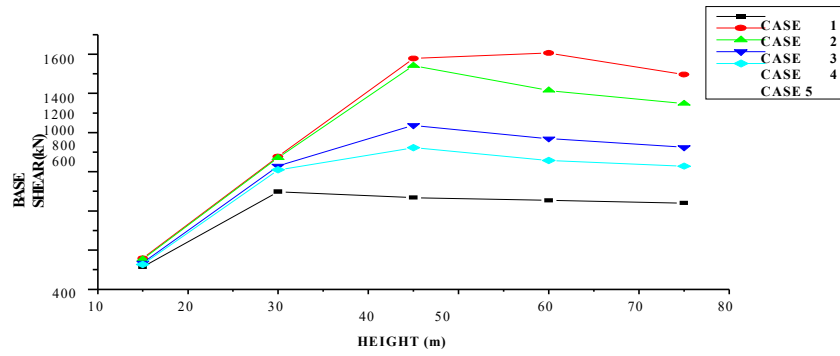


Figure 5.3.1: Height v/s Base Shear for Zone 2 Soft Soil

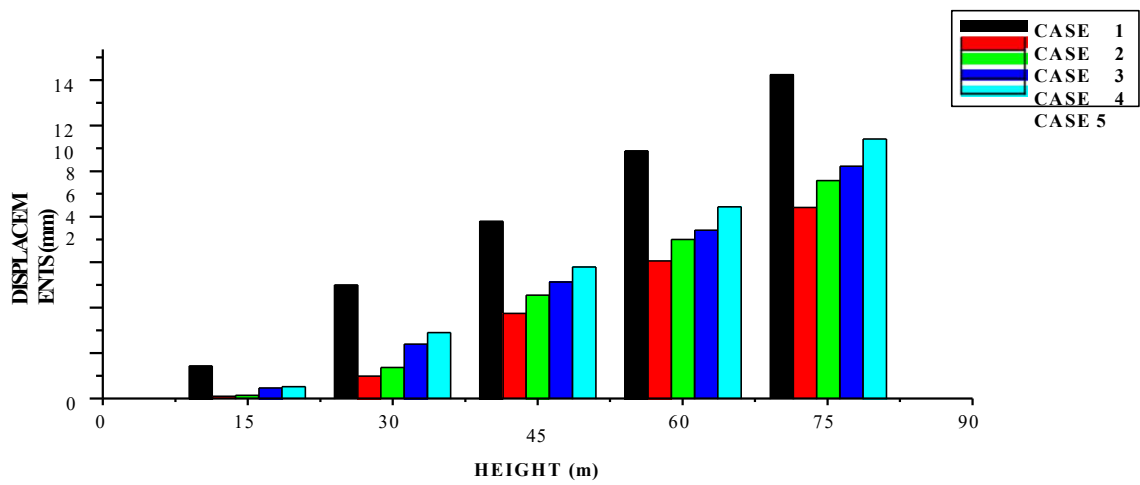


Figure 5.3.2: Displacement Graph for Zone 2 Soft Soil

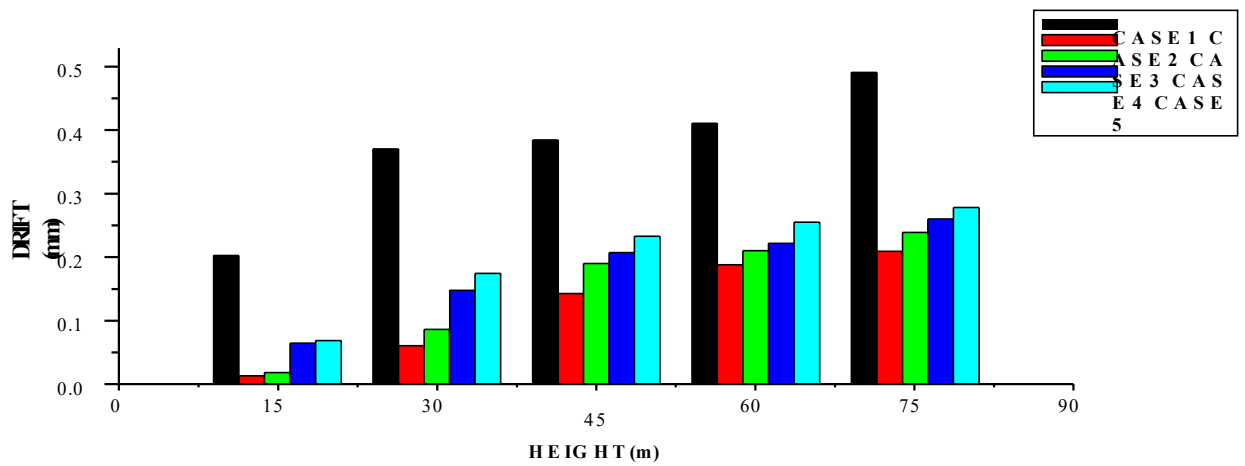


Figure 5.3.3: Drift Graph for Zone 2 Soft Soil

5.3 ZONE 2 (SOFT SOIL)

From the respective table for the soft soil in the seismic zone 2, for the bare frames the maximum storey drift is observed for 75 m, with base shear 840 KN, with time period 2.2544 sec the maximum storey displacement is 14.22 mm and maximum story drift is 0.490 mm.

From the respective table for the soft soil in the seismic zone 2, for the shear wall in the middle for the height 75 m with base shear 1496 KN, time period 1.2759 sec the maximum storey displacement is 8.40 mm and maximum story drift is 0.209 mm.

From the respective table for the soft soil in the seismic zone 2, for the shear wall in the corner for the height 75 m with base shear 1348 KN, time period 1.4653 sec the maximum storey displacement is 9.58 mm and maximum story drift is 0.239 mm.

From the respective table for the soft soil in the seismic zone 2, for the bracings in the middle for the height 75 m with base shear 1125 KN, time period 1.5864 sec the maximum storey displacement is 10.20 mm and maximum story drift is 0.260 mm.

From the respective table for the soft soil in the seismic zone 2, for the bracing in the corners for the height 75 m with base shear 1029 KN, time period 1.7806 sec the maximum storey displacement is 11.40 mm and maximum story drift is 0.278 mm.

From the figure 6.7 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.8 and 6.9 the displacement and drift are maximum for the case 1 respectively.

5.4 Zone 3 Hard Soil (having N above 30, where N is the standard penetration value.)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	809	0.4113	2.31	0.318
30	888	0.8538	4.89	0.362
45	877	1.2990	7.67	0.388
60	860	1.7703	10.54	0.393
75	840	2.2544	13.92	0.410

Table 5.4.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	894	0.1156	0.19	0.022
30	1723	0.3249	1.59	0.098
45	1801	0.5989	3.73	0.154
60	1707	0.9216	5.86	0.184
75	1683	1.2759	8.20	0.206

Table 5.4.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	886	0.1340	0.25	0.029
30	1716	0.3853	2.33	0.139
45	1588	0.7061	4.44	0.185
60	1528	1.0728	6.76	0.213
75	1518	1.4653	9.40	0.237

Table 5.4.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	856	0.2402	0.78	0.104
30	1373	0.5208	3.09	0.190
45	1240	0.8367	5.00	0.210
60	1232	1.1953	7.26	0.229
75	1212	1.5864	9.79	0.240

Table 5.4.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	843	0.2528	0.88	0.111
30	1241	0.5702	3.38	0.201
45	1142	0.9326	5.66	0.226
60	1140	1.3411	8.28	0.253
75	1096	1.7806	11.14	0.274

Table 5.4.5: Results of Bracings at corners

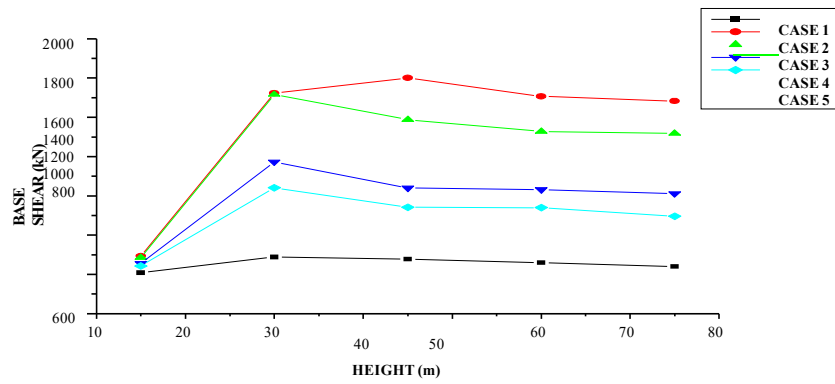


Figure 5.4.1: Height v/s Base Shear for Zone 3 Hard Soil

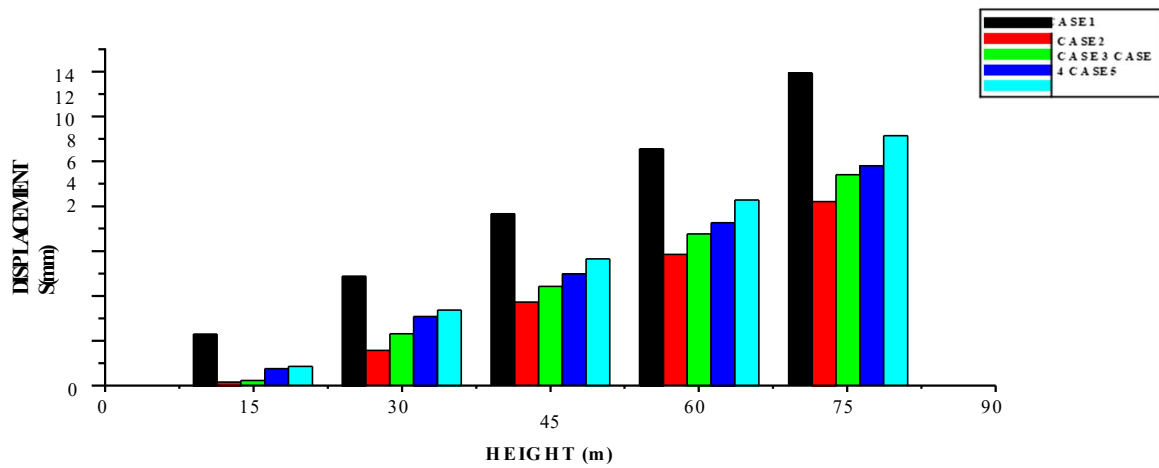


Figure 5.4.2: Displacement Graph for Zone 3 Hard Soil

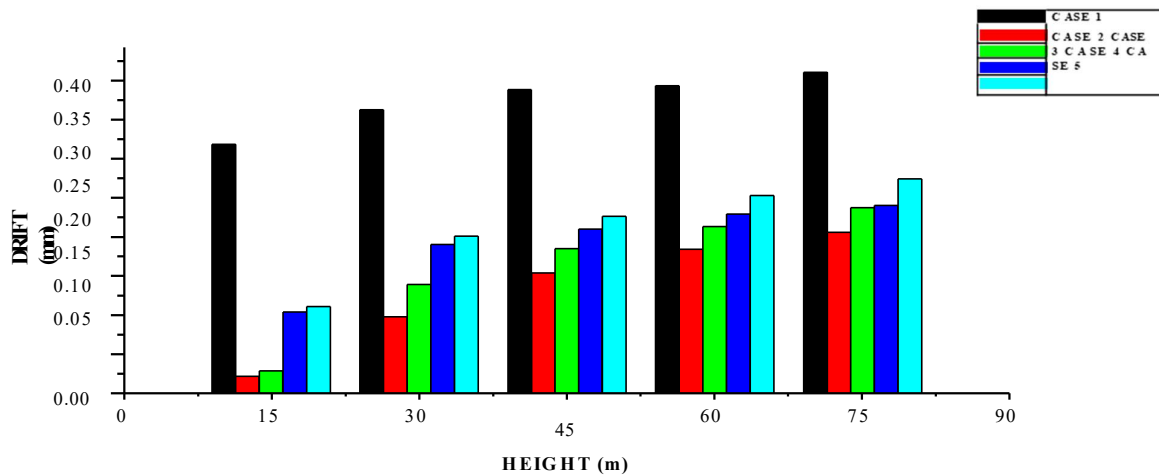


Figure 5.4.3: Drift Graph for Zone 3 Hard Soil

5.4 ZONE 3 (HARD SOIL)

From the respective table for the hard soil in the seismic zone 3, for the bare frames the maximum storey drift is observed for 75 m, with base shear 840 KN, with time period 2.2544 sec the maximum storey displacement is 13.92 mm and maximum story drift is 0.410 mm.

From the respective table for the hard soil in the seismic zone 3, for the shear wall in the middle for the height 75 m with base shear 1683 KN, time period 1.2759 sec the maximum storey displacement is 8.20 mm and maximum story drift is 0.206 mm.

From the respective table for the hard soil in the seismic zone 3, for the shear wall in the corner for the height 75 m with base shear 1518 KN, time period 1.4653 sec the maximum storey displacement is 9.40 mm and maximum story drift is 0.237 mm.

From the respective table for the hard soil in the seismic zone 3, for the bracings in the middle for the height 75 m with base shear 1212 KN, time period 1.5864 sec the maximum storey displacement is 9.79 mm and maximum story drift is 0.240 mm.

From the respective table for the hard soil in the seismic zone 3, for the bracing in the corners for the height 75 m with base shear 1096 KN, time period 1.7806 sec the maximum storey displacement is 11.14 mm and maximum story drift is 0.274 mm.

From the figure 6.10 the case 1 is having the maximum displacement for the case 1, similarly from the figure 6.11 and 6.12 the displacement and drift are maximum for the case 1 respectively.

5.5 Zone 3 Medium Soil (All soils with N between 10 and 30)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	824	0.4113	2.34	0.324
30	1198	0.8538	6.58	0.485
45	1149	1.2990	10.54	0.510
60	1147	1.7703	14.35	0.529
75	1129	2.2544	18.81	0.540

Table 5.5.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	889	0.1156	0.20	0.025
30	1723	0.3249	1.62	0.105
45	2408	0.5989	5.20	0.215
60	2160	0.9216	7.91	0.247
75	2051	1.2759	11.10	0.275

Table 5.5.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	886	0.1340	0.31	0.030
30	1716	0.3853	2.67	0.145
45	2110	0.7061	6.13	0.254
60	1913	1.0728	9.15	0.285
75	1856	1.4653	12.62	0.314

Table 5.5.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	856	0.2402	0.81	0.110
30	1649	0.5208	3.85	0.237
45	1634	0.8367	6.34	0.270
60	1568	1.1953	9.74	0.292
75	1543	1.5864	13.18	0.320

Table 5.5.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	843	0.2528	0.92	0.121
30	1593	0.5702	4.56	0.272
45	1490	0.9326	7.62	0.305
60	1429	1.3411	11.10	0.336
75	1423	1.7806	15.09	0.368

Table 5.5.5: Results of Bracings at corners

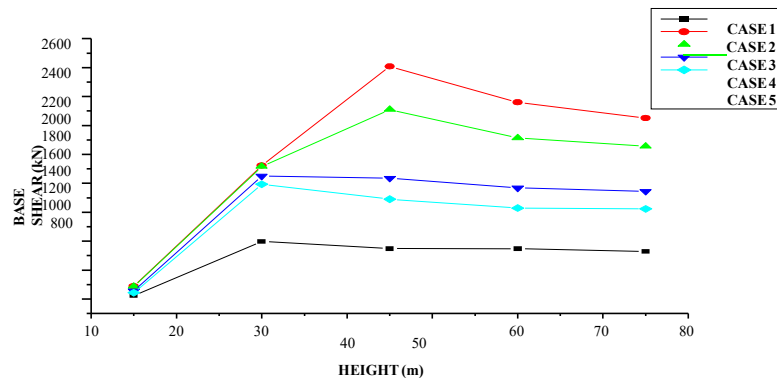


Figure 5.5.1: Height v/s Base Shear for Zone 3 Medium Soil

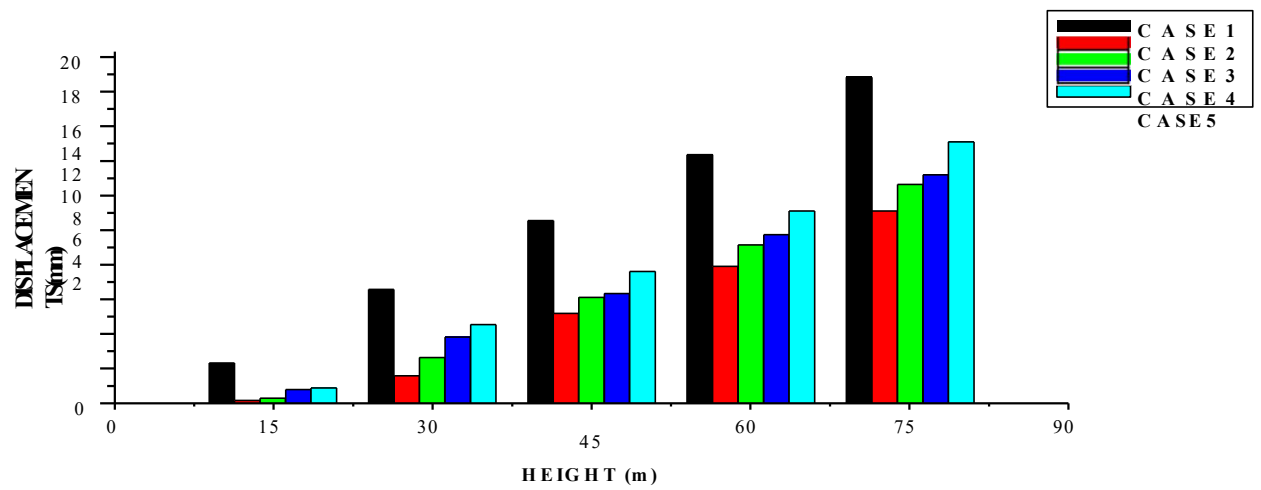


Figure 5.5.2: Displacement Graph for Zone 3 Medium Soil

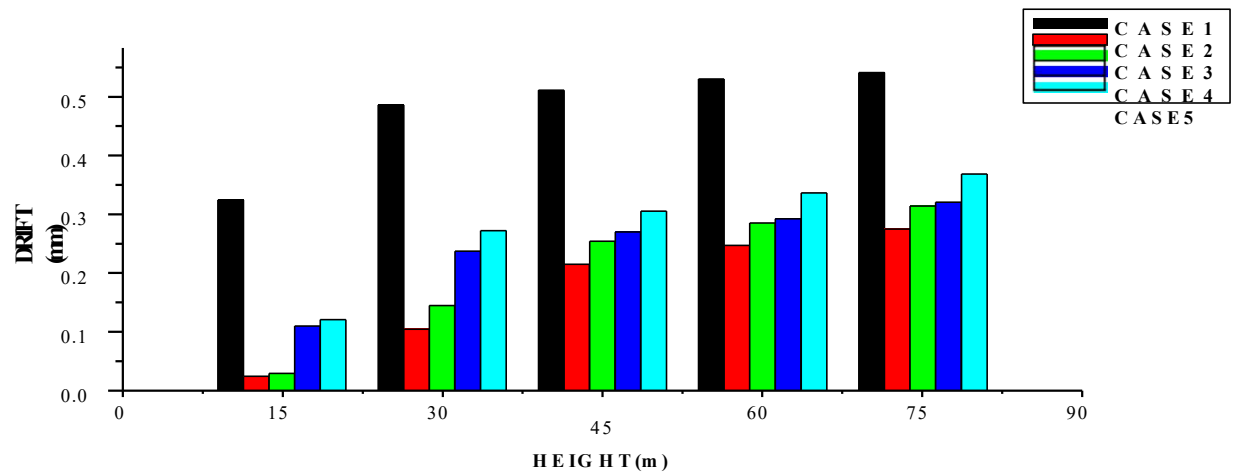


Figure 5.5.3: Drift Graph for Zone 3 Medium Soil

5.5 ZONE 3 (MEDIUM SOIL)

From the respective table for the medium soil in the seismic zone 3, for the bare frames the maximum storey drift is observed for 75 m, with base shear 705 KN, with time period 2.2544 sec the maximum storey displacement is 11.71 mm and maximum story drift is 0.336 mm.

From the respective table for the medium soil in the seismic zone 3, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 6.83 mm and maximum story drift is 0.172 mm.

From the respective table for the medium soil in the seismic zone 3, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 7.87 mm and maximum story drift is 0.196 mm.

From the respective table for the medium soil in the seismic zone 3, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 8.24 mm and maximum story drift is 0.200 mm.

From the respective table for the medium soil in the seismic zone 3, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 9.36 mm and maximum story drift is 0.260 mm.

From the figure 6.13 the case 1 is having the maximum displacement for the case 1, similarly from the figure 6.14 and 6.15 the displacement and drift are maximum for the case 1 respectively.

5.6 Zone 3 Soft Soil (All soils SP with $N < 10$)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STOREY DISPLACEMENTS (mm)	MAX. STOREY DRIFT (mm)
15	824	0.4113	2.34	0.324
30	1438	0.8538	8.10	0.592
45	1389	1.2990	12.44	0.615
60	1366	1.7703	17.40	0.632
75	1352	2.2544	22.69	0.652

Table 5.6.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	894	0.1156	0.22	0.028
30	1723	0.3249	1.73	0.135
45	2525	0.5989	5.55	0.229
60	2569	0.9216	9.70	0.301
75	2393	1.2759	13.62	0.334

Table 5.6.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	886	0.1340	0.40	0.042
30	1716	0.3853	3.20	0.185
45	2468	0.7061	7.30	0.303
60	2264	1.0728	11.23	0.346
75	2156	1.4653	15.31	0.382

Table 5.6.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	856	0.2402	0.85	0.115
30	1649	0.5208	4.35	0.260
45	1980	0.8367	8.18	0.331
60	1871	1.1953	11.92	0.355
75	1801	1.5864	16.10	0.388

Table 5.6.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	843	0.2528	0.98	0.130
30	1617	0.5702	4.68	0.290
45	1798	0.9326	9.31	0.373
60	1693	1.3411	13.62	0.398
75	1647	1.7806	18.10	0.419

Table 5.6.5: Results of Bracings at corners

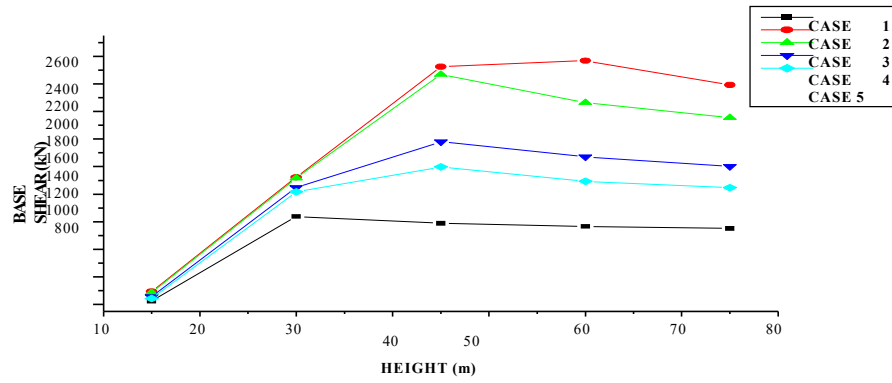


Figure 5.6.1: Height v/s Base Shear for Zone 3 Soft Soil

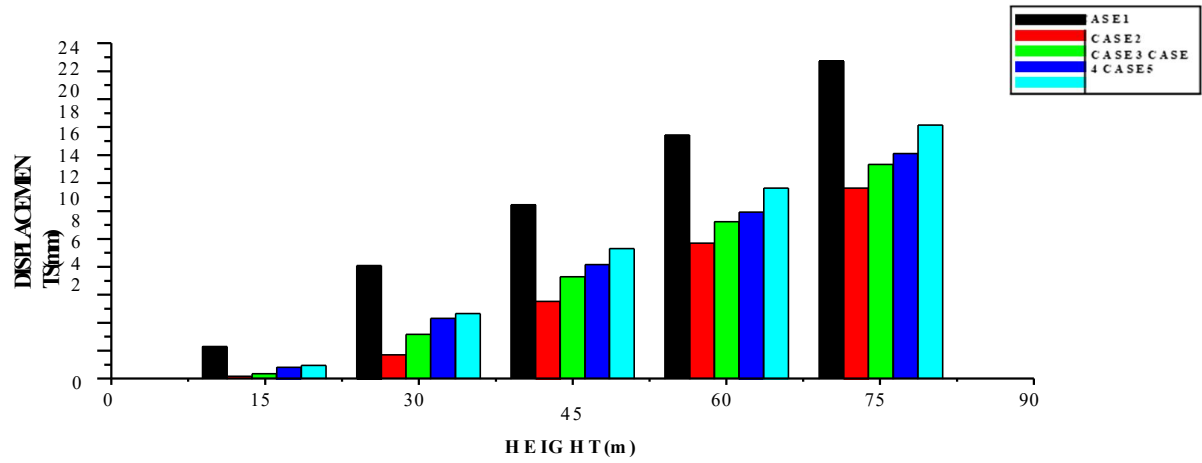


Figure 5.6.2: Displacement Graph for Zone 3 Soft Soil

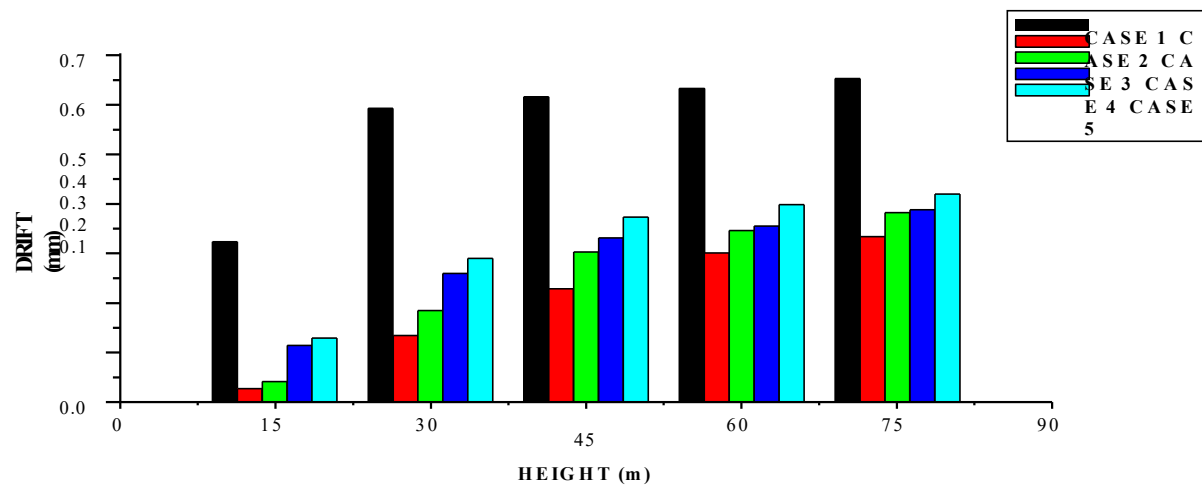


Figure 5.6.3: Drift Graph for Zone 3 Soft Soil

5.6 ZONE 3 (SOFT SOIL)

From the respective table for the soft soil in the seismic zone 3, for the bare frames the maximum storey drift is observed for 75 m, with base shear 840 KN, with time period 2.2544 sec the maximum storey displacement is 14.22 mm and maximum story drift is 0.490 mm.

From the respective table for the soft soil in the seismic zone 3, for the shear wall in the middle for the height 75 m with base shear 1496 KN, time period 1.2759 sec the maximum storey displacement is 8.40 mm and maximum story drift is 0.209 mm.

From the respective table for the soft soil in the seismic zone 3, for the shear wall in the corner for the height 75 m with base shear 1348 KN, time period 1.4653 sec the maximum storey displacement is 9.58 mm and maximum story drift is 0.239 mm.

From the respective table for the soft soil in the seismic zone 3, for the bracings in the middle for the height 75 m with base shear 1125 KN, time period 1.5864 sec the maximum storey displacement is 10.20 mm and maximum story drift is 0.260 mm.

From the respective table for the soft soil in the seismic zone 3, for the bracing in the corners for the height 75 m with base shear 1029 KN, time period 1.7806 sec the maximum storey displacement is 11.40 mm and maximum story drift is 0.278 mm.

From the figure 6.16 the case 1 is having the maximum displacement for the case 1, similarly from the figure 6.17 and 6.18 the displacement and drift are maximum for the case 1 respectively.

5.7 Zone 4 Results

Zone 4 Hard Soil (having N above 30, where N is the standard penetration value.)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1214	0.4113	3.45	0.478
30	1332	0.8538	7.33	0.543
45	1316	1.2990	11.58	0.581
60	1291	1.7703	15.88	0.592
75	1261	2.2544	20.86	0.610

Table 5.7.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1341	0.1156	0.28	0.032
30	2585	0.3249	2.40	0.147
45	2702	0.5989	5.60	0.232
60	2561	0.9216	8.84	0.275
75	2524	1.2759	12.40	0.310

Table 5.7.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1329	0.1340	0.38	0.045
30	2574	0.3853	3.35	0.208
45	2383	0.7061	6.66	0.277
60	2292	1.0728	10.05	0.319
75	2272	1.4653	14.18	0.355

Table 5.7.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1284	0.2402	1.18	0.156
30	2060	0.5208	4.63	0.285
45	1860	0.8367	7.48	0.301
60	1848	1.1953	10.84	0.328
75	1818	1.5864	14.83	0.360

Table 5.7.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1265	0.2528	1.31	0.167
30	1862	0.5702	5.03	0.302
45	1713	0.9326	8.46	0.339
60	1710	1.3411	12.50	0.380
75	1645	1.7806	16.70	0.441

Table 5.7.5: Results of Bracings at corners

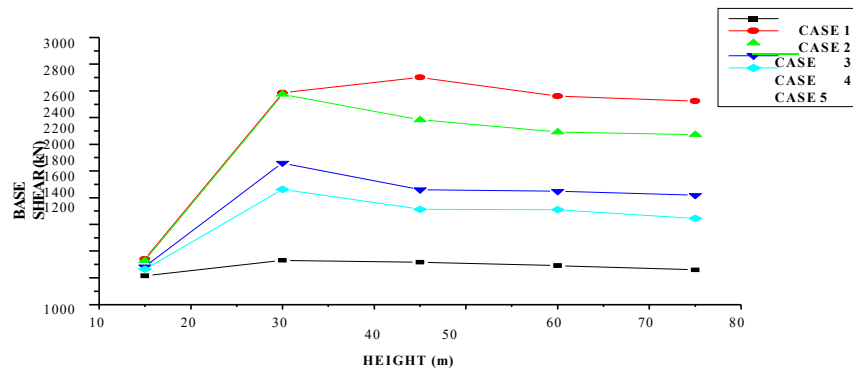


Figure 5.7.1: Height v/s Base Shear for Zone 4 Hard Soil

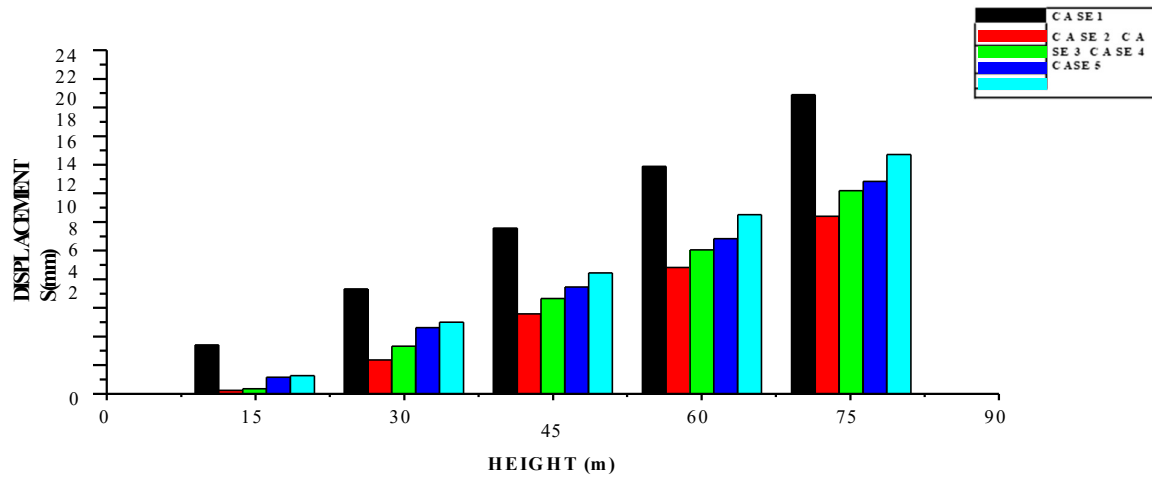


Figure 5.7.2: Displacement Graph for Zone 4 Hard Soil

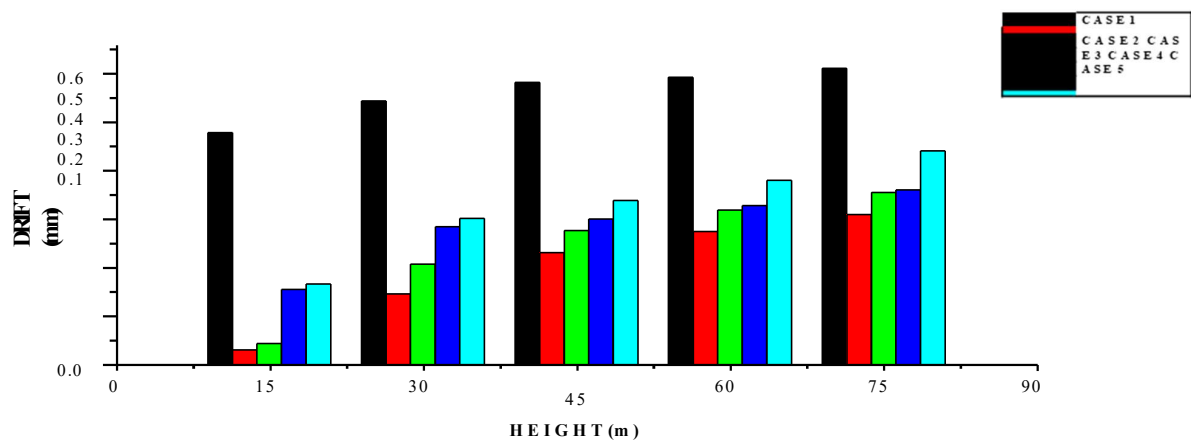


Figure 5.7.3: Drift Graph for Zone 4 Hard Soil

5.7 ZONE 4 (HARD SOIL)

From the respective table for the hard soil in the seismic zone 4, for the bare frames the maximum storey drift is observed for 75 m, with base shear 525 KN, with time period 2.2544 sec the maximum storey displacement is 8.67 mm and maximum story drift is 0.272 mm.

From the respective table for the hard soil in the seismic zone 4, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 5.13 mm and maximum story drift is 0.129 mm.

From the respective table for the hard soil in the seismic zone 4, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 5.86 mm and maximum story drift is 0.148 mm.

From the respective table for the hard soil in the seismic zone 4, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 6.13 mm and maximum story drift is 0.150 mm.

From the respective table for the hard soil in the seismic zone 4, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 6.95 mm and maximum story drift is 0.171 mm.

From the figure 6.19 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.20 and 6.21 the displacement and drift are maximum for the case 1 respectively.

5.8 Zone 4 Medium Soil (All soils with N between 10 and 30)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1236	0.4113	3.52	0.487
30	1798	0.8538	9.87	0.728
45	1724	1.2990	15.39	0.765
60	1720	1.7703	21.49	0.793
75	1693	2.2544	28.13	0.806

Table 5.8.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1341	0.1156	0.30	0.038
30	2585	0.3249	3.20	0.185
45	3612	0.5989	7.81	0.322
60	3240	0.9216	11.98	0.370
75	3077	1.2759	16.70	0.412

Table 5.8.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1329	0.1340	0.42	0.065
30	2574	0.3853	4.35	0.260
45	3165	0.7061	9.20	0.381
60	2870	1.0728	13.79	0.427
75	2785	1.4653	18.95	0.471

Table 5.8.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1284	0.2402	1.32	0.180
30	2473	0.5208	5.78	0.356
45	2451	0.8367	10.10	0.406
60	2353	1.1953	14.61	0.438
75	2314	1.5864	19.89	0.480

Table 5.8.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1265	0.2528	1.92	0.250
30	2390	0.5702	6.84	0.409
45	2235	0.9326	11.49	0.457
60	2144	1.3411	17.65	0.505
75	2135	1.7806	22.25	0.552

Table 5.8.5: Results of Bracings at corners

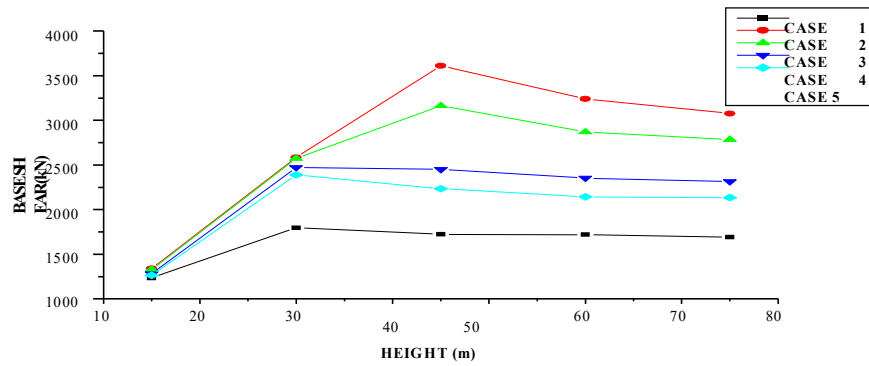


Figure 5.8.1: Height v/s Base Shear for Zone 4 Medium Soil

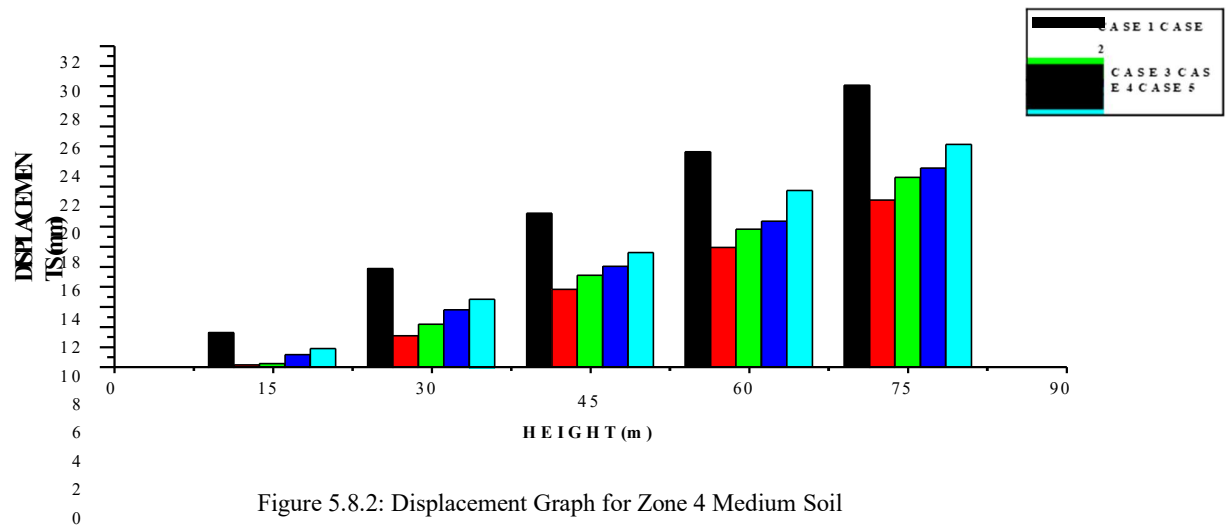


Figure 5.8.2: Displacement Graph for Zone 4 Medium Soil

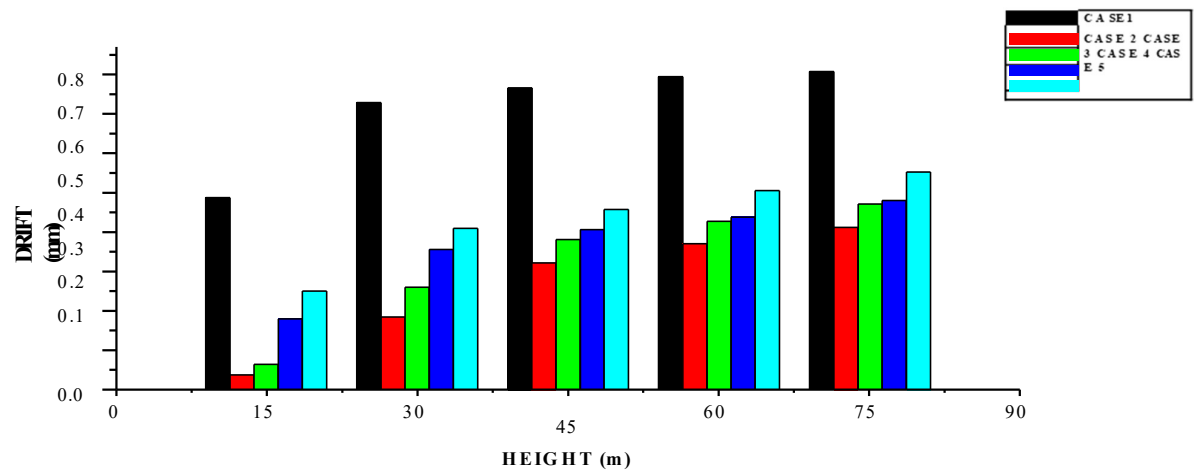


Figure 5.8.3: Drift Graph for Zone 4 Medium Soil

5.8 ZONE 4 (MEDIUM SOIL)

From the respective table for the medium soil in the seismic zone 4, for the bare frames the maximum storey drift is observed for 75 m, with base shear 705 KN, with time period 2.2544 sec the maximum storey displacement is 11.71 mm and maximum story drift is 0.336 mm.

From the respective table for the medium soil in the seismic zone 4, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 6.83 mm and maximum story drift is 0.172 mm.

From the respective table for the medium soil in the seismic zone 4, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 7.87 mm and maximum story drift is 0.196 mm.

From the respective table for the medium soil in the seismic zone 4, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 8.24 mm and maximum story drift is 0.200 mm.

From the respective table for the medium soil in the seismic zone 4, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 9.36 mm and maximum story drift is 0.260 mm.

From the figure 6.22 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.23 and 6.24 the displacement and drift are maximum for the case 1 respectively.

5.9 Zone 4 Soft Soil (All soils SP with $N < 10$)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1236	0.4113	3.52	0.487
30	2157	0.8538	12.10	0.888
45	2084	1.2990	18.81	0.922
60	2049	1.7703	26.00	0.947
75	2036	2.2544	34.34	0.978

Table 5.9.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1341	0.1156	0.30	0.038
30	2585	0.3249	3.20	0.185
45	3788	0.5989	8.32	0.344
60	3854	0.9216	14.66	0.452
75	3590	1.2759	20.95	0.501

Table 5.9.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1329	0.1340	0.42	0.065
30	2574	0.3853	5.95	0.260
45	3702	0.7061	11.02	0.454
60	3397	1.0728	16.91	0.521
75	3235	1.4653	23.04	0.573

Table 5.9.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1284	0.2402	1.32	0.180
30	2473	0.5208	6.59	0.356
45	2970	0.8367	12.31	0.494
60	2806	1.1953	17.78	0.534
75	2701	1.5864	24.10	0.583

Table 5.9.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1265	0.2528	1.92	0.250
30	2390	0.5702	7.38	0.409
45	2697	0.9326	14.10	0.559
60	2539	1.3411	20.15	0.613
75	2471	1.7806	27.32	0.668

Table 5.9.5: Results of Bracings at corners

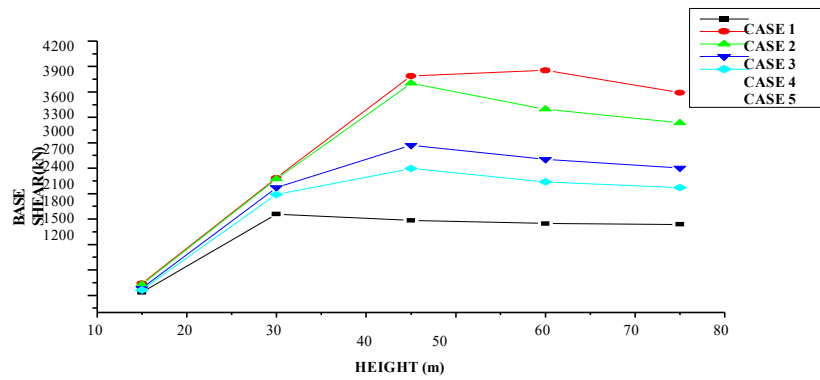


Figure 5.9.1: Height v/s Base Shear for Zone 4 Soft Soil

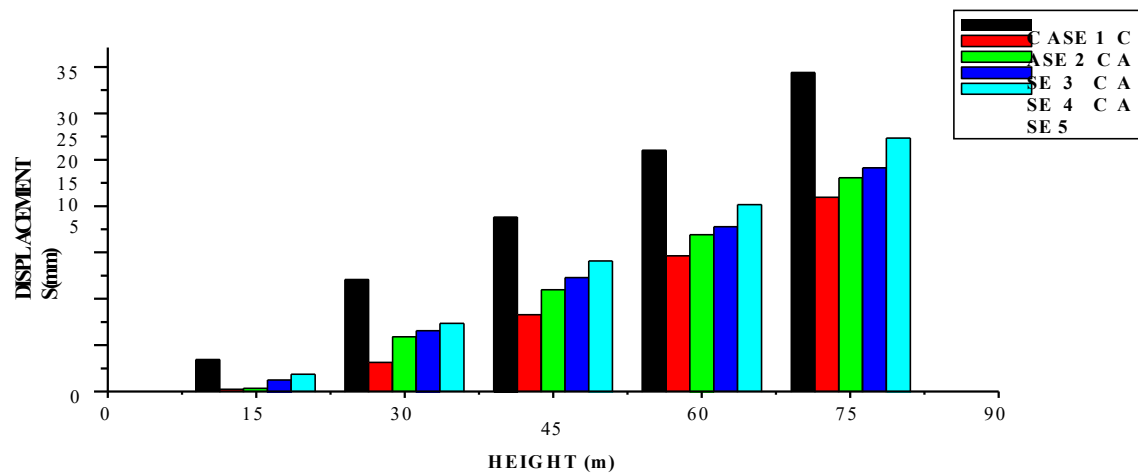


Figure 5.9.2: Displacement Graph for Zone 4 Soft Soil

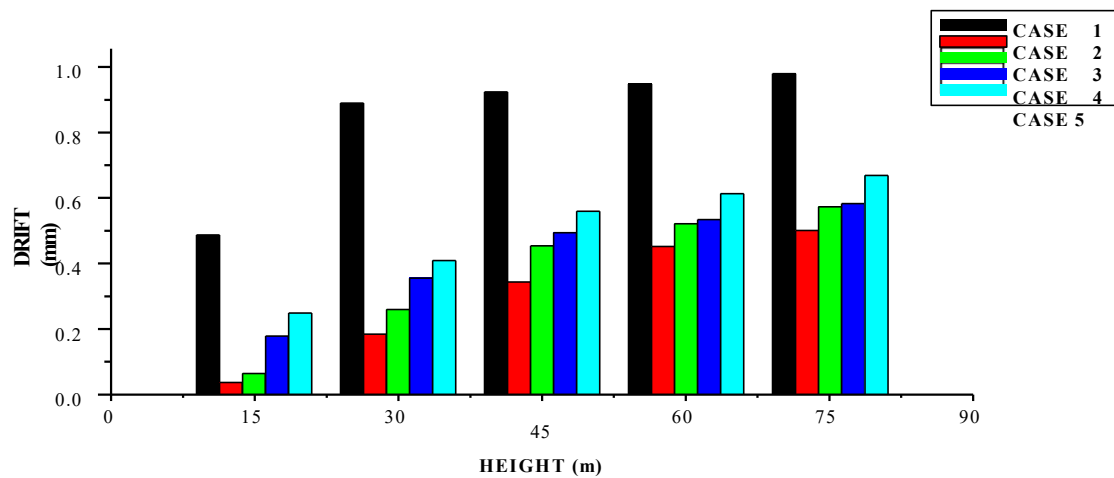


Figure 5.9.3: Drift Graph for Zone 4 Soft Soil

5.9 ZONE 4 (SOFT SOIL)

From the respective table for the soft soil in the seismic zone 4, for the bare frames the maximum storey drift is observed for 75 m, with base shear 840 KN, with time period 2.2544 sec the maximum storey displacement is 14.22 mm and maximum story drift is 0.490 mm.

From the respective table for the soft soil in the seismic zone 4, for the shear wall in the middle for the height 75 m with base shear 1496 KN, time period 1.2759 sec the maximum storey displacement is 8.40 mm and maximum story drift is 0.209 mm.

From the respective table for the soft soil in the seismic zone 4, for the shear wall in the corner for the height 75 m with base shear 1348 KN, time period 1.4653 sec the maximum storey displacement is 9.58 mm and maximum story drift is 0.239 mm.

From the respective table for the soft soil in the seismic zone 4, for the bracings in the middle for the height 75 m with base shear 1125 KN, time period 1.5864 sec the maximum storey displacement is 10.20 mm and maximum story drift is 0.260 mm.

From the respective table for the soft soil in the seismic zone 4, for the bracing in the corners for the height 75 m with base shear 1029 KN, time period 1.7806 sec the maximum storey displacement is 11.40 mm and maximum story drift is 0.278 mm.

From the figure 6.25 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.26 and 6.27 the displacement and drift are maximum for the case 1 respectively.

5.10 Zone 5 Results

Zone 5 Hard Soil (having N above 30, where N is the standard penetration value.)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1821	0.4113	5.15	0.620
30	1998	0.8538	11.10	0.815
45	1975	1.2990	17.34	0.872
60	1936	1.7703	23.75	0.885
75	1891	2.2544	31.41	0.903

Table 5.10.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	2011	0.1156	0.42	0.049
30	3878	0.3249	3.56	0.221
45	4053	0.5989	8.37	0.348
60	3842	0.9216	13.31	0.413
75	3787	1.2759	18.60	0.464

Table 5.10.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1956	0.1340	0.57	0.068
30	3861	0.3853	5.02	0.312
45	3574	0.7061	10.00	0.417
60	3438	1.0728	15.31	0.498
75	3425	1.4653	21.35	0.533

Table 5.10.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1926	0.2402	1.77	0.234
30	3090	0.5208	6.94	0.427
45	2791	0.8367	11.27	0.451
60	2773	1.1953	16.37	0.493
75	2727	1.5864	22.27	0.541

Table 5.10.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1898	0.2528	2.02	0.250
30	2793	0.5702	7.55	0.453
45	2570	0.9326	12.75	0.509
60	2565	1.3411	18.70	0.570
75	2468	1.7806	25.15	0.617

Table 5.10.5: Results of Bracings at corners

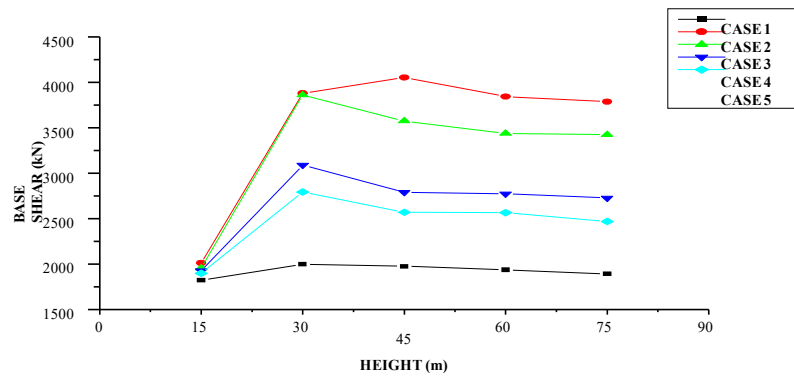


Figure 5.10.1: Height v/s Base Shear for Zone 5 Hard Soil

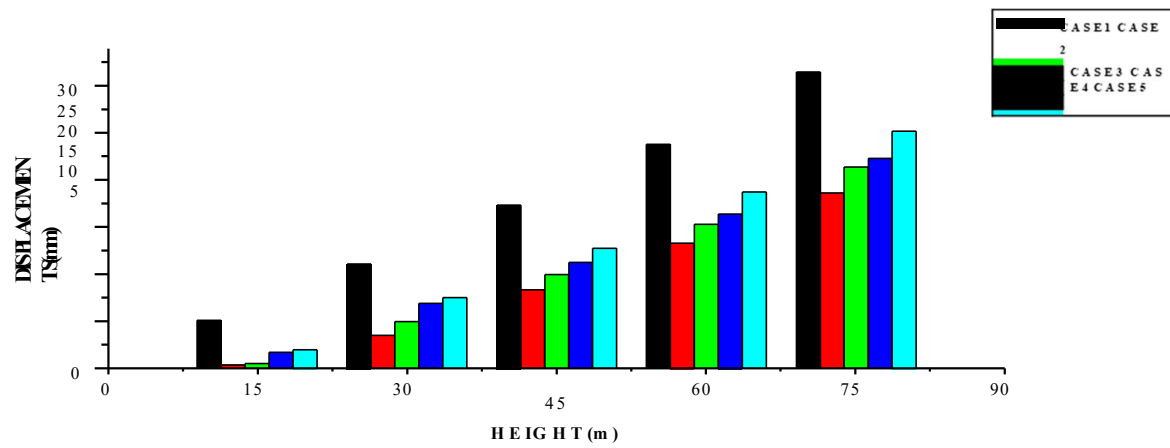


Figure 5.10.2: Displacement Graph for Zone 5 Hard Soil

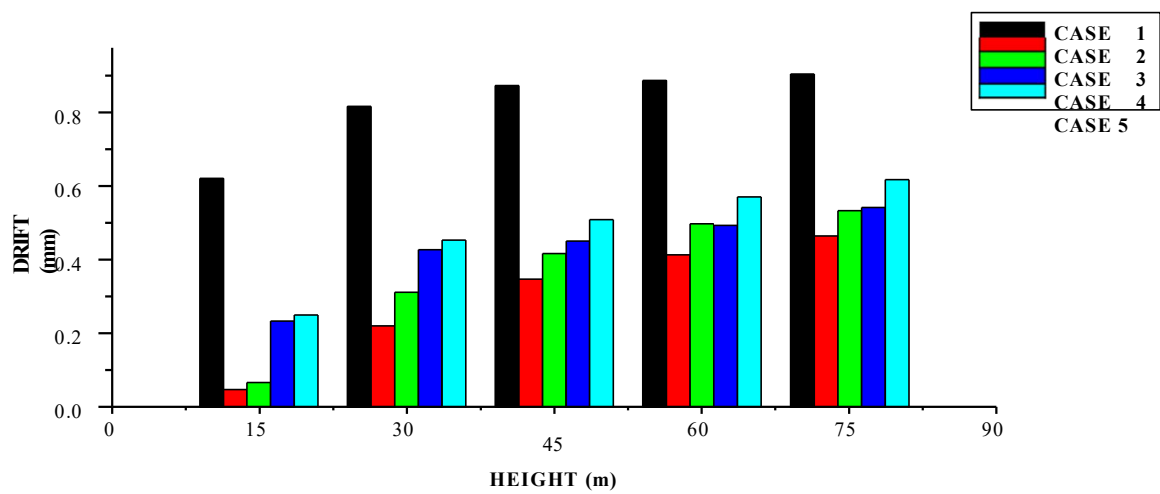


Figure 5.10.3: Drift Graph for Zone 5 Hard Soil

5.10 ZONE 5 (HARD SOIL)

From the respective table for the hard soil in the seismic zone 5, for the bare frames the maximum storey drift is observed for 75 m, with base shear 525 KN, with time period 2.2544 sec the maximum storey displacement is 8.67 mm and maximum story drift is 0.272 mm.

From the respective table for the hard soil in the seismic zone 5, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 5.13 mm and maximum story drift is 0.129 mm.

From the respective table for the hard soil in the seismic zone 5, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 5.86 mm and maximum story drift is 0.148 mm.

From the respective table for the hard soil in the seismic zone 5, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 6.13 mm and maximum story drift is 0.150 mm.

From the respective table for the hard soil in the seismic zone 5, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 6.95 mm and maximum story drift is 0.171 mm.

From the figure 6.28 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.29 and 6.30 the displacement and drift are maximum for the case 1 respectively.

5.11 Zone 5 Medium Soil (All soils with N between 10 and 30)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1855	0.4113	5.29	0.673
30	2697	0.8538	14.79	1.092
45	2587	1.2990	23.11	1.147
60	2581	1.7703	32.10	1.189
75	2540	2.2544	42.26	1.209

Table 5.11.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	2011	0.1156	0.42	0.049
30	3878	0.3249	3.56	0.221
45	5355	0.5989	11.66	0.485
60	4861	0.9216	18.01	0.555
75	4616	1.2759	24.94	0.618

Table 5.11.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1956	0.1340	0.57	0.068
30	3861	0.3853	5.02	0.312
45	4748	0.7061	13.83	0.573
60	4306	1.0728	20.64	0.640
75	4178	1.4653	28.37	0.707

Table 5.11.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1926	0.2402	1.77	0.234
30	3710	0.5208	8.67	0.533
45	3677	0.8367	15.18	0.608
60	3529	1.1953	22.02	0.656
75	3472	1.5864	29.67	0.702

Table 5.11.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1898	0.2528	2.02	0.250
30	3586	0.5702	10.23	0.613
45	3353	0.9326	17.24	0.686
60	3216	1.3411	24.94	0.757
75	3202	1.7806	33.85	0.828

Table 5.11.5: Results of Bracings at corners

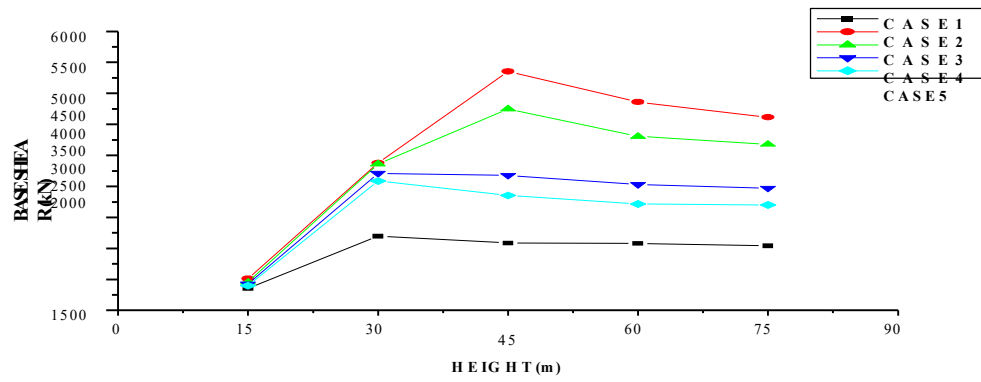


Figure 5.11.1: Height v/s Base Shear for Zone 5 Medium Soil

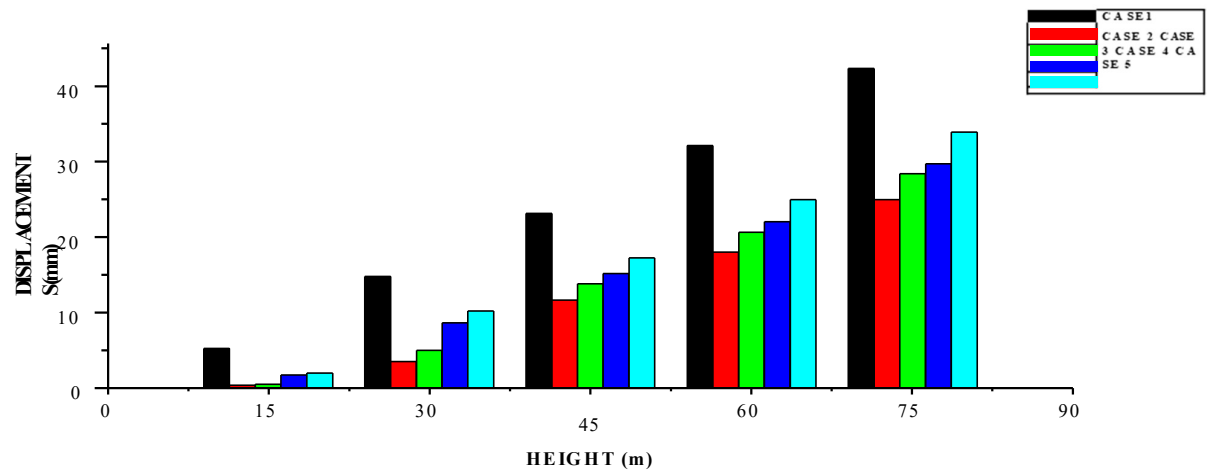


Figure 5.11.2: Displacement Graph for Zone 5 Medium Soil

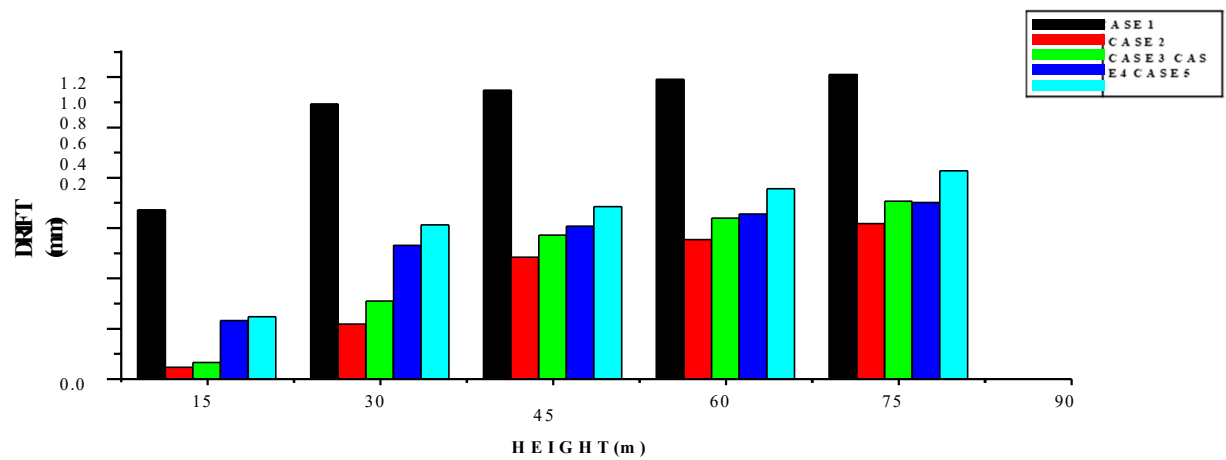


Figure 5.11.3: Drift Graph for Zone 5 Medium Soil

5.11 ZONE 5 (MEDIUM SOIL)

From the respective table for the medium soil in the seismic zone 5, for the bare frames the maximum storey drift is observed for 75 m, with base shear 705 KN, with time period 2.2544 sec the maximum storey displacement is 11.71 mm and maximum story drift is 0.336 mm.

From the respective table for the medium soil in the seismic zone 5, for the shear wall in the middle for the height 75 m with base shear 1054 KN, time period 1.2759 sec the maximum storey displacement is 6.83 mm and maximum story drift is 0.172 mm.

From the respective table for the medium soil in the seismic zone 5, for the shear wall in the corner for the height 75 m with base shear 949 KN, time period 1.4653 sec the maximum storey displacement is 7.87 mm and maximum story drift is 0.196 mm.

From the respective table for the medium soil in the seismic zone 5, for the bracings in the middle for the height 75 m with base shear 757 KN, time period 1.5864 sec the maximum storey displacement is 8.24 mm and maximum story drift is 0.200 mm.

From the respective table for the medium soil in the seismic zone 5, for the bracing in the corners for the height 75 m with base shear 1054 KN, time period 1.7806 sec the maximum storey displacement is 9.36 mm and maximum story drift is 0.260 mm.

From the figure 6.31 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.32 and 6.33 the displacement and drift are maximum for the case 1 respectively.

5.12 Zone 5 Soft Soil (All soils SP with $N < 10$)

BARE FRAME RESULTS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1855	0.4113	5.29	0.673
30	3236	0.8538	18.21	1.332
45	3127	1.2990	28.29	1.383
60	3047	1.7703	39.24	1.421
75	3080	2.2544	51.90	1.467

Table 5.12.1: Results of Bare frame

SHEAR WALL IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	2011	0.1156	0.42	0.049
30	3878	0.3249	3.56	0.221
45	5682	0.5989	12.57	0.517
60	5781	0.9216	22.00	0.677
75	5386	1.2759	29.92	0.751

Table 5.12.2: Results of Shear wall in the middle

SHEAR WALL AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1956	0.1340	0.57	0.068
30	3861	0.3853	5.02	0.312
45	5553	0.7061	16.48	0.681
60	5095	1.0728	25.44	0.781
75	4853	1.4653	34.63	0.859

Table 5.12.3: Results of Shear wall at corners

BRACINGS IN THE MIDDLE

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1926	0.2402	1.77	0.234
30	3710	0.5208	8.67	0.533
45	4455	0.8367	18.59	0.744
60	4210	1.1953	26.91	0.801
75	4052	1.5864	36.42	0.874

Table 5.12.4: Results of Bracings in the middle

BRACINGS AT CORNERS

HEIGHT (m)	BASE SHEAR (kN)	TIME PERIOD (sec)	MAX. STORY DISPLACEMENTS (mm)	MAX. STORY DRIFT (mm)
15	1898	0.2528	2.02	0.250
30	3639	0.5702	10.49	0.629
45	4045	0.9326	21.00	0.839
60	3809	1.3411	29.92	0.919
75	3707	1.7806	40.89	1.002

Table 5.12.5: Results of Bracings at corners

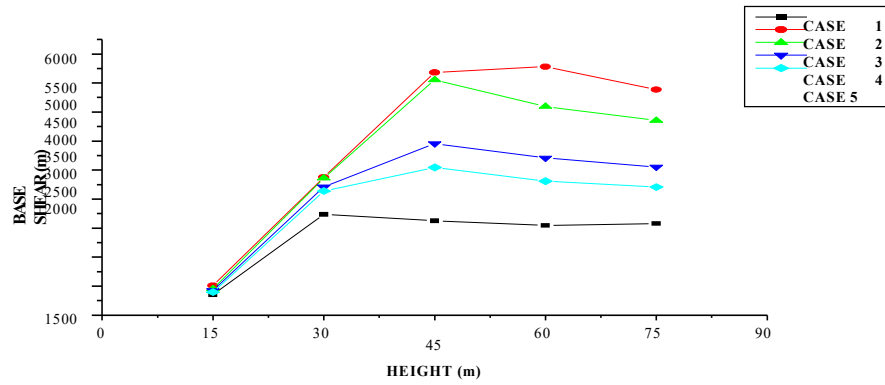


Figure 5.12.1: Height v/s Base Shear for Zone 5 Soft Soil

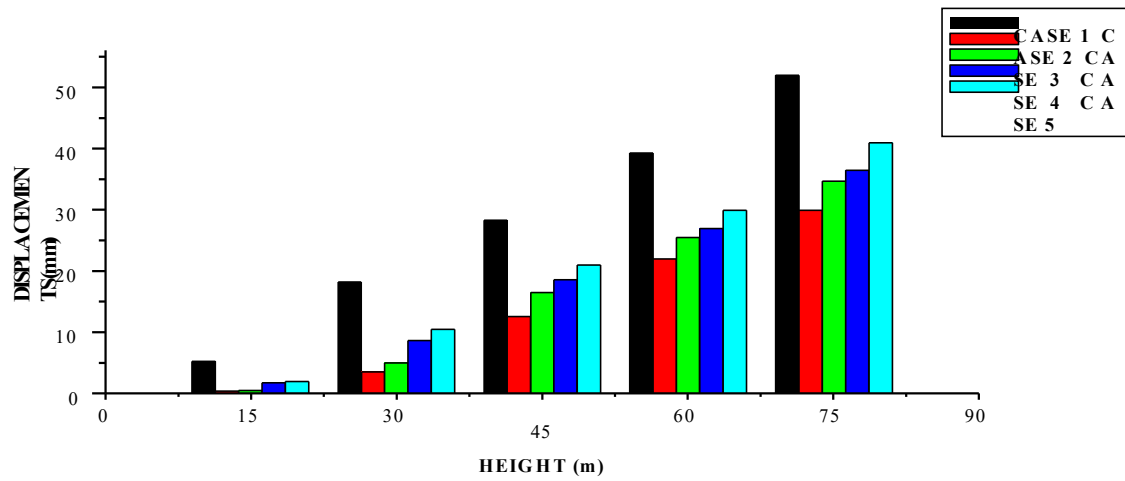


Figure 5.12.2: Displacement Graph for Zone 5 Soft Soil

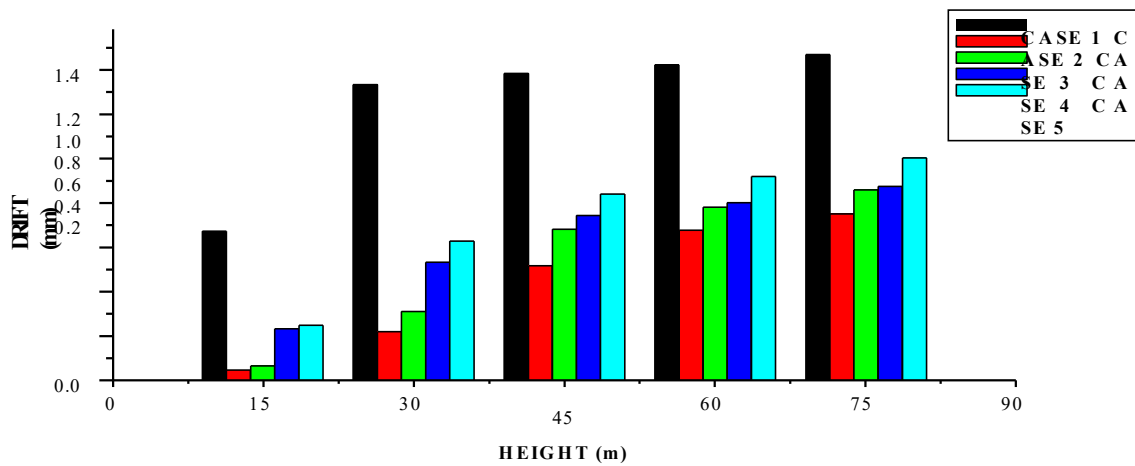


Figure 5.12.3: Drift Graph for Zone 5 Soft Soil

5.12 ZONE 5 (SOFT SOIL)

From the respective table for the soft soil in the seismic zone 5, for the bare frames the maximum storey drift is observed for 75 m, with base shear 840 KN, with time period 2.2544 sec the maximum storey displacement is 14.22 mm and maximum story drift is 0.490 mm.

From the respective table for the soft soil in the seismic zone 5, for the shear wall in the middle for the height 75 m with base shear 1496 KN, time period 1.2759 sec the maximum storey displacement is 8.40 mm and maximum story drift is 0.209 mm.

From the respective table for the soft soil in the seismic zone 5, for the shear wall in the corner for the height 75 m with base shear 1348 KN, time period 1.4653 sec the maximum storey displacement is 9.58 mm and maximum story drift is 0.239 mm.

From the respective table for the soft soil in the seismic zone 5, for the bracings in the middle for the height 75 m with base shear 1125 KN, time period 1.5864 sec the maximum storey displacement is 10.20 mm and maximum story drift is 0.260 mm.

From the respective table for the soft soil in the seismic zone 5, for the bracing in the corners for the height 75 m with base shear 1029 KN, time period 1.7806 sec the maximum storey displacement is 11.40 mm and maximum story drift is 0.278 mm.

From the figure 6.34 the case 1 is having the maximum displacement for the case 1 , similarly from the figure 6.35 and 6.36 the displacement and drift are maximum for the case 1 respectively.

CHAPTER 6

CONCLUSION

The conclusions that can be drawn from the results are as follows:

- As the structure stature expands Lateral displacements and drift increments.
- Compared to any remaining cases Case 1(Bare Frame) produces larger lateral displacements and drifts.
- Lateral displacements and drift is fundamentally lower in the wake of embedding shear wall and bracings in the uncovered casing.
- From the examination obviously CASE 2 (Shear Wall in Middle) is performing preferable and more proficient over any remaining cases.
- Time Period increments as the stature of the structure increments since mass of the general structure increments as time period is directly proportional to the mass.
- One of the significant ends that can be produced using the above investigation is that as the dirt changes from hard to soft there is monstrous expansion in base shear, lateral displacements and lateral drifts. Outrageous consideration to be taken in soft soil.
- Base Shear is diminished as the time span increments.
- Time period is fundamentally brought down in the wake of setting shear walls and bracings.

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