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Earth Quake Analysis of High Rise Building by Lead Rubber Isolation Technique and Comparison of Fixed Base and Base Isolator in Different Seismic Zones Using Etabs

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ABSTRACT

In present examination the base detachment is procedure that has been utilized to shield the structures from the harming impacts of seismic tremor. The establishment of isolators at the base expands the adaptability of the building structures.The point of this exploration is to examine the seismic conduct of various structures under settled condition and base secluded condition. In present examination Modeling is finished by taking a reference plan of a building and investigation of G+15 story RC building is done in ETABS programming for two cases. The first is settled base and the second one is base detached. The Lead elastic bearing (LRB) is planned according to UBC 97 code and the equivalent was utilized for examination of base detachment system.Lead elastic isolator are given to both the structures and afterward investigation are completed for both settled base and base separated structures under zone II and soil type II i.e. medium soil (as per IS 1893(part 1):2002). The outcomes acquired from investigation were Story displacement. Story shear, story speeding up, and Inter story float. Because of the nearness of isolators the entomb story float, story increasing speeds and story shear is incredibly decreased and story displacement is expanded in both X and Y bearings contrasted with settled base structures.

Keywords – *Bare Frame, Lead Rubber Bearing Isolator, ETABS*

INTRODUCTION

1.1 GENERAL

A characteristic cataclysm like an earthquake cause huge death toll and demolition to property consistently. An unsettling influence that causes shaking of earth surface because of development at underground along blame plane or from volcanic action is called earthquake. The seismic powers delivered are destructive and keeps going just for a little length of time. However, people are mistaken for vulnerability as far as its season of event and its inclination. Anyway with advances made in shifts zones of sciences it has been figured out how to pinpoint the areas of earthquake and how to precisely quantify their sizes, nonetheless, this fathoms just a single piece of the issue to ensure a structure. The other part is seismic plan of the structures. Since from the most recent century, this piece of issue has taken different structures, and enhancements in plan logic and techniques have been finished. There are two sorts of strategies for the seismic plan of structures,

1) Conventional technique: This is the customary strategy to oppose horizontal

power is by expanding thedesign limit and firmness. Ex-Shear divider, Braced edges or Moment opposing casings.

2) Non-traditional strategy: Based on decrease of seismic requests rather than increasingcapacity. Ex-Base disconnection, Dampers.

Earthquake is eccentric to the specialists and eventual outcomes of such earthquake is serious. India has encountered most decimating earthquakes on the planet and amid this earthquake part of individuals lost their lives and most structures have crumpled. In this manner it is basic to shield structures from future earthquakes.

The current building found insufficient for opposing future likely earthquake. The structures with ordinary geometry and consistently conveyed firmness and mass both arrangement and in height experience substantially less harm when contrasted with the working with sporadic setups. To diminish the earthquake impacts on building, certain seismic control strategies were embraced.

Traditional seismic plan of building endeavor to make structures that not to experience contend fall amid solid earthquake shaking, however may continue harm to non-basic

components and auxiliary individuals in the building. Uncommon procedures are required to plan structures with the end goal that structure staying intact even in an extreme earthquake.

Two seismic control systems are utilized to shield structures from harming earthquake impacts are Base Isolation Devices and Seismic Dampers. The arrangement of isolators in the structure disconnects the working starting from the earliest stage, that earthquake movements are not transmitted through the building. Seismic dampers are the unique gadgets gave in the working to ingest the vitality created by the solid ground movement amid earthquake. The principle idea of the base disengagement and arrangement of dampers in building is to present adaptability in structures. The seismic enhancement is useful to withstand structure against fall amid serious earthquakes.

The most recent decade or so has seen a reasonable pattern towards "execution based" seismic structure, which can be thought of as an unequivocal plan for various utmost states (or execution levels, in US wording). Breaking down structures for different levels of earthquake force and checking some neighborhood as well as worldwide criteria for each level has been a prevalent scholastic exercise for the most recent few decades, however the vital improvement that happened generally as of late was the acknowledgment of the need for such systems by various rehearsing engineers powerful in code drafting. In the US, following various late earthquakes, especially the 1994 Northridge earthquake, it was understood that while structures worked in industrialized nations mindful of the seismic hazard are when all is said in done enough protected, the expense of harm dispensed in these structures by earthquakes, and additionally the circuitous expense coming about because of business intrusion, requirement for movement, and so on., can be hard to endure. This focuses to the need to address the issue of planning a structure for different execution levels (restrain states), i.e. execution based plan (PBD) (Fajfar and Krawinkler, 1997; Priestley, 2000). Moreover, the need to unequivocally incorporate displacement (or float) as a seismic plan parameter, instead of as a last confirmation of a structure effectively intended for a specific power level, is progressively being perceived (Priestley, 2000).

Doing PBD requires a meaning of the seismic activities that is more point by point than in "code-type" approaches, i.e. as far as possible states must be expressly checked for unmistakable levels of earthquake stacking, which must be chosen considering the significance of the structure to be planned. For example, the SEAOC Blue Book (SEAOC, 1999) characterizes four unmistakable levels of earthquake risk, as pursues:

- Earthquake I (EQ-I), speaking to a "visit" occasion, with a 87% likelihood of being surpassed in 50 years (mean return time of around 25 yr)

- Earthquake II (EQ-II), speaking to an "infrequent" occasion, with a half likelihood of being surpassed in 50 years (mean return time of roughly 72 yr)

- Earthquake III (EQ-III), speaking to an "uncommon" occasion, with a mean return period somewhere in the range of 250 and 800 yr

- Earthquake IV (EQ-IV), speaking to a "most extreme considered" occasion, with a mean return period somewhere in the range of 800 and 2500 yr.

Eurocode 8 (CEN, 2003) partners the workableness confirmation with a 95 yr occasion (this is higher than EQ-II, and furthermore higher than the seismic activity indicated in most other seismic codes for usefulness checks), and a definitive point of confinement state confirmation with a 475 yr occasion (this is like EQ-III in high seismicity zones) on account of structures of common significance.

Principle Objectives of Base Isolation

- To stretch Period of vibration

- To diminish Relative displacements

- Maintain Rigidity at low seismic power of burdens

At whatever point the earth tremor hazard is higher and to build up a successful and temperate seismic safe structure we embrace seclusion system. Security is the real standard to be considered. In the event that Earth Quake powers are overwhelming contrasted with different powers then we utilize Base Isolation. Adaptability and damping are the significant angles in Base separation.

Idea of base detachment

Seismic base detachment of structures, for example, multi-storeybuildings , atomic reactors, scaffolds, and fluid stockpiling tanks are intended to safeguard basic respectability and to anticipate damage to the inhabitants and harm to the substance by lessening the earthquake incited powers and disfigurements in the super-structure. This is a sort of detached vibration control. The execution of these frameworks relies upon two principle attributes:

(1) The limit of moving the framework basic frequency to a lower value, which is well remote from the frequency band of most regular earthquake ground movements.

(2) The vitality dissemination of the isolator.

Sorts of Bearings:

Following sorts of course are accessible according to writing according to their materials:

a) Flexible Columns.

b) Rocking Balls.

c) Springs.

d) Rubbers.

e) Other materials than elastic.

Rubbers are additionally separated into four classifications,

a) Rubber Bearing

b) Steel covered elastic bearing (RB).

c) Lead elastic Bearing (LRB).

d) High damping elastic bearing (HDRB).

Reaction of the working under Earthquake.

Building frequency and period:

The greatness of Building reaction mostly accelerations depends fundamentally upon the frequencies of information ground movements and Buildings normal frequency. At the point when these are equivalent or almost equivalent to each other, the structures reaction achieves a pinnacle level. Sometimes, this dynamic intensification level can expand the building acceleration to a value multiple times or increasingly that of ground acceleration at the base of the building. For the most part structures with higher common frequency and a short normal period will in general endure higher accelerations and littler displacement. Structures with lower normal frequency and a long regular period will in general endure bring down accelerations and bigger displacement. At the point when the frequency substance of the ground movement is around the building's regular frequency, it is said that the building and the ground movement are in reverberation with each other. Reverberation will in general increment or intensify the building reaction by which structures experience the ill effects of ground movement at a frequency near its very own normal frequency.

Building stiffness:

Taller the building, longer the common time frame and he constructing is more adaptable than shorter building.

Pliability:

Pliability is the capacity to experience mutilation or disfigurement without finish breakage or disappointment. With the end goal to be earthquake safe the building will have enough pliability to withstand the size and sort of earthquake it is probably going to involvement amid its lifetime.

Damping:

All structures have some characteristic damping. Damping is because of inner contact and adsorption of vitality by structures auxiliary and non-basic segments. Earthquake safe plan and construction utilize added damping gadgets like safeguards to enhance misleadingly the natural damping of a building.

Seismic disconnection isolates the superstructure from the substructure and it keeps the exchange of ground movement from establishment to superstructure. Disconnected structure has the basic frequency much lower than that of the crucial frequency of settled base structure. The procedure of base disconnection has been produced trying to lessen reaction on the structures and their substance amid the earthquake assaults and has demonstrated that it is a standout amongst the best techniques for an extensive variety of seismic issues on structures. Seismic segregation comprises of the establishment of systems which decouple the structures from the perhaps harming earthquake instigated ground movements. Base isolators protract the central time of the structure to be controlled.

Base isolators are adaptable cushions , while the structures secured by these gadgets are called baseisolated structures. The primary element of the base detachment innovation is that it gives adaptability to the structure. The isolators are intended to retain vitality and in this way add damping to the framework. This aides in diminishing the seismic reaction of the building.Mainly two sorts of isolators; they are elastomeric direction and sliding heading. Elastomeric isolators utilize low parallel solidness of the material to expand the essential time frame though sliding frameworks utilize the qualities of a pendulum to stretch the period. Isolators are given at the base of the building.

DAMPERS

Damping is the strategy that enables a structure to accomplish ideal execution when the structure experience seismic or different sorts of stun and vibration aggravations. Amid solid ground movements regular structures disfigure well past their versatile points of confinement, and in the long run come up short. The idea of supplemental dampers added to a structure accept that the vitality contribution to the structure from a transient will be consumed both structure and supplemental damping components. A glorified damper is in the shape with the end goal that the power delivered by the damper is such a size and it work that the damper powers don't expand the general worry in building. Legitimately executed damper ought to have the capacity to lessen both pressure and avoidance in the structure. Damping gadgets are reasonable for tall structures which can't be viably base confined.

1.3. Detachment DEVICES

For predominant seismic separation of a structure we need to pick the fitting framework and the basic highlights for such framework ought to be as per the following:

- Capable in supporting the structure
- Provide flat adaptability
- Capable to scatter vitality

Disengagement framework ought to be inflexible for low parallel burdens to stay away from vibration at incessant minor earthquakes or wind loads. Fundamental Requirements to build up another base segregation gadget by defeating the conceivable disservices of different gadgets are:

- Possibly its assembling ought to be a mix of a few sorts of seismic isolators.

- Accommodation of pressure powers ought not happen all of a sudden but rather dynamically with the end goal to anticipate affect stacks on the segregated super structure.

- Permanent strain ability to get pressure powers ought to happen in isolator.

METHODOLOGY

3.1 TYPES OF ANALYSIS

Fundamental highlights of seismic technique for examination as per IS1893 (Part 1): 2002 are depicted as pursues

- Equivalent Static Analysis (Linear Static)
- Response Spectrum Analysis (Linear Dynamic)
- Time History Analysis (Nonlinear)
- Pushover Analysis (Nonlinear Static)

Appropriate strategies for examination are given in codes of training; when all is said in done, the more mind boggling and tall the building, the more stringent the investigation that is required.

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Ordinary structures up to around 15 story's in stature can ordinarily be planned utilizing identical static examination; tall structures or those with critical anomalies in height or plan require modular reaction range investigation.

3.1.1 Equivalent Static Analysis

All structure against earthquake impacts must think about the dynamic idea of the heap. Be that as it may, for straightforward ordinary structures, investigation by comparable direct static strategies is frequently adequate. This is allowed in many codes of training for standard, low-to medium-ascent structures and starts with a gauge of pinnacle earthquake stack computed as a component of the parameters given in the code.

3.1.2 Response Spectrum Analysis

It is a dynamic strategy for investigation. In the figuring of auxiliary reaction the structure ought to be so spoken to by methods for a logical or computational model that sensible and reasonable outcomes can be gotten by its conduct, when reaction range strategy is utilized with modular investigation technique. Somewhere around 3 methods of reaction of the structure ought to be considered aside from in those situations where it very well may be demonstrated subjectively that either third mode or the second mode produces immaterial reaction. The model maxima ought to be consolidated utilizing the square foundation of the aggregate of the squares of the individual model values. With the coming of intense personal computers, this kind of examination has turned into the standard. It includes computing the central flexible methods of vibration of a structure. The greatest reactions in every mode are then ascertained from a reaction range and these are summed by proper strategies to create the general most extreme reaction. There are computational points of interest in utilizing the reaction range strategy for seismic investigation for expectation of displacements and part powers in auxiliary frameworks. The technique includes the figuring of just the greatest values of the displacements and part powers in every method of vibration utilizing smooth plan spectra that are the normal of a few earthquake movements.

The significant points of interest of modular reaction range examination (RSA), contrasted and the more perplexing time-history investigation are as per the following.

(1) The span of the issue is lessened to finding just the most extreme reaction of a predetermined number of methods of the structure, instead of figuring the whole time history of reactions amid the earthquake. This makes the issue substantially more tractable in wording both of preparing time and (similarly noteworthy) size of PC yield.

(2) Examination of the mode shapes and times of a structure gives the planner a decent vibe for its dynamic reaction.

(3) The utilization of smoothed envelope spectra makes the examination free of the qualities of a specific earthquake record.

(4) RSA can all the time be valuable as a fundamental examination, to check the sensibility of results created by direct and non-straight time-history investigation.

3.1.3 Time-History Analysis

In this investigation dynamic reaction of the building will be ascertained at each time interims. This examination can be done by taking recorded ground movement information from past earthquake database. A direct time-history investigation of this sort conquers every one of the impediments of Response range examination, gave non-straight conduct isn't included. The technique includes altogether more noteworthy computational exertion than the comparing Response range investigation and something like three agent earthquake movements must be considered to take into consideration the vulnerability in exact frequency substance of the structure movements at a site. With current registering force and programming, the undertaking of playing out the calculating and after that taking care of the huge measure of information created has turned into a non master errand.

3.1.4 PushOver Analysis:

This is a performance based analysis and has aim in controlling the structural damage. In this analysis several built in hinge properties are included from FEMA 356 for concrete members. This analysis will be carried out by using nonlinear software ETABS 2013. This software is able to predict the displacement level and corresponding base shear where first yield of structure occurs. The main objective to perform this analysis is to find displacement vs. base shear graph. Pushover analysis is a simplified, static, nonlinear analysis under a predefined pattern of permanent vertical loads and gradually increasing lateral loads. Typically the first pushover load case is used to apply gravity load and then subsequent lateral pushover load cases are specified to start from the final conditions of the gravity pushover. Typically a gravity load pushover is force controlled and lateral pushovers are displacement controlled. Load is applied incrementally to frameworks until a collapse mechanism is reached. Thus it enables determination of collapse load and ductility capacity on a building frame. Plastic rotation is monitored, and a lateral inelastic force versus displacement response for the complete structure is analytically computed.

For the present study seismic analysis isolated building by static load method is used in ETABSsoftware. This analysis is carried out according to the code IS 1893-2002 (part1). Here type of soil, seismic zone factor should be entered from IS 1893-2002(part1).

Loads on a structure are by and large two sorts.

1. Gravity loads and
2. Lateral loads

3.2.1 Gravity loads:

Gravity loads are the vertical powers that follow up on a structure. The heaviness of the structure, human inhabitance and snow are a wide range of loads that need a total load way to the ground.

3.2**.1.1 Dead Loads:**

Every perpetual construction of the structure frame the dead loads. The dead load includes the weights of dividers, allotments floor completes, false roofs, false floors and the other lasting constructions in the structures. The dead load loads might be figured from the measurements of different individuals and their unit weights. the unit weights of plain concrete and strengthened concrete made with sand and rock or pulverized common stone total might be taken as 24 kN/m3 and 25 kN/m3 individually.

3.2.1.2 Imposed Loads:

Every single perpetual construction of the structure shape the dead loads. The dead load involves the weights of dividers, parcels floor completes, false roofs, false floors and the other lasting constructions in the structures. The dead load loads might be figured from the measurements of different individuals and their unit weights. the unit weights of plain concrete and strengthened concrete made with sand and rock or smashed normal stone total might be taken as 24 kN/m3 and 25 kN/m3 separately.

Live loads are taken as 2kN/m.

3.2.2 Lateral Loads:

Parallel loads are the level powers that are

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follow up on a structure. Wind loads and earthquake loads are the principle horizontal loads follow up on structures.

3.2.2.1 Wind Loads

Fundamental wind speed zones in India are delegated six zones according to IS 875 section - 3-1987.

Table – 3.1: Zone Wise Basic Wind Speeds in m/sec

Zone	Basic wind speed (m/sec)
I	33
II	39
III	44
IV	47
V	50
VI	55

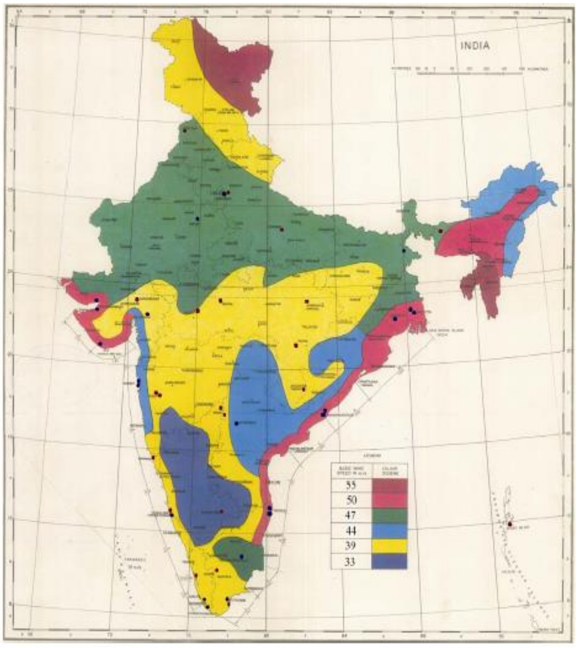

Figure - 3.1: Basic wind speed zone map in Indi

Wind is air in movement with respect to the surface of the earth. The essential driver of wind is followed to earth's revolution and contrasts in earthbound radiation. The radiation impacts are fundamentally in charge of convection either upwards or downwards. The wind for the most part blows flat to the ground at high wind speeds. Since vertical segments of air movement are generally little, the term 'wind' signifies only the flat wind, vertical winds are constantly distinguished thusly. The wind speeds are surveyed with the guide of anemometers or anemographs which are introduced at meteorological observatories at statures for the most part shifting from 10 to 30 meters over the ground.

3.2.2.2 Design Wind Speed (V,)

The essential wind speed (Vh) for any site will be gotten from and will be adjusted to incorporate the accompanying impacts to get configuration wind speed at any stature (Vh) for the picked structure:

A) Risk level;

B) Terrain harshness, tallness and size of structure; and

C) Local geography.

It very well may be scientifically communicated as pursues: Where:

V = Vb X kl X k2X k3

Vb = configuration wind speed at any tallness z in m/s;

kl = likelihood factor (chance coefficient)

k2= landscape, tallness and structure estimate factor

k3 = geology factor

Hazard Coefficient (k1 Factor): Gives fundamental wind speeds for territory Category 2 as pertinent at10 m over the ground level dependent on 50 years mean return period. In the plan everything being equal and structures, a territorial fundamental wind speed having a mean return time of 50 years will be utilized.

Landscape, Height and Structure Size Factor (k2, Factor):

Landscape - Selection of territory classifications will be made with due respect to the impact of deterrents which establish the ground surface harshness. The territory classification utilized in the plan of a structure may differ contingent upon the bearing of wind under thought. Wherever adequate meteorological data is accessible about the idea of wind heading, the introduction of any building or structure might be appropriately arranged.

Geology (k3 Factor) - The essential wind speed Vb assesses the general level of site above ocean level. This does not take into consideration neighborhood topographic highlights, for example, slopes, valleys, bluffs, ledges, or edges which can altogether influence wind speed in their region. The impact of geography is to quicken wind close to the summits of slopes or peaks of precipices, ledges or edges and decelerate the wind in valleys or close to the foot of bluff, soak ledges, or edges.

Wind Pressures and Forces On Buildings/Structures:

The wind stack on a building will be computed for:

a) The working all in all,

b) Individual basic components as rooftops and dividers, and

c) Individual cladding units including coating and their fixings.

Weight Coefficients - The weight coefficients are constantly given for a specific surface or part of the surface of a building. The wind stack acting typical to a surface is gotten by duplicating the region of that surface or its fitting segment by the weight coefficient (C,) and the structure wind weight at the tallness of the surface from the beginning. The normal values of these weight coefficients for some building shapes Average values of weight coefficients are given for basic wind headings in at least one quadrants. With the end goal to decide the most extreme wind stack on the building, the aggregate load ought to be computed for every one of the basic bearings appeared from all quadrants. Where extensive variety of weight happens over a surface, it has been subdivided and mean weight coefficients given for every one of its few sections. At that point the wind stack, F, acting toward a path typical to the individual basic component or Cladding unit is:

$$F = (C_{pe} - C_{pi})\, A\, P_d$$

Where,

C_{pe} = outer weight coefficient,

C_{pi} = inward weight coefficient,

A = surface territory of basic or cladding unit, and

P_d = configuration wind weight component

Wind loads are connected on the structure according to IS 875-1987.i.e wind stack in x-heading WLx and wind stack in y-bearing WLy.

3.2.2 Seismic Loads:

3.2.2.1design Lateral Force

The structure sidelong power will initially be registered for the working in general. This

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plan sidelong power will then be disseminated to the different floor levels. The general structure seismic power along these lines acquired at each floor level will at that point be conveyed to singular sidelong load opposing components relying upon the floor stomach activity.

Earthquake loads are connected according to IS 1893-2002 in earthquake x-heading, y-course Positive x-bearing, negative x-heading, positive y-heading and negative y-heading. Furthermore, stack mixes are considered according to IS 1893-2002.

3.2.2.2 Design Seismic Base Shear

The aggregate structure parallel power or plan seismic base shear (Vb) along any key course will be dictated by the accompanying articulation:

Vb = Ah W

Where,

Ok = flat acceleration range

W = seismic weight of all the floor

Central Natural Period

The surmised crucial regular time of vibration (T,), like a flash, of a minute opposing edge working without block in the boards might be evaluated by the observational articulation:

Ta=0.075 h0.75 for RC outline building

Ta=0.085h0.75 for steel outline building Where,

H = Height of working, in m. This prohibits the cellar stories, where storm cellar dividers are associated with the ground floor deck or fitted between the building segments. Yet, it incorporates the storm cellar stories, when they are not all that associated. The surmised major characteristic time of vibration (T,), in a moment or two, of every single other building, including minute opposing casing structures with block lintel boards, might be assessed by the experimental Expression:

T=.09H/√D

Where,

H= Height of building

D= Base measurement of the working at the plinth level, in m, along the thought about heading of the horizontal power.

Dispersion of Design Force

Vertical Distribution of Base Shear to Different Floor Level

The structure base shear (V) will be disseminated along the stature of the working according to the accompanying articulation:

Qi=Design parallel power at floor I,

Wi= Seismic weight of floor I,

Hi=Height of floor I gauged from base, and

n=Number of stores in the building is the quantity of levels at which the majority are found. Conveyance of Horizontal Design Lateral Force to Different Lateral Force Resisting Elements in the event of structures whose floors are fit for giving inflexible level stomach activity, the aggregate shear in any flat plane will be dispersed to the different vertical components of sidelong power opposing framework, expecting the floors to be interminably unbending in the even plane. If there should be an occurrence of building whose floor stomachs can't be treated as interminably unbending in their very own plane, the parallel shear at each

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floor will be dispersed to the vertical components opposing the sidelong powers, considering the in-plane adaptability of the chart.

Figure - 3.2: Seismic zone guide of India

In India seismic zones are partitioned into four zones, i.e Zone – II, Zone – III, Zone – IV and Zone - V. Zone – II is low earthquake inclined region, Zone – III is moderate zone, Zone – IV is high earthquake inclined region and Zone – V is the highest earthquake intensity zone.

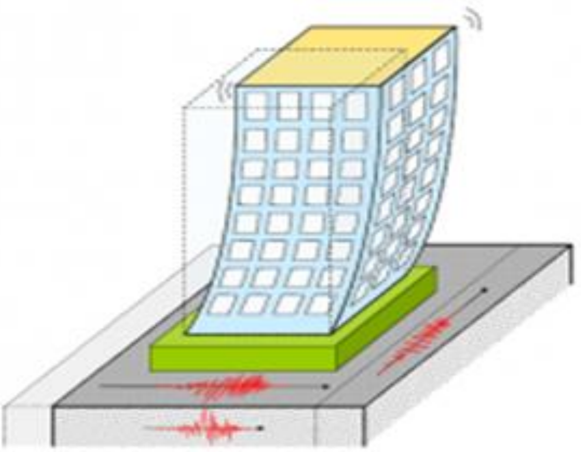
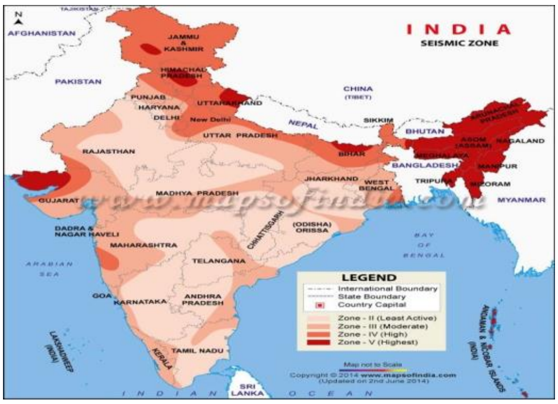


Figure – 3.3: Behavior of building under earth quake

MODELING OF BUILDING

Plan of the building

The plan and modeling of building is done in ETABS AND COMMANDS used in modeling of a building is shown in figures



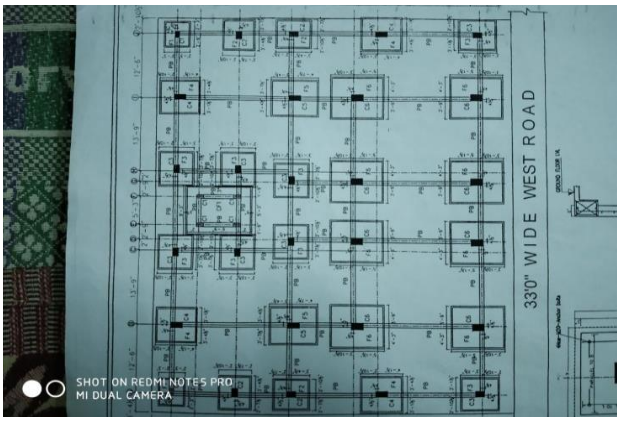


FIG: 4.12 Column frame of the building

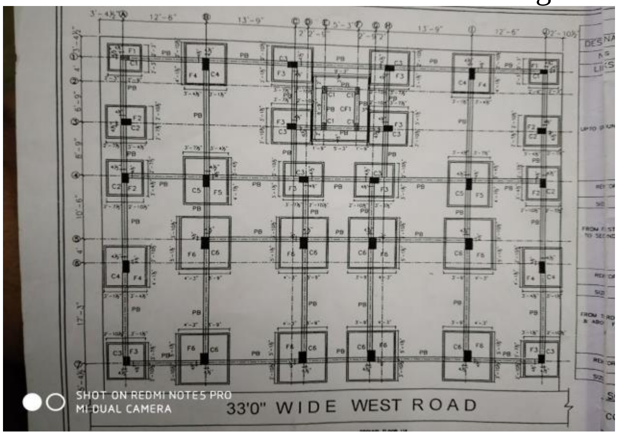


FIG 4.13 : Column framing with center to centre distances between the columns

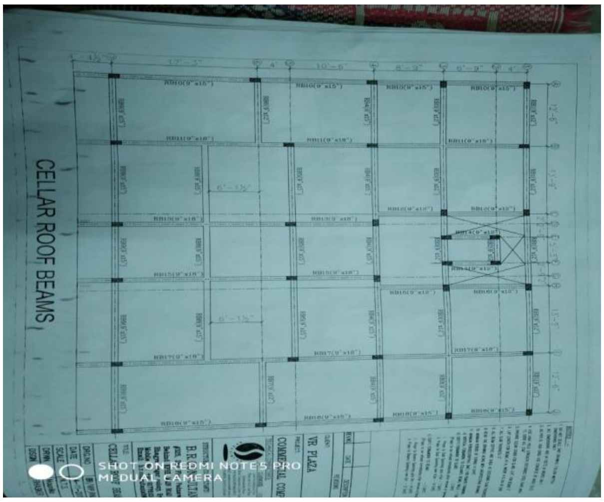


Fig 4.14 : Beam framing of the building

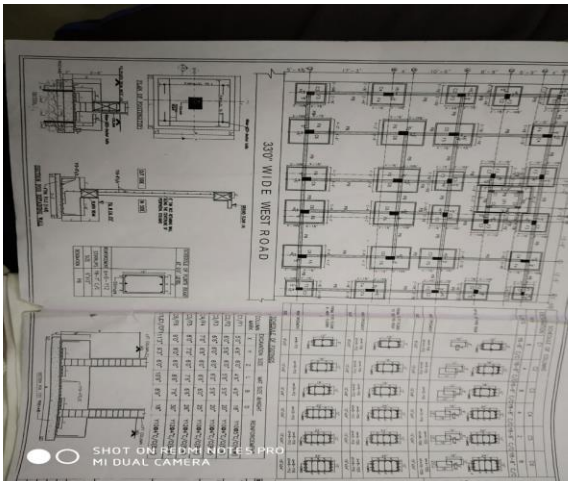


Fig 4.15 : Building plan with other details

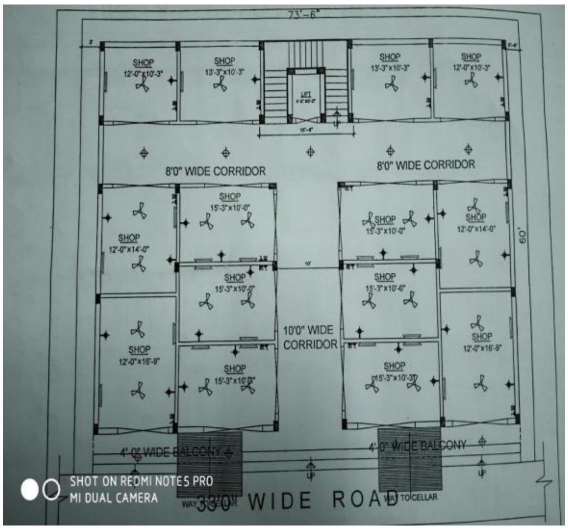


Fig 4.16: Shops showing with sizes of the rooms

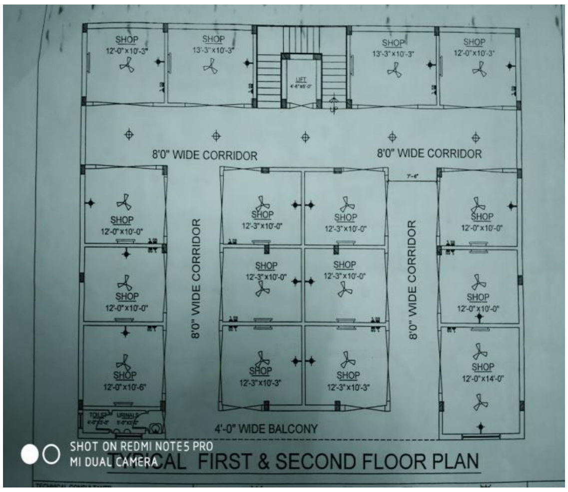


Fig 4.17: Typical first and second floor plan

Modeling of building in ETABS

The modeling of building is done in ETABS with commands are as shown in figures is as follows.

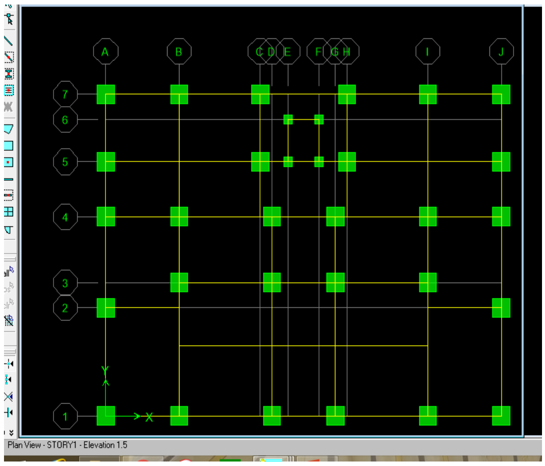


FIG 4.21: Column framing from story 1 to story 7

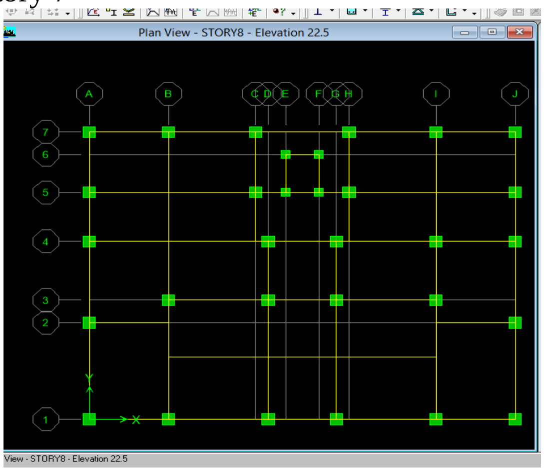


FIG 4.22: Columns from story 8 to story 12 for Plan of a building

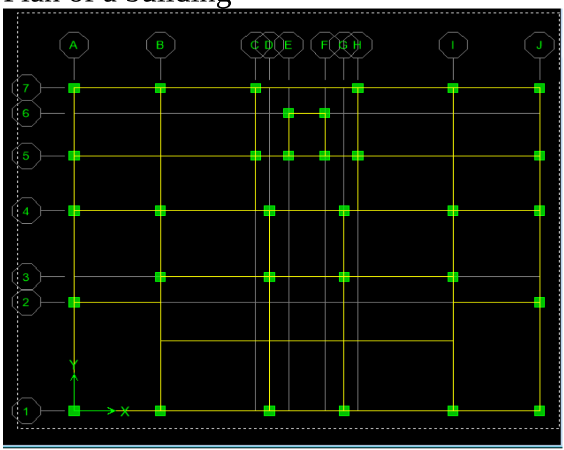


FIG 4.23: Columns from story 13 to story 17 for Plan of a building

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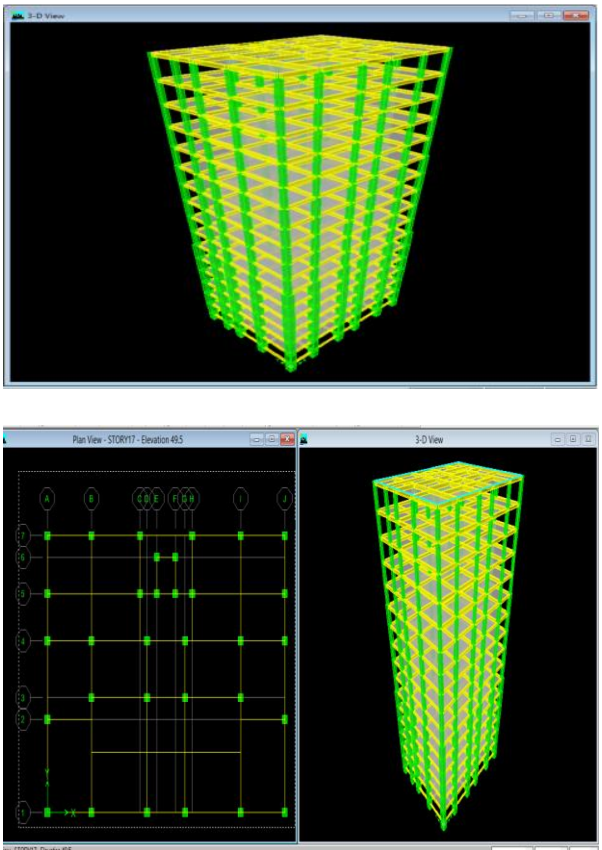
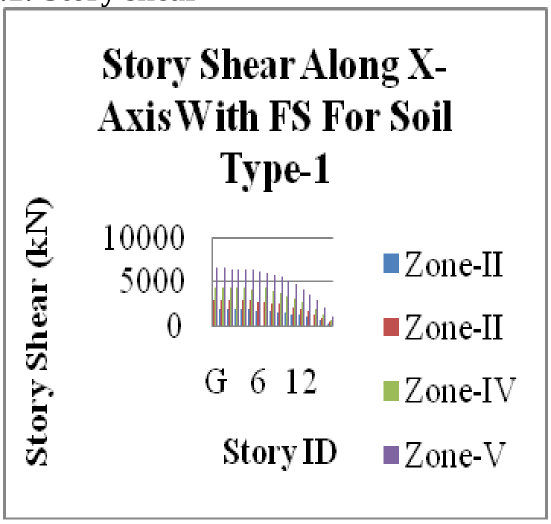


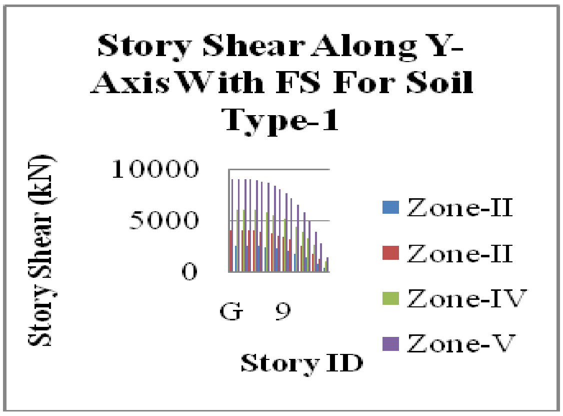
FIG4.24 :Plan and Modeling of a building by ETABS

RESULTS AND DISCUSSION

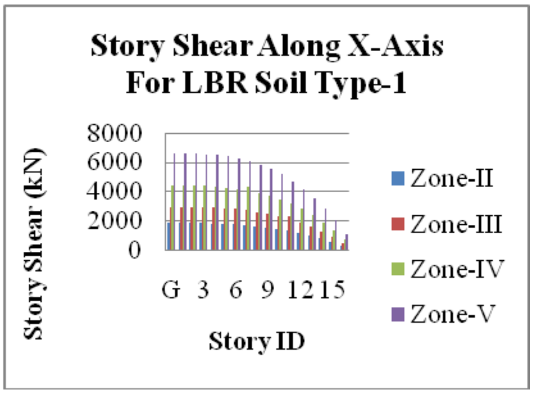
7.1: Story shear



Graph 7.12: Story Shear along X-Axis for Fixed Support for Soil Type-1.

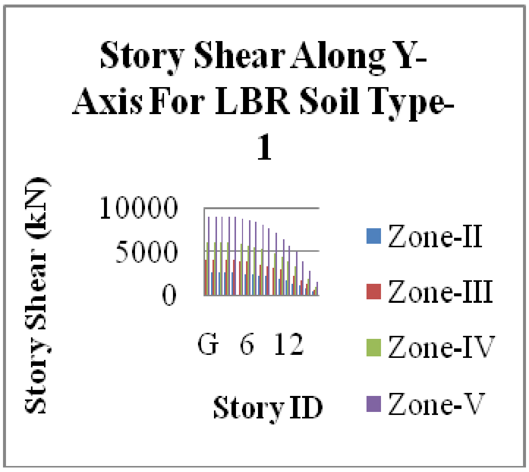


Graph 7.13: Story Shear along Y-Axis for Fixed Support for Soil Type-1.



Graph 7.14: Story Shear along X-Axis for LBR for Soil Type-1.

Graph shows base shear along X and Y Direction with fixed and base isolation support.



Graph 7.15: Story Shear along Y-Axis for LBR for Soil Type-1.

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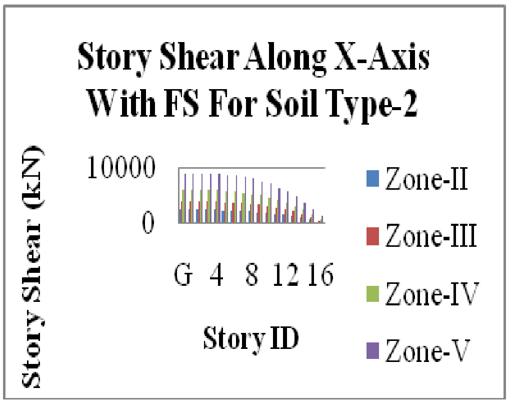
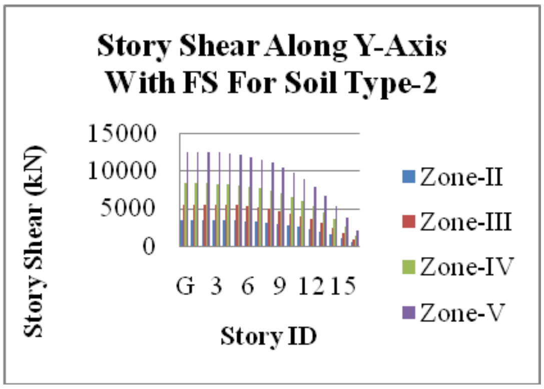
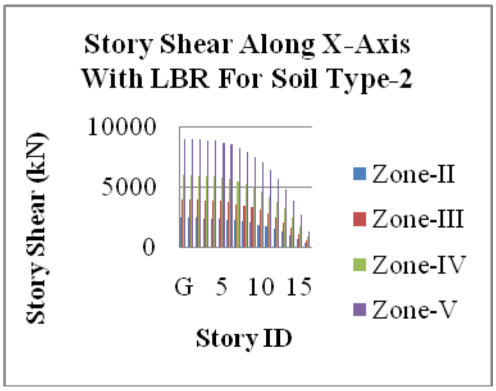


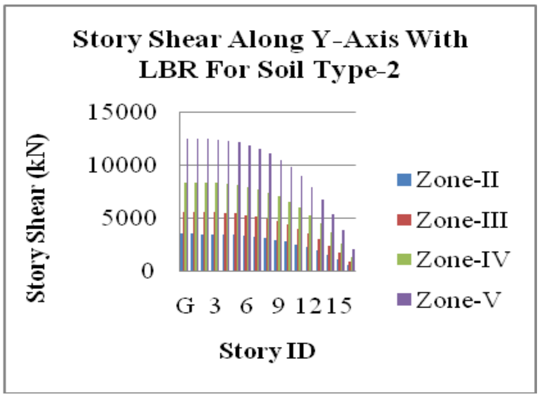
Graph 7.16: Story Shear along X-Axis for Fixed Support with Soil Type-2.



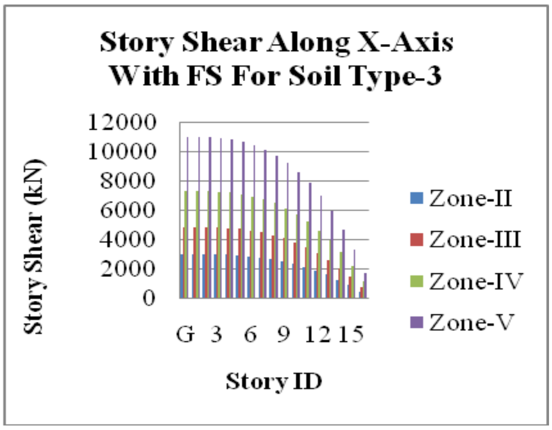
Graph 7.17: Story Shear along Y-Axis for Fixed Support with Soil Type-2.



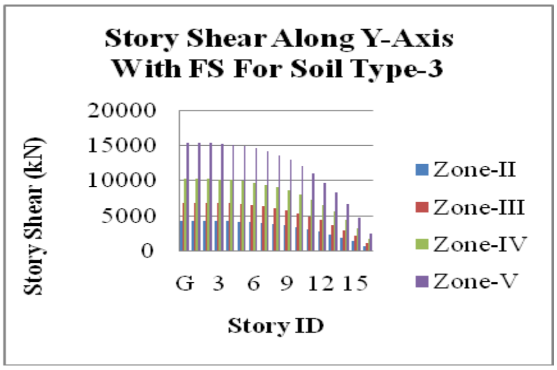
Graph 7.18: Story Shear along X-Axis for LBR for Soil Type-2.



Graph 7.19: Story Shear along Y-Axis for LBR for Soil Type-2.



Graph 7.20: Story Shear along X-Axis for Fixed Support with Soil Type-3.



Graph 7.21: Story Shear along Y-Axis for Fixed Support with Soil Type-3.

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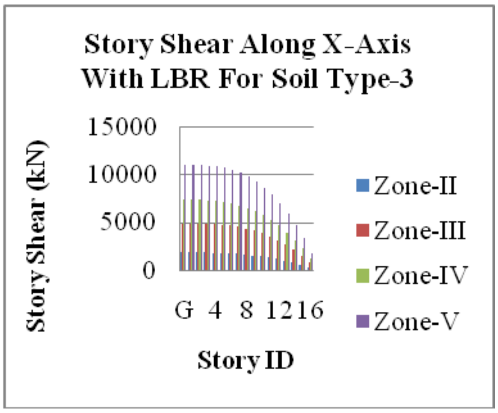
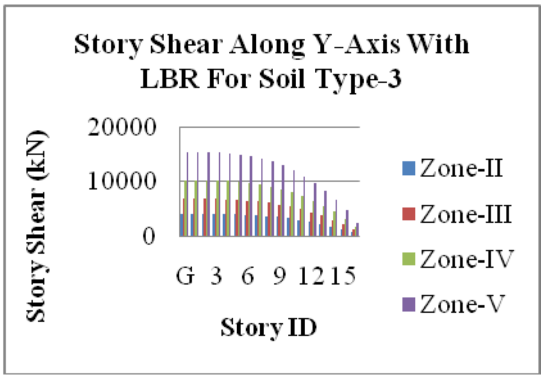
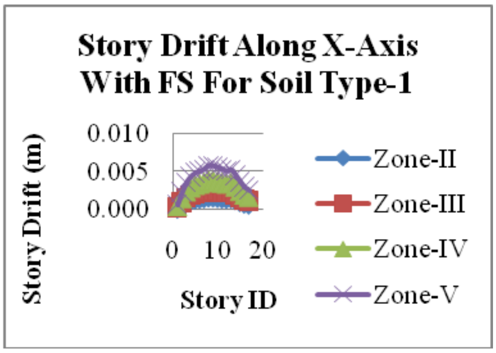


Graph 7.22: Story Shear along X-Axis for LBR for Soil Type-3.

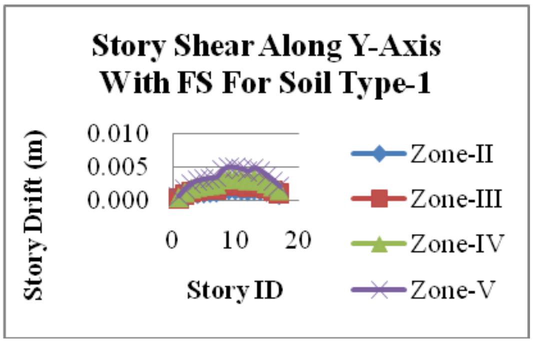


Graph 7.23: Story Shear along Y-Axis for LBR for Soil Type-3

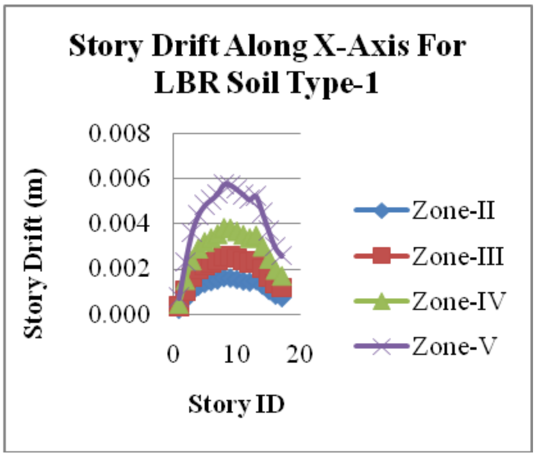
7.2 Story drift



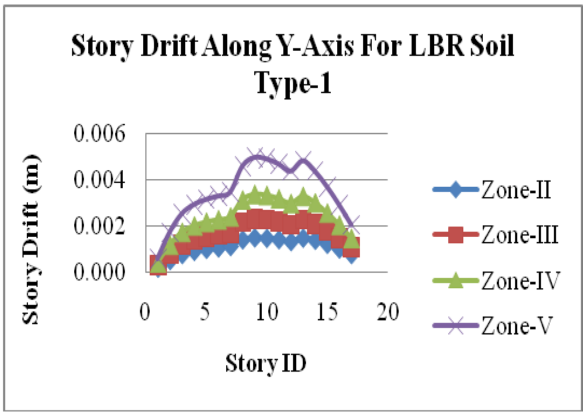
Graph 7.31: Story Drift along X-Axis with Fixed Support with Soil Type-1



Graph 7.32 : Story Drift along Y-Axis with Fixed Support with Soil Type-1



Graph 7.33: Story Drift along X-Axis with LBR with Soil Type-1



Graph 7.34: Story Drift along Y-Axis with LBR with Soil Type-1

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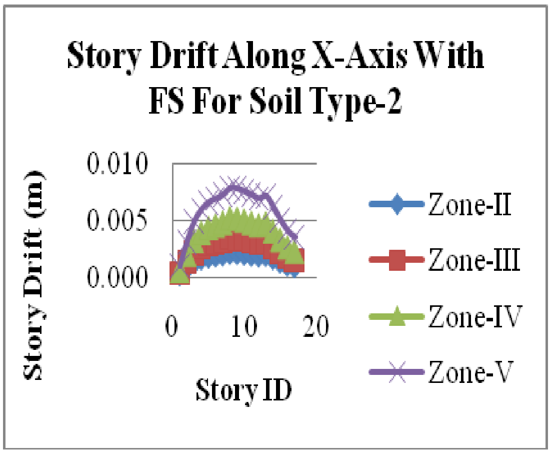
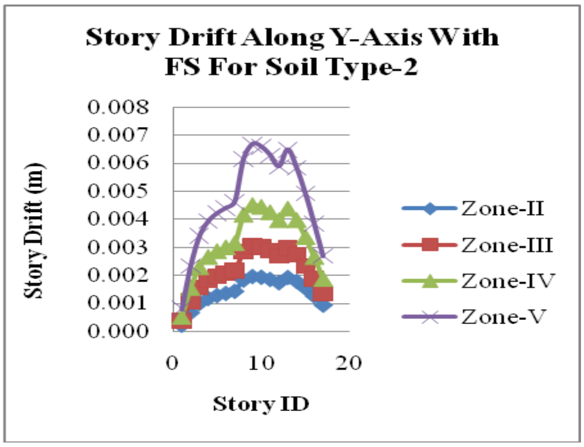
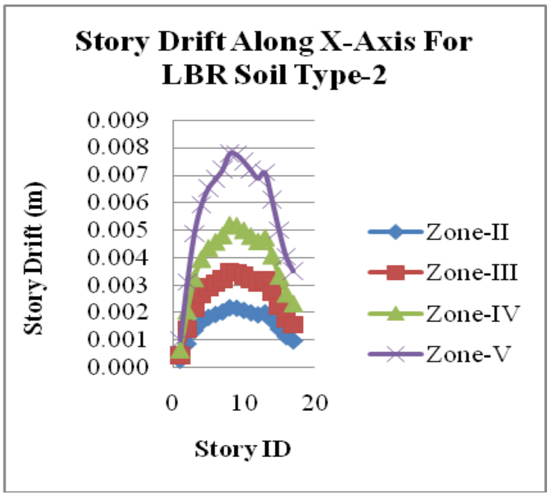


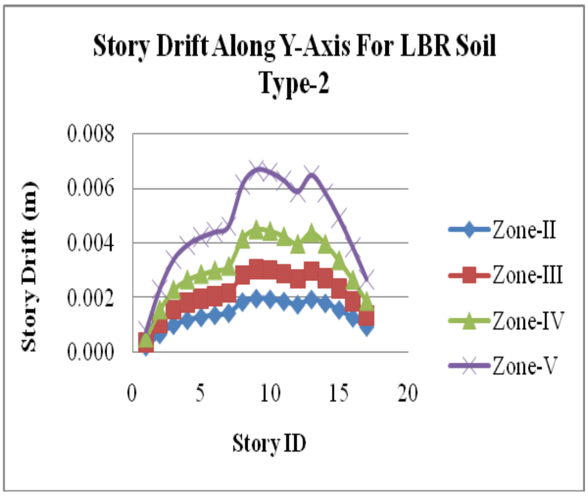
Graph 7.35: Story Drift along X-Axis with Fixed Support with Soil Type-2



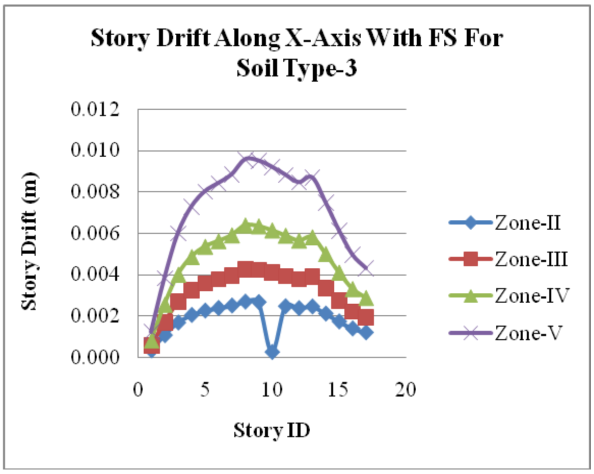
Graph 7.36: Story Drift along Y-Axis with Fixed Support with Soil Type-2



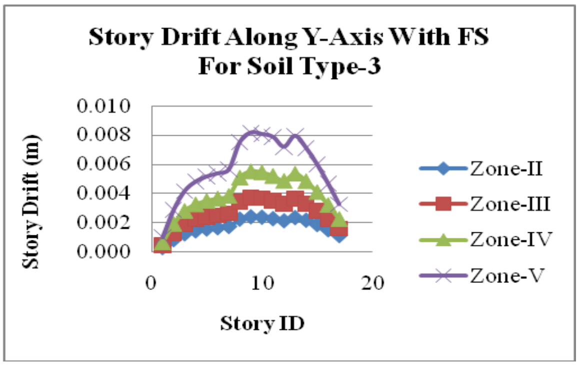
Graph 7.37: Story Drift along X-Axis with LBR with Soil Type-2.



Graph 7.38: Story Drift along Y-Axis with LBR with Soil Type-2.



Graph 7.39: Story Drift along X-Axis with Fixed Support with Soil Type-3



Graph 7.3.40: Story Drift along Y-Axis with Fixed Support with Soil Type-3

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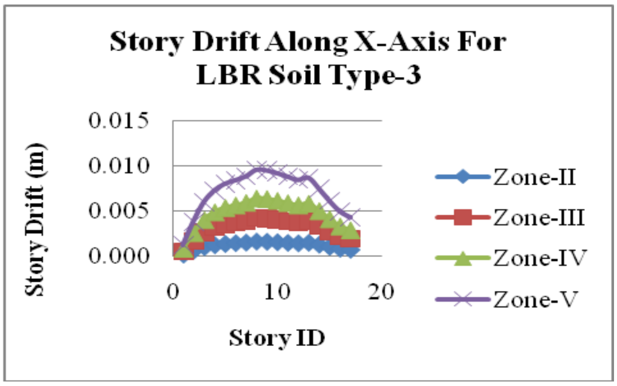
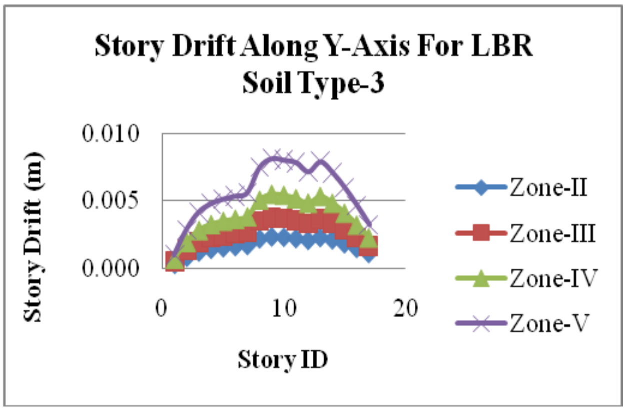
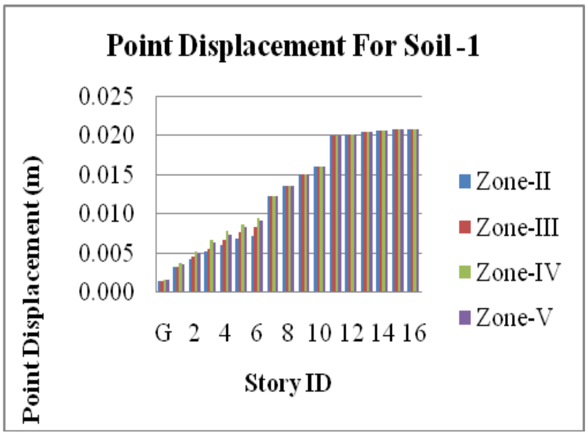


Graph 7.3.2: Story Drift along X-Axis with LBR with Soil Type-3.

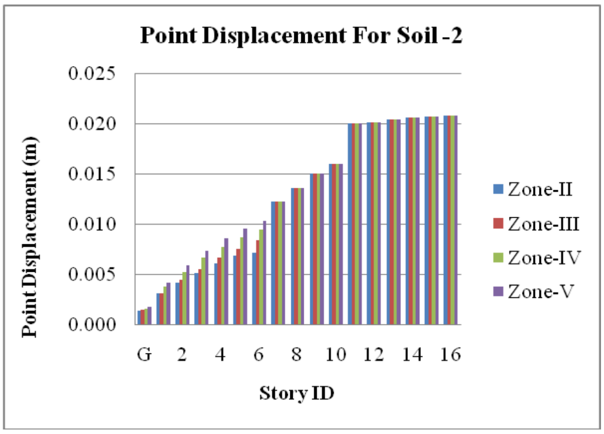


Graph 7.3.3: Story Drift along Y-Axis with LBR with Soil Type

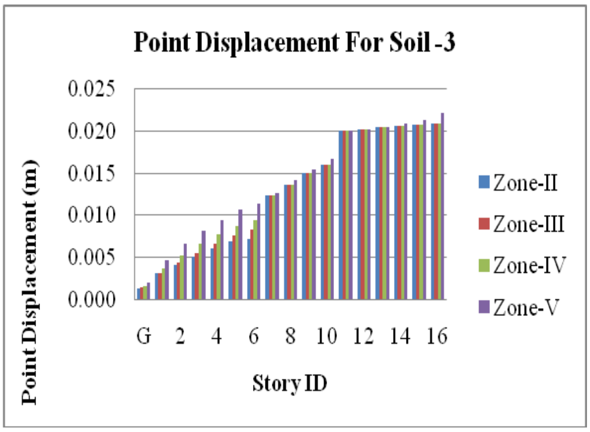
7.3: Point displacement



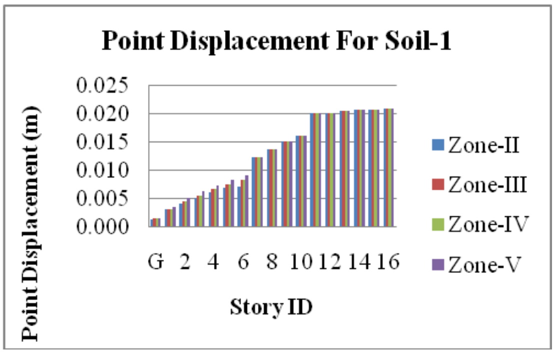
Graph 7.41: Story Displacement for Fixed SupportwithSoil Type-1.



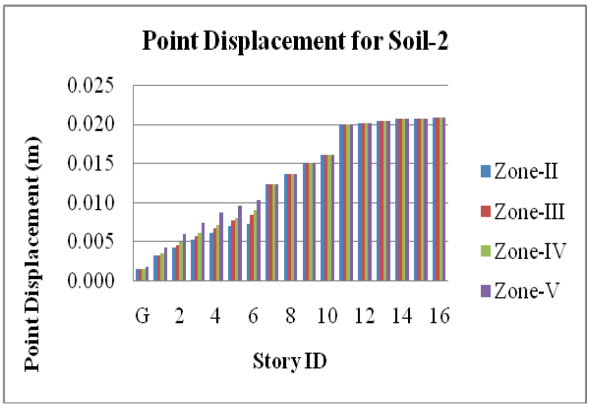
Graph 7.42: Story Displacement for Fixed Support with Soil Type-2.



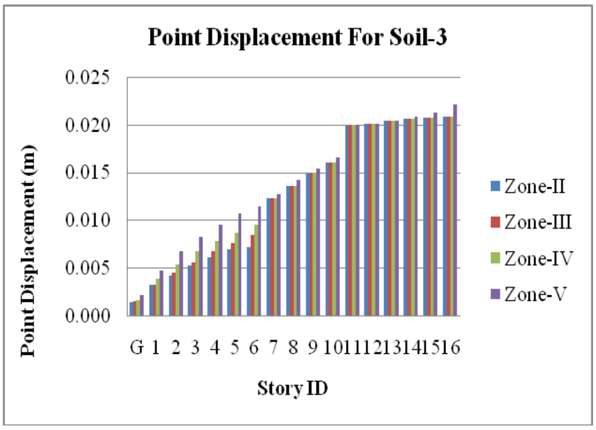
Graph 7.43: Story Displacement for Fixed Support with Soil Type-3.



Graph 7.44: Point Displacement for LBR Support with Soil Type-1.



Graph 7.45: Point Displacement for LBR Support with Soil Type-2.



Graph 7.46: Point Displacement for LBR Support with Soil Type-3.

Table-7.41: Support Reactions for Fixed Support with Soil Type-1

Spt. No	Support Reaction (kN)			
	Zone -II	Zone -III	Zone-IV	Zone-V
1	3528.99	3878.62	4344.78	5044.03
2	4572.00	4572.00	4757.22	5192.97
3	5318.50	5411.97	5888.20	6602.55
4	6026.65	6026.65	6488.79	7232.83
5	4383.45	4768.36	5284.18	6057.91
6	7665.91	7854.48	8616.72	9760.08
7	7994.83	8260.24	9076.43	10300.73
8	7961.23	8242.57	9063.25	10294.28
9	7562.59	7746.31	8495.53	9619.37
10	4349.84	4735.33	5249.32	6020.30
11	3434.59	3778.32	4236.62	4924.08
12	6398.97	7021.60	7851.77	9097.02
13	6778.01	7183.99	7927.83	9043.60
14	4093.68	4326.12	4651.91	5140.60
15	4036.57	4282.41	4610.19	5101.88
16	5734.94	6333.74	7132.13	8329.71
17	5598.53	6188.27	6974.58	8154.05
18	4318.02	4318.02	4598.51	5055.48
19	5700.03	5863.90	6453.19	7337.12
20	6999.26	7423.42	8263.81	9524.39
21	6876.57	7324.43	8163.89	9423.10
22	8508.72	8508.72	8771.01	9685.06
23	4971.29	5206.61	5717.50	6483.83
24	5824.88	5849.42	6353.68	7110.08
25	9368.32	9368.32	9443.14	10375.13
26	8921.21	8921.21	9507.40	10623.89
27	8792.08	8792.08	9451.54	10591.31
28	8957.10	8957.10	9550.77	10695.36
29	1427.34	1600.89	1832.30	2179.42
30	1421.21	1598.09	1833.94	2187.72
31	1443.00	1443.00	1489.60	1601.37
32	1455.27	1455.27	1491.11	1598.78

Table-7.42: Support Reactions for Fixed Support with Soil Type-2

Spt. No	Support Reaction (kN)			
	Zone II	Zone-III	Zone -IV	Zone -V
1	3738.77	4214.25	4848.24	5799.21
2	4572.00	4675.88	5070.96	5663.59
3	5318.50	5754.85	6402.53	7374.05
4	6026.65	6349.91	7024.50	8036.40
5	4613.61	5139.75	5841.26	6893.54
6	7665.91	8403.30	9439.94	10994.91
7	8015.38	8847.90	9957.93	11622.97
8	7996.37	8833.46	9949.59	11623.79
9	7562.59	8285.75	9304.69	10833.11
10	4581.14	5105.40	5804.43	6852.96
11	3640.82	4108.30	4731.59	5666.53
12	6772.55	7619.32	8748.35	10441.89
13	6960.83	7719.56	8731.19	10248.63
14	4228.38	4560.69	5003.77	5668.38
15	4184.07	4518.41	4964.20	5632.89
16	6094.22	6908.58	7994.39	9623.11
17	5952.37	6754.41	7823.80	9427.88
18	4318.02	4513.21	4927.53	5549.00
19	5700.03	6288.19	7089.62	8291.77
20	7171.31	8028.50	9171.43	10885.82
21	7072.59	7928.84	9070.52	10783.03
22	8508.72	8600.39	9429.12	10672.22

23	5053.35	5574.45	6269.26	7311.46
24	5824.88	6212.49	6898.29	7926.99
25	9368.32	9368.32	10114.17	11623.79
26	8921.21	9298.99	10311.27	11829.69
27	8792.08	9238.78	10272.17	11822.26
28	8957.10	9337.12	10374.87	11931.51
29	1531.47	1767.51	2082.23	2554.30
30	1527.34	1767.91	2088.66	2569.79
31	1443.00	1468.74	1570.07	1722.08
32	1455.27	1471.01	1568.63	1715.06

Table-7.43: Support Reactions for Fixed Support with Soil Type-3

Spt. No	Support Reaction (kN)			
	Zone -II	Zone-III	Zone-IV	Zone-V
1	3919.40	4503.28	5281.77	6449.51
2	4572.00	4855.99	5341.13	6068.84
3	5453.64	6050.12	6845.43	8038.39
4	6036.17	6657.44	7485.81	8728.36
5	4813.49	5459.56	6320.98	7613.11
6	7921.18	8875.88	10148.83	12058.24
7	8331.65	9353.94	10716.99	12761.56
8	8314.38	9342.29	10712.83	12768.64
9	7811.87	8750.27	10001.47	11878.27
10	4780.31	5424.08	6282.44	7569.98
11	3818.42	4392.44	5157.81	6305.87
12	7094.24	8134.02	9520.40	11599.97
13	7249.07	8180.74	9422.96	11286.29
14	4354.63	4762.68	5306.75	6122.86
15	4311.09	4721.64	5269.05	6090.16
16	6403.59	7403.58	8736.89	10736.87
17	6257.07	7241.93	8555.07	10524.79
18	4320.52	4702.09	5210.85	5973.98
19	5915.46	6653.55	7637.66	9113.83
20	7496.96	8549.54	9952.99	12058.16
21	7397.88	8449.31	9851.22	11954.09
22	8508.72	8978.20	9995.83	11522.28
23	5251.32	5891.20	6744.38	8024.15
24	5893.54	6525.13	7367.25	8630.44
25	9368.32	9654.39	10716.99	12768.64
26	8921.21	9760.47	11003.49	12868.02
27	8792.08	9709.89	10978.83	12882.24
28	8957.10	9810.21	11084.52	12995.97
29	1621.14	1910.98	2297.44	2877.12
30	1618.73	1914.13	2308.00	2898.80
31	1443.00	1514.93	1639.37	1826.02
32	1455.27	1515.51	1635.38	1815.19

CONCLUSIONS AND SCOPE OF FUTURE WORK

- When contrasted and settled base structure, the base shear is lessened in base disengaged structures, along these lines the reaction of building is great in base secluded structures than settled base structures.

- For base segregated building Response have been expanded from 0.26sec to 0.36 sec. Since the super structure will be exposed to lesser earthquake powers, the expense of disengaged structure will be less expensive.

- This particular arrangement of solidness draws in lesser seismic powers and consequently coming about twofold advantages contrasted with customary structure i.e. decrease of pivotal powers.

- The point displacement for all the dirt kinds will be same, while for seismic zones the point displacement is increments

- Similarly strory float and story shears additionally changes for various seismic zones.

- The rising compositional plans are for the most part unpredictable in geometry which prompts torsional and differential minutes in X and Z bearings. This may cause overemphasize to the casings. This can be overwhelmed by arrangement of Base Isolator as lead.
- A base-detachment framework diminishes Ductility requests on a building, and limits its distortions.

- Base separation builds the adaptability at the base of the structure which helps in Energy Dissipation because of the flat segment of the earthquake.
- Hence the better fitted isolator dependent on the necessity is built monetarily to guarantee Safe structure withstanding harms because of regular catastrophes.
- Based on the vertical limit, greatest stacking conditions and surface weight utilize ISO9001 earthquake adsorbing gadget lead elastic heading of size 200*1200mm for extension and building.

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