CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Earthquake disaster has always been one of the great natural calamities thrust upon the mankind since time immemorial and bringing in its wake untold miseries and Hardships to the people affected. Indian subcontinent has been experienced with some of the most severe earthquakes in the world. The youngest mountain series of Himalayas cover whole northeast boundary region of Indian. The tectonic activities are still continuing which may result in to severe earthquake in future. Therefore, it is essential to analyze and design the building as per the code requirements.

Safety of the life in the seismic event is the prime consideration of earthquake resistance design philosophies. To improve the behavior of inadequate building and to minimize the damages, it is essential to analyze the behavior of the buildings under different seismic load conditions .As regards existing structures, it is necessary to evaluate and strengthen them based on evaluation criteria before an earthquake. The poor performance level, and hence the high level of structural damage in the stock of building structures during the frequent earthquakes happened in our country by the last decade, increased the need to the determination and evaluation of the damages in the buildings type of structures, so much more than ever before.

During the Earthquake, not even strength and ductility plays a major role in building performance, the behavior of buildings also depends on its overall shape, size and geometry. In tall buildings with large height to base size ratio, the horizontal movement of the floors during shaking is large. When the buildings are located in high seismic zones as in Zone IV and V, the structural engineer's role becomes more challenging. Therefore, the structural engineer needs to have a thorough understanding of the seismic response of structures.

In this dissertation work, effect of various parameters on RCC buildings from storey height 2 to 9 lies in critical Earthquake Zones IV and V has been carefully study under the effect of earthquake loading.

1.2 CODAL PROVISIONS OF DIFFERENT COUNTRIES

1. As per the NBC(associate committee on NBC 1995), the seismic design forces are based upon the seismic zoning maps developed in 1985, which gives the contours of seismic zones having different peak accelerations and peak ground velocities of probability of exceeding 10%in 50 years. NBCC 1995 seismic provisions defines the elastic base shear coefficient by the product v*S where “v” is the zonal velocity ratio for a given location and S is the seismic response factor. S factor is intended to represent an idealized acceleration response spectrum for multi degree of freedom systems for unit values of “v” and unit weight for the periods below 0.25S, the S factor is defined with three plateaus each of which corresponds to a different combination of acceleration & velocity related seismic zones(Za>Zv, Za’Zv and Za<Zv). For periods of larger than 0.5 sec, the s curve is defined as the function of fundamental curve linearly varies between periods of 0.25 sec & 0.5 secs.

2. As per the current revised version of Euro code 8, design spectra based upon two different types of seismic action are specified (type 1 for regions with higher and type 2 for regions with lower Seismicity) and a new subsoil classification scheme. Consequently, design spectra of type 2 are applicable for central European regions. Two different types of spectrum shapes (type 1and type 2) are considered for varying seismicity conditions. In this regard, provision of Euro code 8 states” If the earthquakes that contribute most to the seismic hazard defined for the site for the purpose of probabilistic hazard assessment has a surface wave magnitude Ms than 5.5 it is recommended that the Type 2 spectrum is adopted.

3. The NEHRP Recommended Provisions (NEHRP 1985) use seismic response modification Coefficients, RN which are used to determine the minimum design base shear V .Essentially the NEHRP Recommended Provisions determine the minimum design base shear V as V=Ve/RN, where Ve is the elastically determined base shear. The values of RN ranges from 1.25 for unreinforced masonry bearing walls to 8.0 for special moment frames, Also given in the NEHRP Recommended Provisions are the values of the deflections amplification factor Cd for these systems. The factor Cd

accounts for the magnification of the computed elastic displacements due to inelastic action. This factor varies from 1.25 to 6.5 depending on the ductility of the system and type of material.

4. The code for the design of structures for the Federal District of Mexico City (Instituto de Inenieria, 1987) determines the seismic design base shear for long period buildings as V=Ve/Q, where Ve is the elastic seismic coefficient for the three major soil zones within the city, and Q is the equivalent ductility factor . Before the 1985 Mexico EQ, Q factor varied from 2.0 to 6.0 for reinforced concrete structures.

1.3 OBJECTIVE OF STUDY

Nine different models of RCC framed buildings with storey heights varying from 2 to 10 are modeled using computer based software program STAAD PRO V8i followed by the guidelines of IS codes. Material and geometric properties of each building is kept uniform for analysis purpose with typical floor plan at each storey level. The present dissertation work has the following objectives:

1.To develop a model of RCC framed building which is actually constructed up to G+3 but has been analyzed using computer based software "STAAD Pro V8i" by taking different storey heights where each storey height is kept same as 3.35 mts. This building may or may not be perfectly regular as per guidelines of IS 1893.

2. To study the guidelines of IS 1893 PART 1 2002 with respect to general and design criteria.

3.To study the variations of Base Shear in all the buildings models under the effect of EQ in Seismic Zones (IV & V) using Dynamic Analysis (Response Spectrum Method)and various Site Specific Parameters and plotting the results of variations.

4.To study the variations in percentage of mass participation in all building models by varying various Sites structural Parameters in Response Spectrum Analysis.

5.To study the variation in Time Period and Frequency of all building models by varying various Site structural Parameters using Response Spectrum Analysis.

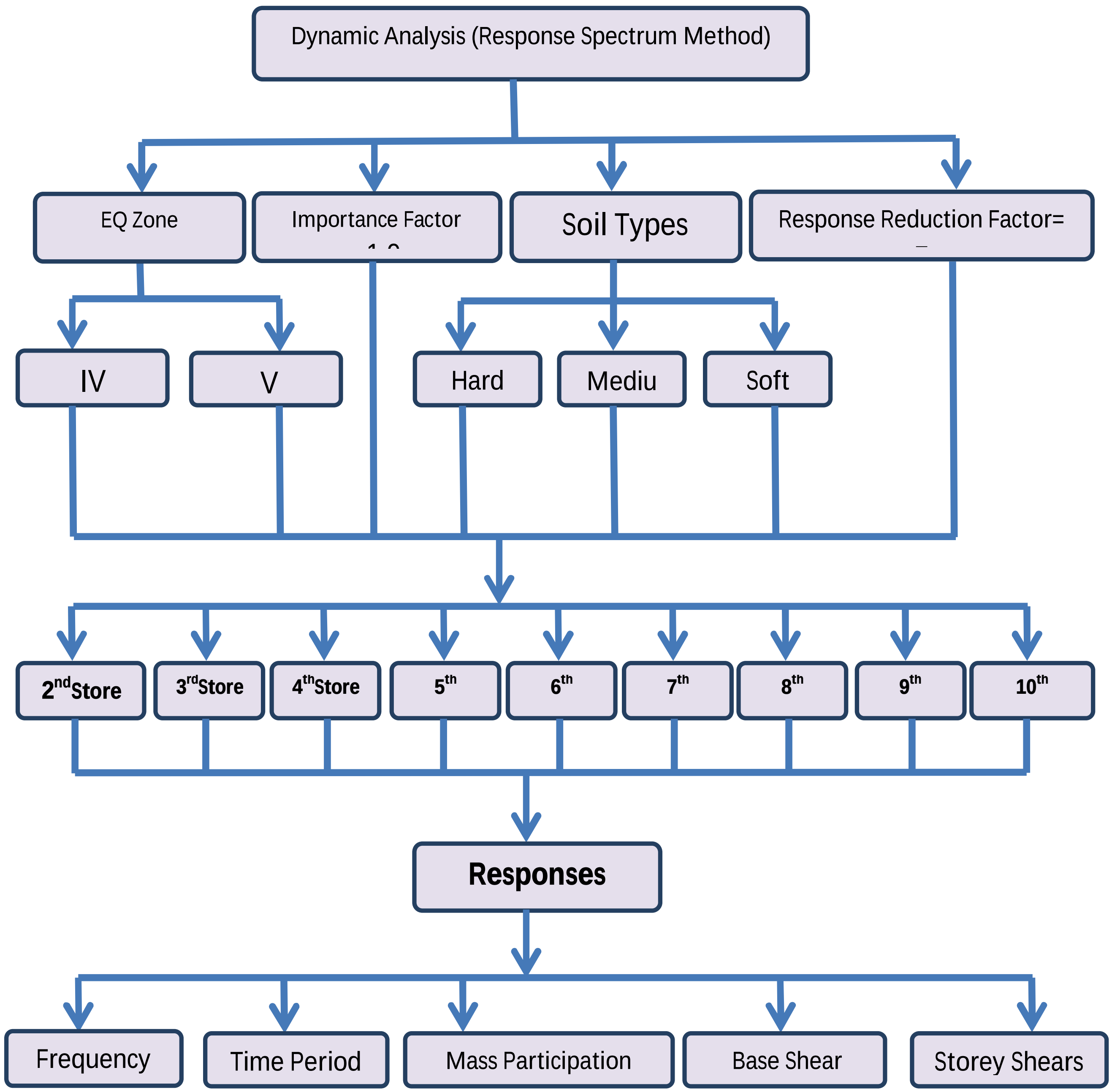


FIG 1: BLOCK DIAGRAM SHOWS THE SCOPE OF STUDY

CHAPTER- 2

THE EARTHQUAKE

2.1 INTRODUCTION

India is one of the active seismic countries, which from the beginning of the 20^{th} century has experienced more than 700 earthquakes of magnitude 5 or more leading to enormous destruction of lively hood. An earthquake is also known as a tremor or temblor. In its most generic sense, the word earthquake is used to describe any seismic event, whether a natural phenomenon or an event caused by humans, that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by volcanic activity, landslides, mine blasts, and nuclear experiments.

An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. Rocks are made of elastic material, and so elastic strain energy is stored in them during the deformations that occur due to the gigantic tectonic plate actions that occur in the Earth. But, the material contained in rocks is also very brittle. Thus, when the rocks along a weak region in the Earth's Crust reach their strength, a sudden movement takes place there, opposite sides of the fault, suddenly slip and release the large elastic strain energy stored in the interface rocks. When large elastic strain energy released spreads out through seismic waves that travel through the body and along the surface of the Earth.

2.2 EARTHQUAKE, EARTHQUAKE WAVES AND GROUND MOTION

Earthquakes produce different types of seismic waves which travel through rock, and provide an effective way to image both sources and structures deep within the Earth. There are three basic types of seismic waves in solids: P-waves, S-waves [both body waves] and interface waves. The two basic kinds of surface waves [Rayleigh and Love] which travel along a solid-air interface can be fundamentally explained in terms of interacting P- and/or S-waves.

The first kind of body wave is the P wave or primary wave. This is the fastest kind of seismic wave. The P wave can move through solid rock and fluids, like water or the liquid layers of the earth. It pushes and pulls the rock, it moves through, just like sound waves push and pull air. P wave reaches the seismogram first and is recorded as the first seismic recording. Hence the detection of P waves for seismic warning systems is of utmost importance.

The second type of body wave is the S wave or secondary wave, it is the second wave felt in an earthquake. An S wave is slower than a P wave and can only move through solid rock. This wave moves rock up and down, or side-to-side.

The first kind of surface wave is called a Love wave, named after A.E.H. Love, a British mathematician who worked out the mathematical model for this kind of wave in 1911. It's the fastest surface wave and moves the ground from side-to-side.

The other kind of surface wave is the Rayleigh wave, named after John William Strutt, Lord Rayleigh, who mathematically predicted the existence of this kind of wave in 1885. A Rayleigh wave rolls along the ground just like a wave rolls across a lake or an ocean. Because it rolls, it moves the ground up and down and side-to-side in the same direction that the wave is moving. Most of the shaking felt from an earthquake is due to the Rayleigh wave, which can be much larger than the other waves.

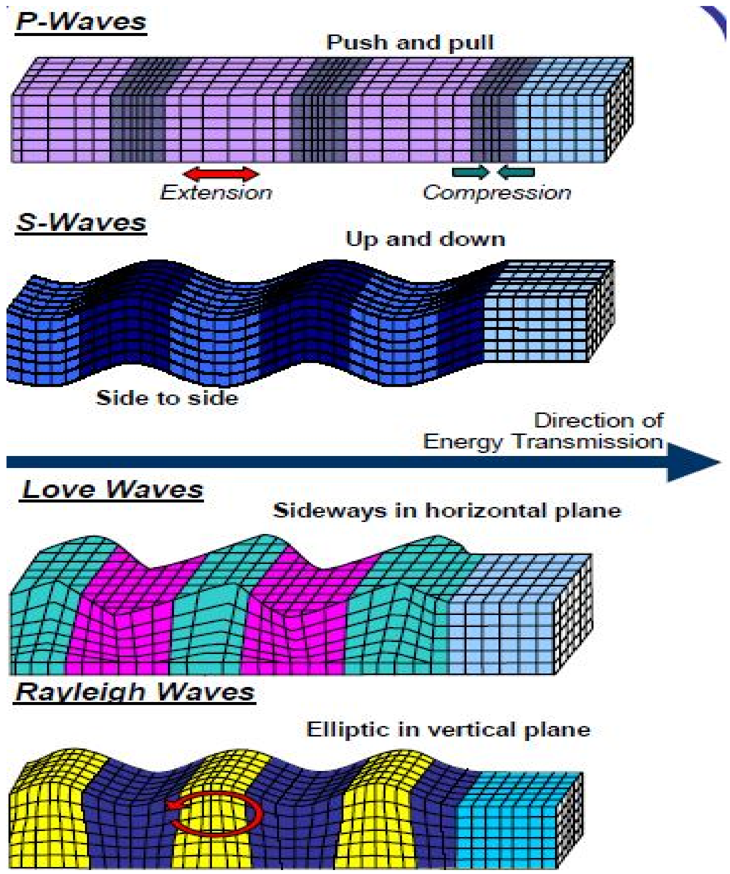


FIG 2: TYPES OF EARTHQUAKE WAVES

The shaking of the earth surface due to these waves is recorded by the seismograph. These graphs are used to locate the earthquake and energy released from the event in terms of magnitude of the earthquake. The magnitude of earthquake is a number, which is a measure of energy released in an earthquake. It is defined as logarithm to the base 10 of the maximum trace amplitude, expressed in microns, which the standard short-period torsion seismometer [with a period of 0.8 s, magnification 2 800 and damping nearly critical] would register due to the earthquake at an epicentral distance of 100 km.

And the effect of earthquake at any place is measured in terms of Intensity. The intensity of an earthquake at a place is a measure of the strength of shaking during the earthquake, and is indicated by a number according to the modified Mercalli Scale or M.S.K. Scale of seismic intensities.

There are 12 levels in this scale. Based on the levels of intensities, sustained during damaging past earthquakes, the 2002 version of the zone map subdivides India into four zones – II, III, IV and V. The maximum Modified Mercalli [MM] intensity of seismic shaking expected in these zones were VI or less, VII, VIII, and IX and higher, respectively.

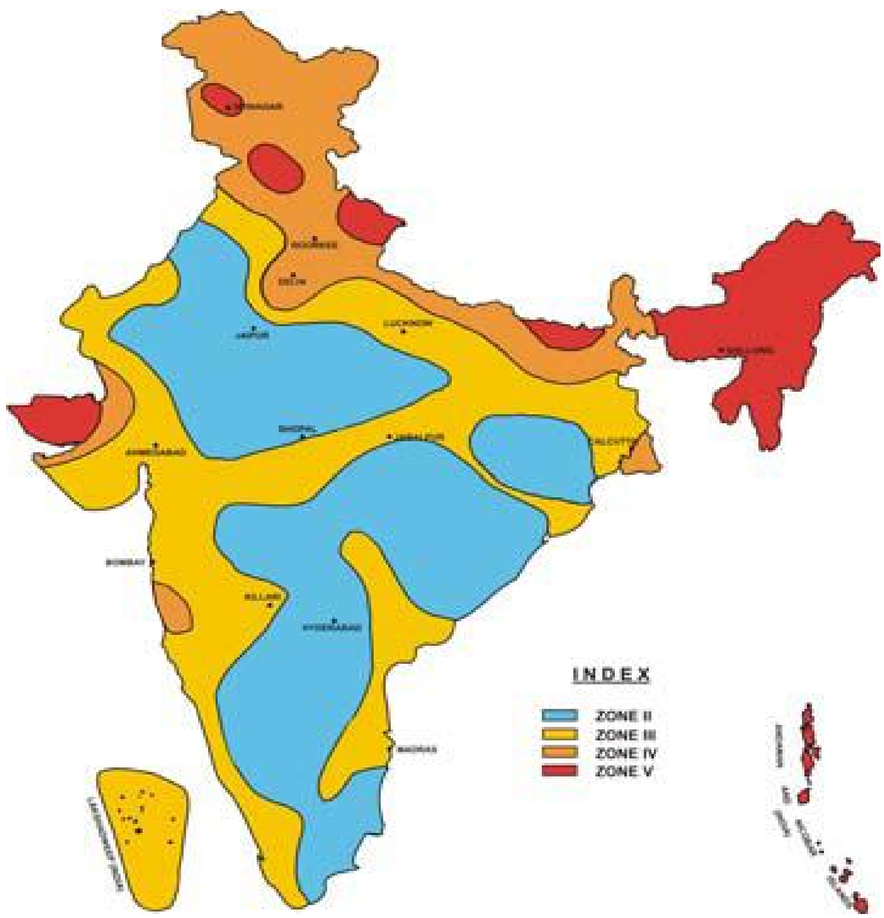


FIG. 3: SIESMIC ZONES IN INDIA AS PER IS 1893-2002

There are four basic causes of earthquake induced damage: ground shaking, ground failure, tsunamis and fire. The principal cause of earthquake-induced damage is ground shaking. As the earth vibrates, all buildings on the ground surface will respond to that vibration in varying degrees. Earthquake induced accelerations, velocities and displacements can damage or destroy a building unless it has been designed and constructed or strengthened to be earthquake resistant. Therefore, the effect of ground shaking on buildings is a principal area of consideration in the design of earthquake resistant buildings. Seismic design loads are extremely difficult to determine due to the random nature of earthquake motions. However, experiences from past strong earthquakes have shown that reasonable and prudent practices can keep a building safe during an earthquake.

2.3 SEISMIC ANALYSIS OF STRUCTURES

Seismic Analysis is a subset of structural analysis and is the calculation of the response of a building [or non building] structure to earthquakes. A building has the potential to 'wave' back and forth during an earthquake [or even a severe wind storm]. This is called the 'fundamental mode', and is the lowest frequency of building response. Most buildings, however, have higher modes of response, which are uniquely activated during earthquakes. Earthquake engineering has developed a lot since the early days, and some of the more complex designs now use special earthquake protective elements either just in the foundation [base isolation] or distributed throughout the structure. Analyzing these types of structures requires specialized explicit finite element computer codes.

Seismic Analysis of the structure can be broadly divided into the following two categories:

2.3.1 EQUIVALENT STATIC ANALYSIS

This approach defines a series of forces acting on a building to represent the effect of earthquake ground motion, typically defined by a seismic design response spectrum. It assumes that the building responds in its fundamental mode. The approximate fundamental natural period of vibration, T (second) of an RC moment-resisting frame (MRF) is to be estimated by the empirical expression:

$$Tn = 0.075h^{0.75}$$

Where,

h = the total height of the main structure, m

The base shear is calculated may be calculated using the following equation obtained by [I.S.-1893: Part 1: (2002)]:

Vb = AhW

Ah = Design horizontal acceleration spectrum value, using the fundamental natural period Ta considered in the direction of vibration.

$$Ah = \frac{Z \ I \ Sa}{2 \ R \ g}$$

W = Seismic weight of building.

The base shear is calculated using the first mode period of the building. To obtain the design seismic force, the elastic force corresponding to the fundamental natural period is then reduced to the actual capacity of the structure with the help of this factor. The calculated design base shear force, VB, is then distributed over the height of the building. The design lateral force, Qi, at the floor i, is obtained by [I.S.-1893: Part 1: (2002)]:

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

Where,

Wi = the seismic weight of floor i

hi = the height of floor I measured from the base

N = the total number of floors in the building (number of levels at which the masses are lumped).

The limitation of equivalent static lateral force analysis is that empirical relationships are used to specify dynamic inertial forces as static forces which do not explicitly account for the dynamic characteristics of the particular structure being designed or analyzed. These formulas were developed to approximately represent the dynamic behavior of regular structures. For such structures, the equivalent static force procedure is most often adequate. Structures that are classified as irregular violate the assumptions on which the empirical formulas, used in the equivalent static force procedure, are developed. Inherently, equivalent static lateral force analysis is based on the following assumptions:

1. Structure is rigid.
2. Perfect fixity between structure and foundation.
3. Same acceleration is induced in each point of structure during ground motion.
4. Dominant effect of earthquake is equivalent to horizontal force of varying magnitude over the height.
5. Base shear on the structure is determined approximately.

2.3.2 DYNAMIC ANALYSIS

Dynamic analysis shall be performed to obtain the design seismic force and its distribution along the height of the building and to the various lateral load resisting elements, for the following buildings:

a.) Regular buildings - Those greater than 40 m in height in Zones IV and V and those greater than 90 m in height in Zones II and III.

b.) Irregular buildings - All framed buildings higher than 12 m in Zones IV and V, and those greater than 40 m in height in Zones II and III.

c.) Modes to be considered: The number of modes to be used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90%.

Dynamic analysis may be performed either by the Time History Method or by the Response Spectrum Method. However, in either method, the design base shear [V_B] shall be compared with a base shear [V_b] calculated using a fundamental period [Tn]. Where V_B is less than V_b, all the response quantities [exp: member forces, displacement, storey forces, storey shears and base reactions] shall be multiplied by V_b/V_B. [I.S.-1893: Part 1: (2002)]:

However, in the present dissertation work, all the Nine building models with Two storey building to Ten storey building have been analysed using dynamic analysis.

2.3.2.1 RESPONSE SPECTRUM ANALYSIS

This approach permits the multiple modes of responses of a building to be taken into account as required in analysis for all except for very simple or very complex structures. This method is an elastic dynamic analysis approach that relies on the assumption that dynamic response may be found by considering the independent responses of each natural mode of vibration and then combined to provide an estimate of the total response of the structure. The response of a structure can be defined as a combination of many special shapes [modes]. Computer analysis can be used to determine these modes for a structure. Combination methods include the following:

1.Absolute (ABS Method) – peak values are added together **:** It is modal combination method based on assumption that all modal peaks occurs at the same time and algebraic sign is ignored to get an upper bound to the peak value of the total response. This upper bound value (ABS VALUE) is too conservative.

$$r_o \leq \sum_{n=0}^{N} r_{no}$$

2. Square root of the sum of the squares [SRSS Method] - Itis approximate for combining modal response. In this method, the squares of a specific response are summed. The square root of this sum is taken to be combines effect. It is important to note that the quantities combined are those for each individual mode.

$$r_o = \left(\sum_{n=1}^{nN} {r_{no}}^2\right)^{0.5}$$

3. Complete quadratic combination [CQC]: In this method ,the peak response quantities are combined as per Complete Quadratic Combination (CQC) method [I.S.-1893: Part 1: (2002)]:

$$\lambda = \sqrt{\sum_{i=1}^{r} \sum_{j=1}^{r} \lambda_i \rho_{ij} \lambda_j}$$

Where;

r = number of modes considered

λ_i = response quantity in mode i (including sign),

λ_j = response quantity in mode j (including sign),

$$\rho_{ij} = \frac{8\varsigma^2(1+\beta)\beta^{1.5}}{(1+\beta^2)^2+4\varsigma^2\beta(1+\beta)^2}$$

ς = modal damping ratio in fraction

β = Frequency ratio = ω_j/ω_i

ω_j = circularfrequency in j^{th} mode, and

ω_i = circular frequency in i^{th} mode

Other methods, like SRSS or ABS method, to combine modes may be used but CQC method is preferred if there are closely spaced modes are present.

The following design spectrum (5% spectra) was utilized in response spectrum analysis for rocky/ hard or medium or soft soil sites in accordance with IS: 1893 [Part1]: 2002,

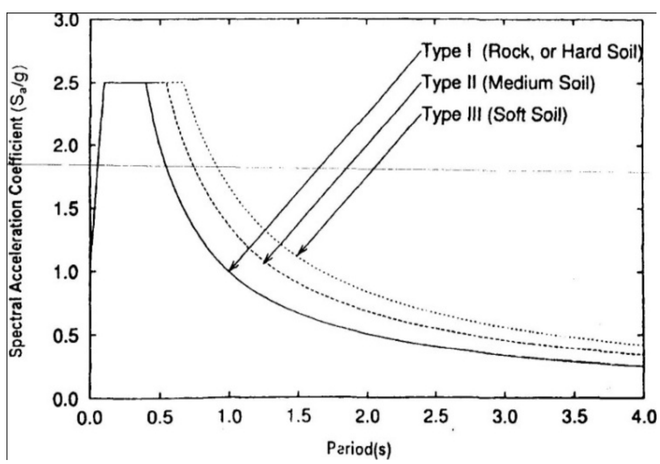


FIG. 4:- RESPONSE SPECTRA FOR DIFFERENT SOIL CONDITIONS.

For Hard/Rocky soil sites:

Sa/g	1+15 T when 0.00 < =T<= 0.10 sec
	2.50 when 0.10 <=T<=0.40 sec
	1 / T when 0.40 <=T<=4.00 sec

For Medium soil sites:

Sa/g	1+15 T when 0.00 < =T<= 0.10 sec
	2.50 when 0.10 <=T<=0.55 sec
	1 .36/ T when 0.55<=T<=4.00 sec

For Soft soils sites:

Sa/g	1+15 T when 0.00 <= T<= 0.10 sec
	2.50 when 0.10 <=T<=0.67 sec
	1.67 / T when 0.67<=T<=4.00 sec

In cases where structures are either too irregular, too tall or of significance to a community in disaster response, the response spectrum approach is no longer appropriate, and more complex analysis is often required, such as non-linear static or dynamic analysis.

2.3.2.1. 2 Response Spectrum Method by using STAAD Pro.

The design lateral forces at each floor in each mode are computed by STAAD Pro in accordance with IS: 1893(Part 1)-2002 .The software provides the result for design values, modal masses and storey wise base shear.
STAAD uses the following procedure to generate lateral seismic loads:

a) User provides the value for ZI/2.R as factors for input spectrum.
b) Program calculates time periods for the modes as specified by user.
c) Program calculates Sa/g for each mode utilizing time period and damping or each mode.
d) The program then calculates the horizontal acceleration spectrum Ah for different modes.
e) The program then calculates mode participation factor for different modes.
f) The peak lateral seismic forces at each floor in each mode are calculated.
g) All response quantities for each mode are calculated.
h) The peak response quantities are then combined as per method (CQC, or SRSS or ABS or TEN) as defined by the user to get the final results.

2.3.2.2 TIME HISTORY ANALYSIS

The dynamic time history analysis is used to determine the dynamic response of a structure through the direct numerical integration of the dynamic equilibrium equations.

Unlike modal response spectrum analysis, which provides the best estimates of the peak response by statistical means such as the SRSS and the CQC rules, peak response quantities determined by dynamic time history analysis are exact, within the framework of the reliability. The only drawbacks of the approach are its sophistication and the relative sensitivity of its outcome to the choice of input ground motions.

2.4 MODES TO BE CONSIDERD

The number of modes to be used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and missing mass correction beyond 33 percent. If modes with natural frequency beyond 33 Hz are to be considered, modal combination shall be carried out only for modes up-to 33 Hz. The effect of higher modes shall be included by considering missing mass correction following well established procedures [I.S.-1893: Part 1: (2002)].

CHAPTER-3

PROGRAMME OF STUDY

3.1 INTRODUCTION

Regular shape plan buildings are one of the basic principles of the seismic resistant design. Inertia forces are obvious in seismic excitation for all the symmetric plan buildings but irregular buildings attract twisting couple along with linear vibrations. A symmetric building shows very disciplined performance during any level of earthquake. In the present work, an actual building (G+3) is modeled and for analysis purpose the height of the buildings is increased with every storey so as to get the different models details of which are presented in coming sections.

3.2 METHOD OF ANALYSIS

To study the responses of RC framed building under the influence of EQ, we can choose software packages available in market. These software are efficient for multi-storey buildings and give results very close to practical values. Many software are available in market likewise ANSYS, ETABS, SAP2000, Staad Pro V8i and many more. Each software has unique capability, mostly can analyzes multi-storey buildings. Staad Pro V8i is most widely and commonly used software in design offices and is popular for structural analysis and design in the construction of industry that is integrated with the Bentley Systems for infrastructure design. Modeling of architecturally rich building is very easier in this software.

3.3 MODELING AND ANALYSIS IN STAAD Pro

Staad Pro V8i is the software which is based on Finite Element method. It is one of the most popular software available now days. The main steps for analyses and design the structure:

1. Creating geometry.
2. Defining the properties of beam, column, plate, surface etc.
3. Defining the constants, specifications, and supports
4. Defining load systems.

5. Analyzing model using appropriate analysis method.
6. Design structure according to desire code.

3.4 INPUT DATA FOR STRUCTURE ANALYSIS IN STAAD PRO.

TABLE 1-STRUCTURAL DATA

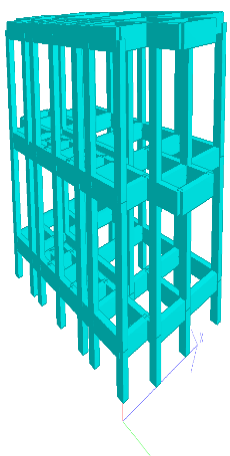
GENERAL DATA	DETAILS
NO OF MODELS OR ANALYSIS	9
NO. OF STOREYS	2 to 10
FLOOR TO FLOOR HEIGHT OF EACH BUILDING MODEL	3.35 m
SIZES OF EACH RCC BEAM ELEMENT IN ALL MODELS	350x500 mm
SIZES OF EACH COLUMN ELEMENT IN ALL MODELS	350x500 mm
CONCRETE GRADE	M25
STEEL GRADE	Fe 500
DENSITY OF CONCRETE	2500 kN/m^3

TABLE 2- EARTHQUAKE DATA

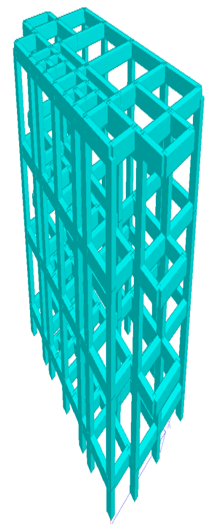
EARTHQUAKE DATA	DETAILS
ZONE VALUE (IV & V)	0.24,0.36
IMPORTANCE FACTOR FOR ALL MODELS	1
RESPONSE REDUCTION FACTOR FOR ALL MODELS	5
TYPE OF SOIL	1,2,3
DAMPING RATIO	0.05
CUT OFF MODE	30

3.5 BUILDING CONFIGURATIONS

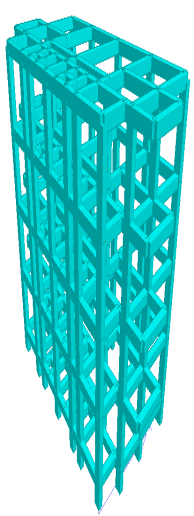
In the present study, Nine models of RCC framed buildings from 2 storey to 10 storey height all having same geometric and material properties have been created using STAAD Pro V8i, with the same loading and floor plans whose configurations are shown as below:



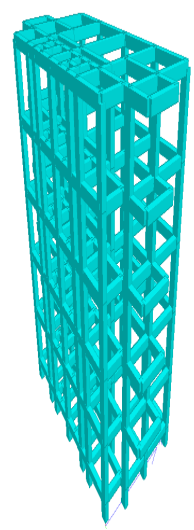
Model 1: ISOMETRIC VIEW: TWO STOREYBUILDING



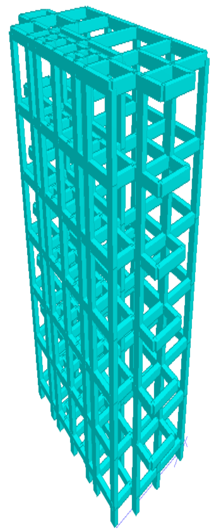
Model 2: ISOMETRIC VIEW: THREE STOREY BUILDING

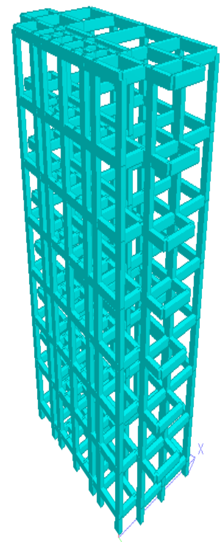


Model 3: ISOMETRIC VIEW: FOUR STOREY BUILDING

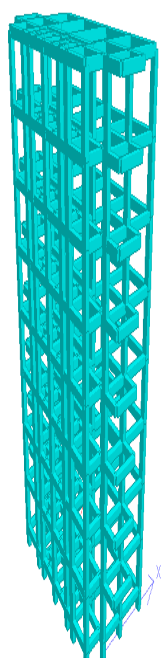


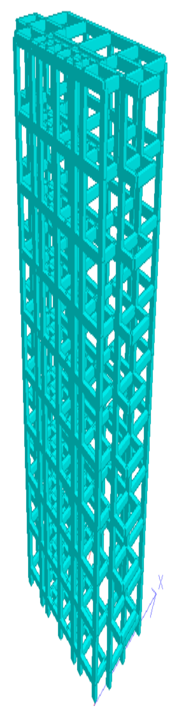
Model 4: ISOMETRIC VIEW: FIVE STOREY BUILDING



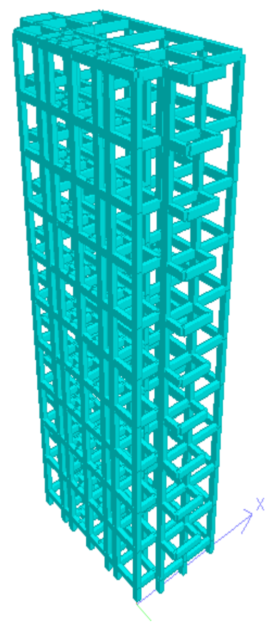


Model 5: ISOMETRIC VIEW: SIX STOREY BUILDING **Model 6: ISOMETRIC VIEW: SEVEN STOREY BUILDING**





Model 7: ISOMETRIC VIEW: EIGHT STOREY BUILDING **Model 8: ISOMETRIC VIEW: NINE STOREY BUILDING**



Model 9: ISOMETRIC VIEW: TEN STOREY BUILDING

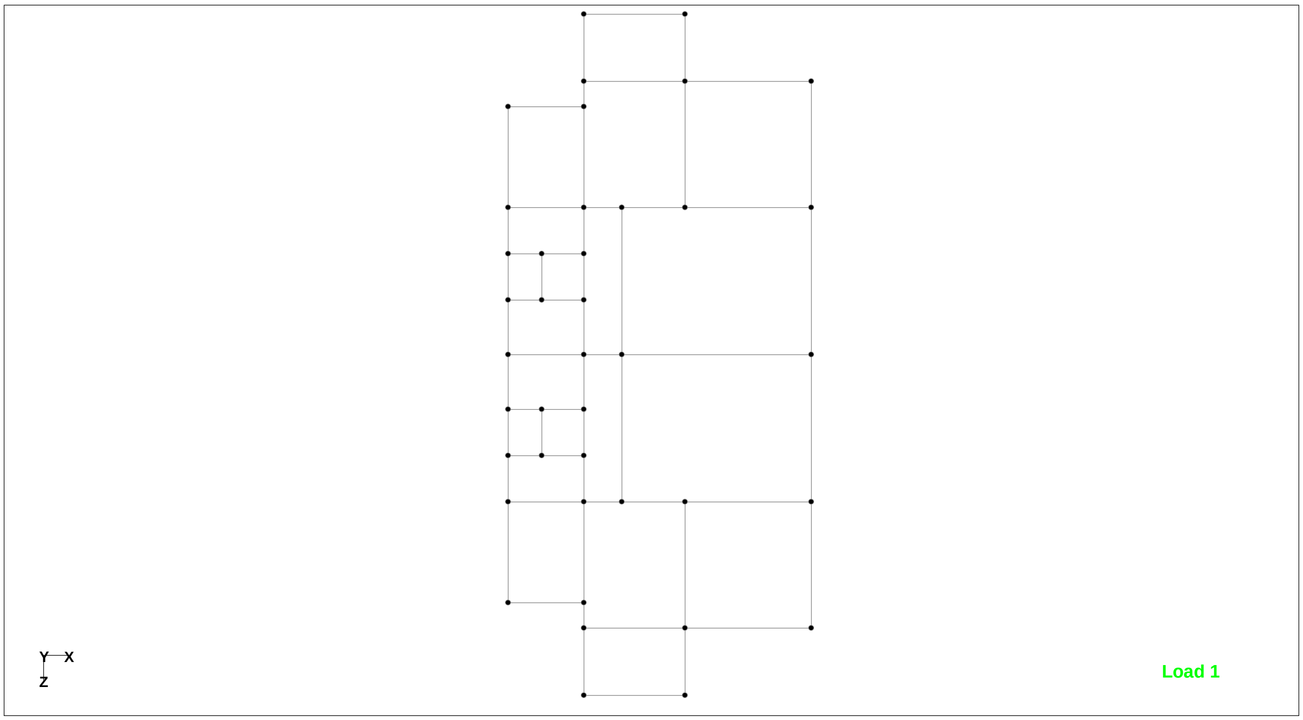


FIG 5 : FLOOR PLAN (TYP.)

(Same at every level for each model)

3.6 INPUT PARAMETERS

Input parameter are weight on each floor, seismic weight on each floor, dimension of building, beam and column, soil type &site condition of building, purpose of building, type of materials used as provided above.

In the present dissertation work, all the three soil types 'i.e. Hard, Medium and Soft soil has been taken and analysis has been carried out.

Following paragraphs describe each input parameter briefly:

Design Acceleration Spectrum: For a specified damping ratio, Design acceleration spectrum refers to an average smoothened plot of maximum acceleration as a function of frequency or time period of vibration for earthquake excitations at the base of a single degree of freedom system (SDOF).

Importance Factor: A factor used to obtain the design seismic force depending on the functional use of the structure, characterized by hazardous aftermaths of its failure, i.e. its post-earthquake functional need, historic or economic importance of the structure. In present study , Importance factor has been taken as 1 for all the models under consideration.

Response Reduction Factor*:* It is the factor by which the actual base shear force, that would be generated if the structure were to remain elastic during its response to the Design Basis Earthquake (DBE) shaking, shall be reduced to obtain the design lateral force. In the present study, Special RC moment resisting frames has been considered, accordingly this factor has been taken as 5.

Zone Factor (Z): It is a factor to obtain the design spectrum depending on the perceived maximum seismic risk characterized by Maximum Considered Earthquake (MCE) in the zone in which the structure is located. In this work, Severe and very severe zone ie IV and V has been considered.

Structural Response Factor ($\frac{s_a}{g}$ ***):*** It is a factor denoting the acceleration response spectrum of the structure subjected to earthquake ground vibrations, and depends on natural period of vibration and damping of the structure.

Damping: The effect of internal friction, imperfect elasticity of material, slipping, sliding, etc. in reducing the amplitude of vibration and is expressed as a percentage of critical damping. 5% damping is considered.

Modal Mass: Modal mass of a structure subjected to horizontal or vertical, as the case maybe, ground motion is a part of the total seismic mass of the structure that is effective in mode ***k*** of vibration. The modal mass for a given mode has a unique value irrespective of scaling of the mode shape.

Normal Mode: A system is said to be vibrating in a normal mode when all its masses attain maximum values of displacements and rotations simultaneously, and pass through equilibrium positions simultaneously.

Seismic Weight: It is the total dead load plus appropriate amounts of specified imposed load.

3.7 LOAD CALCULATIONS

Dead Load:

a) Self weight of the structure. : Self weight of bare frame as modeled in STAAD.

b) Self Weight (Dead Slab) =0 .125*25=3.125 KN/m^2

c). Floor finishes @40mm .04*24=0.96KN/m^2

Total Dead Load=4.1 KN/m^2

Superimposed Dead Load:

Wall Load Intensity –

a) 230 Thk .Wall load: 0.23x1x (3.35-0.46) x20 = 13.29 KN/m

b) Parapet Wall: 0.23x1x1.2 x20 = 5.52 KN/m

Live load =2 KN/~~m~~^{2} (For reduced by 75 % in Earthquake condition [As per IS 875:Part II]= residential Buildings),

3.8 LOAD COMBINATIONS:

According to IS 1893:2002, following load combinations shall be consider for analysis of Reinforced Concrete building:

(a) 1.5 D.L. ± 1.5 L.L.

(b) 1.2 D.L. ± 1.2 L.L. ±1.2 E.L.

(c) 0.9 D.L. ±1.5E.L.

(d) 1.5 D.L. ± 1.5 E.L.

3.9 ASSUMPTIONS IN ANALYSIS

The following assumptions arc made in analysis:

1) The bases of the frames arc assumed as fixed with respect to rotational and translational movements.

2) Bare frames are analyzed for incoming loads from slabs, partitions, and self-weights of the members and infill effect is not considered in analysis.

3) The effect of material deteoration is neglected.

3.10 DETAILS OF STEPS PERFORMED

All building models from (two storey to ten storey) i.e nine no of models as whose isometric view is already shown in previous chapter, are analyzed in STAAD PRO V8i , details of the steps performed are presented below:

1. Once the model is created in software with dimensions and specifications as discussed above in Sl No. 3.3., all the loadings as specified in Sl No. 3.6 & 3.7 is applied on the model.

2.For calculating seismic force, every joint in structure is pinned and static analysis is performed to calculate resulting reaction on each joint. Reaction in global Y direction is calculated under the impact of (DL+25%LL), and its seismic force is applied on each joint.

3.Parameters as required in Response spectrum Method such as value of response Spectrum(Z/2*/I/R),No. of modes ,damping ratio, method of modal mass combination [CQC] to be adopted in analysis with different soil conditions i.e Hard , medium of soft soil are entered into the program and analyzed.

4.Responses under the effect of EQ loading followed by different combinations are analyzed and results are noted down in terms of time period, frequency, Base shear, storey shears, mass participation factors, and is framed in next chapter. Responses for the following Cases under this dissertation work are carried out:

a) Two Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil having total height of building 7.9 mtrs.

b)Three Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil having total height of building as 11.25 mts.

c) Four Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil having total height of building as 14.6 mts.

d) Five Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil. having total height of building as 17.95 mts.

e)Six Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil having total height of building as 21.3 mts.

f)Seven Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil having total height of building as 24.65 mts.

g)Eight Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil having total height of building as 28 mts.

h)Nine Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil, having total height of building as 31.35 mts.

i)Ten Storey Building with Seismic Zone IV and V with Hard, Medium and Soft soil, having total height of building as 34.7 mts.

For each case from (a to j), same strength values, Importance factor and Response Reduction factor are assigned.

3.11 OUTPUT PARAMETERS:

Parameters for which structure is analyzed are frequency, time period, spectral acceleration, base shear, SRSS shear, CQC shear, ABS shear, storey shear, and mass participation factor.

1.Modal Participation Factor: Modal participation factor of mode k of vibration is the amount by which mode k contributes to the overall vibration of the structure under horizontal and vertical earthquake ground motions. Since the amplitudes of 95 percent mode shapes can be scaled arbitrarily, the value of this factor depends on the scaling used for mode shapes.

2.Natural Period: Natural period of a structure is its time period of undammed free vibration.

3.Storey Shear: It is the sum of design lateral forces at all levels above the storey under consideration**.**

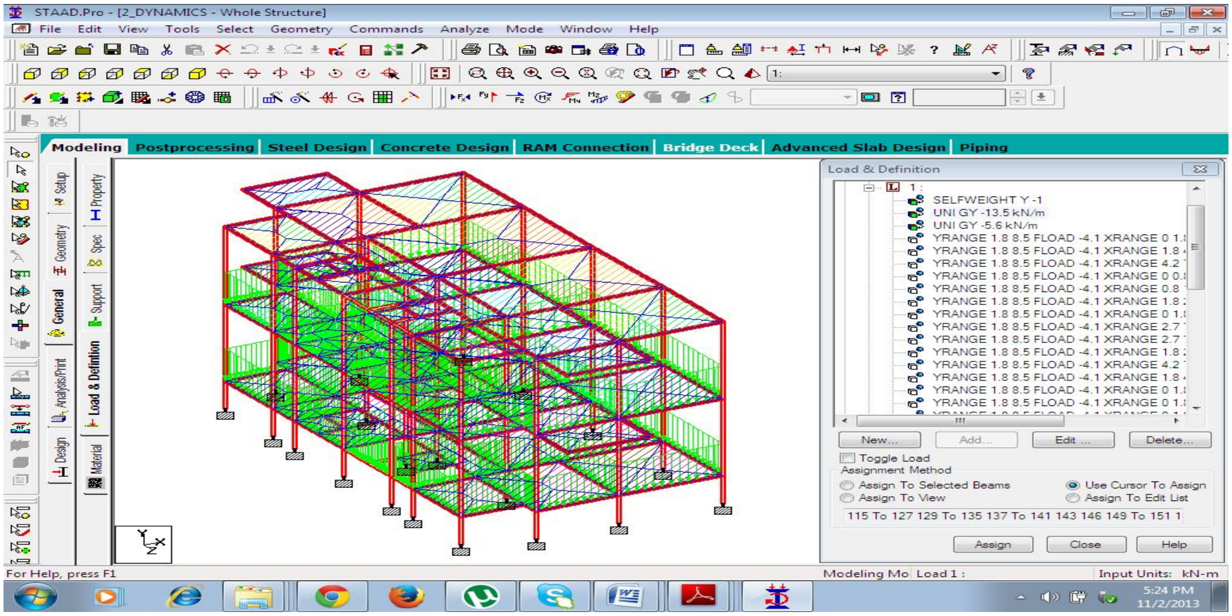


FIGURE 6 -LOADING ON TWO STOREY BUILDING

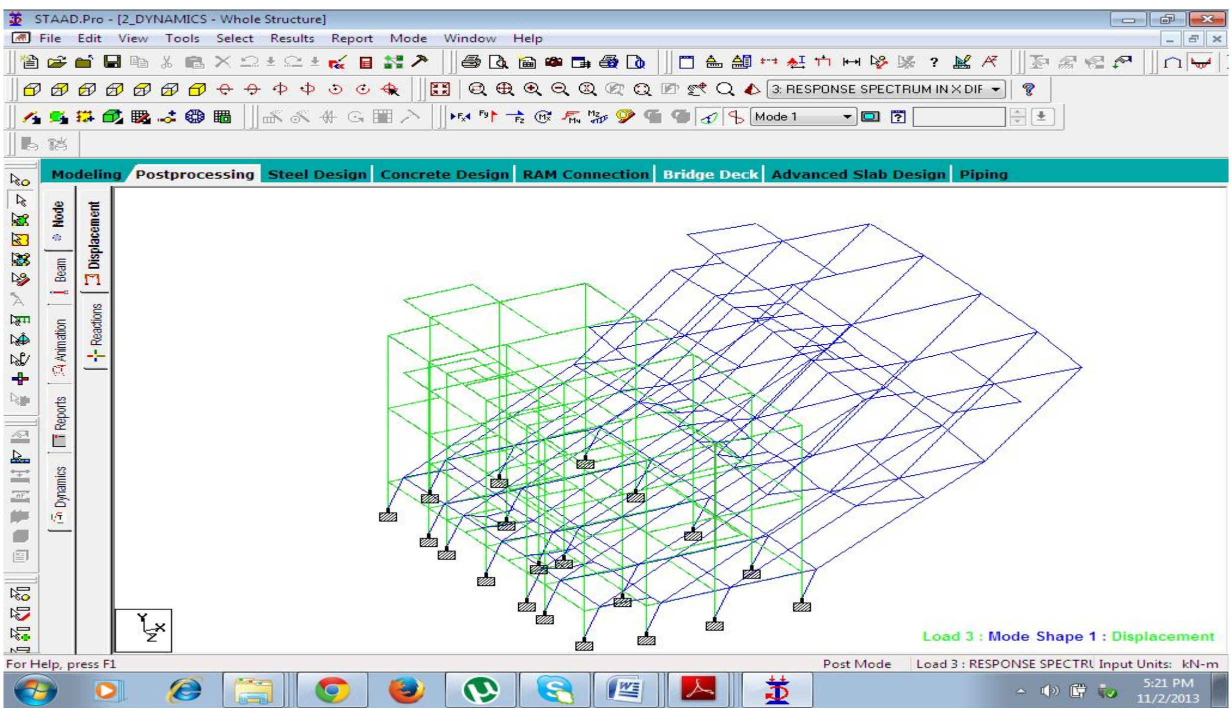


FIGURE 7- MODE SHAPE OF TWO STOREY BUILDING IN MODE 1

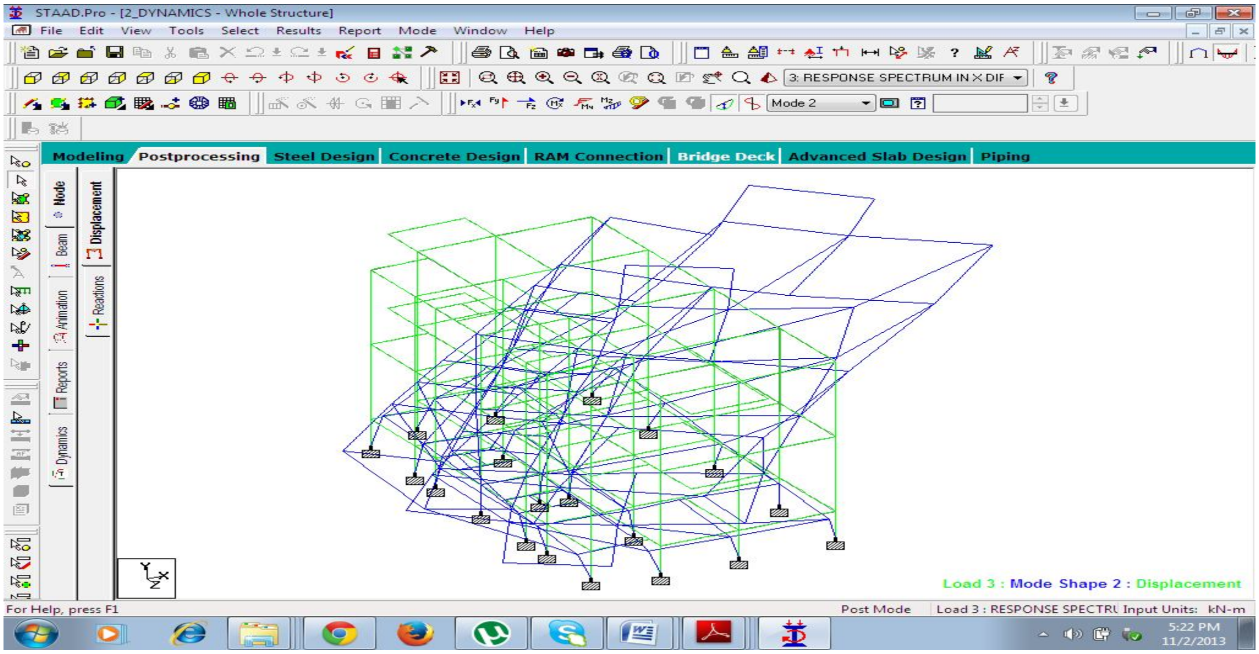


FIGURE 8- MODE SHAPE OF TWO STOREY BUILDING IN MODE 2

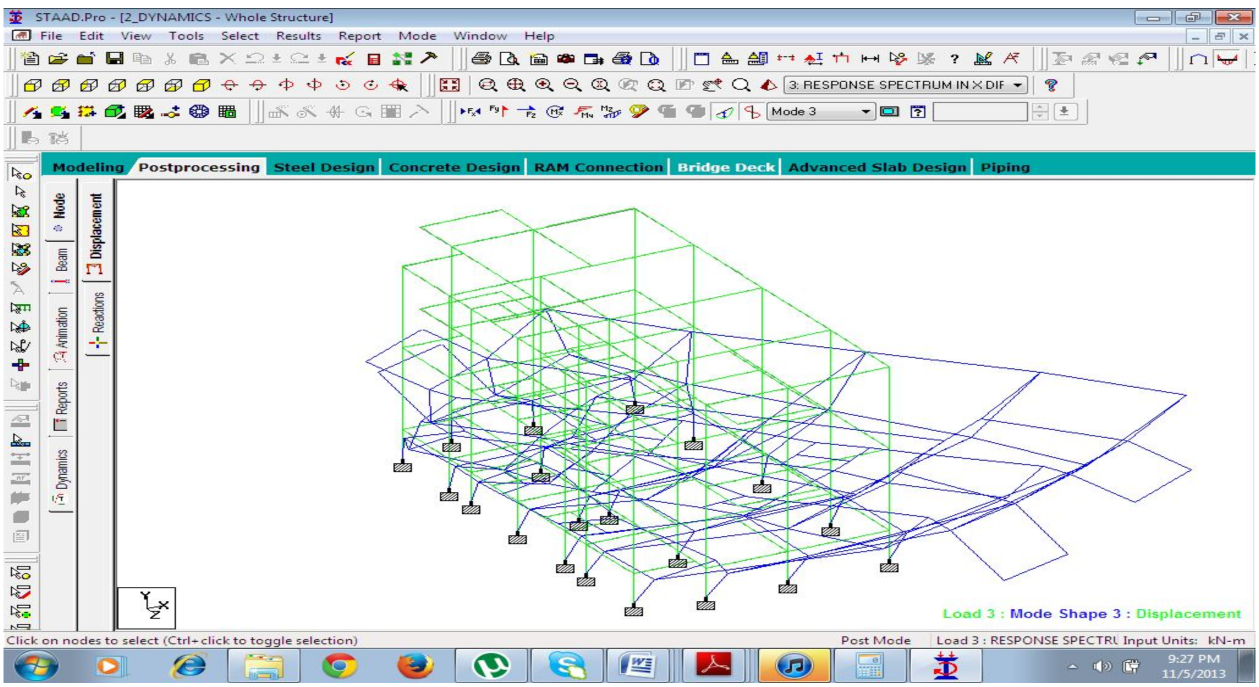


FIGURE 9- MODE SHAPE OF TWO STOREY BUILDING IN MODE 3

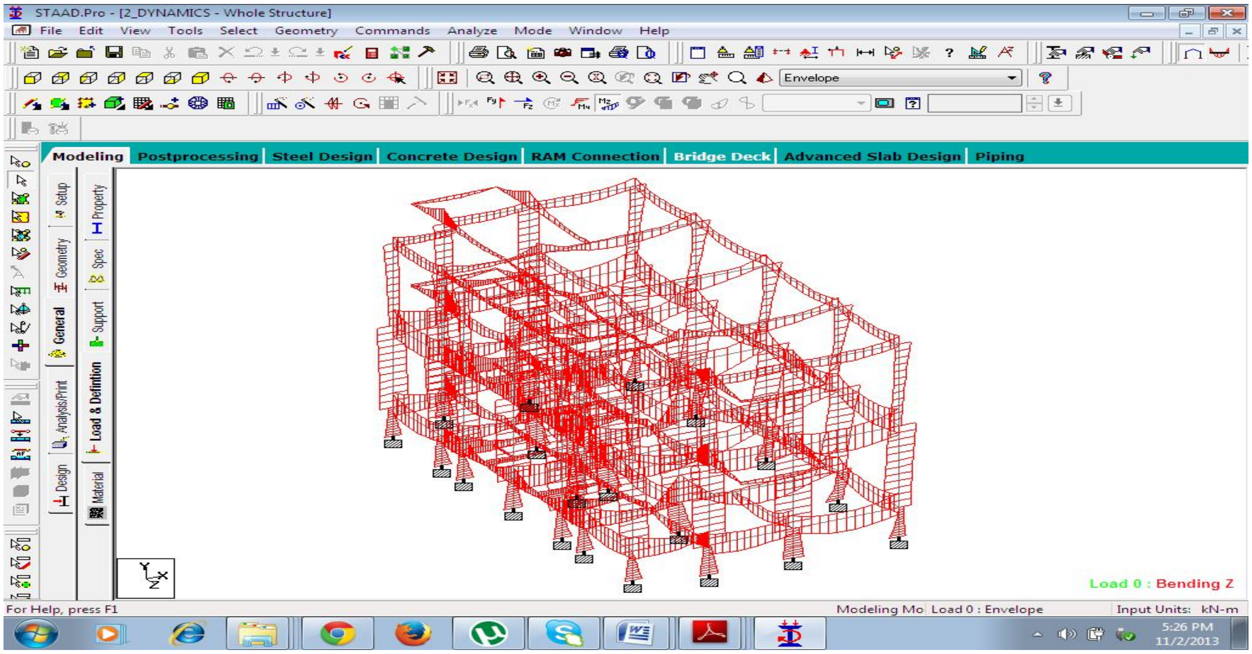


FIGURE 10 - BENDING MOMENT IN TWO STOREY BUILDING (ENVELOPE CASE.)

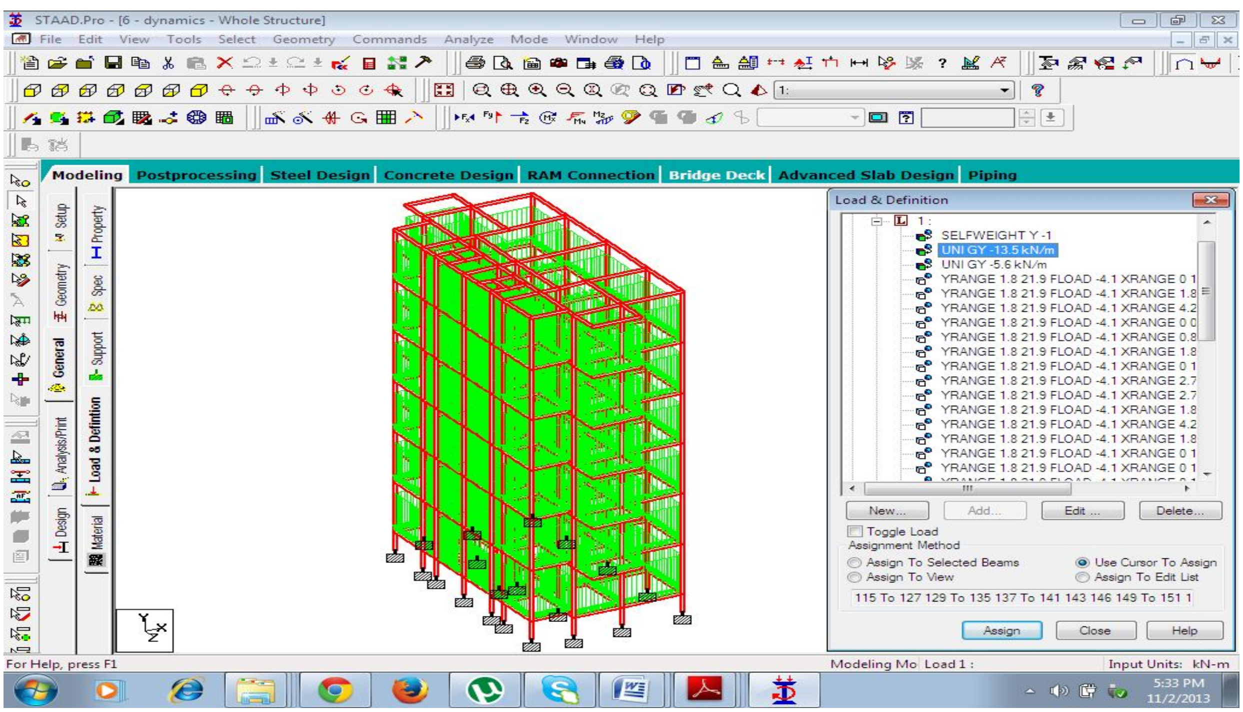


FIGURE 11- LOADING ON SIX STOREY BUILDING

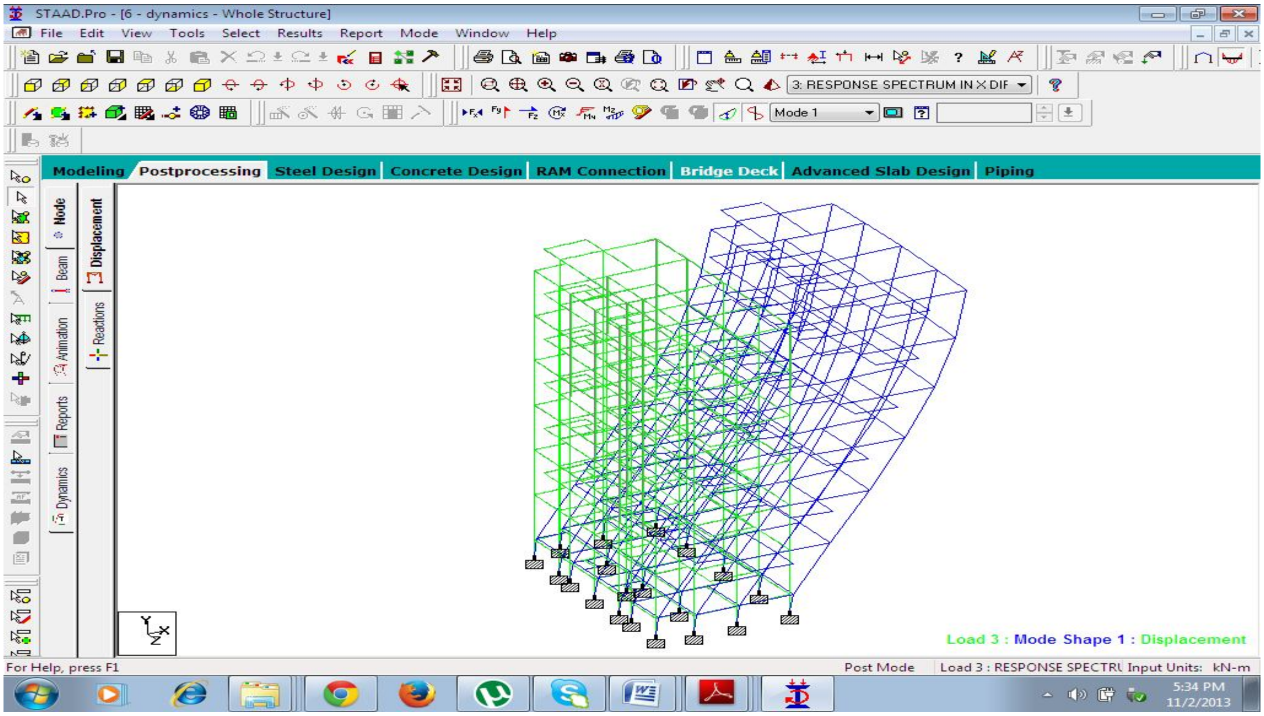


FIGURE 12- MODE SHAPE OF SIX STOREY BUILDING FOR MODE 1

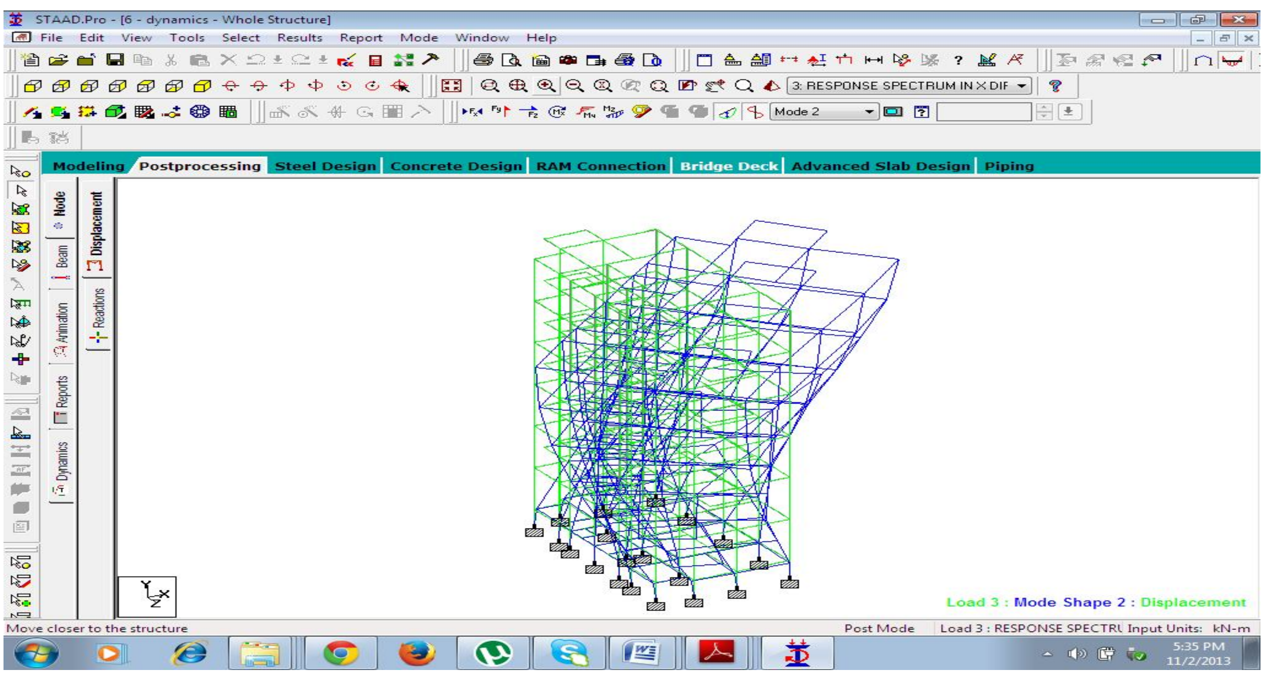


FIGURE 13- MODE SHAPE OF SIX STOREY BUILDING FOR MODE 2

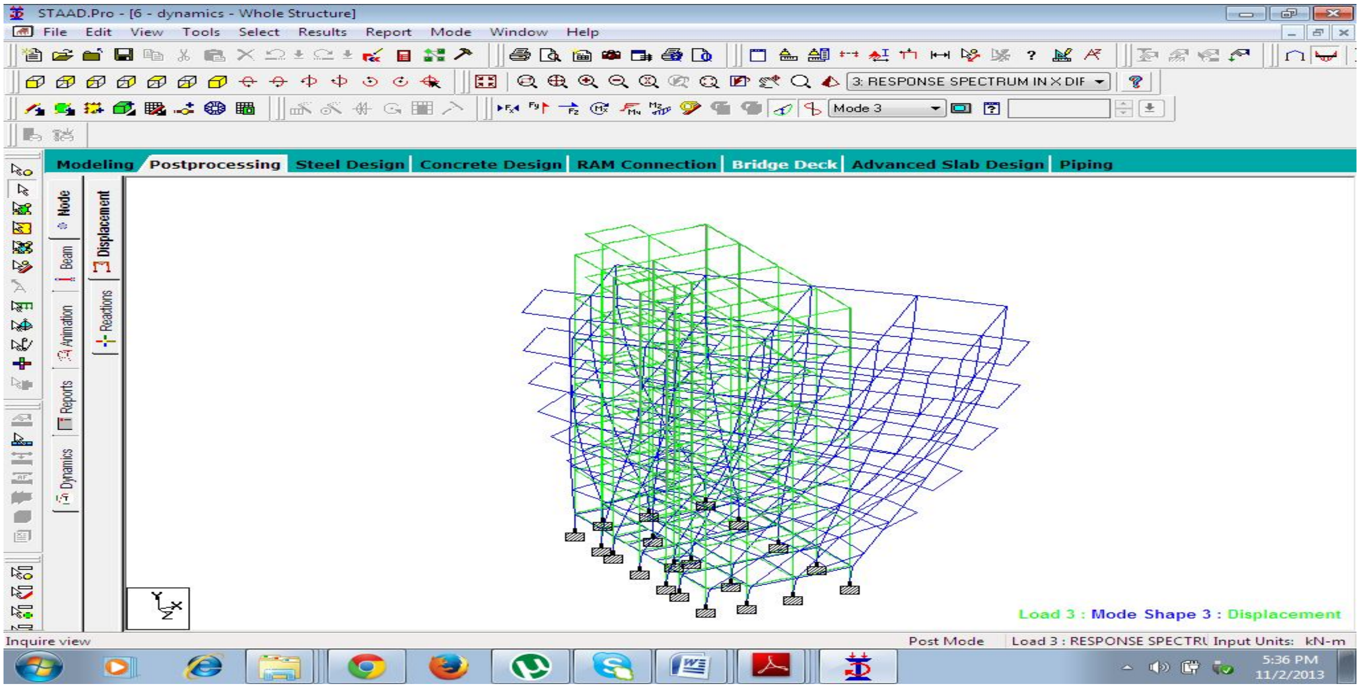


FIGURE 14- MODE SHAPE OF SIX STOREY BUILDING FOR MODE 3

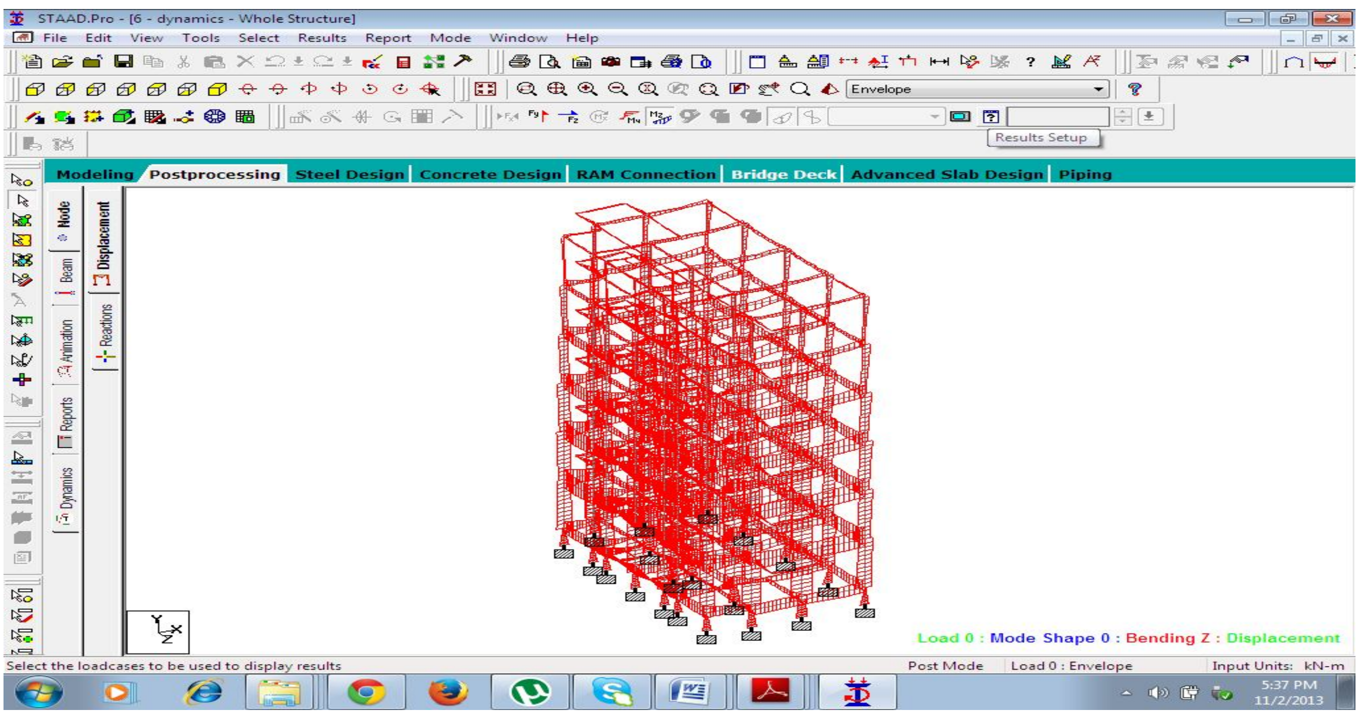


FIGURE 15 - BENDING MOMENT IN SIX STOREY BUILDING (ENVELOPE CASE.)

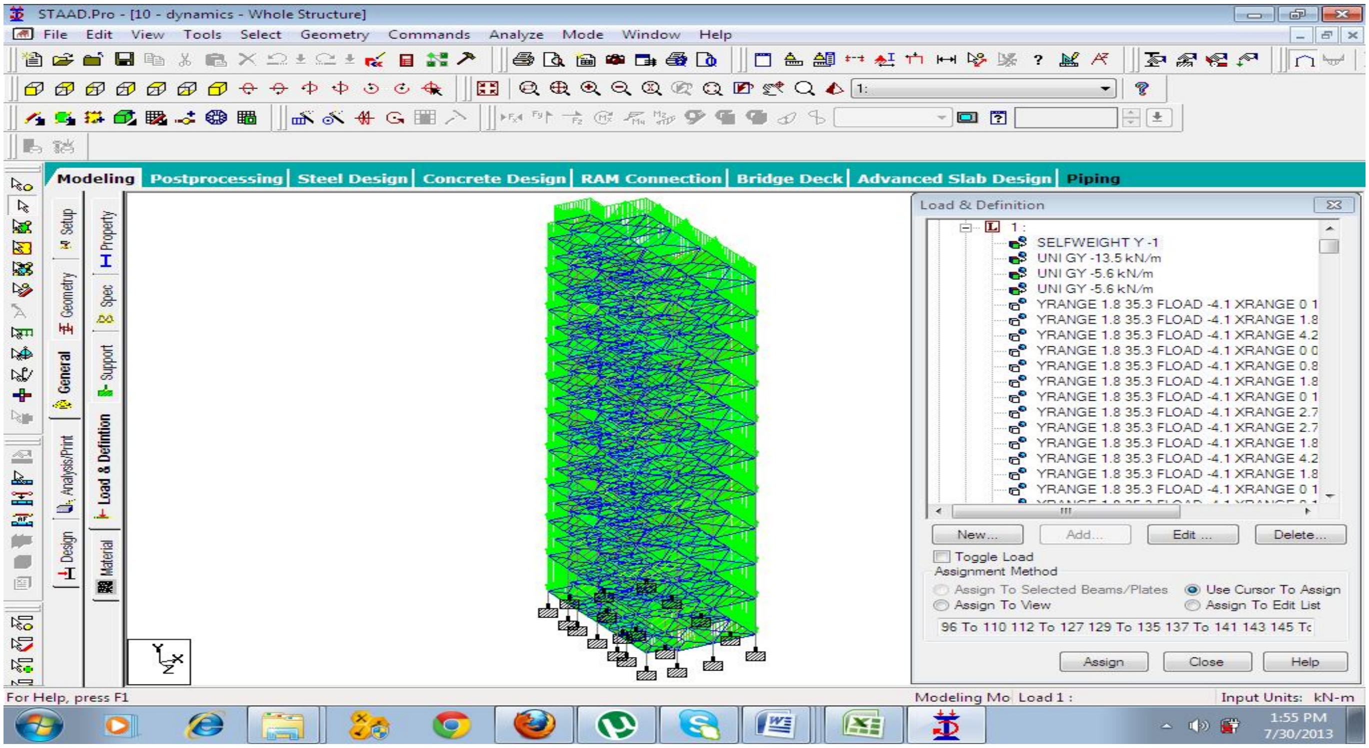


FIGURE 16- LOADING ON TEN STOREY BUILDING

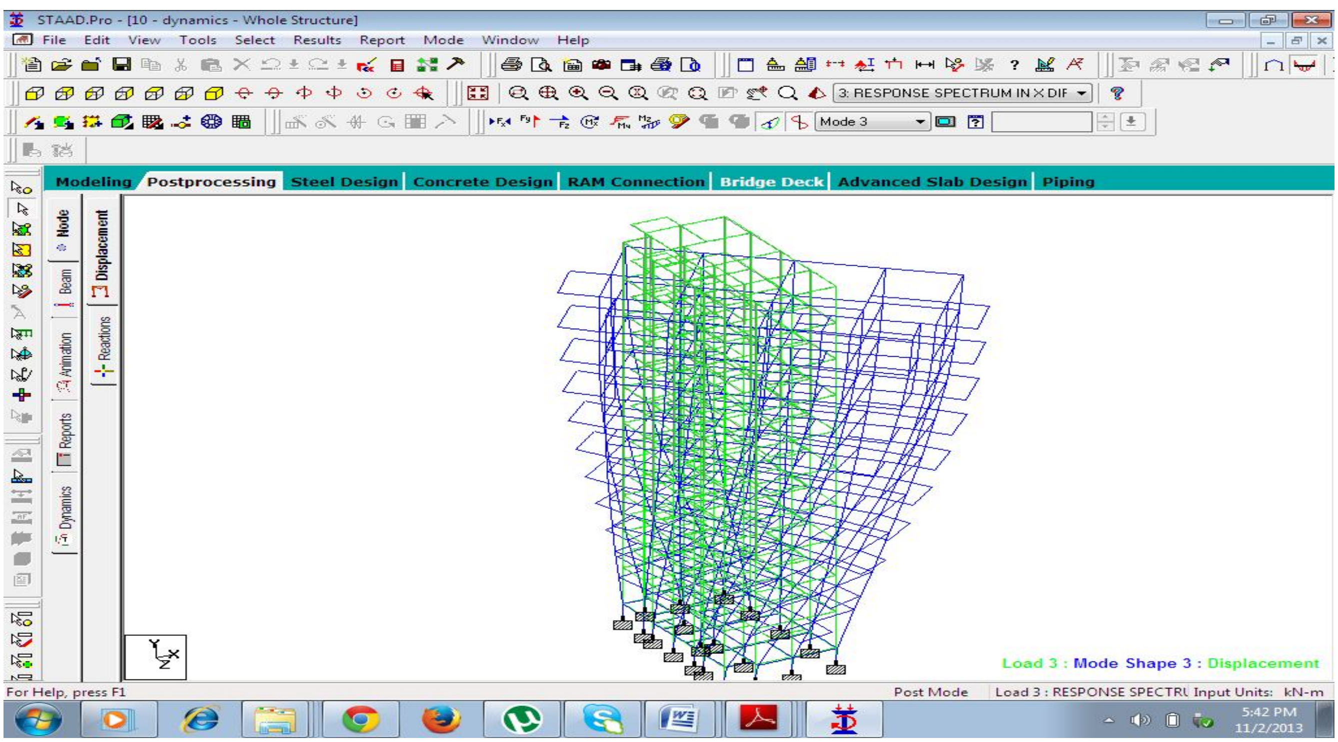


FIGURE 17- MODE SHAPE OF TEN STOREY BUILDING FOR MODE 3

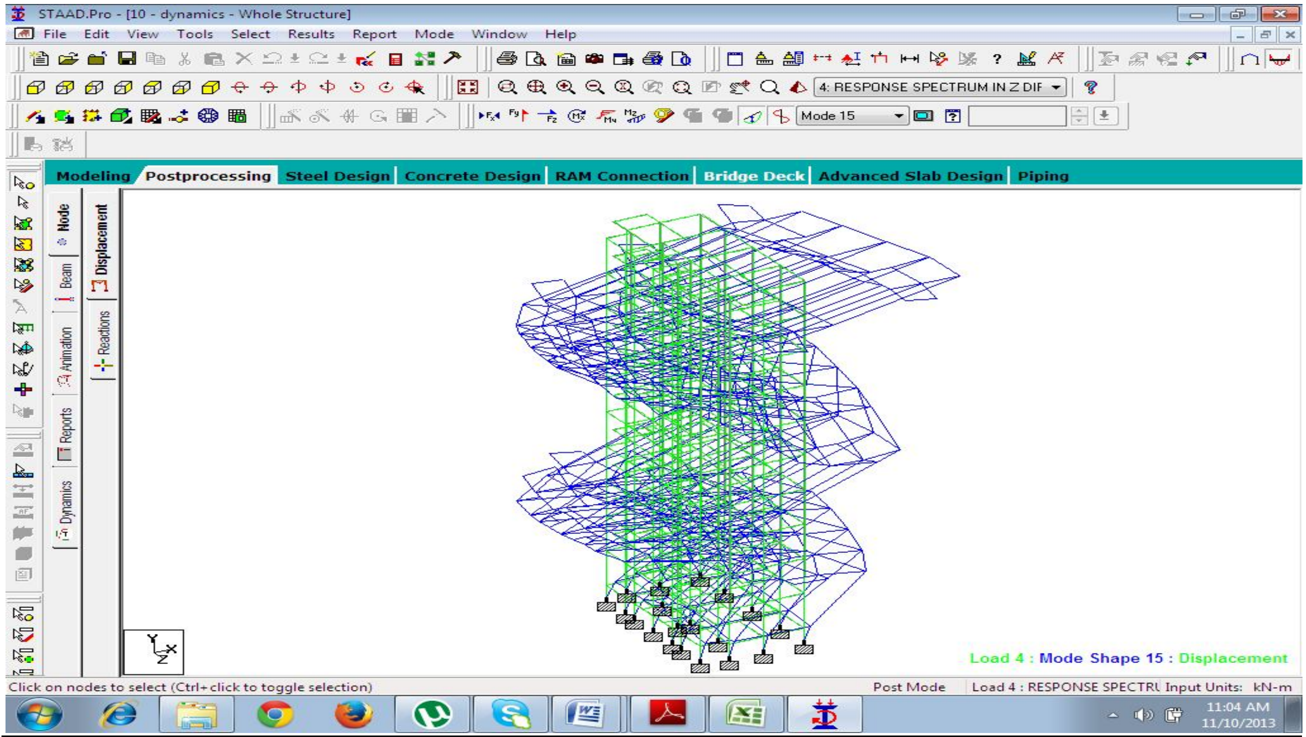


FIGURE 18- MODE SHAPE OF TEN STOREY BUILDING FOR MODE 15

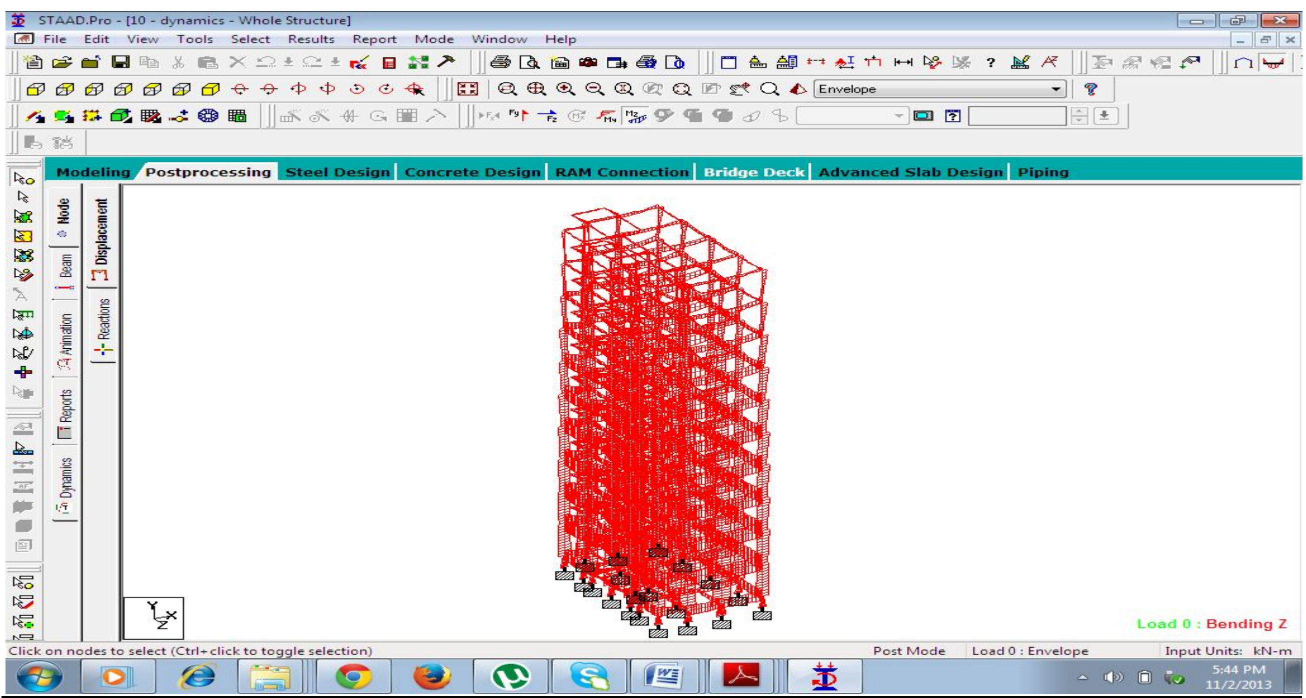


FIGURE 19 - BENDING MOMENT IN TEN STOREY BUILDING (ENVELOPE CASE.)

CHAPTER- 4

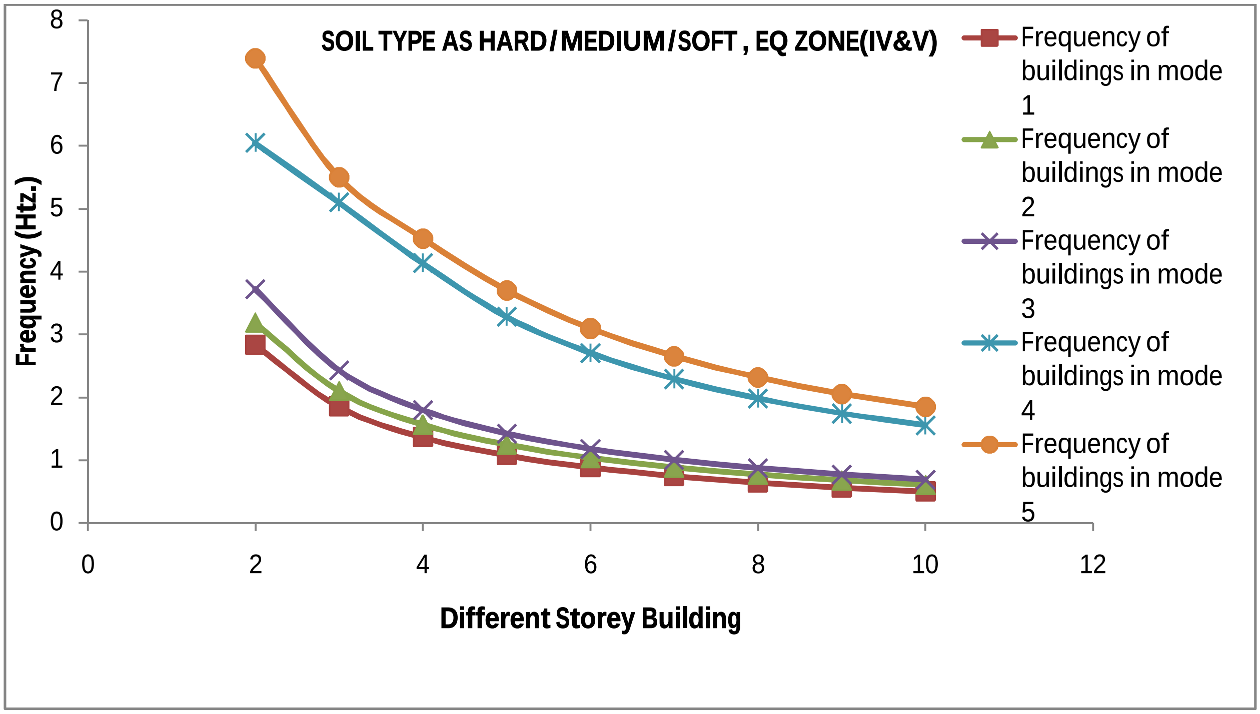
ANALYSIS OF RESULTS& DISCUSSIONS

TABLE 3 - DATA OF FREQUENCY FOR SOIL TYPES AS HARD/MEDIUM/SOFT AND SIESMIC ZONE IV&V

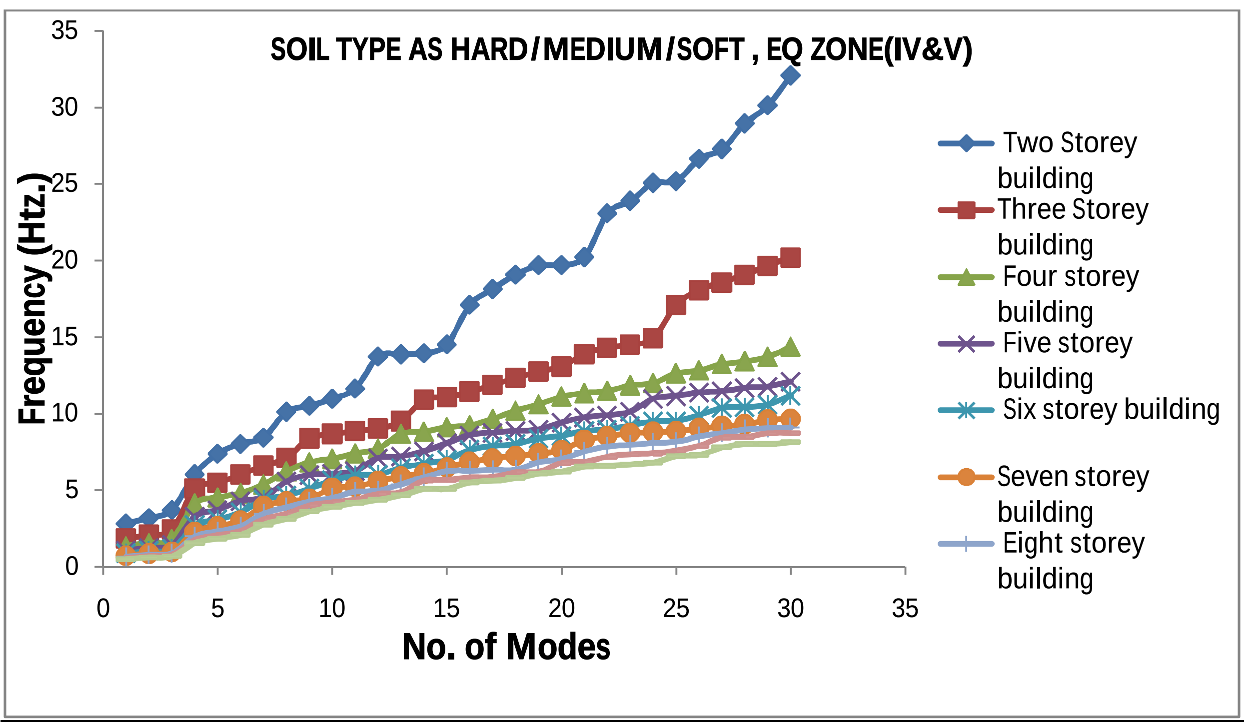
storey building	2	3	4	5	6	7	8	9	10
mode									
1	2.83	1.848	1.362	1.075	0.883	0.746	0.642	0.561	0.497
2	3.186	2.099	1.563	1.246	1.034	0.882	0.767	0.677	0.606
3	3.719	2.427	1.793	1.423	1.178	1.003	0.871	0.768	0.687
4	6.045	5.099	4.133	3.28	2.704	2.291	1.981	1.742	1.554
5	7.397	5.498	4.526	3.7	3.092	2.649	2.312	2.051	1.844
6	8.04	6.041	4.804	4.296	3.561	3.034	2.639	2.336	2.1
7	8.451	6.606	5.386	4.524	4.387	3.98	3.471	3.082	2.771
8	10.13	7.127	6.235	5.568	4.654	4.282	3.877	3.47	3.139
9	10.522	8.392	6.825	5.999	5.113	4.44	4.253	4.008	3.613
10	10.985	8.684	7.057	6.068	5.629	5.151	4.503	4.205	3.932
11	11.651	8.857	7.416	6.259	5.966	5.249	4.908	4.372	4.167
12	13.738	9.027	7.722	7.1	6.026	5.589	4.98	4.767	4.377
13	13.893	9.523	8.692	7.204	6.461	5.902	5.395	4.871	4.67
14	13.954	10.923	8.817	7.548	6.734	6.088	5.857	5.641	5.088
15	14.533	11.09	9.114	8.075	6.978	6.486	6.255	5.652	5.101
16	17.124	11.446	9.237	8.601	7.636	6.838	6.284	5.828	5.519
17	18.152	11.881	9.665	8.761	7.873	7.082	6.336	5.858	5.635
18	19.094	12.337	10.202	8.879	8.013	7.238	6.366	6.167	5.8
19	19.707	12.764	10.63	8.951	8.372	7.404	6.831	6.195	6.096
20	19.721	13.082	11.119	9.413	8.541	7.616	7.05	6.78	6.226
21	20.242	13.912	11.348	9.757	8.858	8.28	7.542	6.856	6.565
22	23.096	14.33	11.501	9.895	8.973	8.515	7.871	7.185	6.61
23	23.921	14.512	11.856	10.13	9.224	8.724	7.972	7.332	6.712
24	25.089	14.937	12.015	10.98	9.493	8.801	8.106	7.403	6.805
25	25.199	17.121	12.64	11.16	9.509	8.864	8.177	7.574	7.225
26	26.656	18.085	12.824	11.37	9.893	9.051	8.519	7.902	7.317
27	27.305	18.585	13.249	11.45	10.374	9.183	8.764	8.445	7.806
28	28.969	19.081	13.43	11.67	10.41	9.303	8.983	8.469	8.021
29	30.152	19.683	13.724	11.76	10.59	9.584	9.064	8.715	8.031
30	32.1	20.211	14.374	12.09	11.171	9.646	9.121	8.737	8.156

TABLE 4 - DATA OF TIME PERIOD FOR SOIL TYPES AS HARD/MEDIUM/SOFT AND SIESMIC ZONE IV&V

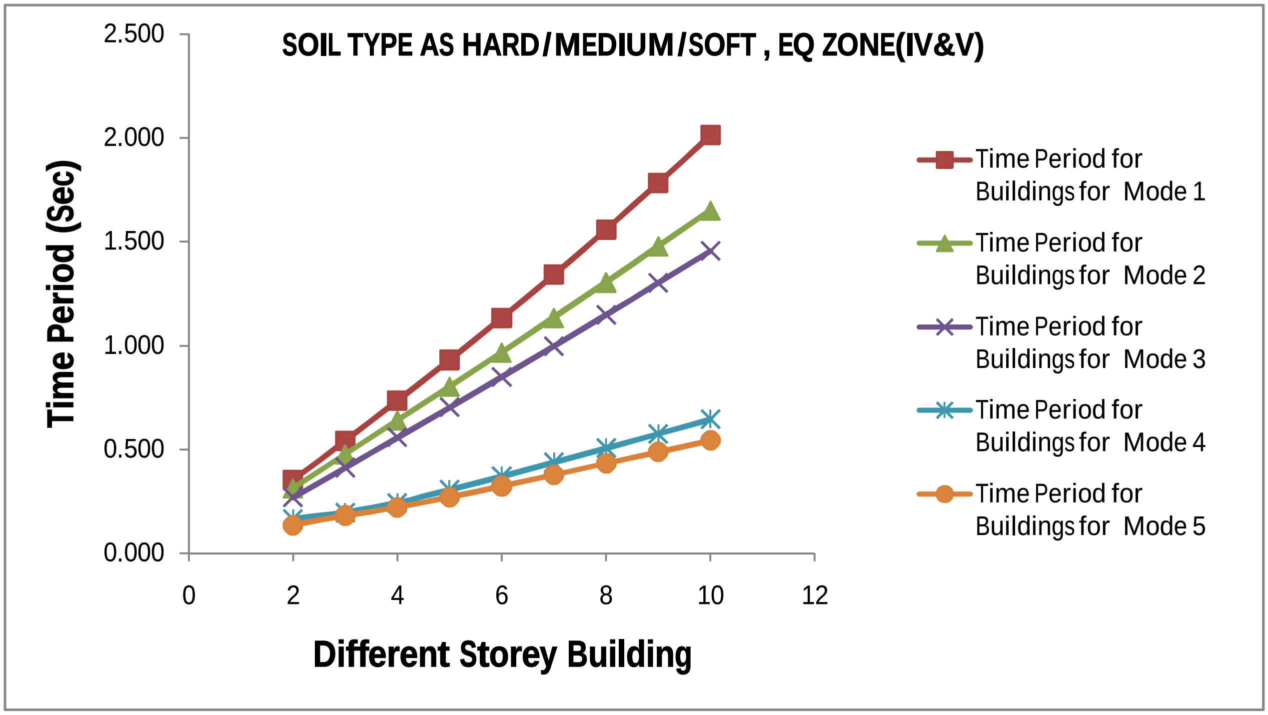
storey building	2	3	4	5	6	7	8	9	10
mode									
1	0.353	0.541	0.734	0.930	1.133	1.340	1.558	1.783	2.012
2	0.314	0.476	0.640	0.803	0.967	1.134	1.304	1.477	1.650
3	0.269	0.412	0.558	0.703	0.849	0.997	1.148	1.302	1.456
4	0.165	0.196	0.242	0.305	0.370	0.436	0.505	0.574	0.644
5	0.135	0.182	0.221	0.270	0.323	0.378	0.433	0.488	0.542
6	0.124	0.166	0.208	0.233	0.281	0.330	0.379	0.428	0.476
7	0.118	0.151	0.186	0.221	0.228	0.251	0.288	0.324	0.361
8	0.099	0.140	0.160	0.180	0.215	0.234	0.258	0.288	0.319
9	0.095	0.119	0.147	0.167	0.196	0.225	0.235	0.250	0.277
10	0.091	0.115	0.142	0.165	0.178	0.194	0.222	0.238	0.254
11	0.086	0.113	0.135	0.160	0.168	0.191	0.204	0.229	0.240
12	0.073	0.111	0.130	0.141	0.166	0.179	0.201	0.210	0.228
13	0.072	0.105	0.115	0.139	0.155	0.169	0.185	0.205	0.214
14	0.072	0.092	0.113	0.132	0.149	0.164	0.171	0.177	0.197
15	0.069	0.090	0.110	0.124	0.143	0.154	0.160	0.177	0.196
16	0.058	0.087	0.108	0.116	0.131	0.146	0.159	0.172	0.181
17	0.055	0.084	0.103	0.114	0.127	0.141	0.158	0.171	0.177
18	0.052	0.081	0.098	0.113	0.125	0.138	0.157	0.162	0.172
19	0.051	0.078	0.094	0.112	0.119	0.135	0.146	0.161	0.164
20	0.051	0.076	0.090	0.106	0.117	0.131	0.142	0.147	0.161
21	0.049	0.072	0.088	0.102	0.113	0.121	0.133	0.146	0.152
22	0.043	0.070	0.087	0.101	0.111	0.117	0.127	0.139	0.151
23	0.042	0.069	0.084	0.099	0.108	0.115	0.125	0.136	0.149
24	0.040	0.067	0.083	0.091	0.105	0.114	0.123	0.135	0.147
25	0.040	0.058	0.079	0.090	0.105	0.113	0.122	0.132	0.138
26	0.038	0.055	0.078	0.088	0.101	0.110	0.117	0.127	0.137
27	0.037	0.054	0.075	0.087	0.096	0.109	0.114	0.118	0.128
28	0.035	0.052	0.074	0.086	0.096	0.107	0.111	0.118	0.125
29	0.033	0.051	0.073	0.085	0.094	0.104	0.110	0.115	0.125
30	0.031	0.049	0.070	0.083	0.090	0.104	0.110	0.114	0.123



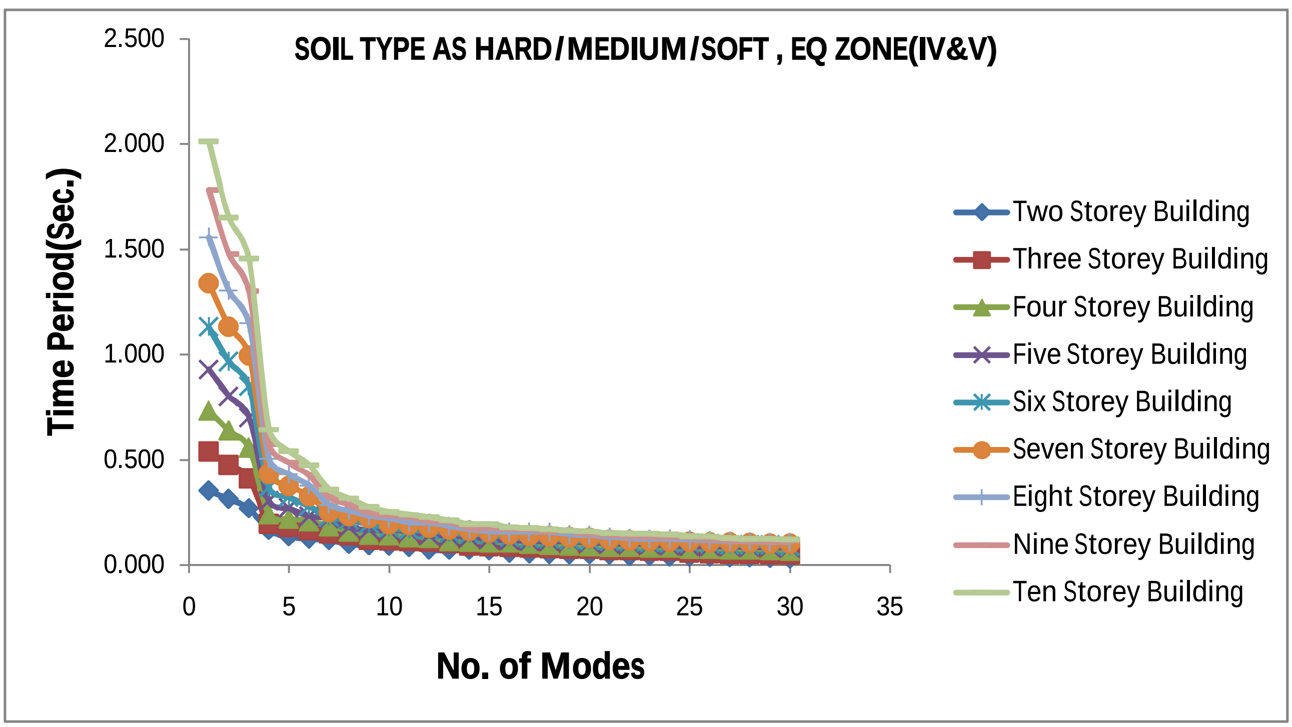
PLOT 1 - VARIATIONS IN FREQUENCY OF DIFFERENT STOREY BUILDINGS FOR MODE 1 TO 5



PLOT 2 - VARIATIONS IN FREQUENCY OF TWO STOREY TO TEN STOREY BUILDING FOR MODE 1 TO 30



PLOT 3 - VARIATIONS IN TIME PERIOD OF DIFFERENT STOREY BUILDINGS FOR MODE 1 TO 5



PLOT 4- VARIATIONS IN TIME PERIOD OF TWO STOREY TO 10 STOREY BUILDING FOR MODE 1 TO 30

Data bases of responses in terms of frequency and time period for all the buildings models from Two Storey to Ten storey is compiled for all soil types and both the EQ Zones in Table No 3& 4 for mode up to 30 and consequently their behavior pattern is plotted from Plot 1 to Plot 4.

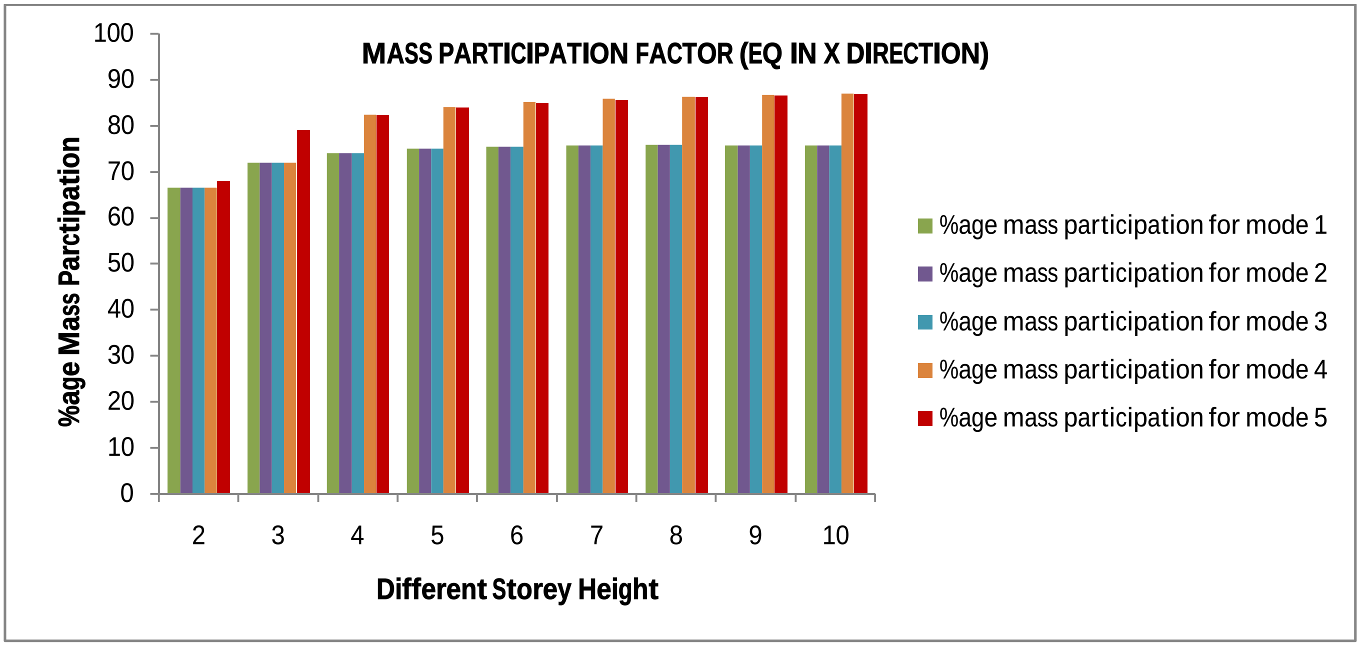
It may be seen that with the increase in the no. of modes in all building models , the frequency of the buildings increases, and since the time period follows the inverse relation with the frequency, it tends to decreases with increasing in modes. .

TABLE 5: MASS PARTICIPATION FACTOR FOR SOIL TYPES AS HARD/MEDIUM/SOFT AND SIESMIC ZONE IV&V (SIESMIC IN X DIRECTION)

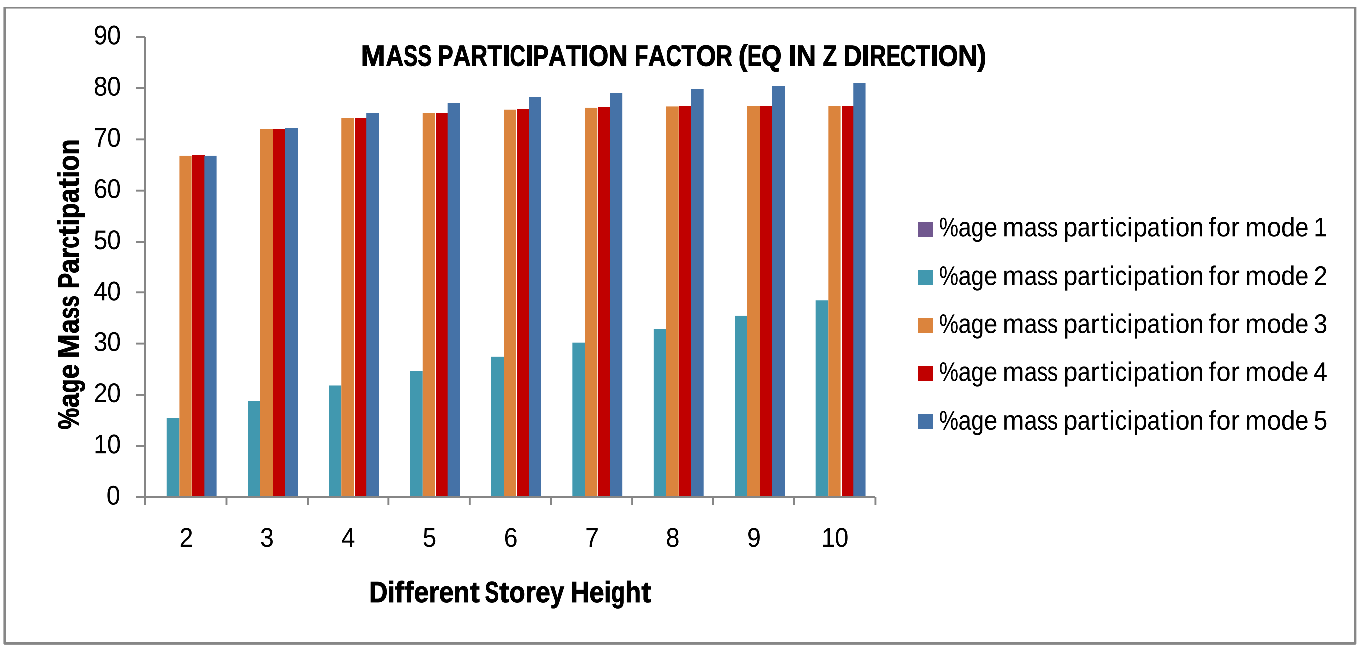
storey	2	3	4	5	6	7	8	9	10
mode									
1	66.491	71.896	73.993	74.957	75.45	75.677	75.741	75.717	75.638
2	66.494	71.967	73.993	74.957	75.45	75.677	75.742	75.718	75.638
3	66.494	71.971	73.993	74.957	75.45	75.677	75.742	75.718	75.639
4	66.494	71.971	82.391	84.06	85.078	85.757	86.25	86.643	86.961
5	68.03	79.139	82.391	84.06	85.078	85.757	86.25	86.644	86.962
6	70.811	79.141	82.391	84.06	85.078	85.757	86.25	86.645	86.964
7	70.812	79.187	82.391	84.06	85.078	88.79	89.4	89.873	90.237
8	70.812	79.187	82.416	86.645	87.944	88.79	89.401	89.876	90.238
9	70.812	80.104	84.446	86.645	87.944	88.79	89.401	89.877	90.238
10	70.824	80.106	84.446	86.65	87.944	88.79	89.401	89.877	91.817
11	70.824	80.16	84.446	86.65	87.946	88.79	90.873	91.412	91.817
12	70.825	80.168	84.47	86.675	87.946	90.155	90.877	91.412	91.817
13	70.825	80.169	84.848	86.675	89.124	90.159	90.879	91.413	91.817
14	70.825	80.169	84.848	87.536	89.137	90.159	90.882	92.032	91.936
15	70.825	80.169	84.848	87.536	89.137	90.16	90.882	92.217	92.683
16	70.826	80.169	84.848	87.558	89.137	90.16	91.344	92.224	92.684
17	70.826	80.169	84.853	87.558	89.215	90.781	91.587	92.224	92.684
18	71.057	80.169	84.853	87.719	89.576	90.781	91.622	92.225	92.685
19	94.002	80.169	84.853	87.719	89.576	90.786	91.624	92.23	92.713
20	94.01	80.172	84.853	87.719	89.576	90.786	91.626	92.315	93.188
21	94.26	80.172	84.853	87.719	89.576	91.033	91.992	92.685	93.188
22	94.332	80.172	84.853	87.719	89.675	91.036	91.992	92.686	93.196
23	94.332	80.181	84.853	89.721	89.675	91.036	91.993	92.686	93.198
24	94.336	80.181	85.855	89.721	89.675	91.036	91.995	92.686	93.2
25	99.856	80.181	85.855	89.721	90.675	91.036	91.996	92.688	93.36
26	99.856	80.181	85.855	89.721	90.675	91.092	92.14	92.916	93.486
27	99.856	80.181	85.855	89.721	90.675	91.092	92.14	92.916	93.487
28	99.869	80.191	88.989	91.721	90.675	91.092	92.14	92.919	93.487
29	99.869	95.911	89.991	91.721	90.675	91.092	92.147	93.006	93.506
30	99.869	96.087	92.116	91.721	90.675	91.093	92.172	93.007	93.509

TABLE 6: MASS PARTICIPATION FACTOR FOR SOIL TYPES AS HARD/MEDIUM/SOFT AND SIESMIC ZONE IV&V (SIESMIC IN Z DIRECTION)

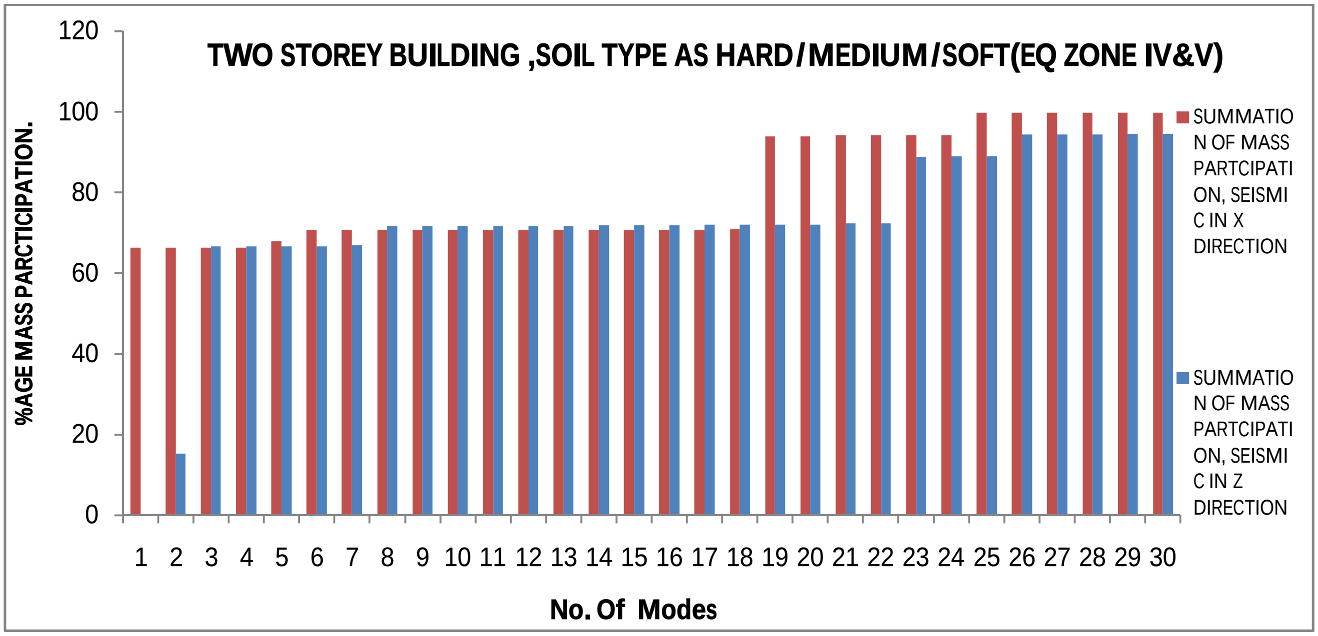
storey	2	3	4	5	6	7	8	9	10
mode									
1	0	0.006	0	0	0	0	0	0	0
2	15.432	18.824	21.734	24.677	27.419	30.126	32.769	35.469	38.38
3	66.716	72.026	74.047	75.107	75.738	76.118	76.341	76.47	76.533
4	66.729	72.059	74.047	75.107	75.738	76.118	76.341	76.47	76.533
5	66.729	72.059	75.075	77.042	78.181	79.034	79.719	80.353	80.991
6	66.729	72.914	75.463	83.994	85.023	85.685	86.174	86.57	86.891
7	67.098	72.914	82.541	84.094	85.057	85.685	86.174	86.57	86.891
8	71.791	79.506	82.541	84.094	85.057	85.818	86.836	87.365	87.823
9	71.863	79.506	82.541	84.296	85.453	86.235	86.838	89.813	90.156
10	71.863	79.507	82.562	84.296	85.46	88.555	89.364	89.814	90.156
11	71.877	79.51	82.72	84.389	85.46	88.839	89.364	89.814	90.161
12	71.877	79.598	82.72	84.389	88.054	88.839	89.41	89.969	90.518
13	71.878	79.613	82.72	86.847	88.054	88.839	89.612	90.118	90.518
14	71.969	80.608	84.731	86.847	88.054	88.991	89.612	90.413	91.595
15	72.044	80.624	84.748	86.912	88.161	88.991	89.707	91.327	91.769
16	72.044	80.781	84.798	86.912	88.165	88.991	89.716	91.327	91.897
17	72.077	80.783	84.798	86.921	88.165	88.991	89.811	91.451	91.954
18	72.077	80.845	84.845	86.921	88.165	90.286	90.953	91.554	91.954
19	72.079	80.866	84.852	86.921	89.283	90.286	91.035	91.554	91.954
20	72.114	80.866	84.852	86.922	89.366	90.345	91.035	91.554	91.954
21	72.432	80.873	85.235	87.624	89.372	90.345	91.036	91.554	92.491
22	72.433	80.898	85.235	87.842	89.372	90.345	91.04	91.645	92.499
23	89.009	80.898	85.287	87.842	89.372	90.346	91.04	92.305	92.802
24	89.023	81.021	85.351	87.879	89.372	90.349	91.049	92.373	92.812
25	89.023	81.021	85.351	87.879	89.374	90.351	91.796	92.374	92.812
26	94.47	81.029	88.351	87.879	89.377	90.351	91.798	92.374	92.813
27	94.487	85.030	88.351	87.944	89.772	90.898	91.798	92.374	92.813
28	94.487	86.030	88.351	87.969	89.772	91.005	91.799	92.375	93.094
29	94.614	91.067	90.351	90.086	90.853	91.005	91.799	92.375	93.1
30	94.615	91.067	90.351	90.086	90.853	91.005	91.799	92.375	93.33



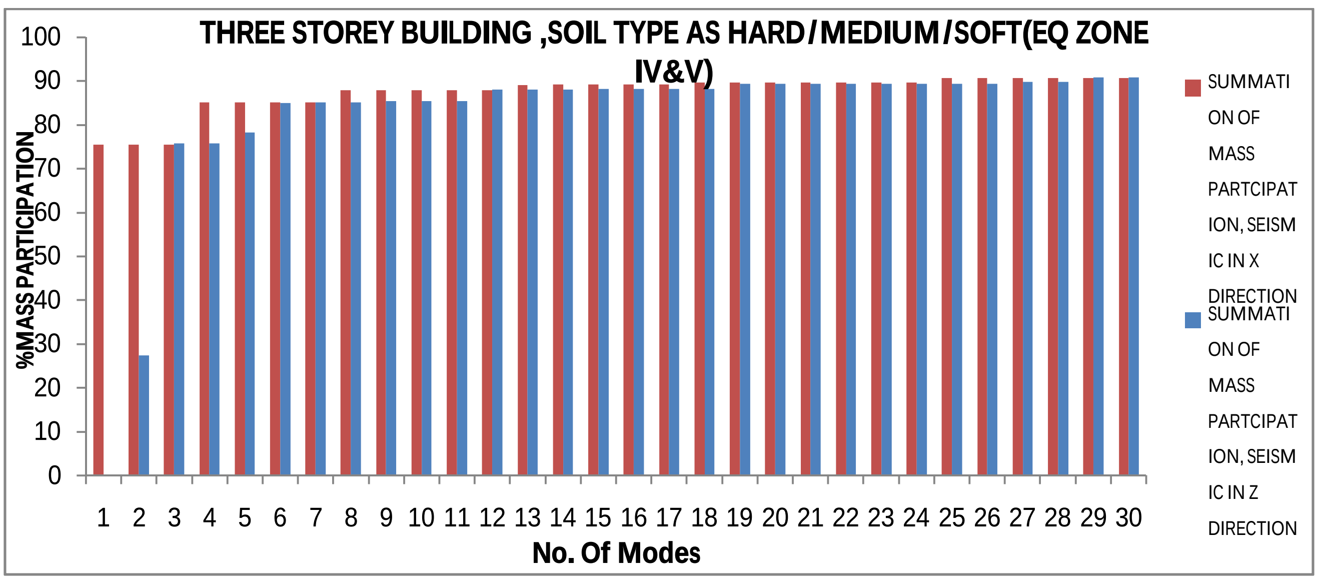
PLOT 5 : MASS PATICIPATION FOR EQ IN EARTHQUAKE IN X DIRECTION FOR SOIL TYPES AS HARD/MEDIUM/SOFT AND SIESMIC ZONE IV & V



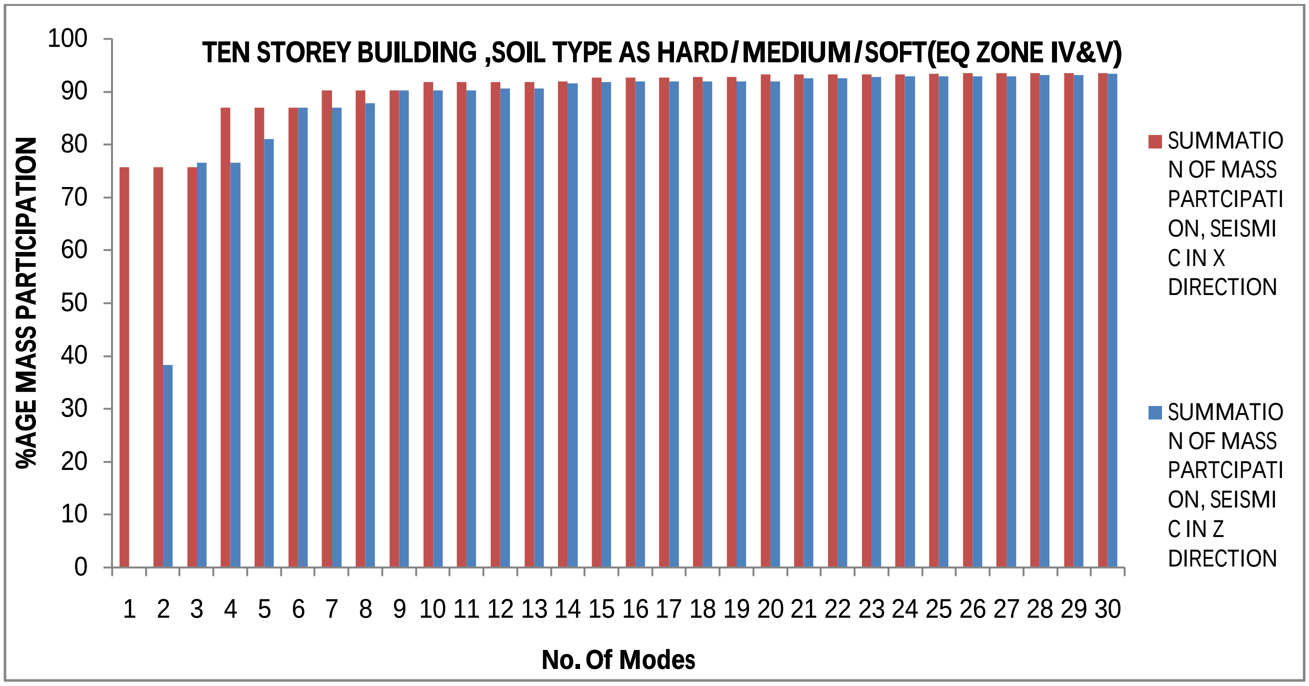
PLOT 6 : MASS PATICIPATION FOR EQ IN EARTHQUAKE IN Z DIRECTION FOR SOIL TYPES AS HARD/MEDIUM/SOFT AND SIESMIC ZONE IV & V



PLOT 7 - VARIATIONS IN MODAL MASS PARTICPATION OF TWO STOREY BUILDING FOR MODE 1 TO 30 (SIESMIC IN X/Z DIRECTION)



PLOT 8 - VARIATIONS IN MODAL MASS PARTICPATION OF SIX STOREY BUILDING FOR MODE 1 TO MODE 30 (SIESMIC IN X /Z DIRECTION)



PLOT 9- VARIATIONS IN MODAL MASS PARTICPATION OF TEN STOREY BUILDING FOR MODE 1 TO 30 (SIESMIC IN X DIRECTION)

Data Base for the modal mass participation factor in both directions (EQ in X and EQ in Z) is shown on Table 5 & 6 In the analysis, no of modes has been so adopted so as to get the percentage of summation of modal masses in both the EQ directions approximate equal and more than 90%.as per Cl No. 7.8.4.2I.S.-1893: Part 1: (2002).In the case of Two storey building , the percentage of mass participation achieves the maximum value of 99.869%. To have the clarity and readability the variation in the above plots No. 5 & 6, of participation factor, has been shown for No. of modes as 5 only though the analysis has been carried out up to 30 modes.

Plot No 7,8 and 9 shows the variation in responses for Two, Six and Ten Storey buildings responses both in X and Z direction for 30 no of modes. Mass Participation in Mode 1 in all building models is in Nil in EQ in Z direction, hence not visible in plot.

TABLE 7: DESIGN BASE SHEAR FOR SOIL TYPES AS HARD/MEDIUM/ SOFT (ZONE-IV)

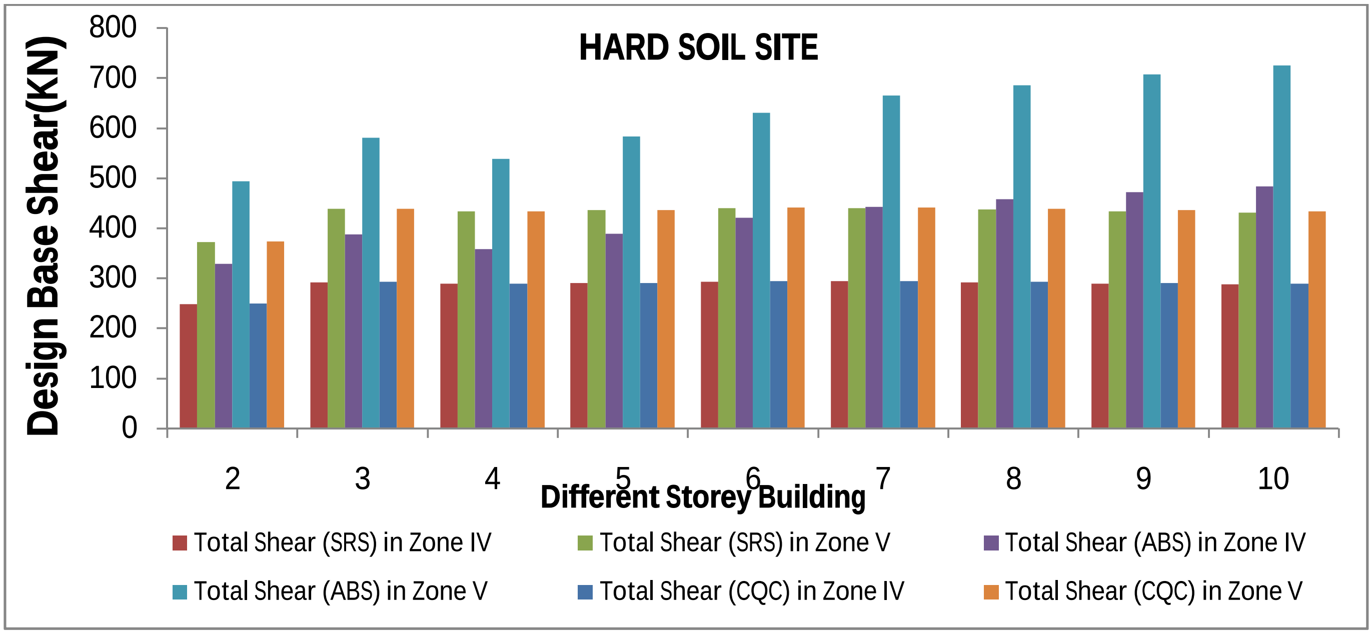
(SIESMIC IN X & Z DIRECTION)

STOREY	SOIL TYPE	SIESMIC IN X			SIESMIC IN Z		
		Total shear(SRS	Total shear(ABS)	Total shear(CQC)	Total shear(SRS)	Total shear(ABS)	Total shear(CQC)
2	HARD	248.54	329.42	249.43	199.06	313.56	215.06
	MEDUIM	248.54	329.42	249.43	199.06	313.56	215.06
	SOFT	248.54	329.42	249.43	199.06	313.56	215.06
3	HARD	292.31	387.64	292.62	290.54	408.35	315.43
	MEDUIM	390.21	487.81	390.5	303.35	432.73	332.39
	SOFT	390.21	487.81	390.5	303.35	432.73	332.39
4	HARD	289.24	359.04	289.39	284.9	438.25	314.6
	MEDUIM	389.37	460.85	389.48	384.45	567.38	424.69
	SOFT	476.17	548.52	476.26	400.95	599.18	447.11
5	HARD	290.8	389.41	291.1	278.43	467.22	312.3
	MEDUIM	388.15	489.82	388.37	373.69	595.03	419.32
	SOFT	473	576.28	473.19	456.43	705.09	512.24
6	HARD	293.48	420.81	294.01	273.91	496.3	311.23
	MEDUIM	387.4	519.57	387.8	365.06	622.69	415.07
	SOFT	469.87	604.63	470.21	444.58	731.53	505.64
7	HARD	293.91	443.34	294.67	270.46	524.63	311.41
	MEDUIM	387.79	550.4	388.4	357.75	649.54	411.92
	SOFT	467.51	633.92	468.01	434.3	757.1	500.06
8	HARD	291.44	457.78	292.55	268.77	549.2	312.24
	MEDUIM	389.7	582.58	390.64	352.82	676.01	410.18
	SOFT	466.34	664.51	467.12	426.51	782.24	495.87
9	HARD	289.34	472.11	290.66	265.26	563.94	310.98
	MEDUIM	390.13	607.17	391.26	349.53	702.6	409.84
	SOFT	467.01	696.21	467.98	420.63	807.51	493.05
10	HARD	287.55	483.57	289.14	261.63	582.19	308.66
	MEDUIM	386.68	617.84	388.03	348.66	738.22	410.95
	SOFT	469.66	726.17	470.87	417.37	841.8	491.61

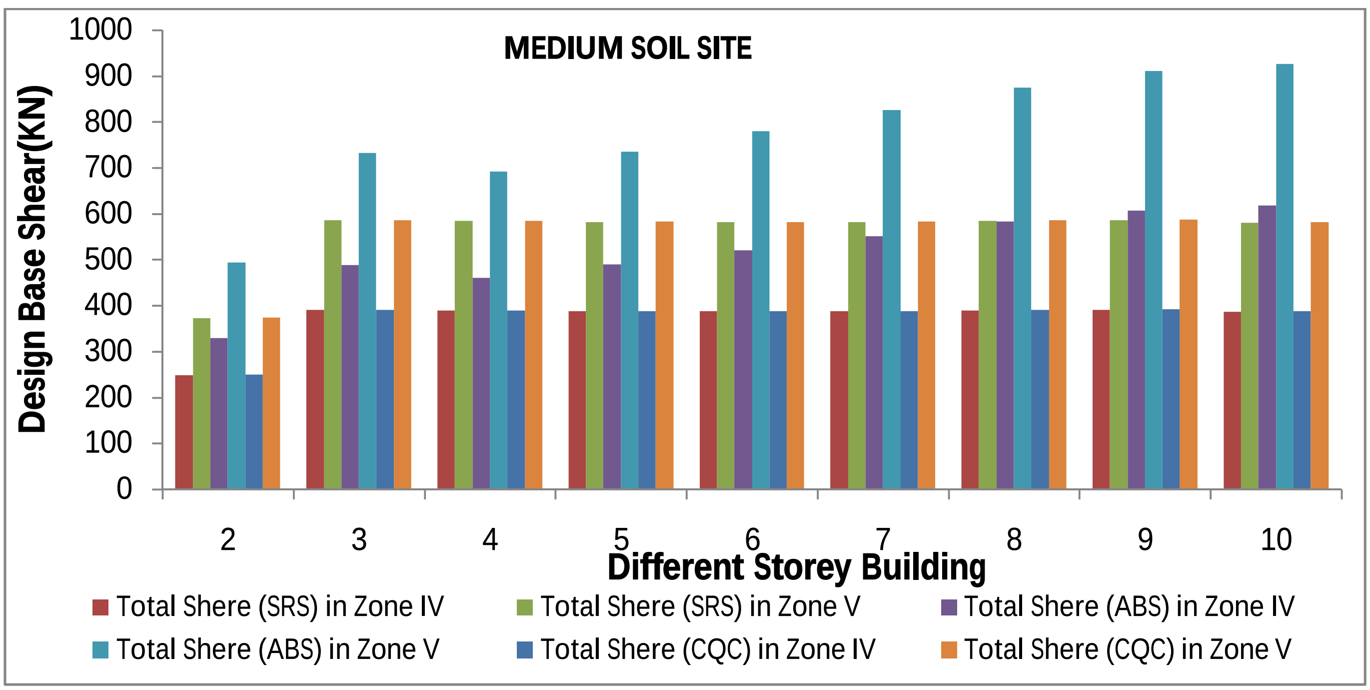
TABLE 8: DESIGN BASE SHEAR FOR SOIL TYPES AS HARD/MEDIUM/ SOFT (ZONE-V)

(SIESMIC IN X & Z DIRECTION)

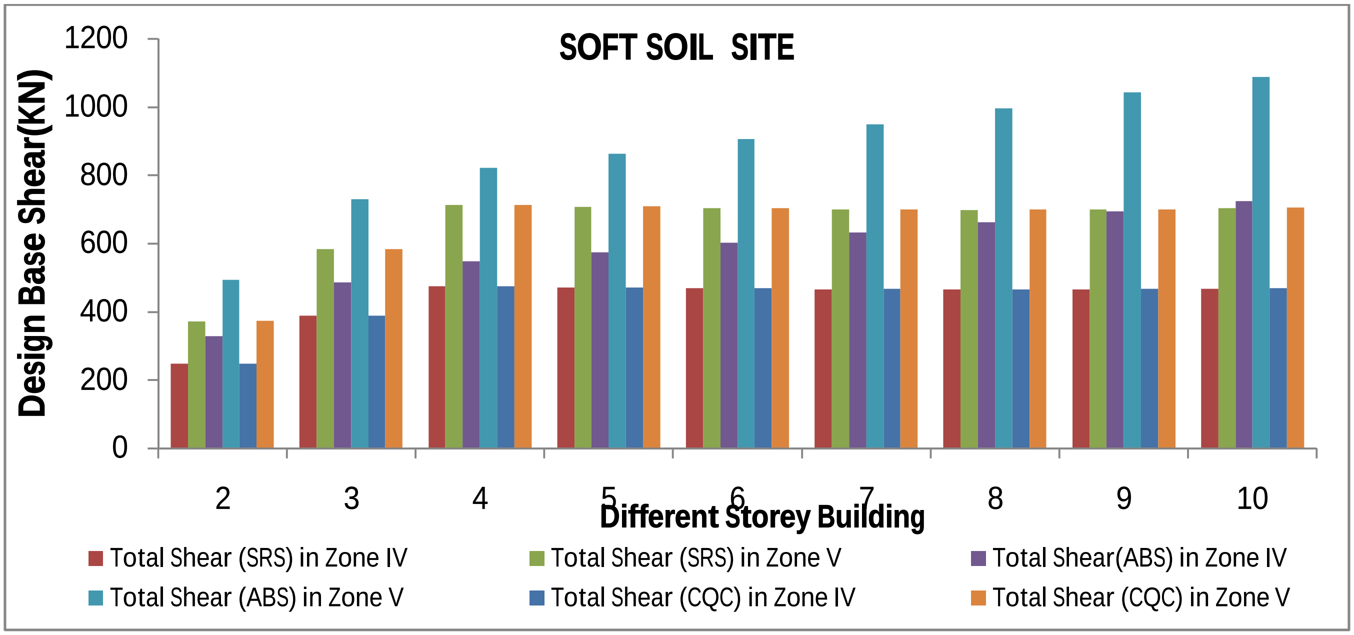
STOREY	SOIL TYPE	SIESMIC IN X			SIESMIC IN Z		
		Total shear(SRS)	Total shear(ABS)	Total shear(CQC)	Total shear(SRS)	Total shear(ABS)	Total shear(CQC)
2	HARD	372.81	494.13	374.14	298.59	470.34	322.58
	MEDUIM	372.81	494.13	374.14	298.59	470.34	322.58
	SOFT	372.81	494.13	374.14	298.59	470.34	322.58
3	HARD	438.47	581.45	438.93	435.82	612.53	473.14
	MEDUIM	585.31	731.72	585.74	455.02	649.1	498.58
	SOFT	585.31	731.72	585.74	455.02	649.1	498.58
4	HARD	433.87	538.55	434.08	427.35	657.38	471.9
	MEDUIM	584.06	691.27	584.22	576.68	851.07	637.03
	SOFT	714.25	822.77	714.38	601.42	898.76	670.67
5	HARD	436.2	584.11	436.65	417.64	700.83	468.45
	MEDUIM	582.22	734.73	582.56	560.54	892.55	628.98
	SOFT	709.5	864.42	709.78	684.64	1057.64	768.37
6	HARD	440.22	631.21	441.02	410.86	744.45	466.85
	MEDUIM	581.1	779.36	581.71	547.58	934.04	622.61
	SOFT	704.81	906.94	705.31	666.88	1097.3	758.45
7	HARD	440.86	665.01	442.01	405.69	786.95	467.11
	MEDUIM	581.68	825.6	582.6	536.63	974.31	617.89
	SOFT	701.26	950.89	702.02	651.44	1135.65	750.1
8	HARD	437.16	686.67	438.82	403.15	823.8	468.35
	MEDUIM	584.55	873.87	585.96	529.23	1014.02	615.27
	SOFT	699.51	996.76	700.68	639.76	1173.37	743.81
9	HARD	434	708.17	436	397.89	845.91	466.46
	MEDUIM	585.19	910.75	586.89	524.3	1053.9	614.76
	SOFT	700.51	1044.31	701.97	630.94	1211.26	739.58
10	HARD	431.32	725.35	433.7	392.45	873.29	462.98
	MEDUIM	580.02	926.75	582.05	523	1107.33	616.43
	SOFT	704.49	1089.25	706.3	626.05	1262.71	737.42



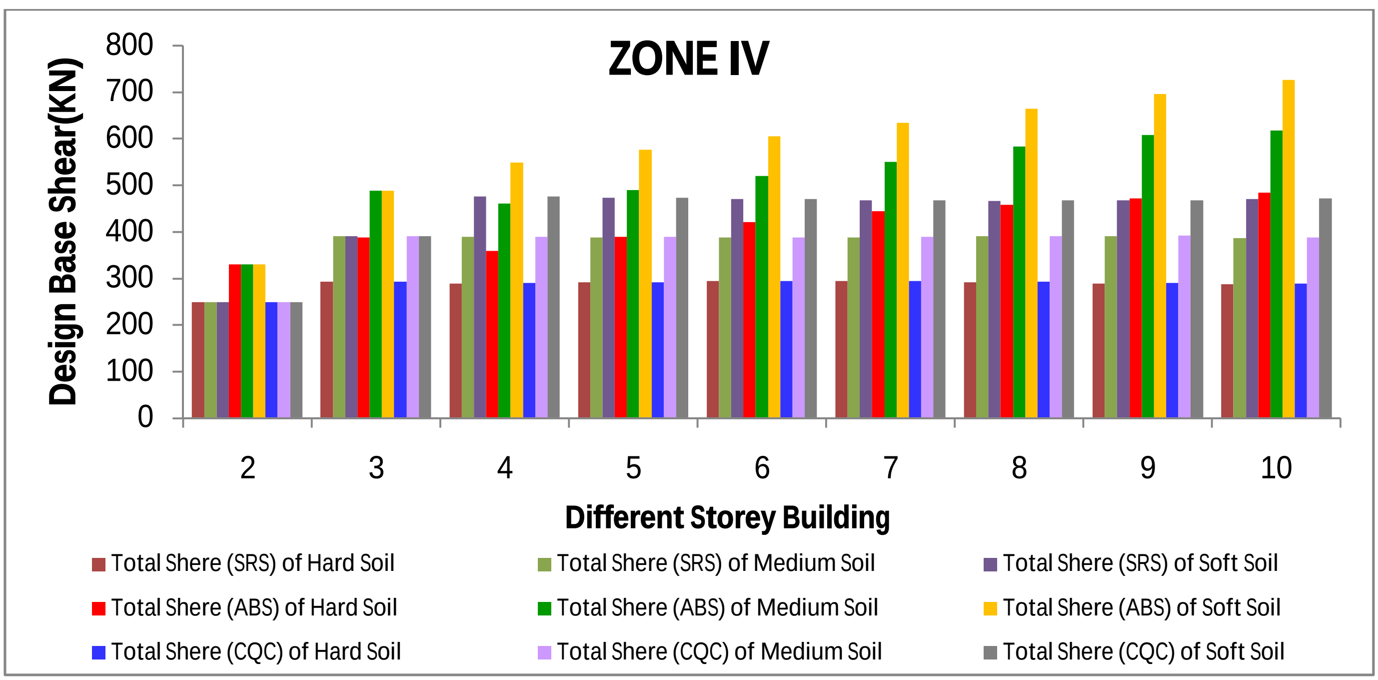
PLOT 10 - VARIATIONS IN MODAL DESIGN BASE SHEAR FOR HARD SOIL IN EQ ZONE IV & V (SIESMIC IN X DIRECTION)



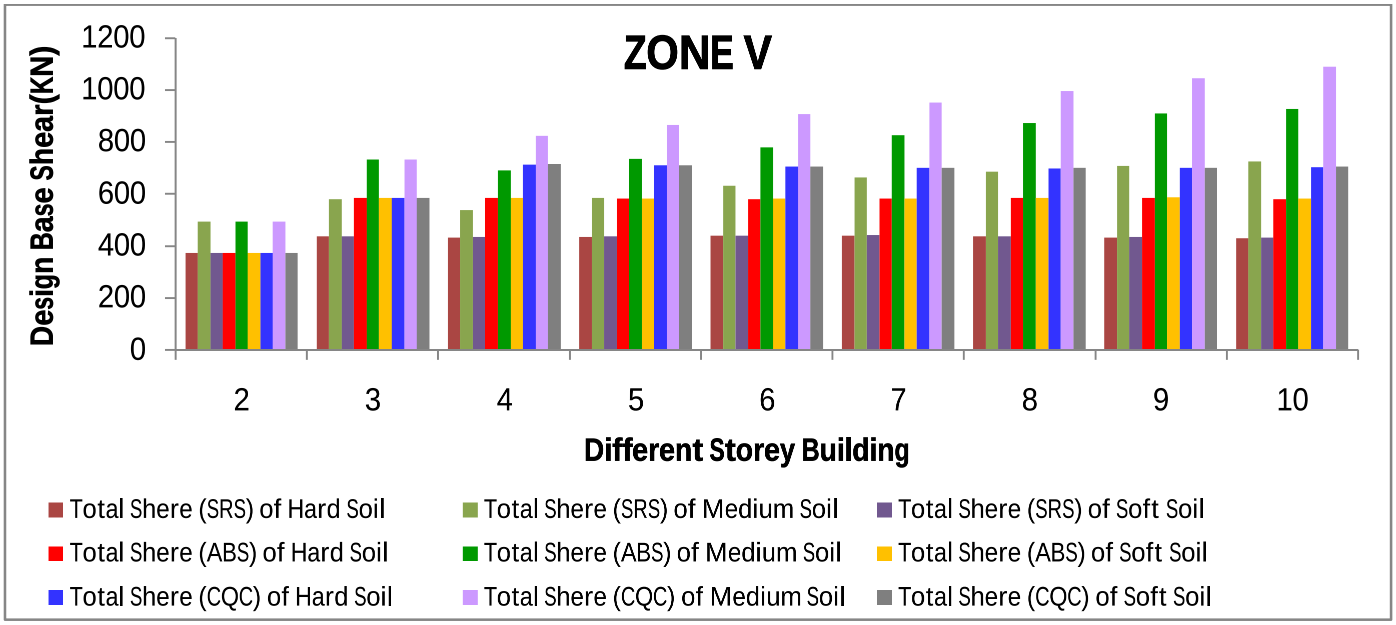
PLOT 11- VARIATIONS IN MODAL DESIGN BASE SHEAR FOR MEDIUM SOIL IN EQ ZONE IV & V (SIESMIC IN X DIRECTION)



PLOT 12- VARIATIONS IN MODAL DESIGN BASE SHEAR FOR SOFT SOIL IN EQ ZONE IV & V (SIESMIC IN X DIRECTION)



PLOT I3 - VARIATIONS IN DESIGN BASE SHEAR FOR ALL STOREY BUILDING IN EQ ZONE IV (SIESMIC IN X DIRECTION)



PLOT I4 - VARIATIONS IN DESIGN BASE SHEAR FOR ALL STOREY BUILDING IN EQ ZONE V (SIESMIC IN X DIRECTION)

Output data from the STAAD analysis is complied and consolidated for design base shear for EQ in X and Z direction considering different response combinations methods ie.ABS, CQC, SRSS for all the buildings in EQ Zone IV and V with different site specific conditions.

Plots no 13 & 14 are managed and bifurcated for different seismic Zones .ie , comparison has been made in design base shear for hard medium and soft soil for zone IV and Zone V in all the combination methods.

TABLE -9 :STOREY SHEAR DATA FOR TWO STOREY BUILDING

SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10												
9												
8												
7												
6												
5												
4	103.83	91.86	155.75	137.79	103.83	91.86	155.75	137.79	103.83	91.86	155.75	137.79
3	232.07	200.68	348.11	301.02	232.07	200.68	348.11	301.02	232.07	200.68	348.11	301.02
2	249.43	215.06	374.14	322.58	249.43	215.06	374.14	322.58	249.43	215.06	374.14	322.58
1	249.43	215.06	374.14	322.58	249.43	215.06	374.14	322.58	249.43	215.06	374.14	322.58

TABLE 10: STOREY SHEAR DATA FOR THREE STOREY BUILDING

SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10												
9												
8												
7												
6												
5	83.83	90.05	125.74	135.08	108.83	94.47	163.24	141.71	108.83	94.47	163.24	141.71
4	207.43	228.09	311.14	342.14	279.24	240.42	418.85	360.62	279.24	240.42	418.85	360.62
3	281.16	308.99	421.74	463.49	379.1	325.66	568.65	488.49	379.1	325.66	568.65	488.49
2	292.62	315.43	438.93	473.14	390.5	332.39	585.74	498.58	390.5	332.39	585.74	498.58
1	292.62	315.43	438.93	473.14	390.5	332.39	585.74	498.58	390.5	332.39	585.74	498.58

TABLE11: STOREY SHEAR DATA FOR FOUR STOREY BUILDING

SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10												
9												
8												
7												
6	69.67	71.84	104.5	107.76	87.17	91.6	130.76	137.4	103.13	95.91	154.69	143.87
5	171.28	183.58	256.93	275.36	226.59	244.89	339.89	367.34	275.09	257.56	412.63	386.34
4	239.97	262.32	359.96	393.48	325.7	356.22	488.56	534.33	399.62	375.33	599.43	563
3	285.78	310.51	428.68	465.77	385.21	419.71	577.81	629.56	471.32	441.93	706.98	662.89
2	289.39	314.6	434.08	471.9	389.48	424.69	584.22	637.03	476.26	447.11	714.38	670.67
1	289.39	314.6	434.08	471.9	389.48	424.69	584.22	637.03	476.26	447.11	714.38	670.67

TABLE12: STOREY SHEAR DATA FOR FIVE STOREY BUILDING

SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10												
9												
8												
7	62.51	61.79	93.76	92.68	75.09	76.21	112.63	114.32	86.91	89.5	130.36	134.24
6	151.46	156.39	227.2	234.59	193.33	203.39	289.99	305.09	230.94	245.08	346.41	367.62
5	208.66	224.05	312.99	336.08	279.15	301.31	418.73	451.97	340.51	368.32	510.76	552.48
4	253.2	274.91	379.8	412.37	343.29	373.09	514.93	559.64	421.02	457.75	631.53	686.62
3	288.19	309.21	432.29	463.82	385.21	415.82	577.82	623.74	469.71	508.3	704.56	762.45
2	291.1	312.3	436.65	468.45	388.37	419.32	582.56	628.98	473.19	512.24	709.78	768.37
1	291.1	312.3	436.65	468.45	388.37	419.32	582.56	628.98	473.19	512.24	709.78	768.37

TABLE13: STOREY SHEAR DATA FOR SIX STOREY BUILDING

SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10												
9												
8	58.69	55.88	88.03	83.82	68.03	66.81	102.04	100.22	77.05	77.11	115.58	115.67
7	141.6	140.5	212.41	210.75	173.57	177.16	260.36	265.74	203.14	210.38	304.72	315.57
6	191.05	199.08	286.57	298.63	247.98	262.31	371.98	393.46	298.55	317.89	447.83	476.84
5	226	243.45	339	365.18	304.55	328.95	456.83	493.42	372.59	402.88	558.89	604.32
4	260.74	280.88	391.11	421.32	351.62	380.07	527.42	570.1	430.3	465.75	645.45	698.63
3	291.41	308.64	437.11	462.96	385.19	412.33	577.78	618.5	467.46	502.66	701.19	753.99
2	294.01	311.23	441.02	466.85	387.8	415.07	581.71	622.61	470.21	505.64	705.31	758.45
1	294.01	311.23	441.02	466.85	387.8	415.07	581.71	622.61	470.21	505.64	705.31	758.45

TABLE14: STOREY SHEAR DATA FOR SEVEN STOREY BUILDING

SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10												
9	54.42	52.03	81.63	78.04	63.72	60.56	95.58	90.84	70.76	68.77	106.14	103.16
8	131.94	130.94	197.91	196.42	161.87	159.96	242.81	239.94	185.35	186.86	278.02	280.3
7	178.21	183.84	267.32	275.76	228.64	235.52	342.96	353.28	270.15	281.83	405.22	422.75
6	208.21	221.51	312.31	332.26	276.64	294.73	414.96	442.1	335.19	358.69	502.79	538.04
5	235.25	253.65	352.87	380.48	317.74	343.31	476.62	514.97	389.1	420.76	583.65	631.14
4	265.49	284.55	398.23	426.82	356.6	383.04	534.9	574.55	434.64	468.41	651.96	702.61
3	292.37	309.09	438.56	463.64	386.06	409.62	579.09	614.42	465.67	497.65	698.5	746.48
2	294.67	311.41	442.01	467.11	388.4	411.92	582.6	617.89	468.01	500.06	702.02	750.1
1	294.67	311.41	442.01	467.11	388.4	411.92	582.6	617.89	468.01	500.06	702.02	750.1

TABLE15: STOREY SHEAR DATA FOR EIGHT STOREY BUILDING

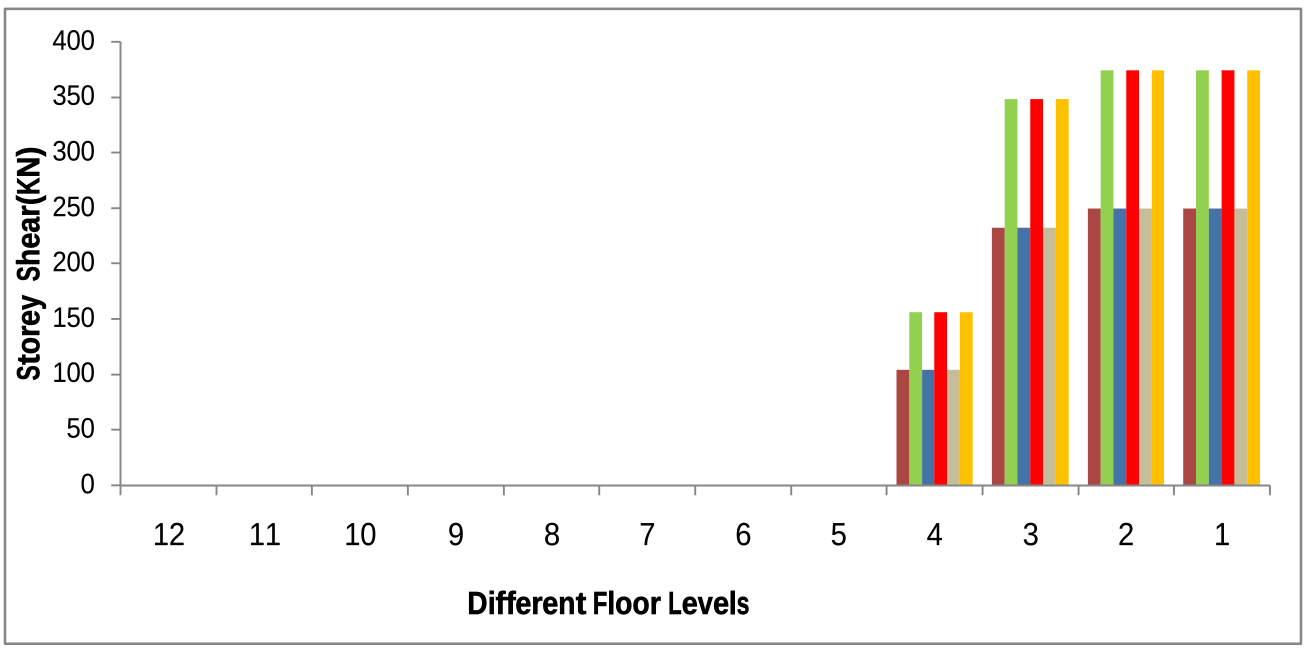
SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11												
10	49.82	48.94	74.74	73.41	60.97	56.26	91.46	84.39	66.6	62.99	99.91	94.49
9	121.67	124.48	182.51	186.72	155.44	148.9	233.16	223.36	174.28	171.04	261.42	256.56
8	165.24	174.19	247.86	261.28	217.79	217.75	326.69	326.62	251.81	256.57	377.72	384.85
7	193.99	207.4	290.98	311.1	259.17	270.27	388.76	405.4	308.93	325.44	463.4	488.17
6	217.46	233.7	326.19	350.55	291.99	313.39	437.99	470.09	355.47	382.55	533.2	573.82
5	241.28	260.09	361.92	390.13	325.63	351.58	488.45	527.37	398.19	430.65	597.29	645.97
4	267.39	287.55	401.08	431.32	360.94	384.8	541.41	577.19	437.29	469.12	655.93	703.69
3	290.53	310.13	435.8	465.2	388.44	408.14	582.67	612.21	465	493.81	697.49	740.72
2	292.55	312.24	438.82	468.35	390.64	410.18	585.96	615.27	467.12	495.87	700.68	743.81
1	292.55	312.24	438.82	468.35	390.64	410.18	585.96	615.27	467.12	495.87	700.68	743.81

TABLE16: STOREY SHEAR DATA FOR NINE STOREY BUILDING

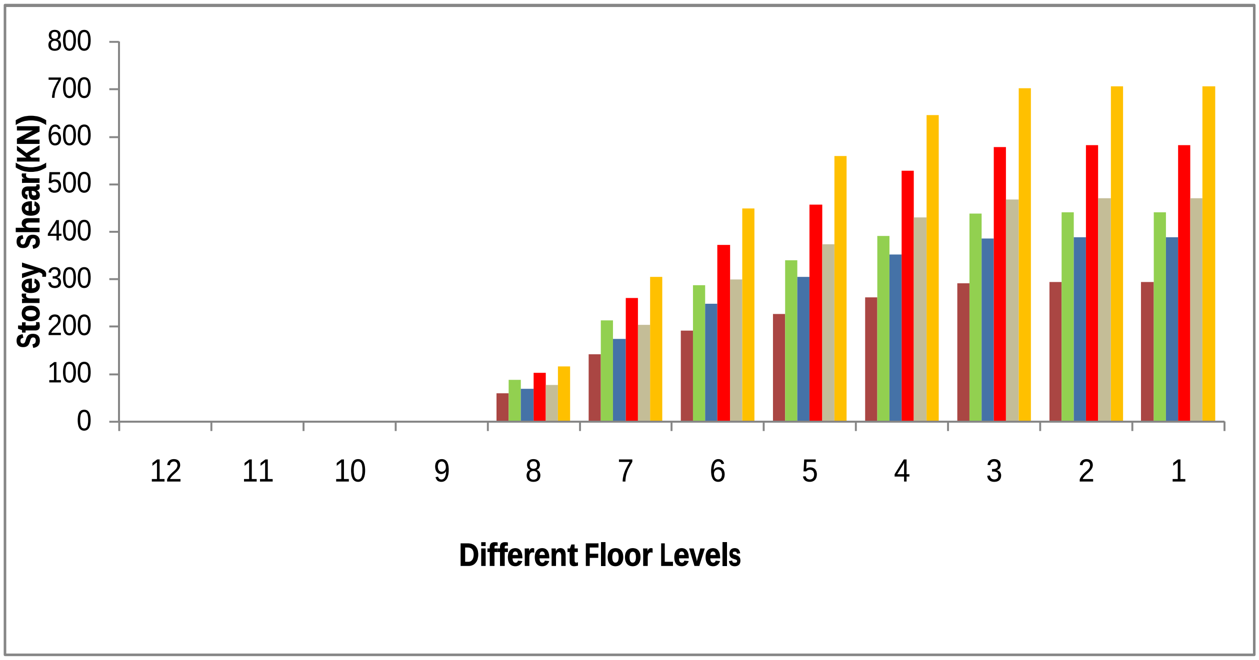
SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12												
11	46.31	45.26	69.47	67.89	57.63	53.11	86.44	79.66	63.62	58.72	95.43	88.08
10	113.75	116.32	170.63	174.48	147.87	141.24	221.8	211.86	166.91	159.7	250.37	239.55
9	155.12	163.73	232.68	245.59	208.12	206.02	312.18	309.03	240.62	238.77	360.93	358.16
8	182.31	195.54	273.46	293.31	246.74	253.76	370.1	380.65	292.12	301.28	438.18	451.93
7	204	219.35	306.01	329.02	274.34	291.36	411.52	437.04	331.26	352.63	496.89	528.95
6	224.2	241.02	336.3	361.53	300.73	324.61	451.1	486.92	367.07	396.95	550.6	595.43
5	245.17	264.6	367.76	396.89	331.26	357	496.9	535.5	404.13	436.5	606.2	654.75
4	268.14	288.87	402.21	433.3	363.93	386.55	545.89	579.83	440.1	469.37	660.15	704.06
3	288.83	309.11	433.25	463.67	389.24	407.98	583.86	611.98	465.98	491.23	698.98	736.85
2	290.66	310.98	436	466.46	391.26	409.84	586.89	614.76	467.98	493.05	701.97	739.58
1	290.66	310.98	436	466.46	391.26	409.84	586.89	614.76	467.98	493.05	701.97	739.58

TABLE17: STOREY SHEAR DATA FOR TEN STOREY BUILDING

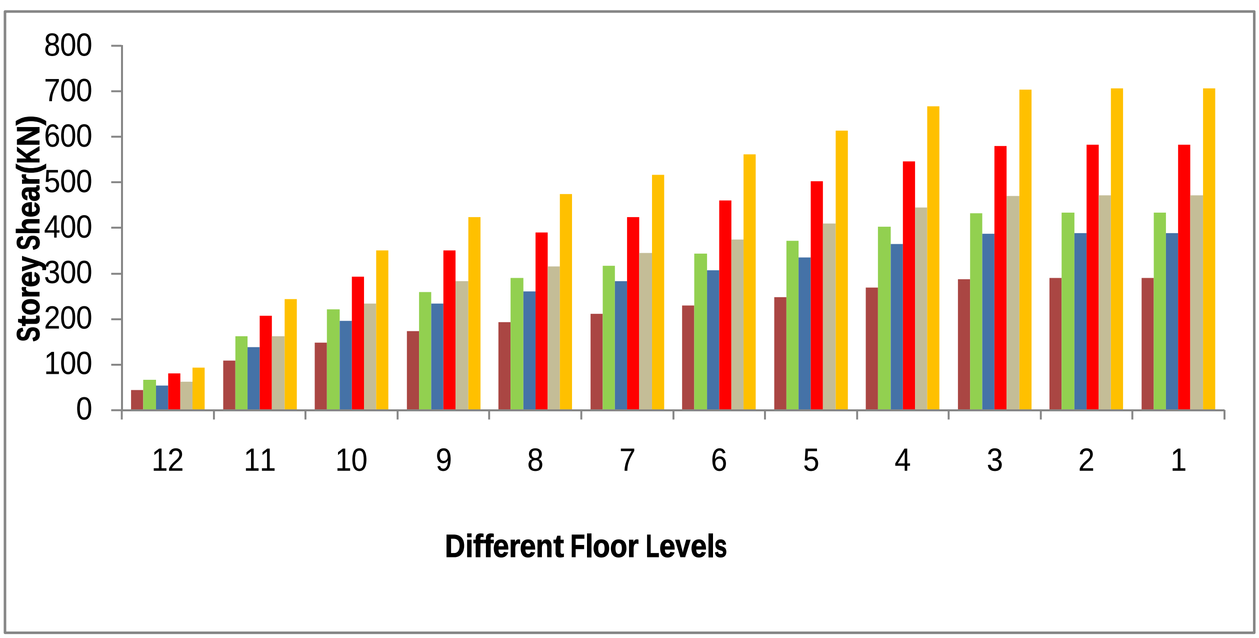
SOIL TYPE	HARD SOIL				MEDIUM SOIL				SOFT SOIL			
EQ ZONE	IV		V		IV		V		IV		V	
floors(nodes)	X	Z	X	Z	X	Z	X	Z	X	Z	X	Z
12	43.85	42.17	65.78	63.26	53.61	51.06	80.42	76.6	61.63	55.74	92.45	83.61
11	107.71	107.97	161.56	161.95	137.69	135.52	206.54	203.28	161.86	151	242.79	226.5
10	146.94	152.92	220.41	229.38	195.03	197.95	292.54	296.93	233.51	225.69	350.26	338.53
9	172.51	183.85	258.77	275.78	232.99	242.88	349.49	364.31	282.07	283.75	423.11	425.62
8	192.73	207.04	289.09	310.56	259.58	276.2	389.37	414.3	315.62	330.11	473.44	495.17
7	211.27	226.91	316.91	340.37	282.39	304.22	423.59	456.33	343.86	369.68	515.79	554.52
6	229.04	246.5	343.56	369.76	306.76	332.01	460.14	498.01	374.35	406.09	561.52	609.14
5	247.42	267.47	371.13	401.21	334.58	361.24	501.87	541.85	409.13	440.33	613.69	660.5
4	268.11	288.86	402.17	433.28	363.59	388.92	545.39	583.38	443.86	469.87	665.79	704.81
3	287.44	306.93	431.15	460.4	386.23	409.17	579.34	613.75	468.96	489.9	703.44	734.85
2	289.14	308.66	433.7	462.98	388.03	410.95	582.05	616.43	470.87	491.61	706.3	737.42
1	289.14	308.66	433.7	462.98	388.03	410.95	582.05	616.43	470.87	491.61	706.3	737.42



PLOT 15: STOREY SHEAR FOR TWO STOREY BUILDING:



PLOT 16 : STOREY SHEAR FOR SIX STOREY BUILDING



PLOT 17 : STOREY SHEAR FOR TEN STOREY BUILDING

Table No 9 to 17 consists the storey shear database for all the building models extracted from Staad Pro and compiled according to EQ zones IV and V and Site Specific parameters as Hard, Medium and Soft. Storey Shears graphs has been plotted for Two Six and Ten storey Building only since the variation in storey shears is gradual from Three Storey to Ten Storey.

CONCLUSIONS:

1) The study reveals that, with the increase in storey height of the building, the time period of the buildings increases, frequency follows the inverse nature with time period consequently follows the same pattern of decreasing with the increase in storey height.

2) Both the parameters, i.e. Time period and Frequency are found to independent of Type of Soil and Seismic Zones under purview of this dissertation work.

3) The maximum percentage of sum of all modal masses (mass participation factor) comes out to be equal or more than 90% in the present study taking in account the No. of modes as 30 for the analysis, and found to be predominant in EQ in X direction.

4) The Base Shear is found to be maximum for Seismic Zone V, Soft Soils, with minimum for hard soils Seismic Zone IV.

5) Out of all modal combination methods under the purview of work, i. e CQC, ABS, SRSS, ABS method found to be more conservative and gives the maximum response value of Base Shear,

6) Storey Shears follows a linear way with increases in storey heights in all building models except for two Storey building, the storey Shear founds to be constant for all the soil sites,

SCOPE OF FURTHER STUDY:

Mass and stiffness are the two basic parameters to estimate the dynamic responses o a structural system under vibratory motions. Tall buildings behave differently depending upon the various parameters like stiffness distribution, foundations and soil conditions. In the present study, dynamic analysis of an actual regular building model plan has been carried out. An exhaustive study of different irregular buildings can be carried out and variations in responses may be observed by varying mass and stiffness.

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APPENDIX:

STAAD PROGRAM FOR TEN STOREY BUILDING MODEL

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 03-march-13
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0.6 0; 2 1.8 0.6 0.6; 3 4.2 0.6 0.6; 4 7.2 0.6 0.6; 5 0 0.6 -2.4;
6 7.2 0.6 -2.4; 7 0 0.6 -5.9; 8 7.2 0.6 -5.9; 9 0 0.6 -3.5; 10 2.7 0.6 -5.9;
11 2.7 0.6 -2.4; 12 0 0.6 -8.3; 13 0 0.6 -9.4; 14 7.2 0.6 -9.4;
15 2.7 0.6 -9.4; 16 0 0.6 -11.8; 17 4.2 0.6 -12.4; 18 1.8 0.6 -12.4;
19 0 1.8 0; 20 1.8 1.8 0.6; 21 4.2 1.8 0.6; 22 7.2 1.8 0.6; 23 0 1.8 -2.4;
24 7.2 1.8 -2.4; 25 0 1.8 -5.9; 26 7.2 1.8 -5.9; 27 0 1.8 -3.5;
28 2.7 1.8 -5.9; 29 2.7 1.8 -2.4; 30 0 1.8 -8.3; 31 0 1.8 -9.4;
32 7.2 1.8 -9.4; 33 2.7 1.8 -9.4; 34 0 1.8 -11.8; 35 7.2 1.8 -12.4;
36 4.2 1.8 -12.4; 37 1.8 1.8 -12.4; 38 1.8 1.8 0; 39 1.8 1.8 -11.8;
40 1.8 1.8 -2.4; 41 1.8 1.8 -3.5; 42 0 1.8 -4.6; 43 1.8 1.8 -4.6;
44 1.8 1.8 -8.3; 45 1.8 1.8 -9.4; 46 0 1.8 -7.2; 47 1.8 1.8 -7.2; 48 0 5.15 0;
49 1.8 5.15 0.6; 50 4.2 5.15 0.6; 51 7.2 5.15 0.6; 52 0 5.15 -2.4;
53 7.2 5.15 -2.4; 54 0 5.15 -5.9; 55 7.2 5.15 -5.9; 56 0 5.15 -3.5;
57 2.7 5.15 -5.9; 58 2.7 5.15 -2.4; 59 0 5.15 -8.3; 60 0 5.15 -9.4;
61 7.2 5.15 -9.4; 62 2.7 5.15 -9.4; 63 0 5.15 -11.8; 64 7.2 5.15 -12.4;
65 4.2 5.15 -12.4; 66 1.8 5.15 -12.4; 67 1.8 5.15 0; 68 1.8 5.15 -11.8;
69 1.8 5.15 -2.4; 70 1.8 5.15 -3.5; 71 0 5.15 -4.6; 72 1.8 5.15 -4.6;
73 1.8 5.15 -8.3; 74 1.8 5.15 -9.4; 75 0 5.15 -7.2; 76 1.8 5.15 -7.2;
77 0 8.5 0; 78 1.8 8.5 0.6; 79 4.2 8.5 0.6; 80 7.2 8.5 0.6; 81 0 8.5 -2.4;
82 7.2 8.5 -2.4; 83 0 8.5 -5.9; 84 7.2 8.5 -5.9; 85 0 8.5 -3.5;
86 2.7 8.5 -5.9; 87 2.7 8.5 -2.4; 88 0 8.5 -8.3; 89 0 8.5 -9.4;
90 7.2 8.5 -9.4; 91 2.7 8.5 -9.4; 92 0 8.5 -11.8; 93 7.2 8.5 -12.4;
94 4.2 8.5 -12.4; 95 1.8 8.5 -12.4; 96 1.8 8.5 0; 97 1.8 8.5 -11.8;
98 1.8 8.5 -2.4; 99 1.8 8.5 -3.5; 100 0 8.5 -4.6; 101 1.8 8.5 -4.6;
102 1.8 8.5 -8.3; 103 1.8 8.5 -9.4; 104 0 8.5 -7.2; 105 1.8 8.5 -7.2;
106 4.2 5.15 2.2; 107 4.2 8.5 2.2; 108 1.8 5.15 2.2; 109 1.8 8.5 2.2;
110 4.2 5.15 -2.4; 111 4.2 5.15 -9.4; 112 4.2 1.8 -2.4; 113 4.2 8.5 -2.4;
114 0.8 1.8 -8.3; 115 0.8 5.15 -8.3; 116 0.8 8.5 -8.3; 117 7.2 0.6 -12.4;
118 0.8 1.8 -7.2; 119 0.8 5.15 -7.2; 120 0.8 8.5 -7.2; 121 0.8 1.8 -3.5;
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130 1.8 5.15 -14; 131 4.2 8.5 -14; 132 1.8 8.5 -14; 133 1.8 1.8 -5.9;
134 1.8 5.15 -5.9; 135 1.8 8.5 -5.9; 136 1.8 0.6 -5.9; 137 0 11.85 0;
```

138 1.8 11.85 0.6; 139 4.2 11.85 0.6; 140 7.2 11.85 0.6; 141 0 11.85 -2.4;
142 7.2 11.85 -2.4; 143 0 11.85 -5.9; 144 7.2 11.85 -5.9; 145 0 11.85 -3.5;
146 2.7 11.85 -5.9; 147 2.7 11.85 -2.4; 148 0 11.85 -8.3; 149 0 11.85 -9.4;
150 7.2 11.85 -9.4; 151 2.7 11.85 -9.4; 152 0 11.85 -11.8; 153 7.2 11.85 -12.4;
154 4.2 11.85 -12.4; 155 1.8 11.85 -12.4; 156 1.8 11.85 0; 157 1.8 11.85 -11.8;
158 1.8 11.85 -2.4; 159 1.8 11.85 -3.5; 160 0 11.85 -4.6; 161 1.8 11.85 -4.6;
162 1.8 11.85 -8.3; 163 1.8 11.85 -9.4; 164 0 11.85 -7.2; 165 1.8 11.85 -7.2;
166 4.2 11.85 2.2; 167 1.8 11.85 2.2; 168 4.2 11.85 -2.4; 169 0.8 11.85 -8.3;
170 0.8 11.85 -7.2; 171 0.8 11.85 -3.5; 172 0.8 11.85 -4.6; 173 4.2 11.85 -9.4;
174 4.2 11.85 -14; 175 1.8 11.85 -14; 176 1.8 11.85 -5.9; 177 0 15.2 0;
178 1.8 15.2 0.6; 179 4.2 15.2 0.6; 180 7.2 15.2 0.6; 181 0 15.2 -2.4;
182 7.2 15.2 -2.4; 183 0 15.2 -5.9; 184 7.2 15.2 -5.9; 185 0 15.2 -3.5;
186 2.7 15.2 -5.9; 187 2.7 15.2 -2.4; 188 0 15.2 -8.3; 189 0 15.2 -9.4;
190 7.2 15.2 -9.4; 191 2.7 15.2 -9.4; 192 0 15.2 -11.8; 193 7.2 15.2 -12.4;
194 4.2 15.2 -12.4; 195 1.8 15.2 -12.4; 196 1.8 15.2 0; 197 1.8 15.2 -11.8;
198 1.8 15.2 -2.4; 199 1.8 15.2 -3.5; 200 0 15.2 -4.6; 201 1.8 15.2 -4.6;
202 1.8 15.2 -8.3; 203 1.8 15.2 -9.4; 204 0 15.2 -7.2; 205 1.8 15.2 -7.2;
206 4.2 15.2 2.2; 207 1.8 15.2 2.2; 208 4.2 15.2 -2.4; 209 0.8 15.2 -8.3;
210 0.8 15.2 -7.2; 211 0.8 15.2 -3.5; 212 0.8 15.2 -4.6; 213 4.2 15.2 -9.4;
214 4.2 15.2 -14; 215 1.8 15.2 -14; 216 1.8 15.2 -5.9; 217 0 18.55 0;
218 1.8 18.55 0.6; 219 4.2 18.55 0.6; 220 7.2 18.55 0.6; 221 0 18.55 -2.4;
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238 1.8 18.55 -2.4; 239 1.8 18.55 -3.5; 240 0 18.55 -4.6; 241 1.8 18.55 -4.6;
242 1.8 18.55 -8.3; 243 1.8 18.55 -9.4; 244 0 18.55 -7.2; 245 1.8 18.55 -7.2;
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342 7.2 28.6 -2.4; 343 0 28.6 -5.9; 344 7.2 28.6 -5.9; 345 0 28.6 -3.5;
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426 2.7 35.3 -5.9; 427 2.7 35.3 -2.4; 428 0 35.3 -8.3; 429 0 35.3 -9.4;
430 7.2 35.3 -9.4; 431 2.7 35.3 -9.4; 432 0 35.3 -11.8; 433 7.2 35.3 -12.4;
434 4.2 35.3 -12.4; 435 1.8 35.3 -12.4; 436 1.8 35.3 0; 437 1.8 35.3 -11.8;
438 1.8 35.3 -2.4; 439 1.8 35.3 -3.5; 440 0 35.3 -4.6; 441 1.8 35.3 -4.6;
442 1.8 35.3 -8.3; 443 1.8 35.3 -9.4; 444 0 35.3 -7.2; 445 1.8 35.3 -7.2;
446 4.2 35.3 2.2; 447 1.8 35.3 2.2; 448 4.2 35.3 -2.4; 449 0.8 35.3 -8.3;
450 0.8 35.3 -7.2; 451 0.8 35.3 -3.5; 452 0.8 35.3 -4.6; 453 4.2 35.3 -9.4;
454 4.2 35.3 -14; 455 1.8 35.3 -14; 456 1.8 35.3 -5.9;
MEMBER INCIDENCES
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1306 442 443; 1307 437 443; 1308 444 428; 1309 444 450; 1310 445 442;
1311 418 447; 1312 447 446; 1313 446 419; 1314 448 422; 1315 419 448;
1316 449 442; 1317 450 445; 1318 451 439; 1319 452 441; 1320 451 452;
1321 449 450; 1322 453 430; 1323 434 453; 1324 435 455; 1325 434 454;
1326 455 454; 1327 456 426; 1328 445 456; 1329 441 456; 1330 443 431;
1331 438 427;
SUPPORTS
1 TO 18 117 136 FIXED
*19 TO 37 48 TO 66 77 TO 95 133 TO 135 137 TO 155 176 TO 195 216 TO 235 256 -
*257 TO 275 296 TO 315 317 336 TO 357 376 TO 397 416 TO 437 456 PINNED
DEFINE MATERIAL START
ISOTROPIC CONCRETE1
E 2.17185e+007
POISSON 0.17
DENSITY 25
ALPHA 1e-005
DAMP 0.05
*ISOTROPIC CONCRETE0
*E 2.792e+007
*POISSON 0.17
*DENSITY 1e-007
*ALPHA 1e-005
*DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
96 TO 105 109 110 112 TO 114 157 TO 165 168 TO 170 172 174 175 224 TO 232 -
235 TO 237 239 TO 242 464 465 537 TO 545 548 TO 550 552 TO 555 636 TO 644 -
647 TO 649 651 TO 654 735 TO 743 746 TO 748 750 751 834 TO 842 845 TO 847 -
849 TO 851 933 TO 944 947 TO 949 951 TO 954 1035 TO 1043 1046 TO 1048 1050 -
1051 TO 1053 1055 1134 TO 1142 1145 TO 1147 1149 TO 1154 1233 TO 1241 1244 -
1245 TO 1246 1248 TO 1253 PRIS YD 0.35 ZD 0.5
106 TO 108 166 167 171 233 234 238 534 TO 536 546 547 551 576 645 646 650 -
675 744 745 749 774 843 844 848 873 945 946 950 975 1044 1045 1049 1074 1143 -
1144 1148 1173 1242 1243 1247 1272 PRIS YD 0.35 ZD 0.5
115 TO 127 129 TO 135 137 TO 141 143 145 TO 156 186 TO 223 253 TO 290 431 -
432 TO 444 449 451 453 466 TO 468 471 472 474 476 482 483 486 TO 488 -
491 TO 493 496 497 502 503 508 TO 511 514 TO 526 528 529 532 533 577 TO 635 -
676 TO 734 775 TO 833 874 TO 932 976 TO 1034 1075 TO 1133 1174 TO 1232 1273 -
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1274 TO 1331 PRIS YD 0.5 ZD 0.35
CONSTANTS
MATERIAL CONCRETE1 ALL
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**************************** ZONE-IV***************************************
*DEFINE 1893 LOAD
*ZONE 0.24 RF 5 I 1 SS 1 ST 1 DM 0.05
**********************************************************************************
**************************************************************************************
*DEFINE 1893 LOAD
*ZONE 0.24 RF 5 I 1 SS 2 ST 1 DM 0.05
*************************************************************************************
****************************************************************************************
DEFINE 1893 LOAD
ZONE 0.24 RF 5 I 1 SS 3 ST 1 DM 0.05
**************************************************************************************
*************************************************************************************
*************************************************************************************
******************************* ZONE-V***************************************
*DEFINE 1893 LOAD
*ZONE 0.36 RF 5 I 1 SS 1 ST 1 DM 0.05
*************************************************************************************
****************************************************************************************
*DEFINE 1893 LOAD
*ZONE 0.36 RF 5 I 1 SS 2 ST 1 DM 0.05
**************************************************************************************
*************************************************************************************
*DEFINE 1893 LOAD
*ZONE 0.36 RF 5 I 1 SS 3 ST 1 DM 0.05
*************************************************************************************
****************************************************************************************
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JOINT WEIGHT
19 weight 56.544
20 weight 76.57
21 weight 121.033
22 weight 69.507
23 weight 79.923
24 weight 144.083
25 weight 83.485
26 weight 147.435
27 weight 77.86
28 weight 201.193
29 weight 214.251
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30 weight 77.86
31 weight 79.923
32 weight 144.083
33 weight 214.251
34 weight 56.544
35 weight 69.507
36 weight 121.033
37 weight 76.57
48 weight 55.909
49 weight 168.281
50 weight 210.213
51 weight 72.829
52 weight 82.905
53 weight 145.071
54 weight 101.538
55 weight 151.525
56 weight 105.466
57 weight 213.474
58 weight 224.601
59 weight 105.466
60 weight 82.905
61 weight 145.071
62 weight 224.601
63 weight 55.909
64 weight 72.829
65 weight 210.213
66 weight 168.281
77 weight 56.288
78 weight 166.18
79 weight 208.902
80 weight 72.862
81 weight 83.746
82 weight 145.654
83 weight 101.715
84 weight 151.566
85 weight 105.579
86 weight 212.54
87 weight 226.921
88 weight 105.579
89 weight 83.746
90 weight 145.654
91 weight 226.921
92 weight 56.288
93 weight 72.862

94 weight 208.902
95 weight 166.18
133 weight 54.805
134 weight 134.484
135 weight 133.49
137 weight 56.272
138 weight 166.491
139 weight 209.098
140 weight 72.879
141 weight 83.623
142 weight 145.558
143 weight 101.688
144 weight 151.573
145 weight 105.588
146 weight 212.682
147 weight 226.493
148 weight 105.588
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152 weight 56.272
153 weight 72.879
154 weight 209.099
155 weight 166.491
176 weight 133.626
177 weight 56.27
178 weight 166.443
179 weight 209.068
180 weight 72.873
181 weight 83.643
182 weight 145.574
183 weight 101.692
184 weight 151.569
185 weight 105.583
186 weight 212.659
187 weight 226.569
188 weight 105.582
189 weight 83.643
190 weight 145.574
191 weight 226.57
192 weight 56.269
193 weight 72.873
194 weight 209.068
195 weight 166.443

216 weight 133.607
217 weight 56.27
218 weight 166.451
219 weight 209.073
220 weight 72.874
221 weight 83.64
222 weight 145.571
223 weight 101.691
224 weight 151.57
225 weight 105.583
226 weight 212.664
227 weight 226.557
228 weight 105.586
229 weight 83.636
230 weight 145.571
231 weight 226.551
232 weight 56.274
233 weight 72.874
234 weight 209.074
235 weight 166.452
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257 weight 56.274
258 weight 166.45
259 weight 209.072
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262 weight 145.573
263 weight 101.691
264 weight 151.57
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267 weight 226.555
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271 weight 226.586
272 weight 56.249
273 weight 72.875
274 weight 209.06
275 weight 166.447
296 weight 133.61
297 weight 56.245
298 weight 166.455
299 weight 209.068

300 weight 72.875
301 weight 83.655
302 weight 145.564
303 weight 101.691
304 weight 151.569
305 weight 105.565
306 weight 212.705
307 weight 226.579
308 weight 105.642
309 weight 83.225
310 weight 145.588
311 weight 225.756
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313 weight 72.865
314 weight 209.183
315 weight 167.964
317 weight 7.506
336 weight 133.695
337 weight 55.525
338 weight 167.712
339 weight 209.13
340 weight 72.873
341 weight 83.272
342 weight 145.637
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344 weight 151.589
345 weight 105.686
346 weight 212.613
347 weight 225.697
348 weight 105.702
349 weight 83.087
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352 weight 55.061
353 weight 72.867
354 weight 209.209
355 weight 170.869
356 weight 7.757
357 weight 12.74
376 weight 133.757
377 weight 54.915
378 weight 173.297
379 weight 209.633
380 weight 72.771

381 weight 82.553
382 weight 145.312
383 weight 101.537
384 weight 151.48
385 weight 105.247
386 weight 213.85
387 weight 226.007
388 weight 105.242
389 weight 82.573
390 weight 145.31
391 weight 226.03
392 weight 54.937
393 weight 72.773
394 weight 209.62
395 weight 173.067
396 weight 10.27
397 weight 10.456
416 weight 134.006
417 weight 31.695
418 weight 85.758
419 weight 105.321
420 weight 42.714
421 weight 40.826
422 weight 81.182
423 weight 50.672
424 weight 86.364
425 weight 45.122
426 weight 108.355
427 weight 98.73
428 weight 45.123
429 weight 40.822
430 weight 81.183
431 weight 98.728
432 weight 31.695
433 weight 42.714
434 weight 105.323
435 weight 85.778
436 weight 1.787
437 weight 1.769
456 weight 37.463
CUT OFF MODE SHAPE 30
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LOAD 1 LOADTYPE Dead
SELFWEIGHT Y -1

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MEMBER LOAD
115 TO 127 129 TO 135 137 TO 141 143 146 149 TO 151 153 154 186 TO 223 253 -
254 TO 290 431 TO 444 449 451 453 467 468 471 474 476 482 483 487 488 492 -
493 496 497 502 503 508 TO 511 514 TO 518 521 TO 526 528 529 532 533 577 -
578 TO 635 676 TO 734 775 TO 833 874 TO 932 976 TO 1034 1075 TO 1133 1174 -
1175 TO 1232 UNI GY -13.5
MEMBER LOAD
431 TO 436 508 TO 511 514 515 615 TO 617 628 TO 630 714 TO 716 727 TO 729 -
813 TO 815 826 TO 828 912 TO 914 925 TO 927 1014 TO 1016 1027 TO 1029 1113 -
1114 TO 1115 1126 TO 1128 1212 TO 1214 1225 TO 1227 1274 1276 TO 1280 1288 -
1289 TO 1292 1294 TO 1297 1300 1303 1308 1311 TO 1313 1324 TO 1325 -
1326 UNI GY -5.6
*1175 1177 TO 1181 1189 TO 1193 1195 TO 1198 1201 1204 1209 1212 TO 1214 1225 -
*1226 TO 1227 1274 1276 TO 1280 1288 TO 1292 1294 TO 1297 1300 1303 1308 1311 -
*1312 TO 1313 1324 TO 1326 UNI GY -5.6
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*25*.125 = 3.125KN/M2+ FLOOR FINISHES @ 40MM THK ie .04*22=.88KN/M2
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FLOOR LOAD
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -2.4 0  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 1.8 4.2  ZRANGE -2.4 0.6  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 4.2 7.2  ZRANGE -2.4 0.6  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 0.8  ZRANGE -4.6 -3.5  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0.8 1.8  ZRANGE -4.6 -3.5  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 1.8 2.7  ZRANGE -5.9 -2.4  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -5.9 -4.6  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 2.7 7.2  ZRANGE -5.9 -2.4  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 2.7 7.2  ZRANGE -9.4 -5.9  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 1.8 2.7  ZRANGE -9.4 -5.9  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 4.2 7.2  ZRANGE -12.4 -9.4  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 1.8 4.2  ZRANGE -12.4 -9.4  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -11.8 -9.4  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -9.4 -8.3  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -8.3 -7.2  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -7.2 -5.9  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 1.8 4.2  ZRANGE 0.6 2.2  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 1.8 4.2  ZRANGE -14 -12.4  GY
YRANGE 1.8 35.3 FLOAD -4.1 XRANGE 0 1.8  ZRANGE -3.5 -2.4  GY
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LOAD 2 LOADTYPE Live  TITLE LIVE LOAD
FLOOR LOAD
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YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -2.4 0 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 1.8 4.2 ZRANGE -2.4 0.6 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 4.2 7.2 ZRANGE -2.4 0.6 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 0.8 ZRANGE -4.6 -3.5 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0.8 1.8 ZRANGE -4.6 -3.5 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 1.8 2.7 ZRANGE -5.9 -2.4 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -5.9 -4.6 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 2.7 7.2 ZRANGE -5.9 -2.4 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 2.7 7.2 ZRANGE -9.4 -5.9 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 1.8 2.7 ZRANGE -9.4 -5.9 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 4.2 7.2 ZRANGE -12.4 -9.4 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 1.8 4.2 ZRANGE -12.4 -9.4 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -11.8 -9.4 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -9.4 -8.3 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -8.3 -7.2 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -7.2 -5.9 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 1.8 4.2 ZRANGE 0.6 2.2 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 1.8 4.2 ZRANGE -14 -12.4 GY
YRANGE 1.8 35.3 FLOAD -2 XRANGE 0 1.8 ZRANGE -3.5 -2.4 GY
****
LOAD 3 RESPONSE SPECTRUM IN X DIRECTION
JOINT LOAD
19 fx 56.544 fz 56.544
20 fx 76.57 fz 76.57
21 fx 121.033 fz 121.033
22 fx 69.507 fz 69.507
23 fx 79.923 fz 79.923
24 fx 144.083 fz 144.083
25 fx 83.485 fz 83.485
26 fx 147.435 fz 147.435
27 fx 77.86 fz 77.86
28 fx 201.193 fz 201.193
29 fx 214.251 fz 214.251
30 fx 77.86 fz 77.86
31 fx 79.923 fz 79.923
32 fx 144.083 fz 144.083
33 fx 214.251 fz 214.251
34 fx 56.544 fz 56.544
35 fx 69.507 fz 69.507
36 fx 121.033 fz 121.033
37 fx 76.57 fz 76.57
48 fx 55.909 fz 55.909
49 fx 168.281 fz 168.281
50 fx 210.213 fz 210.213

51 fx 72.829 fz 72.829
52 fx 82.905 fz 82.905
53 fx 145.071 fz 145.071
54 fx 101.538 fz 101.538
55 fx 151.525 fz 151.525
56 fx 105.466 fz 105.466
57 fx 213.474 fz 213.474
58 fx 224.601 fz 224.601
59 fx 105.466 fz 105.466
60 fx 82.905 fz 82.905
61 fx 145.071 fz 145.071
62 fx 224.601 fz 224.601
63 fx 55.909 fz 55.909
64 fx 72.829 fz 72.829
65 fx 210.213 fz 210.213
66 fx 168.281 fz 168.281
77 fx 56.288 fz 56.288
78 fx 166.18 fz 166.18
79 fx 208.902 fz 208.902
80 fx 72.862 fz 72.862
81 fx 83.746 fz 83.746
82 fx 145.654 fz 145.654
83 fx 101.715 fz 101.715
84 fx 151.566 fz 151.566
85 fx 105.579 fz 105.579
86 fx 212.54 fz 212.54
87 fx 226.921 fz 226.921
88 fx 105.579 fz 105.579
89 fx 83.746 fz 83.746
90 fx 145.654 fz 145.654
91 fx 226.921 fz 226.921
92 fx 56.288 fz 56.288
93 fx 72.862 fz 72.862
94 fx 208.902 fz 208.902
95 fx 166.18 fz 166.18
133 fx 54.805 fz 54.805
134 fx 134.484 fz 134.484
135 fx 133.49 fz 133.49
137 fx 56.272 fz 56.272
138 fx 166.491 fz 166.491
139 fx 209.098 fz 209.098
140 fx 72.879 fz 72.879
141 fx 83.623 fz 83.623
142 fx 145.558 fz 145.558

143 fx 101.688 fz 101.688
144 fx 151.573 fz 151.573
145 fx 105.588 fz 105.588
146 fx 212.682 fz 212.682
147 fx 226.493 fz 226.493
148 fx 105.588 fz 105.588
149 fx 83.623 fz 83.623
150 fx 145.558 fz 145.558
151 fx 226.493 fz 226.493
152 fx 56.272 fz 56.272
153 fx 72.879 fz 72.879
154 fx 209.099 fz 209.099
155 fx 166.491 fz 166.491
176 fx 133.626 fz 133.626
177 fx 56.27 fz 56.27
178 fx 166.443 fz 166.443
179 fx 209.068 fz 209.068
180 fx 72.873 fz 72.873
181 fx 83.643 fz 83.643
182 fx 145.574 fz 145.574
183 fx 101.692 fz 101.692
184 fx 151.569 fz 151.569
185 fx 105.583 fz 105.583
186 fx 212.659 fz 212.659
187 fx 226.569 fz 226.569
188 fx 105.582 fz 105.582
189 fx 83.643 fz 83.643
190 fx 145.574 fz 145.574
191 fx 226.57 fz 226.57
192 fx 56.269 fz 56.269
193 fx 72.873 fz 72.873
194 fx 209.068 fz 209.068
195 fx 166.443 fz 166.443
216 fx 133.607 fz 133.607
217 fx 56.27 fz 56.27
218 fx 166.451 fz 166.451
219 fx 209.073 fz 209.073
220 fx 72.874 fz 72.874
221 fx 83.64 fz 83.64
222 fx 145.571 fz 145.571
223 fx 101.691 fz 101.691
224 fx 151.57 fz 151.57
225 fx 105.583 fz 105.583
226 fx 212.664 fz 212.664

227 fx 226.557 fz 226.557
228 fx 105.586 fz 105.586
229 fx 83.636 fz 83.636
230 fx 145.571 fz 145.571
231 fx 226.551 fz 226.551
232 fx 56.274 fz 56.274
233 fx 72.874 fz 72.874
234 fx 209.074 fz 209.074
235 fx 166.452 fz 166.452
256 fx 133.61 fz 133.61
257 fx 56.274 fz 56.274
258 fx 166.45 fz 166.45
259 fx 209.072 fz 209.072
260 fx 72.874 fz 72.874
261 fx 83.637 fz 83.637
262 fx 145.573 fz 145.573
263 fx 101.691 fz 101.691
264 fx 151.57 fz 151.57
265 fx 105.587 fz 105.587
266 fx 212.655 fz 212.655
267 fx 226.555 fz 226.555
268 fx 105.574 fz 105.574
269 fx 83.661 fz 83.661
270 fx 145.571 fz 145.571
271 fx 226.586 fz 226.586
272 fx 56.249 fz 56.249
273 fx 72.875 fz 72.875
274 fx 209.06 fz 209.06
275 fx 166.447 fz 166.447
296 fx 133.61 fz 133.61
297 fx 56.245 fz 56.245
298 fx 166.455 fz 166.455
299 fx 209.068 fz 209.068
300 fx 72.875 fz 72.875
301 fx 83.655 fz 83.655
302 fx 145.564 fz 145.564
303 fx 101.691 fz 101.691
304 fx 151.569 fz 151.569
305 fx 105.565 fz 105.565
306 fx 212.705 fz 212.705
307 fx 226.579 fz 226.579
308 fx 105.642 fz 105.642
309 fx 83.225 fz 83.225
310 fx 145.588 fz 145.588

311 fx 225.756 fz 225.756
312 fx 55.504 fz 55.504
313 fx 72.865 fz 72.865
314 fx 209.183 fz 209.183
315 fx 167.964 fz 167.964
317 fx 7.506 fz 7.506
336 fx 133.695 fz 133.695
337 fx 55.525 fz 55.525
338 fx 167.712 fz 167.712
339 fx 209.13 fz 209.13
340 fx 72.873 fz 72.873
341 fx 83.272 fz 83.272
342 fx 145.637 fz 145.637
343 fx 101.723 fz 101.723
344 fx 151.589 fz 151.589
345 fx 105.686 fz 105.686
346 fx 212.613 fz 212.613
347 fx 225.697 fz 225.697
348 fx 105.702 fz 105.702
349 fx 83.087 fz 83.087
350 fx 145.648 fz 145.648
351 fx 225.402 fz 225.402
352 fx 55.061 fz 55.061
353 fx 72.867 fz 72.867
354 fx 209.209 fz 209.209
355 fx 170.869 fz 170.869
356 fx 7.757 fz 7.757
357 fx 12.74 fz 12.74
376 fx 133.757 fz 133.757
377 fx 54.915 fz 54.915
378 fx 173.297 fz 173.297
379 fx 209.633 fz 209.633
380 fx 72.771 fz 72.771
381 fx 82.553 fz 82.553
382 fx 145.312 fz 145.312
383 fx 101.537 fz 101.537
384 fx 151.48 fz 151.48
385 fx 105.247 fz 105.247
386 fx 213.85 fz 213.85
387 fx 226.007 fz 226.007
388 fx 105.242 fz 105.242
389 fx 82.573 fz 82.573
390 fx 145.31 fz 145.31
391 fx 226.03 fz 226.03

392 fx 54.937 fz 54.937
393 fx 72.773 fz 72.773
394 fx 209.62 fz 209.62
395 fx 173.067 fz 173.067
396 fx 10.27 fz 10.27
397 fx 10.456 fz 10.456
416 fx 134.006 fz 134.006
417 fx 31.695 fz 31.695
418 fx 85.758 fz 85.758
419 fx 105.321 fz 105.321
420 fx 42.714 fz 42.714
421 fx 40.826 fz 40.826
422 fx 81.182 fz 81.182
423 fx 50.672 fz 50.672
424 fx 86.364 fz 86.364
425 fx 45.122 fz 45.122
426 fx 108.355 fz 108.355
427 fx 98.73 fz 98.73
428 fx 45.123 fz 45.123
429 fx 40.822 fz 40.822
430 fx 81.183 fz 81.183
431 fx 98.728 fz 98.728
432 fx 31.695 fz 31.695
433 fx 42.714 fz 42.714
434 fx 105.323 fz 105.323
435 fx 85.778 fz 85.778
436 fx 1.787 fz 1.787
437 fx 1.769 fz 1.769
456 fx 37.463 fz 37.463
****
*SPECTRUM CQC 1893 X 0.024 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 1
*LOAD 4 RESPONSE SPECTRUM IN Z DIRECTION
*SPECTRUM CQC 1893 Z 0.024 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 1
****
*SPECTRUM CQC 1893 X 0.024 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 2
*LOAD 4 RESPONSE SPECTRUM IN Z DIRECTION
*SPECTRUM CQC 1893 Z 0.024 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 2
****
SPECTRUM CQC 1893 X 0.024 ACC SCALE 1 DAMP 0.05
SOIL TYPE 3

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LOAD 4 RESPONSE SPECTRUM IN Z DIRECTION
SPECTRUM CQC 1893 Z 0.024 ACC SCALE 1 DAMP 0.05
SOIL TYPE 3
*************** ZONE - V **********************
**********************************************
*SPECTRUM CQC 1893 X 0.036 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 1
*LOAD 4 RESPONSE SPECTRUM IN Z DIRECTION
*SPECTRUM CQC 1893 Z 0.036 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 1
**********************************************
*SPECTRUM CQC 1893 X 0.036 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 2
*LOAD 4 RESPONSE SPECTRUM IN Z DIRECTION
*SPECTRUM CQC 1893 Z 0.036 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 2
******************************************
*SPECTRUM CQC 1893 X 0.036 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 3
*LOAD 4 RESPONSE SPECTRUM IN Z DIRECTION
*SPECTRUM CQC 1893 Z 0.036 ACC SCALE 1 DAMP 0.05
*SOIL TYPE 3
*********************************************************
***as per IS1893 :2002,Cl 7.3.1(To calculate lumped mass)
*LOAD COMBINATION 6
*1 1.0 2 0.25
*******************************************
LOAD COMBINATION 10
1 1.5 2 1.5
LOAD COMBINATION 11
1 1.2 2 1.2 3 1.2
LOAD COMBINATION 12
1 1.2 2 1.2 3 -1.2
LOAD COMBINATION 13
1 1.2 2 1.2 4 1.2
LOAD COMBINATION 14
1 1.2 2 1.2 4 -1.2
LOAD COMBINATION 15
1 1.5 3 1.5
LOAD COMBINATION 16
1 1.5 3 -1.5
LOAD COMBINATION 17
1 1.5 4 1.5
LOAD COMBINATION 18
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1 1.5 4 -1.5
LOAD COMBINATION 19
1 0.9 3 1.5
LOAD COMBINATION 20
1 0.9 3 -1.5
LOAD COMBINATION 21
1 0.9 4 1.5
LOAD COMBINATION 22
1 0.9 4 -1.5
***********************************************
PERFORM ANALYSIS
START CONCRETE DESIGN
CODE INDIAN
FC 25000 ALL
FYMAIN 500000 ALL
MAXMAIN 25 ALL
MAXSEC 10 ALL
DESIGN BEAM 115 TO 127 129 TO 135 137 TO 141 143 145 TO 156 186 TO 223 253 -
254 TO 290 431 TO 444 449 451 453 466 TO 468 471 472 474 476 482 483 -
486 TO 488 491 TO 493 496 497 502 503 508 TO 511 514 TO 526 528 529 532 533 -
577 TO 635 676 TO 734 775 TO 833 874 TO 932 976 TO 1034 1075 TO 1133 1174 -
1175 TO 1232 1273 TO 1331
DESIGN COLUMN 96 TO 110 112 TO 114 157 TO 172 174 175 224 TO 242 464 465 534 -
535 TO 555 576 636 TO 654 675 735 TO 751 774 834 TO 851 873 933 TO 954 975 -
1035 TO 1053 1055 1074 1134 TO 1154 1173 1233 TO 1253 1272
END CONCRETE DESIGN
FINISH
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