SEISMIC RESISTANT ANALYSIS AND DESIGN OF MULTISTORY BUILDING

A
PROJECT REPORT

Submitted in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

Under the supervision
of

Dr. SAURAV
(Assistant Professor)

By

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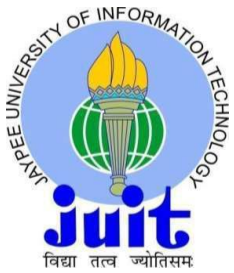

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

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HIMACHAL PRADESH, INDIA

MAY 2019

STUDENT'S DECLARATION

I hereby declare that the work presented in the Project report entitled **"SEISMIC RESISTANTANALYSIS AND DESIGN OF MULTISTORY BUILDING"** submitted for partial fulfillment of the requirements for the degree of Bachelor of Technology in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of my work carried out under the supervision of **Dr. Saurav**. This work has not been submitted elsewhere for the reward of any other degree/diploma. I am fully responsible for the contents of my project report.

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CERTIFICATE

This is to certify that the work which is being presented in the project report titled **"SEISMIC RESISTANT ANALYSIS AND DESIGN OF MULTISTORY BUILDING"** in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Civil Engineering and submitted to the Department of Civil Engineering, **Jaypee University of Information Technology,Waknaghat** is an authentic record of work carried out by **Ahtesham Hussain (151670**) during a period from July 2018 to May 2019 under the supervision of**Dr.Saurav**Department of Civil Engineering, Jaypee University of Information Technology,Waknaghat.

The above statement made is correct to the best of our knowledge.

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ABSTRACT

The ground vibration along with seismic tremors is the reason to the breakdown of structures. So as to spare loss of life and property; the structures should be planned against the powers originating from ground vibration. In this work A RCC encircled five-storied structure has been broke down and intended to endure the quakes in which the Indian seismic zone IV is inclined to, the site of structure is in Jalandhar. Device utilized for calculations is STAAD-pro 2000.

The investigation has been done for quake and According to Indian Standard codes 1893:2002 (section 1) and IS-875:1987 (section 3) individually. Fortified solid structure is finished with point of confinement state technique complying with IS-456:2000 built in the STAAD.pro. The plan results are confirmed additionally alongside handbook structure arbitrarily. At last, the fortification specifying is done carefully according to Seems to be 13920:1993 in order to give flexibility to auxiliary individuals including joints. The fortifications of different individuals are as illustrations. The loads have been dissected utilizing technique for fixity and intended for irrefutably the greatest responses at section bases.

The structure was investigated without block infill boards which may have caused underestimation of parallel solidness of the structure making the plan more secure. To the extent of further work is concerned, the infill boards might be associated with examination and progressively efficient plan can be gotten.

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CHAPTER 1

INTODUCTION

1.1General

Building improvement is the planning courses of action with the advancement of structure, for instance, private houses. In a clear structure can be portray as an encase space by dividers with housetop, nourishment, fabric and the essential needs of people. In the early old events individuals lived in natural hollows, over trees or under trees to shield themselves from wild animals, downpour, sun, etc as the events go as individuals being started living in cabins made of timber branches. The asylums of those old have been shaped nowadays into stunning houses. Rich people live in present day condition houses

Structures are the noteworthy pointer of social headway of the territory. Every human needs to have pleasant homes on a typical generally one experiences his two)third time on earth times in the houses. The security city feeling of the commitment. These are the few reasons which are able that the individual do most extraordinary effort and spend hard earned saving in owning houses.

Nowadays the house building is genuine work of the social headway of the area. Step by step new strategies are being created for the improvement of houses monetarily quickly and fulfilling the necessities of the system authorities and artists do the structure work masterminding and plan, etc of the structures. Originator is responsible for doing the outline works of structure as for the heading of pros and designers. The Draftsman must know his and should have the ability to hold fast to the direction of the planner and should have the ability to draw the required delineation of the structure site plans and organization designs, etc regarding the essentials' The arrangement is made using programming on helper examination structure (STAAD PRO) The structure presented to both the vertical loads similarly as even loads. The vertical weight includes dead stack of helper parts, for instance, bars, segments, pieces, etc and live loads.

The dimension trouble contains the breeze controls consequently collecting is proposed for dead weight, live weight and wind load as indicated by IS 875 The structure is arranged as two dimensional vertical edge and dismembered for the most outrageous and least bending minutes and shear controls by experimentation procedures as per IS 456-2000 (The help is taken by programming available in foundation and the computations of weights minutes and shear controls and obtained from this item.

1.1.1 Design of structure elements

The design of any structure is arranged into the accompanying two fundamental sorts;

i. Functional Design
ii. Structural Design

The procedure of auxiliary structure includes the accompanying stages:

- Structural arranging
- Action of Forces and calculation of burdens
- Method of investigation
- Member Design
- Detailing, drawing and readiness of calendars

1.2Auto cad

Auto Cad is commercial software or programming application for 2D and 3D Computer Aided plan (CAD) (As shown in figure 1.2) and drafting open since 1982 as a work zone and since 2010 as an adaptable web-and cloud based application promote as AutoCAD 360.Developed Created and market by means of Autodesk Inc.… AutoCAD was first released in December 1982 Running on microcomputer with inside representations controller. Before the introduction of AutoCAD most business CAD program on unified server PCs or minicomputer with each CAD head customer working at an alternate reasonable terminal. AutoCAD is used over a wide scope of endeavors by organizer's .

Project boss specialists visual originator and distinctive specialists it is maintained by 750 instructional center point overall beginning at 1994. As Autodesk lead thing by March 1986 AutoCAD has transformed into the most universal CAD program worldwide As of 2014 AutoCAD is in its twenty ninth period and Collective with all its variety continues being the most for the most part used CAD program all through Most of the world.

1.3 History

AutoCAD was gotten from a program off in 1997 and discharged in 1979 called web CAD Additionally implied in early Autodesk document as littler scale CAD. Which was formed going before Autodesk (by then Marin-chip programming associates) course of action by means of Autodesk individual advocate Mike Riddle. The essential structure by the Autodesk association was appeared at the 1982 Comdex and discharged that December the 2016 release exhibit the 30th noteworthy release for the AutoCAD for Windows. The 2014 release feature the fourth consecutive year for AutoCAD for Mac.

1.4 Work spaces of AutoCAD

i) 2D DESIGING
ii) 3D MODELING
iii) DRAFTING AND ANNOTATION

2D Designing

i) Draft plan all the more rapidly without utilizing stencils and specialized illustration instrument.
ii) Create site plans, refine idea, sketch specialized illustration and offers your thoughts.
Alter layout and all the more accurately
iii) Team up with partners and customers utilizing other perfect information records When utilizing authentic DWG document configuration to work together with Customers and partners.

3D Modeling

i) 3D Modeling is a procedure of creating Mathematical portrayal of any three dimensional surface.

ii) 3D Models represent to a 3D object utilizing an accumulation of focuses in 3D Space joined by different geometric elements, for example, line, triangle, bended, surface and so forth.

iii) 3D Models are utilized anyplace in 3D illustrations or graphics

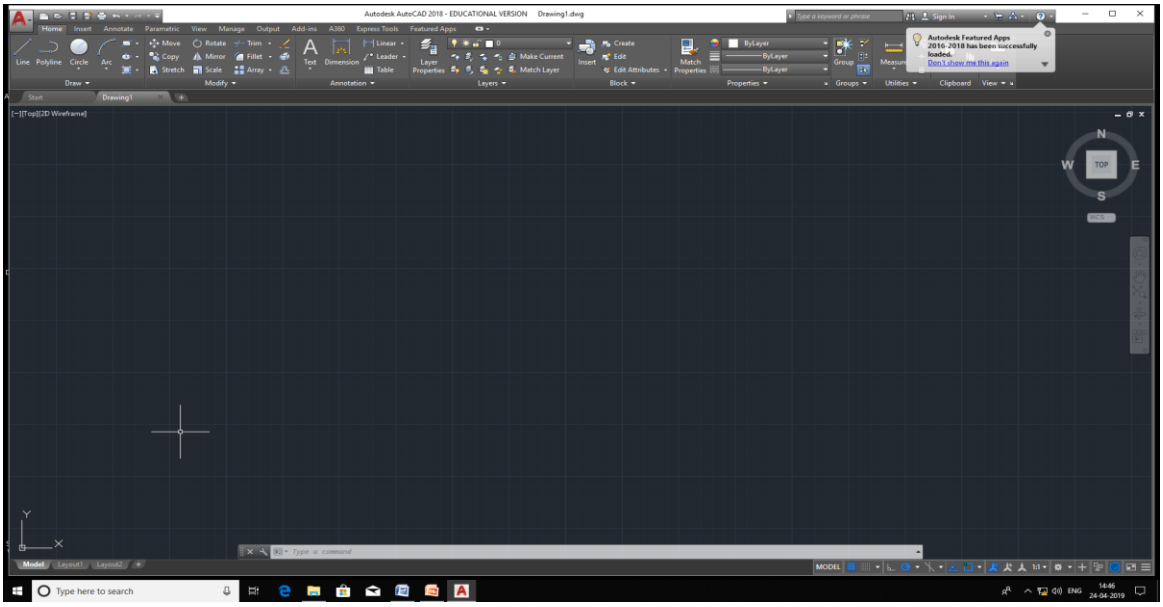


Figure1.1: Auto Cad working Interface

1.5 STAAD PRO.

In each part of human development we required structures to live in or to get what we need. In any case, it isn't just structure structures however to fabricate proficient structures with the goal that it can satisfy the principle reason for what it was made for. Here comes the job of structural designing and all the more exactly the job of investigation of structure

There are numerous established strategies to take care of plan issue, and with time new programming's additionally becoming an integral factor. Here in this undertaking work dependent on programming named Staad professional has been used. Few standard issues likewise have been unraveled to demonstrate how Staad star can be utilized in various cases

These ordinary issues have been settled utilizing essential idea of stacking, examination, condition according to IS code. These essential strategies might be discovered helpful for further investigation of issues

Examination of the structure intends to assurance of the inside powers like hub pressure bowing minute, shear constrain and so on in the segment part for which the part are to be planned under the activity of given outside burden. The plan is procedure of segment percussion from the examination results by utilizing appropriate investigation method. The point of configuration is to accomplishment of a satisfactory likelihood that structures being planned will perform agreeably amid their proposed life

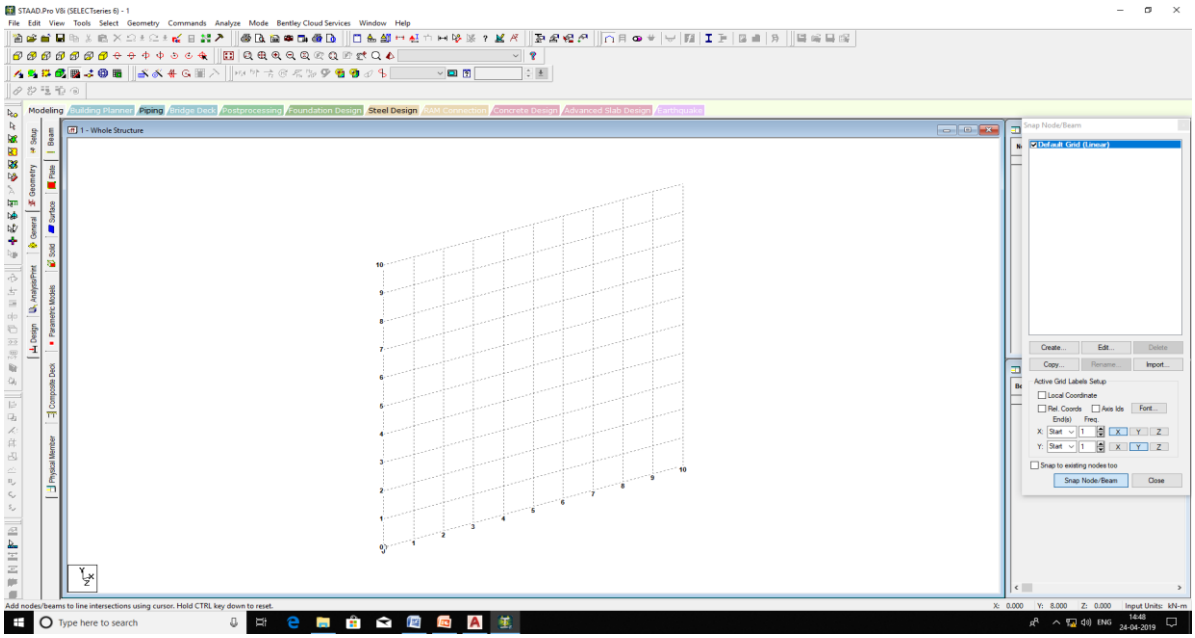


Figure 1.2: STAAD PRO working Interface

1.5.1 Advantages of STAAD PRO software

i) Flexible modeling environment

ii) Availability of wide ranges for designing code

iii) Open architecture

iv) All feature of structural engineering

v) Report and documentation

vi) Quality assurances

vii) International code

Investigation of structure of different components of structure.

i) Planning of different parts of a structure with section situating
ii) Introduction of STAAD.Pro
iii) Modeling of the structure in the STAAD.Pro giving all limit conditions (Underpins, stacking and so on)
iv) Analysis and Design of different basic parts of the modular structure
v) Study of investigation Data of the product
vi) Detailing of shafts, segments, piece with area proportioning and fortification.

BEAM: Beams are commonly horizontal structural member which transfer the load Horizontal along their length to the support where the load are commonly resolved into vertical forces. Beams are used for revisiting vertical load, bending moment and shear forces.

There are three types of RCC beam.

- Singly reinforced beam
- Doubly reinforced beam
- Flanged beam

Singly reinforced beam: In case of singly reinforced beams, the Concrete on upper portion (top fibers) is subjected to compression and the Reinforcements are provided toresist tension on lower part . In this case however the depth of the beam is greater. As shown in Figure 1.3

Doubly reinforced beam; Beam or shaft sustained with steel in weight and strain zones are called doubly reinforced columns. This kind of shaft will be found significant when on account of head room thought or building thought the significance of the bar is kept

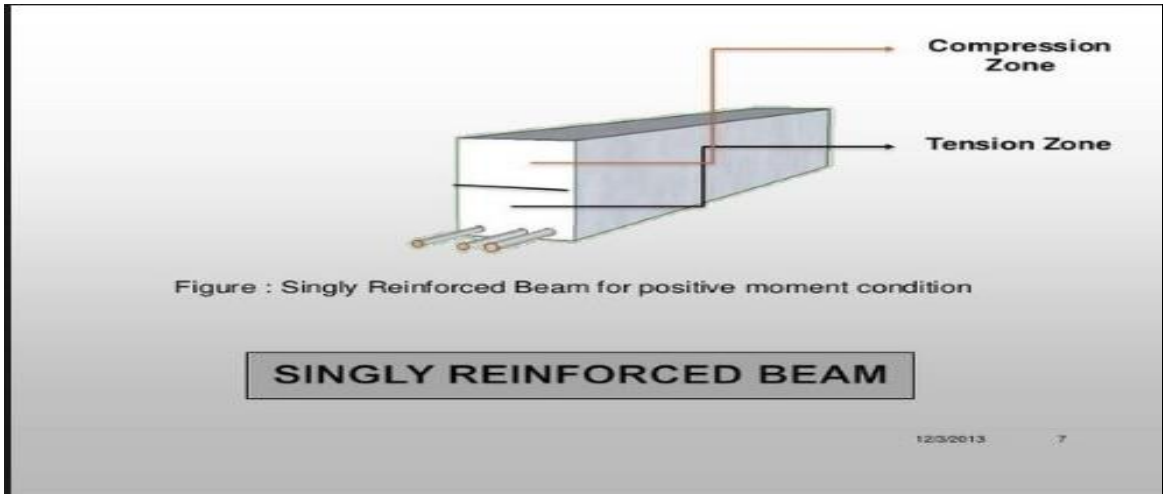


Figure 1.3: Singly reinforced beam (imagesr.org)

Flanged Beam; A T-beam (or tee beam), utilized in development, is a heap bearing structure of strengthened solid, wood or metal, with a t-molded cross segment. The web (vertical segment) of the shaft underneath the pressure spine serves to oppose shear pressure and to give more prominent division to the coupled powers of bowing. As shown in Figure 1.4

A Flanged beam are of two types;

- T BEAM
- L BEAM

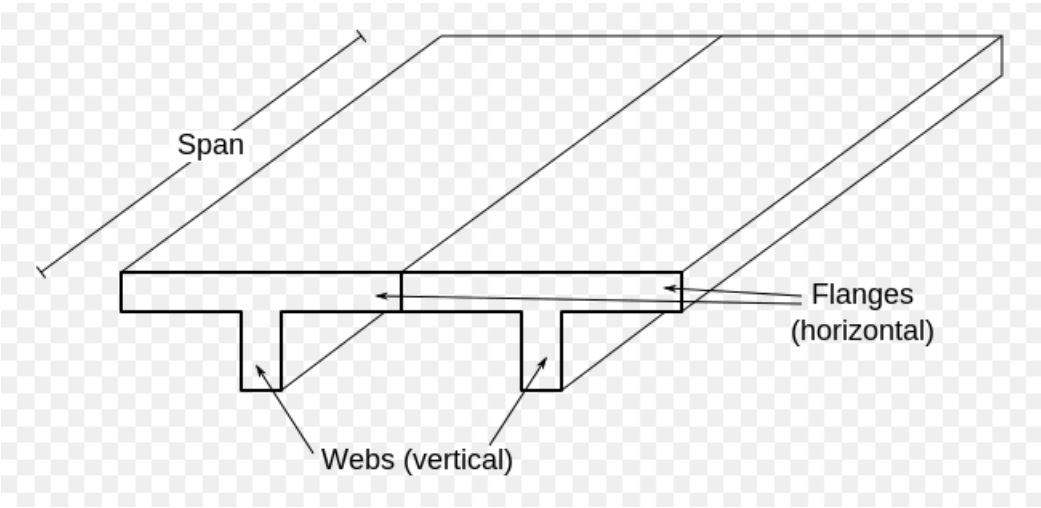


Figure 1.4: Flanged T Beam (Wikipedia)

COLUMN; A column might be characterized as a issue applied vital to help hub compressive burdens and with a tallness of a least more than one instances its parallel dimension. The satisfactory of segment is predicated at the satisfactory of substances, form and length of go segment, duration and degree of corresponding and willpower limits at its closures.

SLAB; Slabs are constructed to provide flat surfaces, normally flat, in structure floors, rooftops, spans, and one-of-a-kind sorts of structures. The chunk might be upheld by means of dividers, through strengthened strong bars ordinarily solid solidly with the phase, by way of basic metal pillars, by way of segments, or through the floor. The depth of a slab is generally very small as compared to its span

1.5.1 Aim of STAAD PRO

This undertaking goes for relearning of idea of basic plan with the assistance of PC helps. Quickly we have experienced finishing calls attention to of the venture work

i) Comprehension of plan and itemizing idea.
ii) Main goal for example learning of STAAD.Pro programming bundle.
iii) Learning of examination and plan procedure which can be valuable in the field.
iv) Understanding of seismic tremor obstruction plan idea.
v) Approach for expert practice in the field of basic designing

1.6 Earthquake

The portion accomplishes a prologue to the fundamental qualities of the tremor safe plan of structures with an extraordinary accentuation on related extra highlights in contrast with structural building plan. It is essential for Planning of Earthquake Resistant Structures constantly, tremors end the thousands of people life's, and wreck belongings value billions. It is essential that structures are proposed to contradict seismic tremor forces, to diminish the loss of life. additional structure assumes a critical job. Here, various tips and methods utilized in planning Earthquake Resistant structures are talked about.

1.6.1 What is an Earthquake?

A seismic tremor is a sudden; A seismic tremor is the shaking of the surfaces of the Earth, coming about in view of the unexpected entry of imperativeness in the Earth's lithosphere that makes seismic waves. Shakes can keep running in size from those that are feeble to the point that they can't be felt to those savage enough to fling people around and demolish whole urban networks. The seismicity or seismic activity of a domain insinuates the repeat, type and size of tremors experienced over some stretch of time. At the Earth's surface, seismic tremors show themselves by shaking and a portion of the time development of the ground.

At the point when the focal point of a vast quake is found seaward, the seabed might be movement adequately to cause a wave. Seismic tremors can likewise trigger destruction of property, landslide, and at times volcanic movement injury of people and even kills. For a gigantic number of years, the powers of tectonic plates have mold the Earth as the enormous plates that structure the Earth's surface move progressively finished. A seismic tremor's purpose of introductory burst is called its focus or hypocenter. The focal point is the point at ground level straightforwardly over the hypocenter.

The dynamic response of structure to seismic tremor ground development is the most basic explanation behind shudder incited mischief to structures. The mischief that a structure suffers essentially depends not upon its removing, anyway after accelerating. While dislodging is the genuine detachment the ground and building may move in the midst of a shudder, stimulating is an extent of how quickly they change speed as they move. The standard method to manage seismic tremor safe arrangement of structures depends on outfitting the structure with quality, solidness and inelastic twisting limits which are incredible to withstand a given component of shudder formed drive

1.7 Earthquake waves

Tremor waves are seismic waves that are made when vitality develops in rocks and they break. Researchers gauge there are a few million tremors every year. Each tremor produces P waves and S waves yet just bigger quakes produce

There are three types of waves: primary wave, secondary waves , R and L waves

Primary or P waves are push and force waves. they're additionally referred to as longitudinal waves that is shown in figure 1.5. these waves seem like sound waves, considering the fact that each are pressure dilatation or strain rarefaction waves. In those waves every molecule vibrates to and fro towards unfold. P waves go through gases, fluids and solids in a similar manner. these waves journey outward from the reason of unsettling have an effect on every which way in instantly lines. they may be the fastest of all seismic tremor waves. Their everyday pace is 5.three km a second and a limit of 10.6 km every second. P waves are the primary to attain the focus. The manner completed by these waves the earth is inward

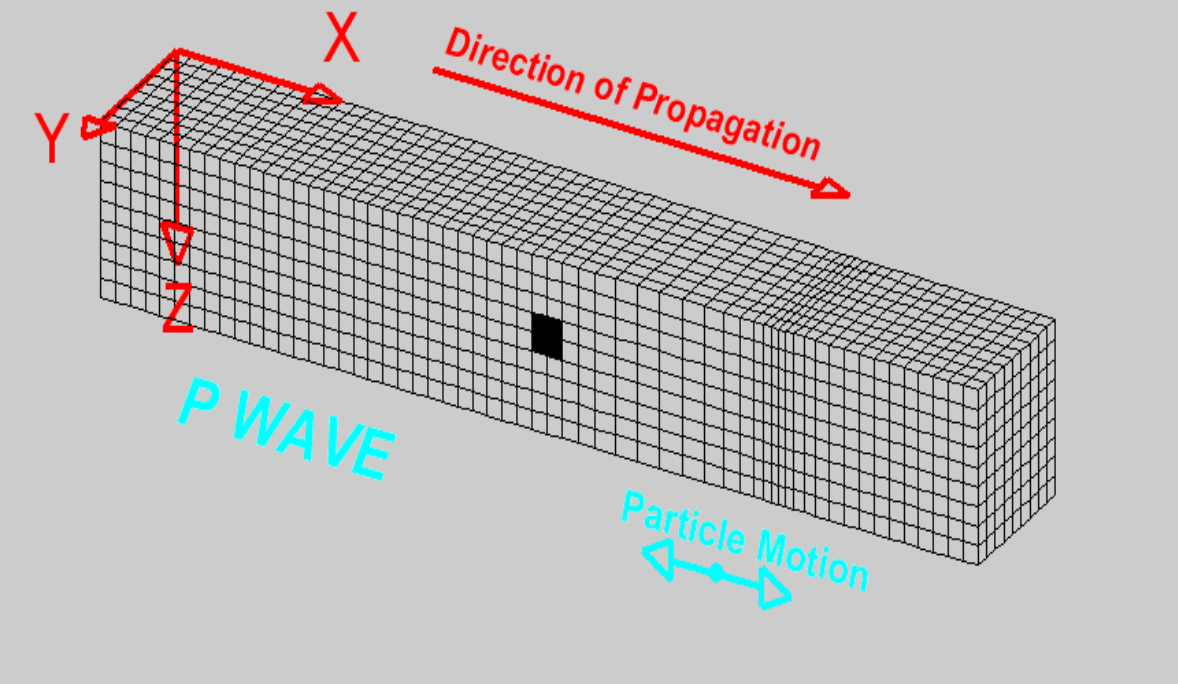


Figure 1.5: P waves (web.ua.es)

Secondary, S (shear wave**)** or on the other hand Shear Waves are additionally called transverse wave. which is shown in Figure1.6. In those waves the debris vibrate at right factors to the heading wherein they tour (the direction of proliferation). S waves pas simply via solids. They can not go through fluids. it's far intriguing to find out that in a comparable form of shake the paces of motion of P and S waves are numerous in mild of the reality that they rely on numerous houses. the speed of P waves is represented via the thickness and compressibility of the stone, although that of S waves relies upon its thickness and inflexibility. In fact, P waves travel at approximately 1.7 occasions the rate of shear waves. Be that as it can, shear waves intently pursue the P waves. in spite of the truth that the rate of S wave is not as a good deal as that of P wave, the preceding (S wave) is increasingly risky. P and S waves motive the shaking motion of the earth.

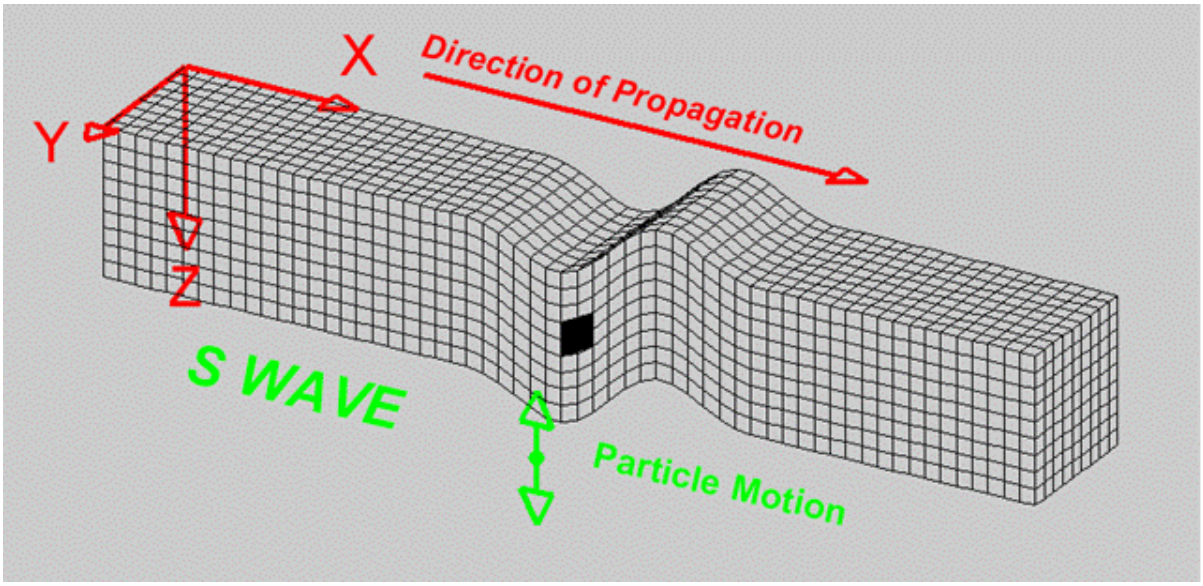


Figure1.6: S waves (web.ics.purdue.edu)

R and L Waves achieve the Earth surface after P and S waves. Surface wave goes with a lower speed than the other two around the outside of the earth. Surface wave is extremely dangerous**.** R and L wave shown in Figure 1.7.

There are two types of L waves:

Rayleigh Waves

Love Waves.

Rayleigh waves are described by the movement of particles in curved circles in the plane of spread. In the second sort of waves for example love waves, the movement of particles is even and at 90° point of the course of their development. Both of these waves give entirely significant data to recognizing the mainland and maritime kinds of outside layer. Other than the above named three noteworthy waves for example P, S, and L, there are some other minor waves called 'microseism'. It merits recollecting that the focal point of a tremor can be found when its separation from the three strategically located stations is known. By a nearby examination of the record of P and S waves, the thickness of the world's outside and its variety in various pieces of the earth can be determined

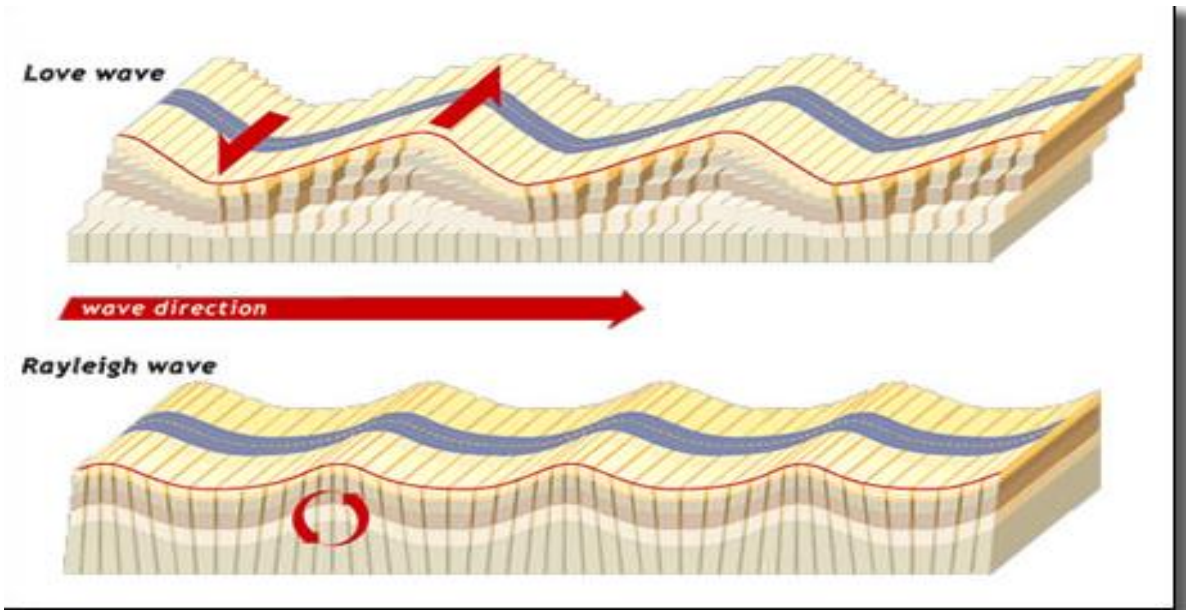


Figure 1.7: R and L waves (burkemusem.org)

1.7.2 How do Earthquakes affect Reinforced Concrete Buildings?

A run of the mill RC building is made of even of even those (columns and pieces) and vertical people (portions and dividers), and reinforced by foundations that lay on ground. The structure including RC segments and partner bars is known as a RC Frame. The RC diagram shares in restricting the seismic tremor powers. Seismic tremor shaking makes torpidity controls in the structure, which are in respect to the structure mass. Since a substantial segment of the structure mass is accessible at floor levels, tremor started inertness controls in a general sense make at the floor levels. These forces travel downwards – through piece and bars to sections and dividers, and a short time later to the foundations from where they are dispersed to the ground. As inaction powers total downwards from the most noteworthy purpose of the structure, the portions and dividers at lower stories experience higher seismic tremor provoked powers and are as needs be planned to be more grounded than those in stories above.

1.7.3 Protection from Earthquakes

For a structure to remain safe in the midst of seismic tremor trembling, The earthquake-resistant bracing has been designed for homes with a mullion-and-transom design, and connects the horizontal beams with the vertical submit. when exposed to wind or tremors, the connectors need to be rigid sufficient to maintain deformation to a minimal – but additionally elastic sufficient to resist strong earthquakes. If deformation does occur, it does now not cause important pressure – in other words, the constructing sways, but does now not fall apart.

1.7.4 Design philosophy of Earthquake Resistant Building

a) Beneath minor but visit shaking, the primary individuals from the structures that bring vertical and horizontal powers ought not to be harmed; besides structures parts that do not deliver load may additionally aid repairable damage.

b) under mild yet incidental shaking, the principle individuals might also aid repairable harm, whilst unique elements that don't deliver load may hold repairable harm.

c) Beneath stable/tough however unusual shaking, the number one people may additionally aid critical damage, yet the structure ought not fall.

d) whereas, a notable part of the abrupt are caught up within the pressure driven liquids and simply little is transmitted above to the undercarriage of the car. on the point when seismic energy is transmitted thru them, dampers ingest a few part of it, and consequently soggy the motion of the structure.

1.7.5 Earthquake Resistance Active Control Devices

a. Sensors to quantify outer excitation or potentially auxiliary reaction/or structural response
b. Computer hardware and software (PC) equipment and programming to register control power based on watched excitation and additionally basic reaction
c. Actuators to give the important control compel

1.7.6 Analysis of the Structure

The building was divided into portal frames. The structure was partitioned into gateway Outlines and these casing have been investigated utilizing the STAAD.Pro.2000 Programming. The five-story gateway was ruined down for live load, dead load and Earthquake load combinations. The examination gave the force rising in the individuals, to be specific transverse beam and sections, because of the above burdens and these individuals were intended for the severest of force acquired because of the load combination

1.8 Seismic Zone of India

The changeable topography at various areas in the nation infers that the probability of harming seismic tremors occurring at various areas is having different seismic zone values for different locations. In this way, a seismic region map is essential so structures and different structures situated in various areas can be intended to withstand distinctive dimension of ground shaking. The current zoning of map divided into four zones in India II, III, IV and V, are shown in Figure 1.8

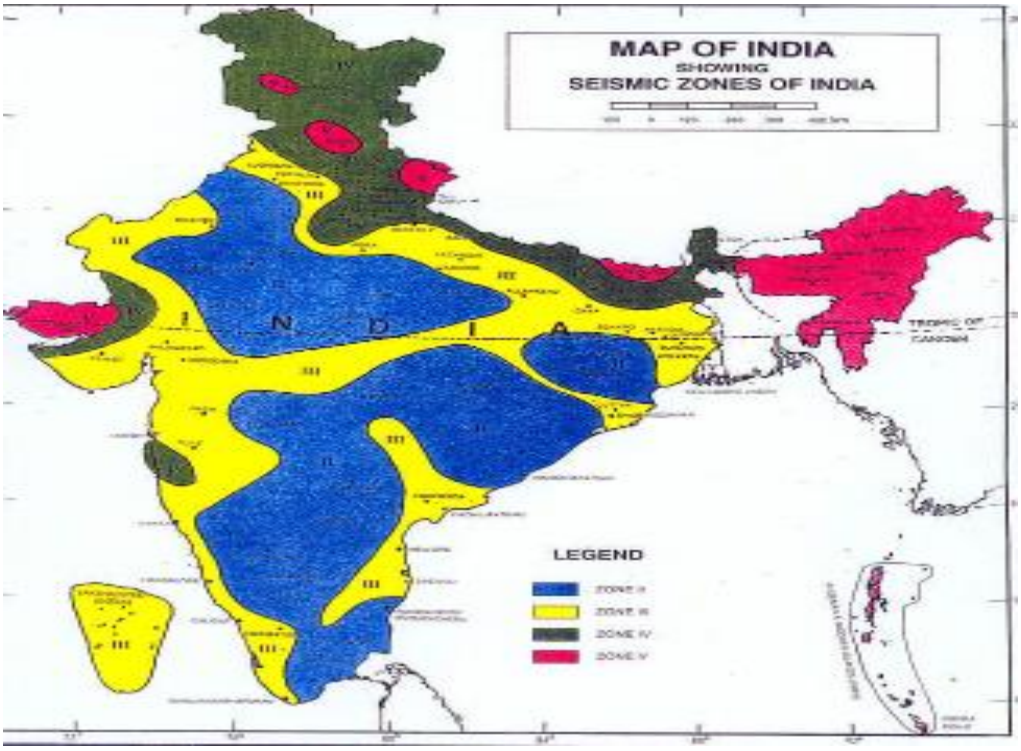


Figure 1.8: Seismic Zones (Ghrapedia.com)

CHAPTER 2

LITERATURE REVIEW

2.1. State of the art

Bhattacharjee et al[1] The goal of this undertaking is to analyses and design layout a multistory building [G+21 (3 dimensional body)] mistreatment STAAD professional. the making plans involves load calculations manually and reading the whole structure through STAAD expert. the planning methods employed in STAAD-pro analysis square measure limit country style conformist to Indian Everyday Code of look at. STAAD. seasoned alternatives a progressive interface, image equipment, effective analysis and fashion engines with advanced finite element and dynamic evaluation abilties. From version generation, evaluation and fashion to image and end result verification, STAAD. seasoned is that the professional's opportunity. ab initio we generally tend to began with the analysis of easy a pair of dimensional frames and manually checked the accuracy of the software device with our consequences. The effects attempted to be terribly accurate. we generally tend to analyzed and designed a G+7 degree building together with basement [2-D body] ab initio for all capability load combos [useless, stay, and unstable loads]. STAAD. seasoned encompasses a terribly interactive interface that permits the customers to draw the frame and input the load values and dimensions. Then in keeping with the favored criteria appointed it analyses the structure and styles the individuals with reinforcement details for RCC frames. we tend to continuing with our paintings with a few extra multistory 2-D and 3-D frames beneath varied load combinations. Our final paintings became the right analysis and style of a G+21 3-D RCC frame beneath numerous load mixtures. we generally tend to thought of a 3-D RCC frame with the dimensions of four bays. The coordinate axis consisted of G+ floors. the whole numbers of beams in every floor were twenty-eight and consequently the numbers of columns have been sixteen. the bottom floor peak became 4m and the rest of the 5 floors had a top of 3.6m. The structure became subjected to self weight, dead load, stay load, wind load and risky loads underneath the burden case info of STAAD.pro.

The seismic load esteems were produced by STAAD.Pro taking into consideration the given seismic powers at totally extraordinary statures and carefully perpetual by the determinations of IS 875.unstable burden computations were finished after IS 1893-2000.The materials were explicit and cross-segments of the shaft and section individuals were delegated. The backings at the base of the structure were conjointly explicit as attached. The codes of training to be pursued were conjointly explicit for style reason with elective fundamental subtleties. At that point STAAD.Pro was acclimated break down the structure and style the individuals. inside the post-handling mode, when finishing of the arranging, we can take a shot at the structure and concentrate the twisting minute and shear drive esteems with the created graphs. we will in general may check the avoidance of differed individuals underneath the given stacking blends. the arranging of the structure relies on the base needs as recommended inside the Indian ordinary Codes. The base needs relating the auxiliary wellbeing of structures square measure being covered by strategy for parturition down least style hundreds that should be expected for dead hundreds, mandatory hundreds, and elective outer hundreds, the structure would be required modern. Severe adjustment to stacking norms advised amid this code, it's trusted, can ensure the basic wellbeing of the structures that square measure being planned. Structure and basic parts were typically planned by Limit State system. refined and skyscraper structures might want frightfully time taking and bulky computations abuse run of the mill manual ways. STAAD.Pro gives US a brisk, productive, simple to utilize and address stage for breaking down

Saatcioglu, M. and Humar, J[2]The projected 2005 edition of the National codification of North yank country specifies dynamic analysis as a result of the foremost well-liked methodology for computing unstable vogue deflections, and force whereas to maintain the equivalent static force methodology for an areas of low seismicity and for the buildings with positive height boundaries. Comprising of the flexible modular reaction range approach or the numerical mix direct time history philosophy, or nonlinear (inelastic) reaction history examination. while each straight and nonlinear examinations might want cautious explanatory displaying, the last needs extra issues for appropriate recreation of hysteretic reaction partner degreed requires an uncommon report that includes expand survey of support partner degreed supporting investigations by an independent group of architects, with talks on scientific demonstrating of structures, auxiliary components, and hysteretic reaction. A discourse of the assurance of basic amount to be used in relationship with the proportional static power technique is introduced

Duan, X.N. and Chandler, A.M[3] Based on Associate in Nursing uneven multistoryframe constructing model, this paper investigates the have an impact on of a constructing's better vibration modes on its useless torsional reaction and evaluates the adequacy of the provisions of modern seismal building codes and consequently the modal analysis method in accounting for improved malleability demand in frames settled at or close to the stiff fringe of such buildings. it's entire that the affect of upper vibration modes at the response of the top-storey columns of stiff-edge frames will boom extensively with the building's standard unconnected lateral quantity and consequently the significance of the stiffness eccentricity. the appliance of the equal static torsional provisions of certain building codes may want to cause non-conservative estimates of the height malleability call for, extensively for systems with massive stiffness eccentricity. In these instances, the critical additives rectangular degree prone to immoderate extra malleability demand and, consequently,

could also be difficulty to appreciably a number of severe structural harm than in corresponding radially symmetrical buildings. it's observed that frequently choppy homes excited properly into the useless vary won't be carefully designed mistreatment linear elastic modal evaluation idea. unique caution is wanted once making use of this method to the look of stiff-aspect body additives in extremely choppy systems.

Fu, F.[4] A third-dimensional limited part model structured by the creator was utilized in this paper to inquire about the dynamic breakdown of a multi-story steel composite edge building. The anticipated model will speak to the world 3-D conduct of the multi-story working underneath the sharp segment evacuation circumstances. upheld this model, consistent amount contemplates were distributed to inquire about the basic conduct with varieties in: quality of steel, quality of cement and support work measure. Through the consistent amount examine, the measures to relieve dynamic breakdown inside the future style were advised.

Mwafy [5] Attributable to the straightforwardness of springless static sucker examination contrasted with springless powerful investigation, the investigation of this framework has been the theme of the numerous examinations as of late. amid this paper, the legitimacy and along these lines the importance of this framework square measure surveyed by examination with 'dynamic sucker' romanticized envelopes got from dynamic unique breakdown investigation. this is frequently attempted misuse common and fake seismic tremor records required on twelve RC structures of different qualities. This includes sequential scaling and use of each accelerogram pursued by evaluation the very pinnacle of reaction, up to the activity of the auxiliary breakdown. The consequences of more than 100 springless unique examinations utilizing a cautious second demonstrating methodology for everything about twelve RC systems are used to accumulate the dynamic weakling envelopes and contrast these and the static sucker results with very surprising burden designs. savy relationship is gotten between the determined admired envelopes of the dynamic examinations and static weakling results for a plot class of structure. wherever inconsistencies were resolved, serious examinations bolstered Fourier plentifulness investigation of the reaction were attempted and traditionalist suspicions were recommended

Estekanchi et al.[6] a brand new methodology for overall performance based earthquake evaluation and style has been brought. for the duration of this technique, the structure is subjected to accelerograms that impose increasing dynamic call for on the structure with time. Specied damage indexes vicinity unit monitored as much as the collapse degree or unique overall performance restrict that dense the persistence indefinite quantity for the shape. also, a manner for generating common accumulating accelerograms has been delineate. 3 accelerograms are generated victimization this system. moreover, the concept of endurance Time has been delineate by using applying those accelerograms to single and multi degree of freedom linear systems. the appliance of this system for evaluation of complex nonlinear systems has been explained. endurance Time method affords the equal approach to volatile evaluation and style of complex structures that may be implemented in numerical and experimental investigations

Cassiano et al.[7] Seismic standard enable enhancing the structural malleability and dominant the injury distribution. Therefore, particularization rules and style necessities given by current unstable codes can be conjointly useful to enhance the structural hardiness. during this paper a comprehensive constant quantity study dedicated to quantifying the effectiveness of unstable particularization for steel Moment Resisting Frames (MRF) in limiting the progressive collapse below column loss eventualities is given and mentioned. the structural performance was analyzed through nonlinear static and dynamic analyses. With this regard the subsequent cases were examined: (i) MRF structures designed for wind actions consistent with Euro code 1; (ii) MRF structures designed for unstable actions consistent with Euro code eight. The investigated parameters were (i) the quantity of storey's; (ii) the interstorey height; (iii) the span length; (iv) the building set up layout; and (v) the column loss state of affairs.

Results show that structures styled consistent with capability design principles square measure less strong than wind designed ones, only if the connections have an equivalent capability threshold in each cases. additionally, the numerical outcomes show that each the quantity of parts higher than the removed column and stiffness of beams square measure the key parameters in sensational progressive collapse.

Wilkinson et al[8] A tangibly non-direct plane-outline model is presented that is fit for investigating elevated structures exposed to tremor powers. The model speaks to each floor of the structure by Associate in Nursing get together of vertical and even shaft segments The model presents yield pivots with perfect plastic properties in a normal plane casing. The relocations are spoken to by the elucidation (influence) of each floor and along these lines the pivot of all beam– segment crossing points. The mass is basically identified with the interpretations, thus the examination are regularly apportioned as a static buildup of the turns, joined with combination of the dynamic conditions for the interpretations. The dynamic incorporation is here apportioned by utilization of the Runge– Kutta topic. This methodology allows a structure to be displayed by m(n + 2) degrees of opportunity (where m is that the assortment of story's and n is that the assortment of sounds). The position of the dense solidness network is basically m. Its development, which needs the reversal of the motility, rank m(n + 1), solidness framework, is required exclusively at time-steps wherever the example of yielding has adjusted from the past time-step. This model is particularly captivating for non-straight reaction history investigation of tall structures since it is prudent, allows each floor to have various redundancies, and each affiliation Three confirmation precedents are given and subsequently the outcomes from static push-over examination are contrasted and time– history results from the streamlined model. The outcomes confirm that the model is equipped for action non-straight reaction history investigation on normal elevated structures.

Naser, M,[9] The first essential in basic designing is that the style of simple fundamental components and individuals from structure viz., pieces, bars, sections and footings. the essential advance in any style is to settle on a choice the mastermind of the genuine structure. the arrangement of pillars and segments square measure decided. At that point the vertical hundreds like dead

and live hundreds square measure determined. When the hundreds square measure acquired, the component that takes the heap starting for example the sections are regularly structured. From the chunks, the hundreds square measure exchanged to the shafts. the hundreds returning from the chunks onto the shaft is additionally tetragon or triangular. depending on this, the pillar is additionally structured. the hundreds (mostly shear) from the shafts square measure at that point exchanged to the segments. For arranging sections, it's important to get a handle on the minutes they're exposed to. For this reason, outline examination is finished by Moment Distribution system.

The greater part of the sections structured amid this task were thought of to be pivotally stacked with uniaxial twisting. At long last, the footings square measure structured bolstered the stacking from the section and conjointly the dirt bearing capacity cost for that singular space. All component parts square measure checked for quality and strength. The structure was abdominal muscle initio planned according to IS 456: 2000 while not considering quake hundreds abuse STAAD.pro PC code. At that point the structure was broke down for seismic tremor hundreds according to Equivalent static examination procedure and once getting the base shear according to IS1893

Mohammad Adil Dar, et al. [10] Catastrophes are unpredicted activities which have negatively influenced human's existence due to the fact that the start of the day of our reality. due to such occasions, there have been endeavors to alleviate overpowering impacts of these fiascos. results of such endeavors are very guide in urbanized countries however tragically and miserably terrible in developing international locations collectively with our personal.

Seismic tremors are one of the nature's most outstanding dangers on our planet that have taken overwhelming toll on human lifestyles and belongings considering the fact that antiquated activities . The abrupt and sudden nature of the tremor event aggravates it even on mental dimension and shakes the lesson of the overall populace. man views the mom earth for safety and power beneath his feet and whilst it itself trembles, the stun he receives is in reality scary.

Notwithstanding the primary seismic tremor configuration IS code 1893 the BIS (Bureau of Indian Standards) has distributed other pertinent quake configuration codes for tremor safe development Masonry structures (IS-13828 1993)

- As per the, code Horizontal bands should be provide at lintels, roof level also plinth.
- As per the code, Giving vertical fortification at significant areas, for example, interior and outside divider intersection, corners
- As per the code, Grade of mortar should be specified for different types of seismic tremor zones.
- Both in plan and vertical configuration Irregular shapes should be avoided.

Quality affirmation and appropriate workmanship must be guaranteed at all expense with no trade off.

In RCC framed structures (IS-13920)

- As per the code the spacing of lateral ties should be kept closer In RCC framed structures.
- For better anchoragement The hook in the ties should be at 135 degree in its place of 90 degree
- As per the code, the arrangement of lateral ties in the columns and must be continued through the joint as well.
- As per the code the lateral ties (stirrups for beams) should be at closer Spacing. whenever laps are to be provided

Jaswant N. et al. [11] Open first story is a run of the mill highlight in the advanced multistory developments in urban India. Such highlights are exceedingly bothersome in structures worked in seismically dynamic zones; this has been confirmed in various encounters of solid shaking amid the past quakes. This paper features the significance of unequivocally perceiving the nearness of the open and close multi-stockpiling in the examination of the structure. The mistake engaged

with demonstrating such structures as total uncovered edges, disregarding the nearness of infills in the upper stories, is brought out through the investigation of a precedent structure with various logical models. This paper contends for prompt measures to forestall the unpredictable utilization of delicate first stories in structures, which are planned without respect to the expanded removal, pliability and power requests in the primary story sections. Substitute measures, including solidness equalization of the open first story and the story above, are proposed to diminish the anomaly presented by the open first story.

Gaikwad et al[12] The essential objective of earthquake engineers is to fashion and build a shape in such the only manner that injury to the structure and its structural element all through the earthquake is minimize. For the evaluation purpose models of G +9 stories of RCC and metal with unsymmetrical plan is think about. The evaluation is by carried by means of victimization F.E primarily based more often than not software program package deal. numerous parameter like lateral force, base shear , story glide , tale shear are frequently determined .For dynamic evaluation time records approach or reaction spectra technique is hired .Dynamic analysis have to be accomplished for symmetrical furthermore as unsymmetrical building. Dynamic evaluation are frequently within the style of complete nonlinear dynamic time records analysis .If the RCC and steel constructing rectangular measure unsymmetrical, Torsional result are going to be turn out in each the building and so square measure compared with one another to see the economical building underneath the result of torsion

2.2 OBJECTIVES

- Draw a plan of multistory building in Auto Cad G+5.
- Analysis and Design of Earthquake resistant of multistory building.
- To analyse the seismic response of a structure using the following two methods with the help of software STAAD.Pro 2000.

✓ Seismic coefficient Method

✓ Time history analysis

CHAPTER 3

Seismic Analysis Method

3.1 Seismic Design Philosophy

The design philosophy of seismic plan can be outlined as:

a) The layout philosophy adopted in the code is to make sure that systems acquire at the least a minimal strength to

i) resist minor earthquake (<DBE) which may arise often, without harm

ii) face up to moderate earthquake (DBE) wit out large structural harm thru some non structural harm

iii) Resist main earthquake (MCE) without disintegrate

"DESIGN BASIS EARTHQUAKE (DBE) is defined as the maximum earthquake that reasonably can be expected to experience at the site once during lifetime of the structure. The earthquake corresponding to the ultimate safety requirement is often called as the Maximum Considered Earthquake (MCE) .Generally DBE is half the MCE"

b) The genuine powers that show up on the structures amid quakes are a lot higher than the plan powers indicated in the code .the fundamental criteria for seismic tremor safe plan ought to be founded on horizontal quality just as deformability and flexibility limit of the structure with constrained harm yet no breakdown .pliability in the structures will emerge from inelastic material, conduct and specifying of support in such a way, that fragile disappointment is evaded and bendable conduct is actuated by enabling steel to yield in controlled way.

c) The plan sidelong powers indicated in the code will be considered in every one of the two symmetrical headings of structures. for structures which have sidelong power opposing Element in two symmetrical ways just the plan horizontal power will be considered along one bearing at time as well as both way at the same time.

d) Quake producing vertical idleness powers are to be considered in structure except if it isn't huge. Vertical speeding up ought to be considered in structures with expansive ranges, those in which dependability is the rule for plan or for generally speaking soundness of the Structures. The reaction of a structure to the ground vibrations is a component of the idea of establishment of the dirt ; materials; structure; size and method of development of structures; advertisement the term and attributes of ground movement

e) The response of the structure to ground vibration is a segment of soil foundation or idea of soil establishment, structure, material volume and development mode. The code indicated configuration compel for structure firms soil, standing rock. Which don't condense or slide because of loss of solidarity amid ground vibration.

3.2 Seismic design method

Civil engineering are usually design the building structures are based on two primary criteria that are strength and rigidity. The strength are usually identified on associated to extreme breaking point state or damage point state pretentious that the power force created in structures stays in as far as possible, or some constrained to plastic twisting. The unbending nature is associated with the workableness of farthest point state, for which the basic relocation must remain in certain cutoff points. This assures no harm happen in the non-basic fundamentals or non-structural elements.

3.3 Methods for seismic testing

Shaking table test: This test is used to determining the dynamic response of the structure to know the seismic response of soil and rock slopes. This method is most realistic tentative for determining dynamic response of the structure. In this test the structure is exposed to the heap history which is typically a position of ground movement recorded amid the seismic tremor is reproduced. This test is also used in other engineering field to test to vehicles qualifies and component of vehicles that required heavy vibration, and some application are aerospace or militant standard.

Pseudo dynamic test: This test is also called computer actuator online test or hybrid test. In this test software applying slowly varying forces to the structures to observe the motion and

deformation of the model and experience like actual happing during the earthquake dynamic conditions are simulated. The basic concept of PDT is to show the dynamic response of the structure in each time step during analysis process.

Quasi static test; Quasi static test is not a dynamic test, in which the rate of uses of burden is exceptionally low so the material strain rate impacts don't impact the basic conduct and latency powers are not created. The heap or disfigurement is connected semi statically at different position of the structure, contingent upon the reestablishing power legitimately estimated amid the test.

3.4 Seismic Coefficient Method

As per IS-1893-2002 For calculating the equivalent lateral loads on multistoried buildings are using seismic coefficient method.

As the level of seismic coefficients India has been separated into four zones as to level For critical structures these coefficient can be expanded by half. The flat quake power ought to be determined for dead loads and some level of live loads.

The natural moment period of multistoried building in clause 7.6 of IS 1893 (part 1); 2000.

$T_a=0.075h^{0.75}$ for share walls or moment resisting frame without bracing. $T_a=0.09h/\sqrt{d}$ for share walls or all Multistory building including moment resisting frame or structure along with bracing.

d = Base length of structure in m, along with considered path of lateral force

h= total height of buildings in m. Where, n = number of storey's counting basement

The formula used for calculating the base shear is;

VB = KCαhW. αh= seismic design coefficient =βIα0,W=Total weight of multistory Building including dead load and live load with appropriate percentages.

C= a coefficient defining the flexibility of the structure which is not more than 1.

I= Importance factor depending upon the purpose of the structure

K= performance factor depending on the structural frame arrangement system and brittleness or ductility of construction.

Total design lateral force can be calculated by, clause 7.5 of IS 1893 (PART1): 2000.

$V_b = A_h W$ A_h = design horizontal seismic coefficient for a structure
W = seismic weight of building . $A_h = (Z/2)(I/R)(S_a/g)$ Z = Zone factor
I = Importance factor R = Response reduction factor
S_a/g = Spectral acceleration ($S_a/g = 1/T$ For hard soil)

Distribution of forces along the height of building is given by

$Qi = VB(Wihi^2/\sum wihi^2)$ Where, VB=Base share
Qi= lateral forces at the floor i VB= Base share
hi = height measured from the base of the building to the floor
n= number of storey's including the basement. Wi= load of the floor i

3.5 Final analysis

STAAD-pro 2000 used to analyses the multistory building. The given input data

- Geometry of the structure
- Materials Properties are beams, columns, and slabs are given.
- At Base Nodes Fixed supports are provided
- As per IS-456:2000 and IS-875:1987 Part-5 Loads combinations data are to be adopted.

3.6 plan of the project

One of the major problem in the Indian country and world also facing the rapidly growth Of population this can be solved to certain extent with the construction of building And apartment which can be live many people in available area.

The project consist of two living\dining room (5625 X 3100), two bathroom (2100 X 1500), Kitchen (2400 X1800), bedroom (3050 X 3435) and with all basic Amenities as shown in figure 3.1.

And other figure are shown in fig 2.2,2.3, and 2.4 view from z, y, and 3d view axis In STAAD.Pro.

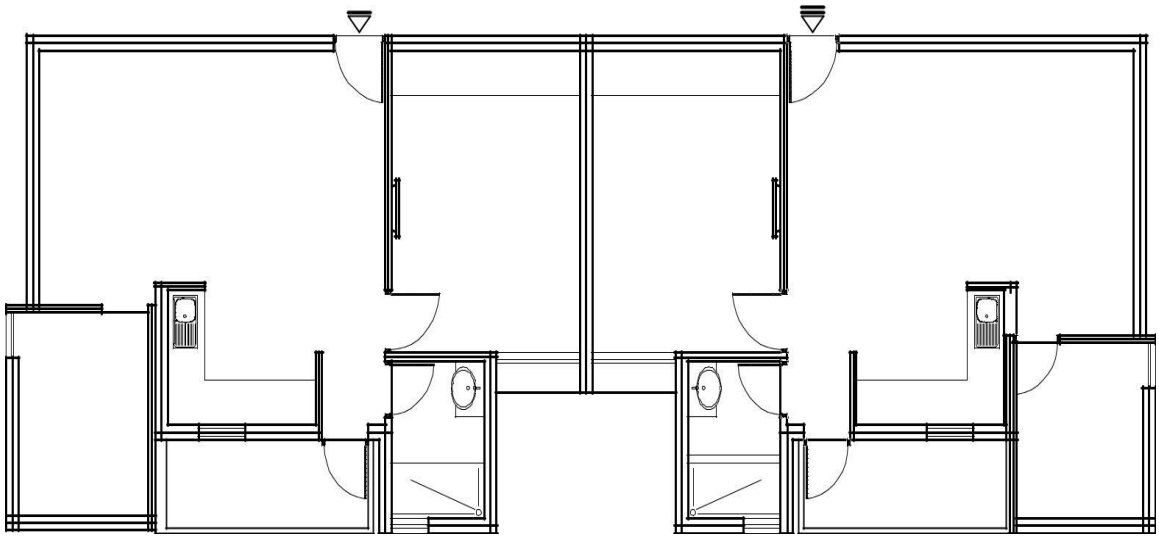


Figure 3.1: Proposed residential building plan

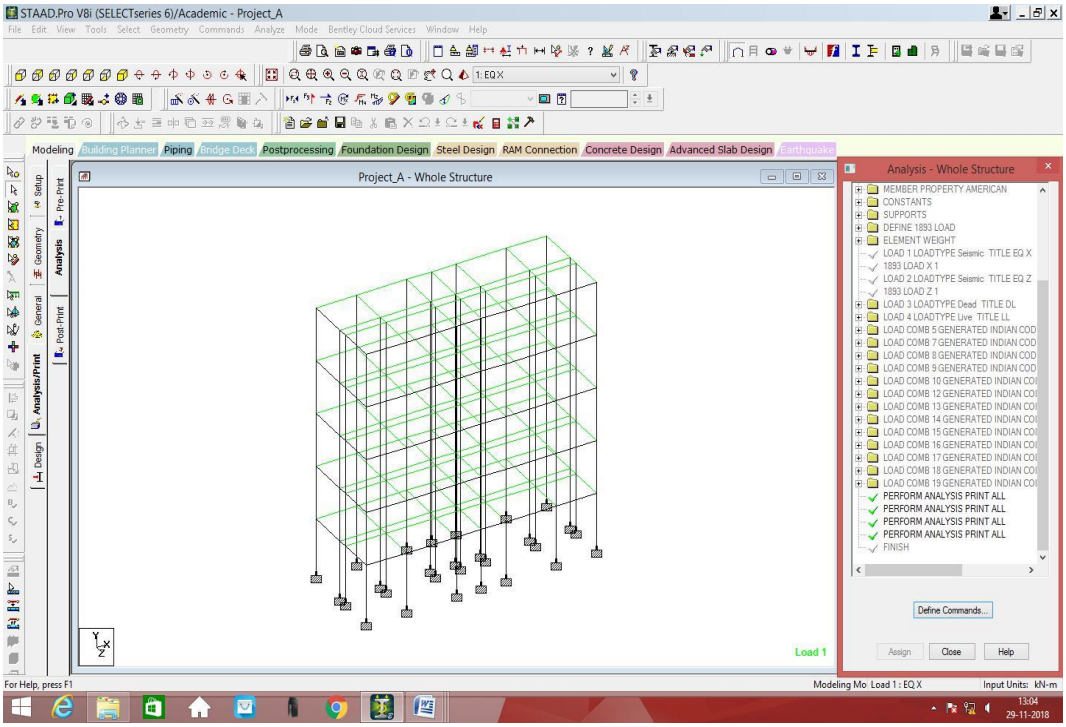


Figure 3.2: View from -z axis

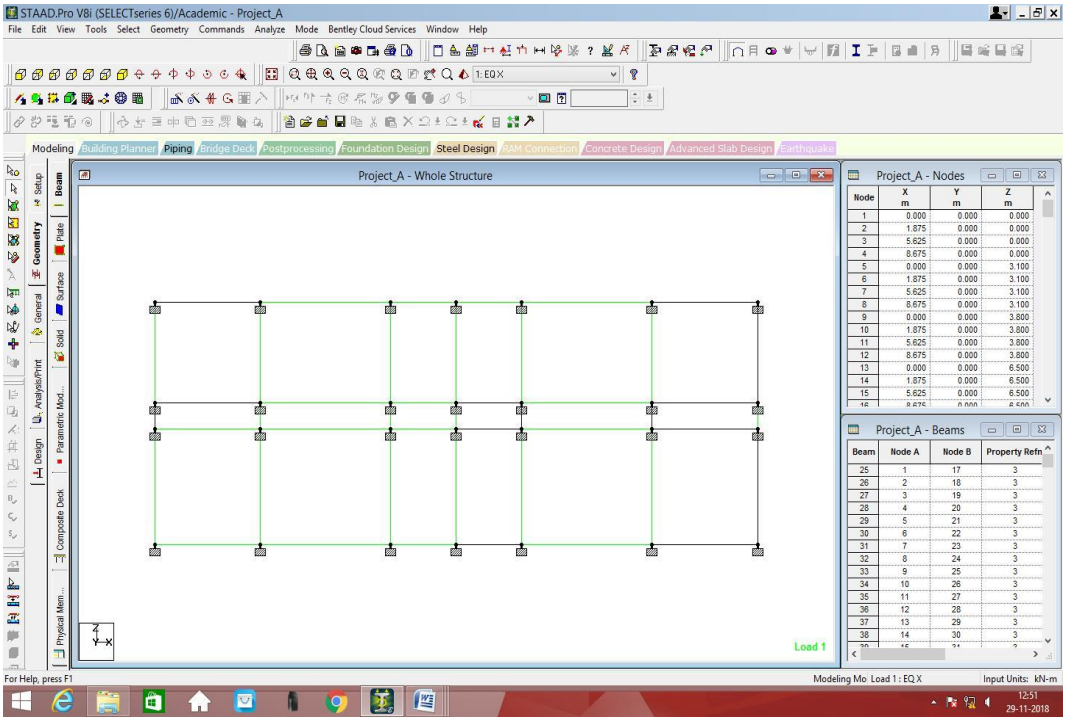


Figure 3.3: view from – y axis

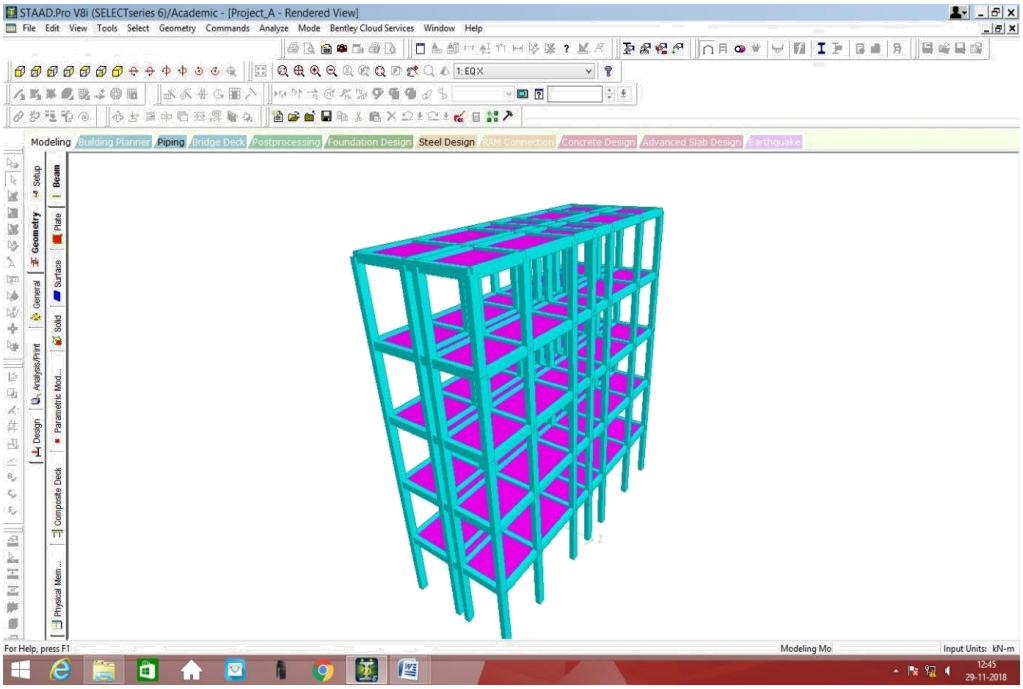


Figure 3.4: 3-D View in STADD PRO

3.7 General details

- A 3-D RCC (Reinforced Cement Concrete) frame an area contain of 86.75m x 65.0m in XZ plane, and y direction consisted of G+5 for multistory building for residential
- Buildings serve several collective needs – primarily need as shelter from climate condition, safety/security, living space, privacy/ space to yourself , to store property, and to comfortably live and work. A building as a shelter represents a physical division of the human being (a place for comfort and safety).

3.8 Design Data Considered

Table 3.1: Design data considered

Live load	4.0 KN/m^2
Roof load	1.0 KN/m^2
Floor finish	1.0 KN/m^2
Location	jalandhar
Wind load	As per IS: 875-Not designed for wind load, since earthquake loads only considered
Earthquake load	As per IS-1893 (Part 1) – 2002
Damping ratio	5%
Type of soil	Type II, Medium as per IS:1893
Storey height	3.66 m
Thickness of slab	180mm
Size of beam	250mm×400mm
Size of column	400mm×300mm
Walls	230 mm thick brick masonry walls

Property of Materials

Concrete

For design: M25 grade all

$E_c = 5000 (f ck)^{0.5}$ N/mm ^{2}

$= 25000$ N/mm^2

Steel

HYSD (High Yield Strength Deformation) reinforcement of grade Fe 450 confirm to IS: 1786 is used all through.

Loads Considered

Dead Loads: Dead loads are stationary or permanent load which are transfer to structure for the period of the life expectancy. Dead burden is fundamentally because of self load of basic individuals, lasting segment dividers, fixed changeless gears and weight of various materials. It significantly comprises of the heaviness of rooftops, walls, beams and columns section and so on which are generally the continuous parts of the structure**.** Dead load cab be calculated by following IS 875 (Part 1) - 1987

Imposed Loads: The minimum values of live loads to be assumed are given in IS 875 (Part 2)– 1987. Live load is formed by the proposed use or inhabitance of a structure including the heaviness of portable segments, conveyed and focused burdens, load because of effect and vibration and residue loads. These heaps are thought to be delivered by the proposed use or inhabitance of the structure including loads of portable furniture etc..

Seismic Loads: The seismic loads are determined in a way related to gravity loads. The heaviness of sections and dividers in any story will be similarly conveyed to the floors above and underneath the story. Subsequent reduced level are used for analysis of live loads (as per IS : 1893 (part 1): 2002) terrace 0%, and floor 50%.

3.9 Time history analysis

A direct/linear time history investigation conquers the drawbacks of model response range examination model of response spectrum analysis, provide non – linear behavior isn't included. The technique requires more noteworthy computational endeavors for ascertaining the response at discrete period. One fascinating favorable position of such method is that the overall indication of response amounts is exhibited in the response history. This is essential for cooperation impacts are considered in structure among stress resultants. Dynamic response of the plane edge show with infill's to a foreordained time history to IS code go for 5% Damping proportion of unpleasant hard soil has been evaluate using way of superposition technique

The time history data taken for time history analysis.

1) El Centro

The 1940 El Centro earthquake (or 1940 Imperial Valley earthquake) occurred at 21:35 Pacific Standard Time on May 18 (05:35 UTC on May 19) in the Imperial Valley in south-eastern Southern California near the international border of the United States and Mexico. It had a moment magnitude of 6.9. It was the first major earthquake to be recorded by a strong-motion seismograph located next to a fault rupture. The earthquake was characterized as a typical moderate-sized destructive event with a complex energy release signature. It was the strongest recorded earthquake to hit the Imperial Valley, and caused widespread damage to irrigation systems and led to the deaths of nine people.

2) Kobe

The earthquake of 17 January, 1995 near Kobe city in Japan has provided strong motion records at several locations. The earthquake measured 7.2 on the Richter scale and inflicted significant damage to the prosperous city of Kobe. There were extensive liquefaction induced failures in the reclaimed areas and sea-front sites. Most notable of these failures were the quay walls which failed following liquefaction and led to failure of heavy machinery like overhead cranes, gantries and even effected nearby

Buildings. This report concerns itself with the analyses of ground motions recorded at the Port Island site which is one of the reclaimed areas. Strong motion records at different observation sites in Kobe were recorded by CEORKA (the Committee of Earthquake Observation and Research in the Kansai Area).

3) Northridge

The 1994 Northridge earthquake occurred on January 17, and had its epicenter in Reseda, a neighborhood in the north-central San Fernando
Valley district of Los Angeles, California. It had a term of roughly 10– 20 seconds. The visually impaired push quake had a minute extent (Mw) of 6.7, which created ground increasing speed that was the most noteworthy at any point instrumentally recorded in a urban territory in North America, estimating 1.8g (16.7 m/s2) with solid ground movement felt as far away as Las Vegas, Nevada, around 220 miles (360 km) from the focal point. The pinnacle ground speed at the Rinaldi Receiving Station was 183 cm/s (4.09 mph or 6.59 km/h), the quickest pinnacle ground speed at any point recorded. Also, two 6.0 Mw post-quake tremors happened, the first around one moment after the underlying occasion and the second roughly 11 hours after the fact, the most grounded of a few thousand delayed repercussions taking all things together. The loss of life was 57, with in excess of 8,700 harmed. What's more, property harm was evaluated to be somewhere in the range of $13 and $50 billion, making it one of the costliest catastrophic events in U.S. history.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Results for Seismic Coefficient Method

Table 4.1: Node Displacement of Seismic Coefficient Method

			Horizontal	Vertical	Horizontal	Resultant	Rotational		
	Node	L/C	X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
Max X	159	12 GENERAT	**33.406**	-3.080	-1.105	33.566	0.000	-0.000	-0.001
Min X	84	14 GENERAT	**-33.406**	-3.080	-1.105	33.566	0.000	0.000	0.001
Max Y	83	2 EQ Z	0.003	**0.757**	36.171	36.179	0.000	-0.000	-0.000
Min Y	83	15 GENERAT	-0.011	**-5.946**	-54.608	54.931	-0.000	0.000	0.000
Max Z	84	17 GENERAT	-0.002	-1.264	**54.049**	54.064	0.001	-0.000	0.000
Min Z	96	15 GENERAT	-0.008	-2.451	**-54.611**	54.666	-0.001	-0.000	0.000
Max rX	20	13 GENERAT	-0.006	-0.854	12.052	12.082	**0.002**	0.000	-0.000
Min rX	32	15 GENERAT	-0.005	-0.744	-12.078	12.101	**-0.002**	-0.000	-0.000
Max rY	84	14 GENERAT	-33.406	-3.080	-1.105	33.566	0.000	**0.000**	0.001
Min rY	159	12 GENERAT	33.406	-3.080	-1.105	33.566	0.000	**-0.000**	-0.001
Max rZ	20	14 GENERAT	-7.369	-0.969	-0.174	7.435	-0.000	0.000	**0.002**
Min rZ	111	12 GENERAT	7.369	-0.969	-0.174	7.435	-0.000	-0.000	**-0.002**
Max Rs	83	15 GENERAT	-0.011	-5.946	-54.608	**54.931**	-0.000	0.000	0.000

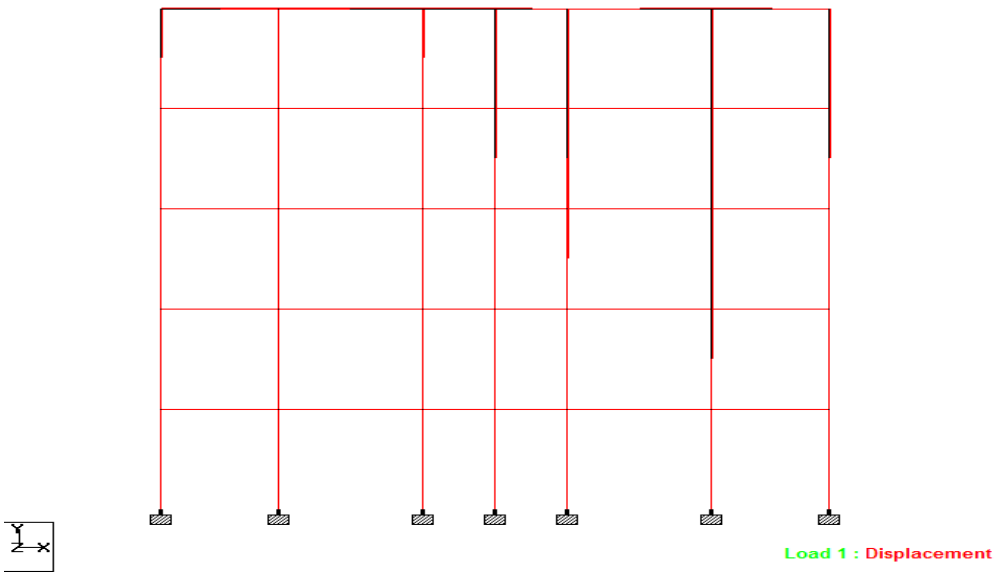


Figure 4.1: Nodal displacement of frame structure

Table 4.2 Beam End Moment of Seismic Coefficient Method

	Beam	L/C	Node	Fx kN	Fy kN	Fz kN	Mx kN-m	My kN-m	Mz kN-m
Max Fx	27	15 GENERAT	3	**1532.063**	1.317	46.938	0.010	-92.013	1.623
Min Fx	27	2 EQ Z	3	**-224.557**	-0.090	-30.255	-0.007	60.063	-0.129
Max Fy	54	15 GENERAT	24	-0.827	**115.808**	-0.241	1.773	0.110	45.537
Min Fy	54	13 GENERAT	28	-0.434	**-114.923**	0.260	-1.764	0.111	44.224
Max Fz	75	15 GENERAT	27	924.334	2.821	**52.951**	-0.006	-98.019	4.874
Min Fz	71	13 GENERAT	23	907.629	2.709	**-53.985**	0.008	99.733	4.665
Max Mx	239	13 GENERAT	110	1.259	33.398	-0.005	**1.777**	0.016	15.367
Min Mx	43	13 GENERAT	19	1.259	33.398	0.005	**-1.777**	-0.016	15.367
Max My	71	13 GENERAT	23	907.629	2.709	-53.985	0.008	**99.733**	4.665
Min My	75	15 GENERAT	27	924.334	2.821	52.951	-0.006	**-98.019**	4.874
Max Mz	71	12 GENERAT	23	966.209	60.597	-1.534	0.112	2.782	**111.032**
Min Mz	262	14 GENERAT	113	966.209	-60.597	-1.534	-0.112	2.782	**-111.032**

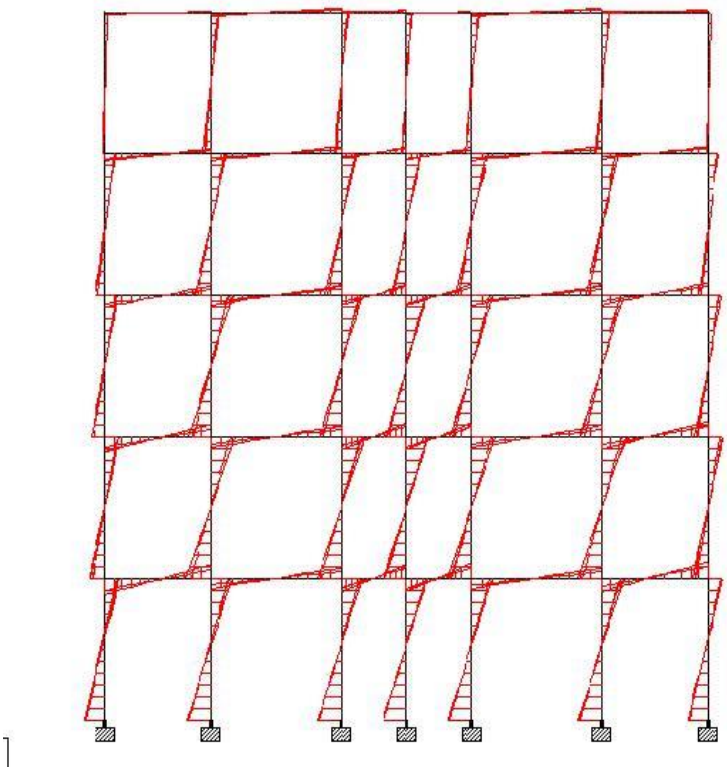


Figure 4.2: Beam End moment of seismic coefficient Method

Table 4.3: Beam and column Design

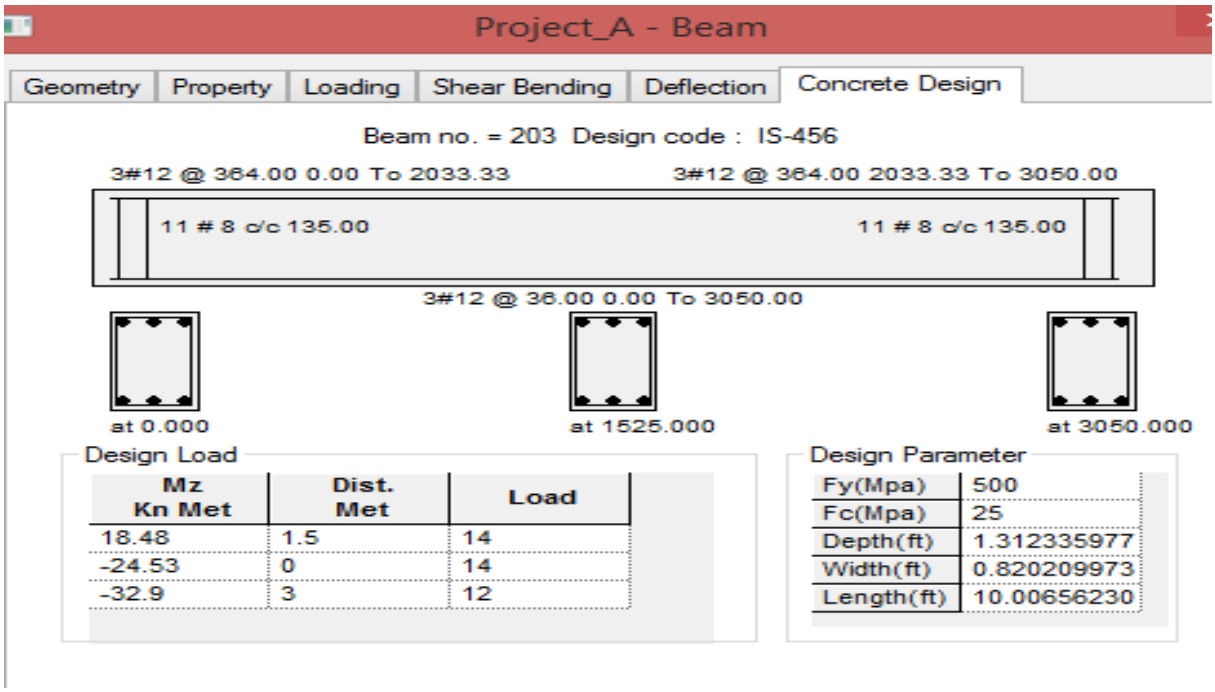
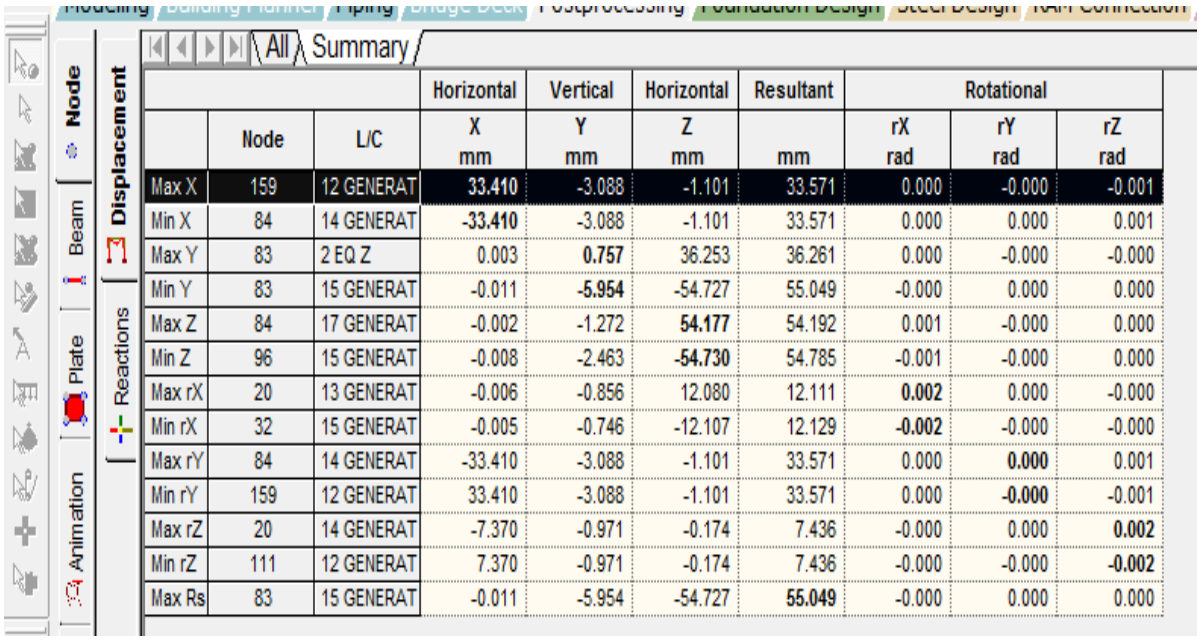


Table 4.4: Node Displacement of Time History Analysis (El Centro)



All | Summary

	Node	L/C	Horizontal X mm	Vertical Y mm	Horizontal Z mm	Resultant mm	Rotational rX rad	rY rad	rZ rad
Max X	159	12 GENERAT	**33.410**	-3.088	-1.101	33.571	0.000	-0.000	-0.001
Min X	84	14 GENERAT	**-33.410**	-3.088	-1.101	33.571	0.000	0.000	0.001
Max Y	83	2 EQ Z	0.003	**0.757**	36.253	36.261	0.000	-0.000	-0.000
Min Y	83	15 GENERAT	-0.011	**-5.954**	-54.727	55.049	-0.000	0.000	0.000
Max Z	84	17 GENERAT	-0.002	-1.272	**54.177**	54.192	0.001	-0.000	0.000
Min Z	96	15 GENERAT	-0.008	-2.463	**-54.730**	54.785	-0.001	-0.000	0.000
Max rX	20	13 GENERAT	-0.006	-0.856	12.080	12.111	**0.002**	0.000	-0.000
Min rX	32	15 GENERAT	-0.005	-0.746	-12.107	12.129	**-0.002**	-0.000	-0.000
Max rY	84	14 GENERAT	-33.410	-3.088	-1.101	33.571	0.000	**0.000**	0.001
Min rY	159	12 GENERAT	33.410	-3.088	-1.101	33.571	0.000	**-0.000**	-0.001
Max rZ	20	14 GENERAT	-7.370	-0.971	-0.174	7.436	-0.000	0.000	**0.002**
Min rZ	111	12 GENERAT	7.370	-0.971	-0.174	7.436	-0.000	-0.000	**-0.002**
Max Rs	83	15 GENERAT	-0.011	-5.954	-54.727	**55.049**	-0.000	0.000	0.000

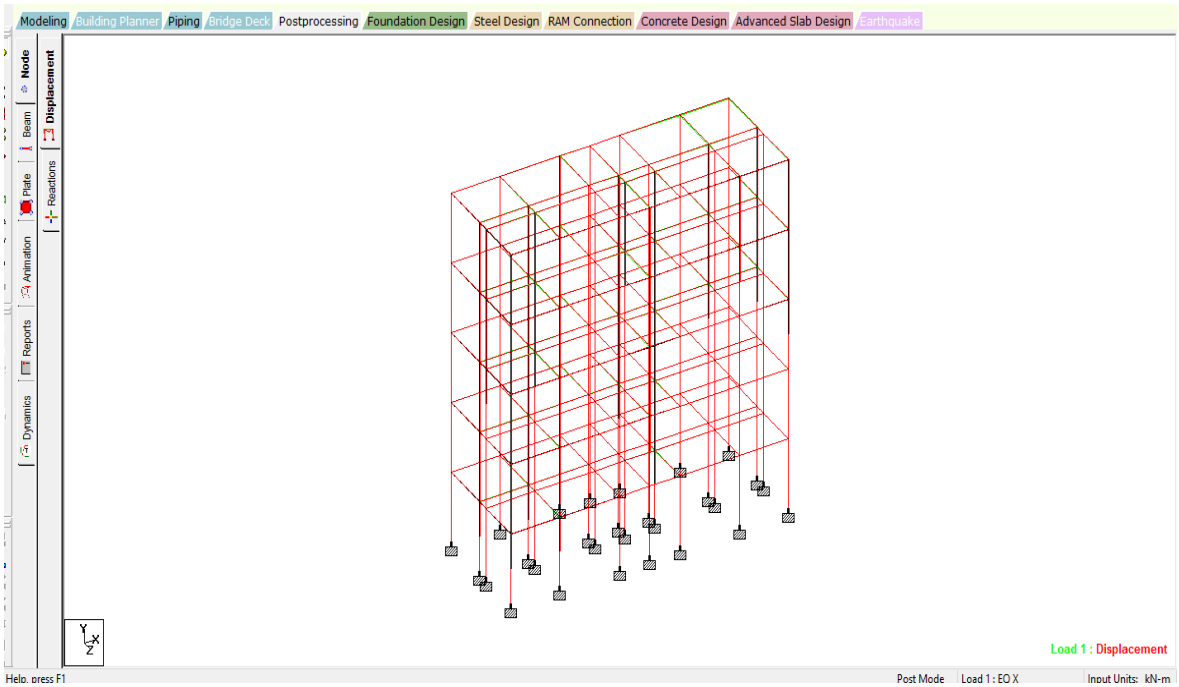


Figure 4.3: Pictorial view of Time history analysis (El Centro)

Table 4.5: Beam End moment displacement (El Centro)

Modeling | Building Planner | Piping | Bridge Deck | Postprocessing | Foundation Design | Steel Design | RAM Connection

Node | Beam | Plate | mation | Forces | Stresses | Graphs

All | Summary | Envelope

	Beam	L/C	Node	Fx lb	Fy lb	Fz lb	Mx kN-m	My kN-m	Mz kN-m
Max Fx	27	15 GENERAT	3	**345.17772E**	286.221	10603.157	0.011	-92.370	1.572
Min Fx	27	2 EQ Z	3	**-50731.001**	-14.931	-6829.280	-0.007	60.268	-0.101
Max Fy	61	15 GENERAT	28	-403.749	**19514.208**	0.493	0.391	0.009	78.567
Min Fy	61	13 GENERAT	32	355.764	**-19256.075**	-1.177	-0.384	-0.030	92.044
Max Fz	75	15 GENERAT	27	207.65379E	671.862	**11943.165**	-0.007	-98.309	5.189
Min Fz	71	13 GENERAT	23	203.83180E	645.885	**-12181.717**	0.008	100.065	4.974
Max Mx	54	15 GENERAT	24	-151.832	16408.177	-116.940	**2.870**	0.264	26.035
Min Mx	248	15 GENERAT	114	-151.832	16408.177	116.940	**-2.870**	-0.264	26.035
Max My	71	13 GENERAT	23	203.83180E	645.885	-12181.717	0.008	**100.065**	4.974
Min My	75	15 GENERAT	27	207.65379E	671.862	11943.165	-0.007	**-98.309**	5.189
Max Mz	71	12 GENERAT	23	216.94982E	13628.801	-364.441	0.113	2.947	**111.082**
Min Mz	262	14 GENERAT	113	216.94982E	-13628.801	-364.441	-0.113	2.947	**-111.082**

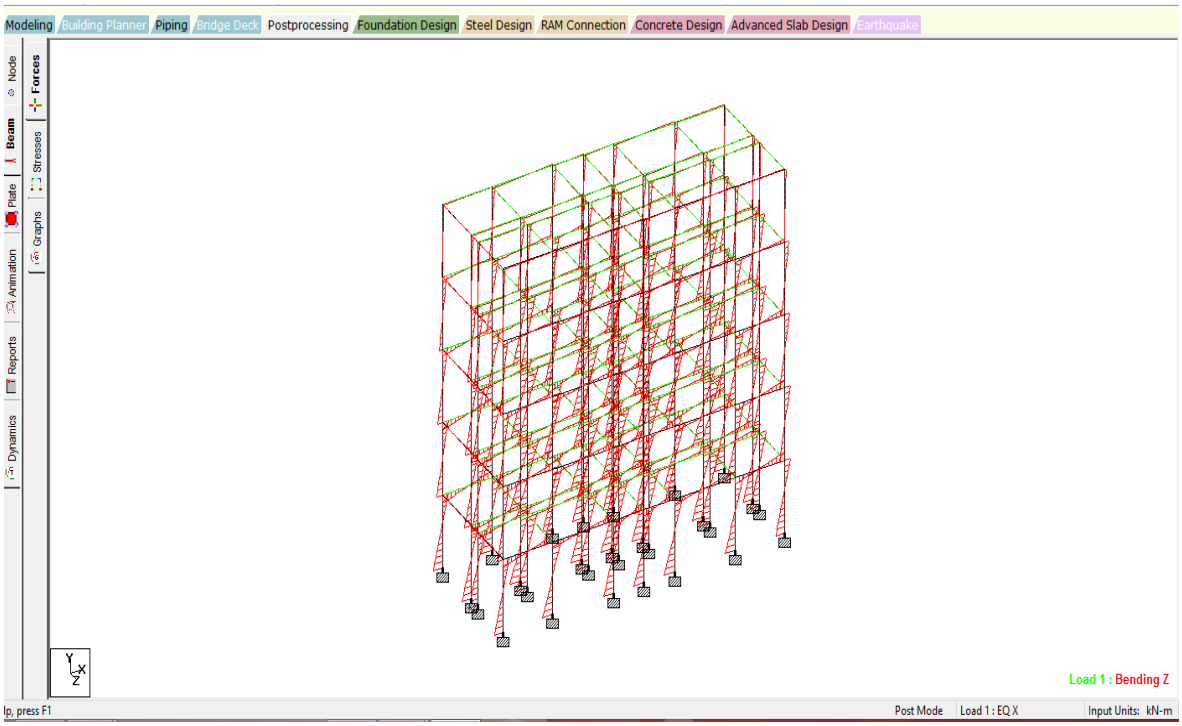


Figure 4.4: Beam End moment of Time History Analysis (El Centro)

Time History Graph for Node-93

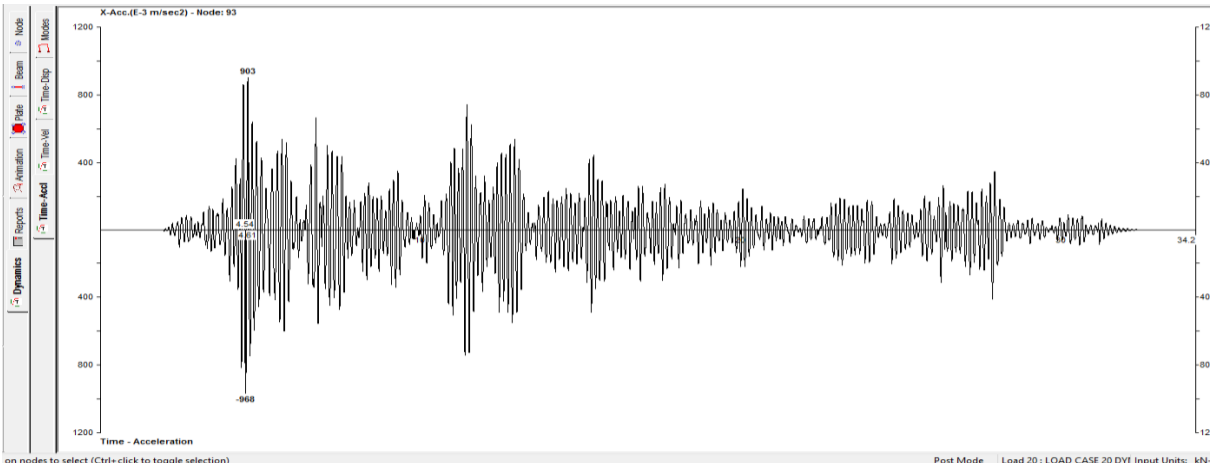


Figure 4.5 (a) EL CENTRO (Acceleration Vs Time Graph in x)

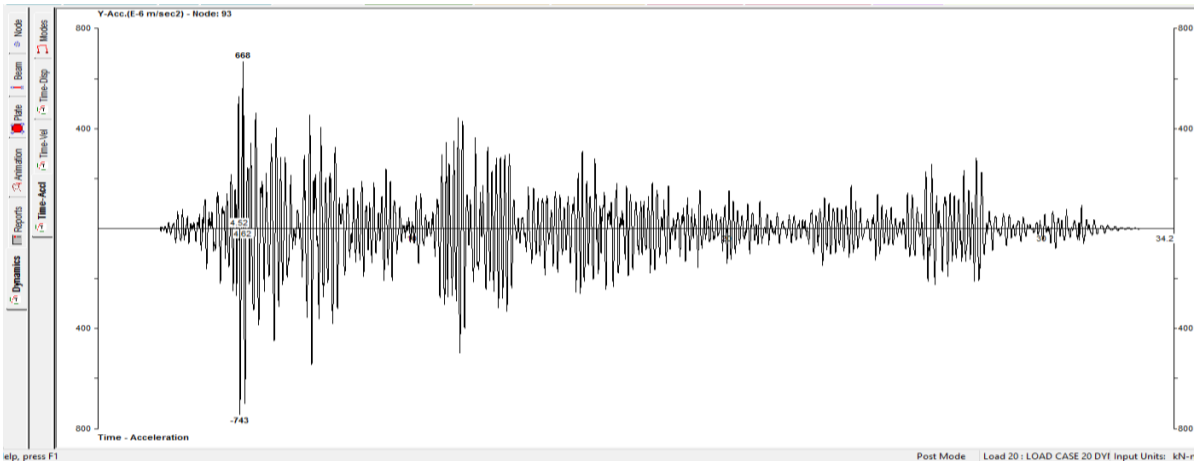


Figure 4.5 (b) EL CENTRO (Acceleration Vs Time Graph in y)

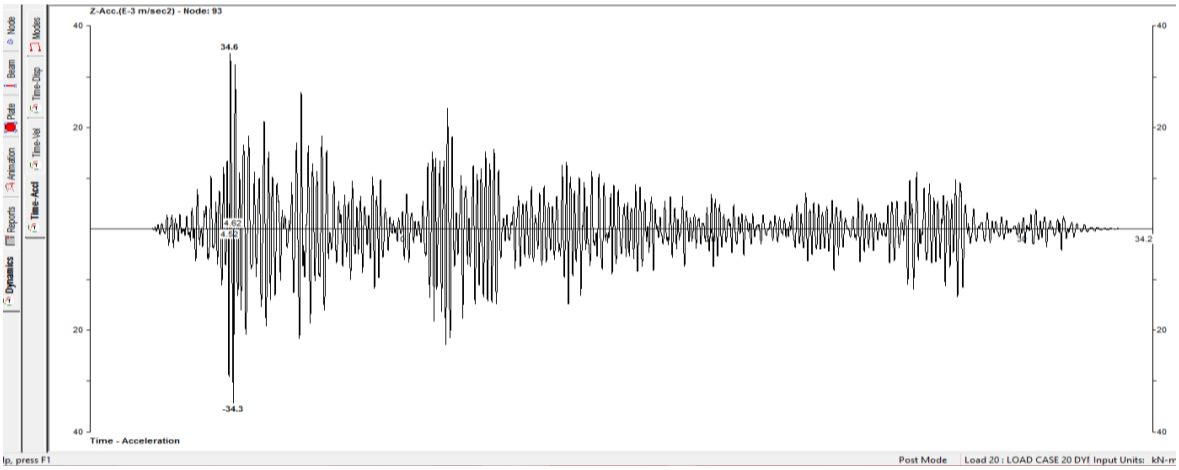


Figure 4.5 (c) EL CENTRO (Acceleration Vs Time Graph in z)

Time History Graph for Node-93

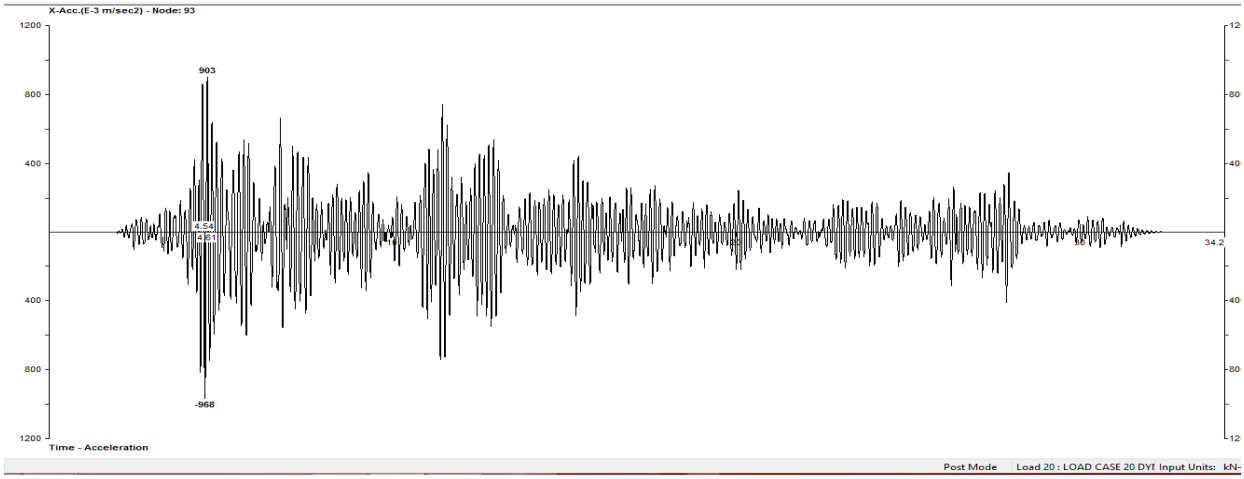


Figure 4.6 (a) KOB (Acceleration Vs Time Graph in x)

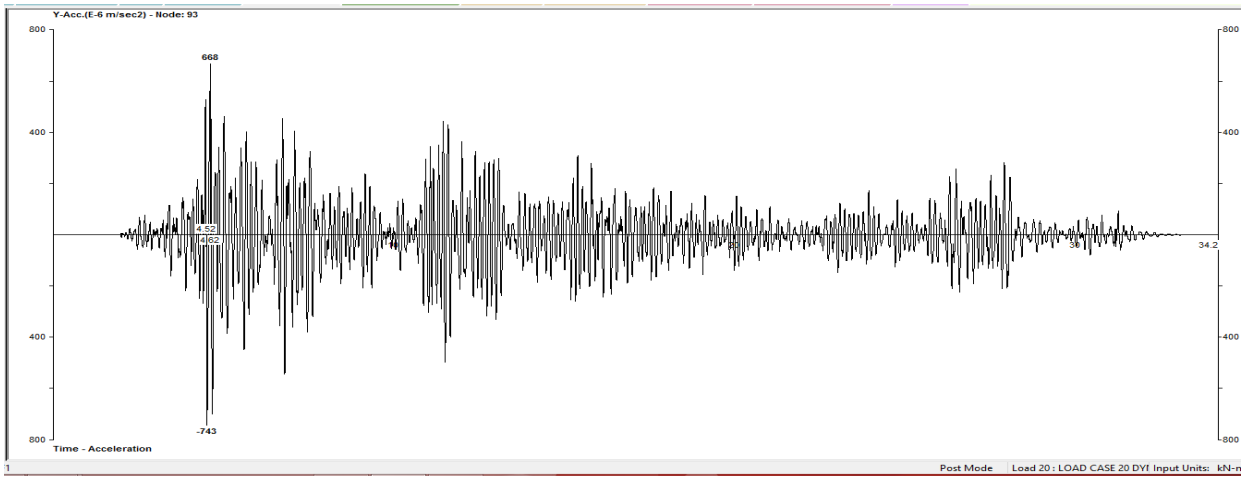


Figure 4.6 (b) KOB (Acceleration Vs Time Graph in y)

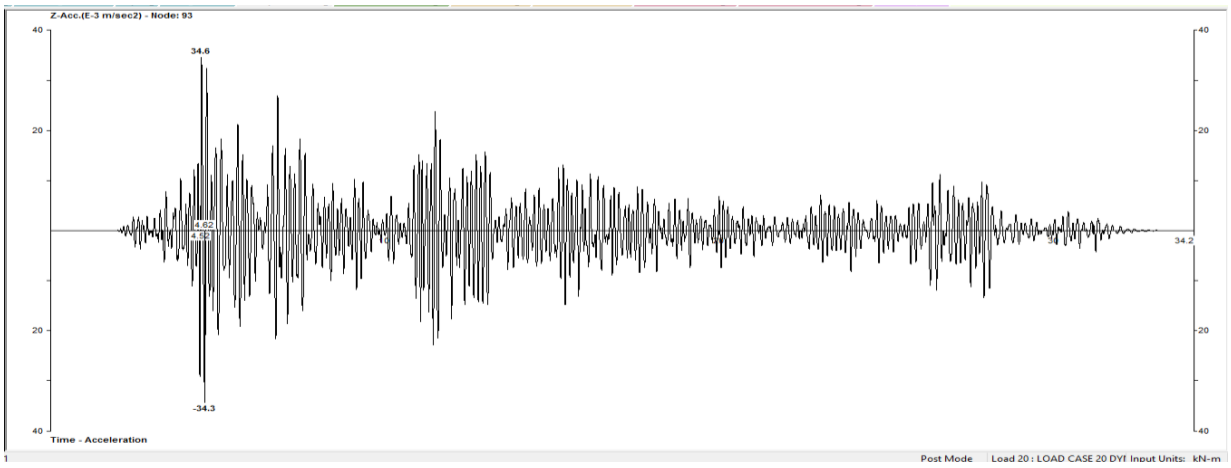


Figure 4.6 (c) KOB (Acceleration Vs Time Graph in z)

Time History Graph for Node-93

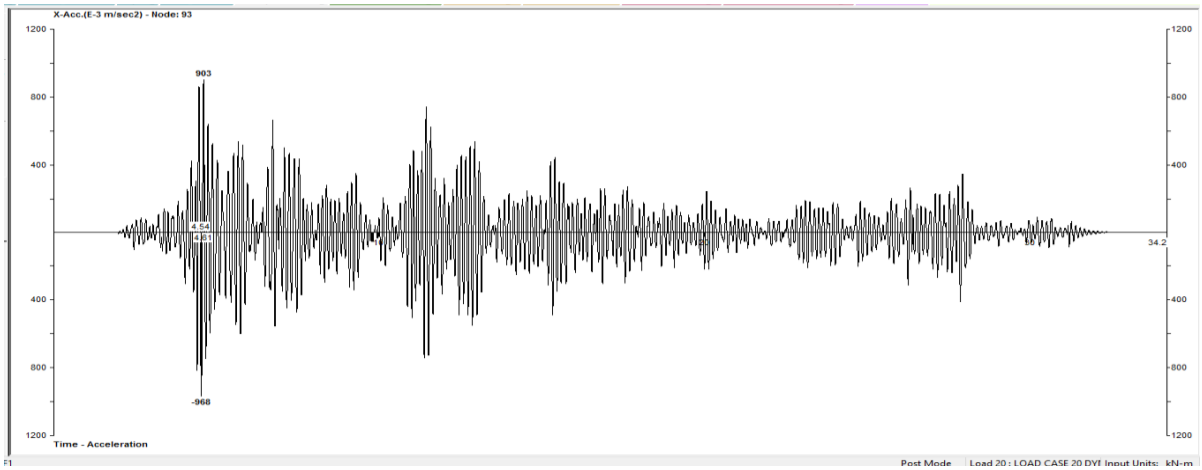


Figure 4.7 (a) Northridge (Acceleration Vs Time Graph in x)

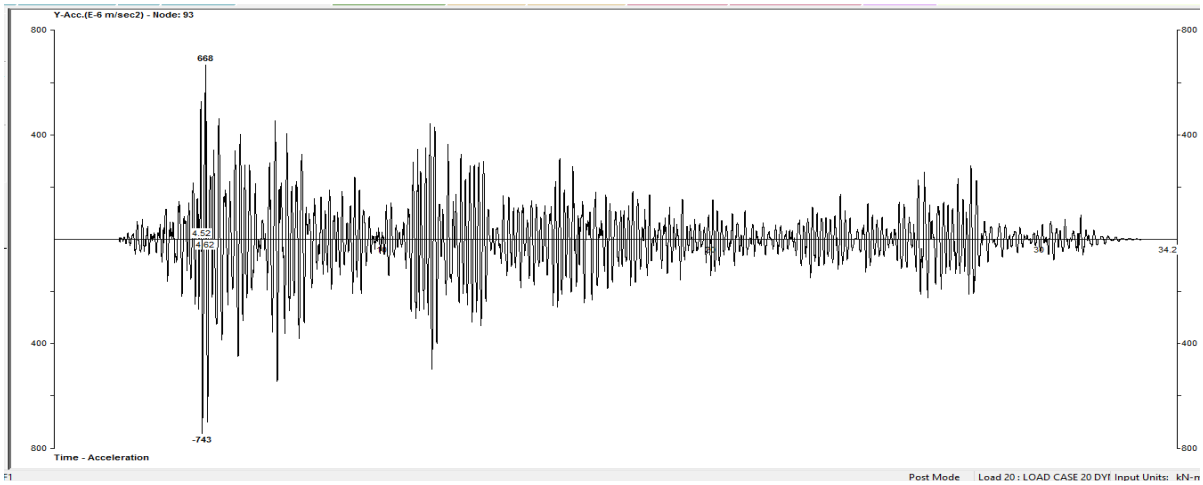


Figure 4.7 (b) Northridge (Acceleration Vs Time Graph in y)

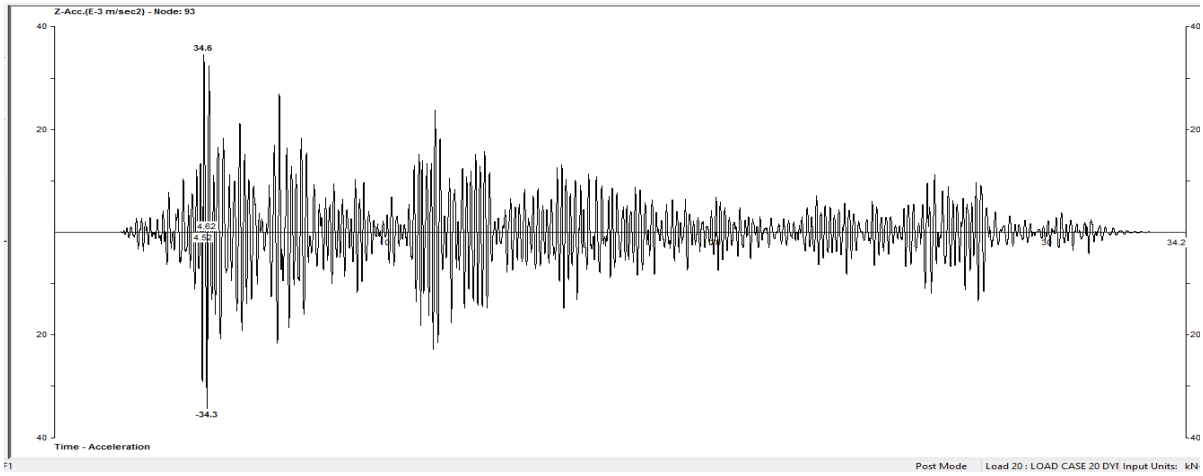


Figure 4.7 (c) Northridge (Acceleration Vs Time Graph in z)

CHAPTER 5

5.1 Conclusion

The structure is completely investigated for seismic loads by seismic coefficient Method. The structure site lies in Seismic zone - IV. As the site is particularly tremor inclined so the fortification solid plan of the structure is done which can give enough flexibility to the structure as indicated by IS-456:2000 by farthest point state strategy. At that point building is examined basic burden mixes with the assistance of STAAD-PRO. After investigation, the outcomes were observed to be in cutoff points and solid.

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