JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SEISMIC RESISTANT ANALYSIS AND DESIGN OF MULTISTORY BUILDING

[1]Mohan Lal sahu,[2]Parmehswar sahu,[3]Pushpendra kumar sahu

[1]Mtech Scholar,[2]Assistant Professor,[3]Assistant Professor
[1]MTech (Structure Engineering),
[1]Shri Rawatpura Sarkar University, Raipur(c.g.),India

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 II is inclined to, the site of structure is in Dantewara. Device utilized for calculations is STAAD-pro2000.The main change in the map for the state of Chhattisgarh was the merging of zone Iand II under which much state falls. A silver of the district of Dantewara lies in zone II. Part of the northern districts of Bilaspur, Janjgir, Korba, Koria and Sarguja lie in zone III.

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 response sat section bases.

The structure was investigated without block in fill 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.

I. INTRODUCTION

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, down pour, 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 extra ordinary 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 forth 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.

II. PREVALENT AND USE

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 Auto desk Inc.…AutoCAD was first released in December 1982 Running on micro computer with inside representations controller. Before the introduction of Auto CAD most business CAD program on unified server PCs or minicomputer with each CAD head customer working at an alternate reasonable terminal. Auto CAD 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.

III. 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.

IV. 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 1.1. 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

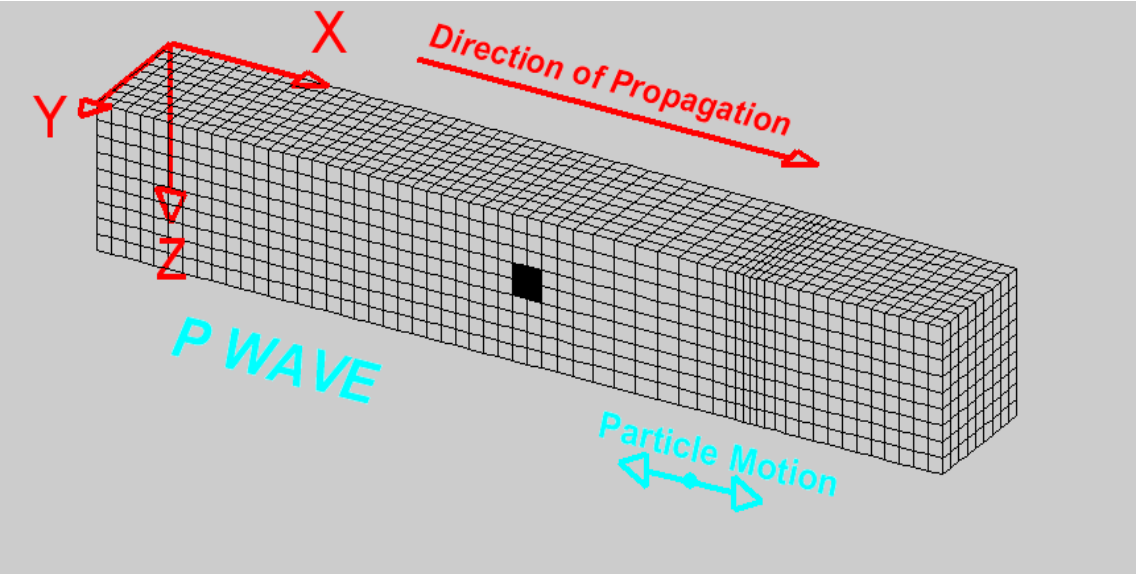


Figure 1.1: P waves

Secondary, S (shear wave) or on the other hand Shear Waves are additionally called transverse wave. which is shown in Figure 1.2. 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.

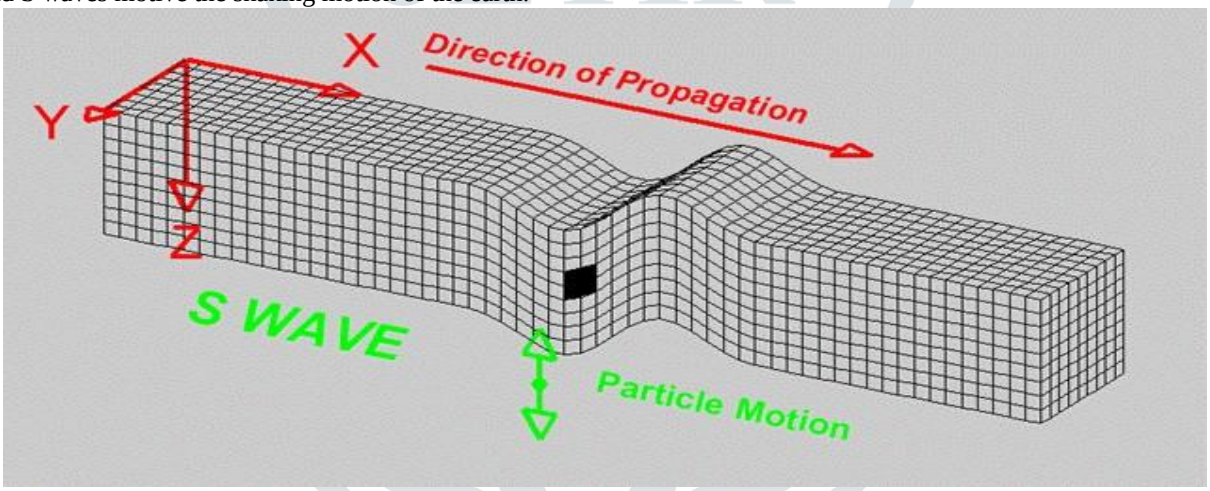


Figure 1.2: S waves

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 1.3. There are two types of L waves: Rayleigh Waves Love Waves.

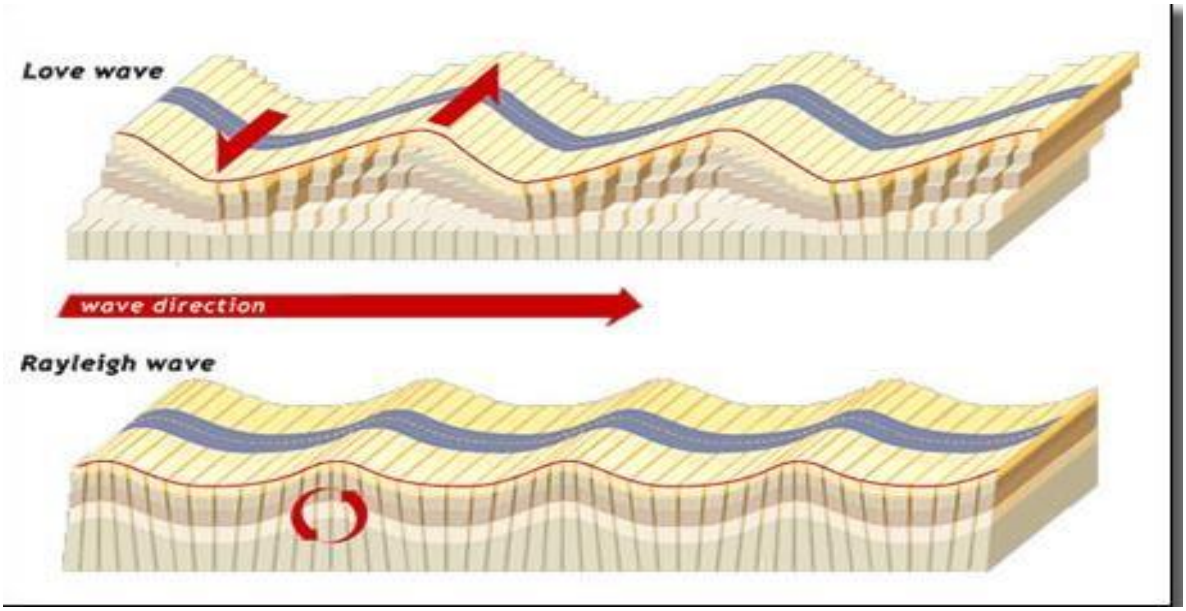


Figure 1.3:R and L wave

Protection from Earthquakes

For a structure to remain safe in the midst of seismic tremor trembling, The earthquakeresistant 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.

V.LITERATURE REVIEW

1. **Bhattacharjee et al**. 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.
2. **Saatcioglu, M. and Humar, J**.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.
3. **Duan, X.N. and Chandler, A.M**. 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

4. **Estekanchi et al**. 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
5. **Cassiano et al.** 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.
6. **Wilkinson et al**. 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.
7. **Mohammad Adil Dar, et al**. 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.

VI. RESEARCH METHODOLOGY

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.

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.

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. Ta=0.075h0.75 for share walls or moment resisting frame without bracing. Ta=0.09h/√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. Vb= AhW Ah = design horizontal seismic coefficient for a structure W = seismic weight of building .Ah = (Z/2)(I/R)(Sa/g) Z = Zone factor I = Importance factor R = Response reduction factor Sa/g = Spectral acceleration (Sa/g=1/T For hard soil) Distribution of forces along the height of building is given by Qi=VB(Wihi2 /∑wihi2) 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

Final analysis

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

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 6.1. And other figure are shown in fig 6.2,6.3, and 6.4 view from z, y, and 3d view axis In STAAD.Pro.

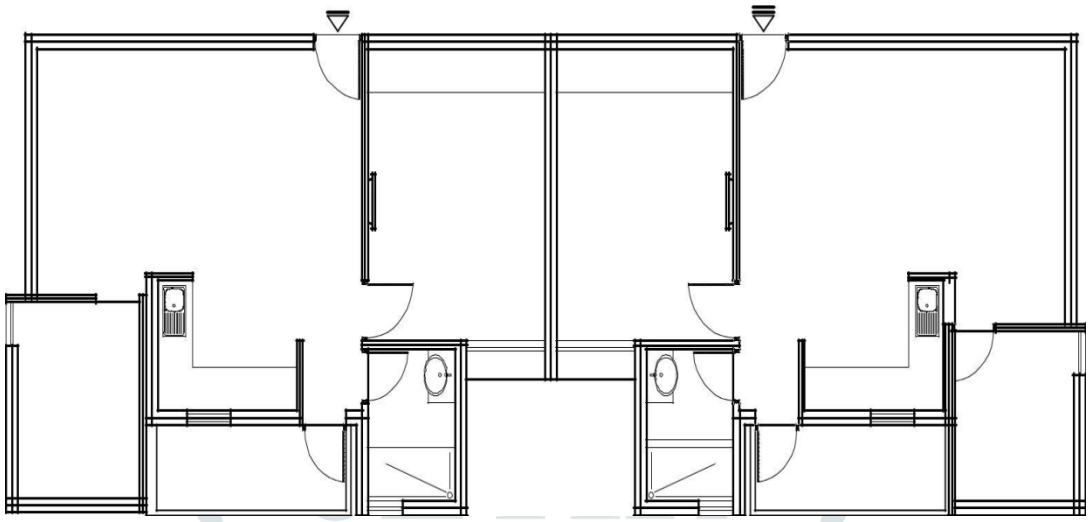


Figure6.1: Proposed residential building plan

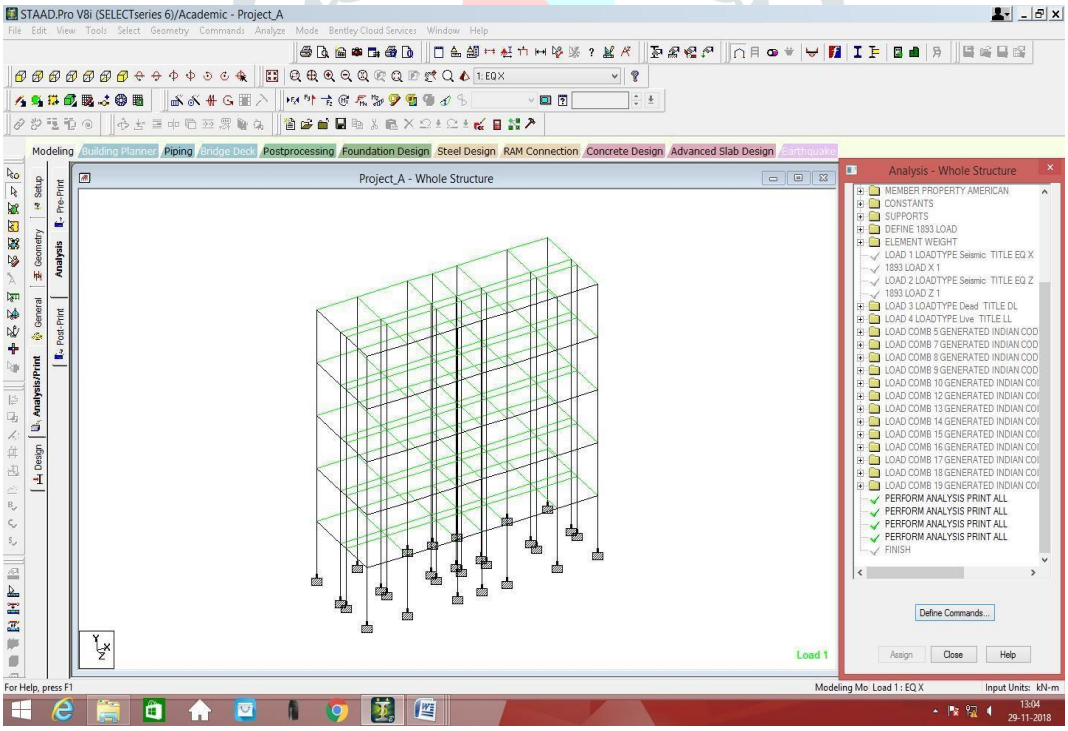


Figure6.2: View from-zaxis

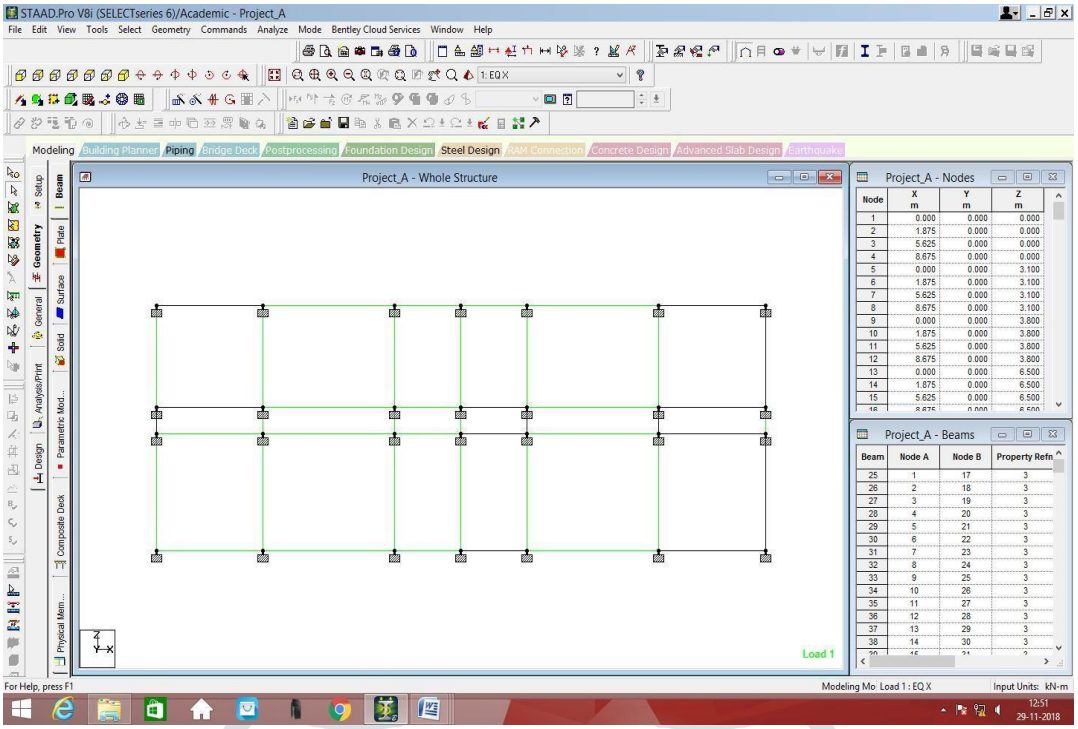


Figure6.3: view from–y axis

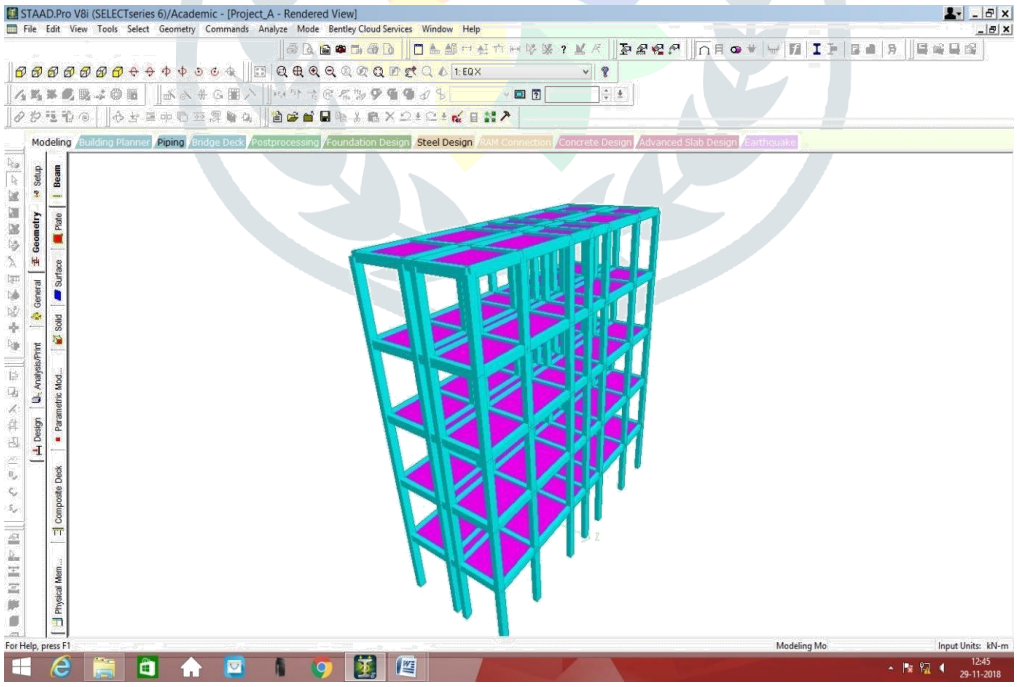


Figure6.4:3-D View in STADD-PRO

DESIGN DATA CONSIDERED

Table- design data consider

Live load	4.0KN/m^2
Roof load	1.0KN/m^2
Floor finish	1.0KN/m^2
Location	Dantewara
Wind load	AsperIS:875Notdesignedforwindload, Since earthquake loads only considered
Earthquake load	AsperIS-1893 (Part1)–2002
Damping ratio	5%
Type of soil	TypeII,MediumasperIS:1893
Storey height	3.66m
Thickness of slab	180mm
Size of beam	250mm×400mm
Size of column	400mm×300mm
Walls	230 mm thick brick masonry walls

VII. RESULTS AND DISCUSSION

Table7.1: 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

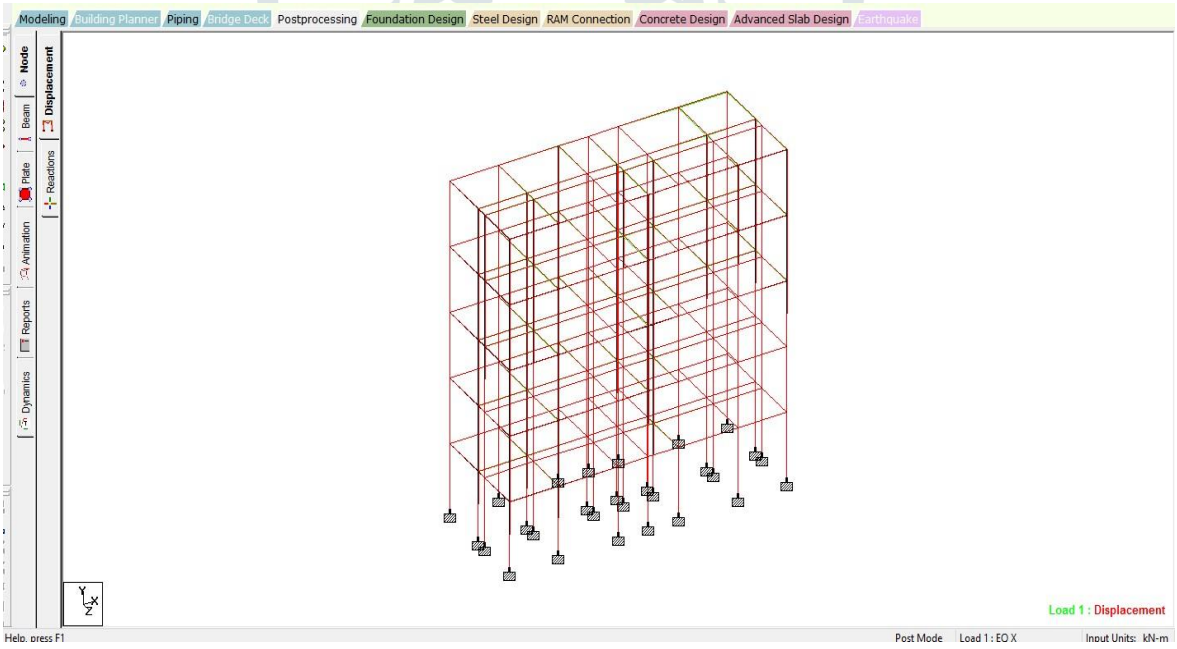


Figure7.1: Pictorial view of Time history analysis (El Centro)

Table7.2: 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**

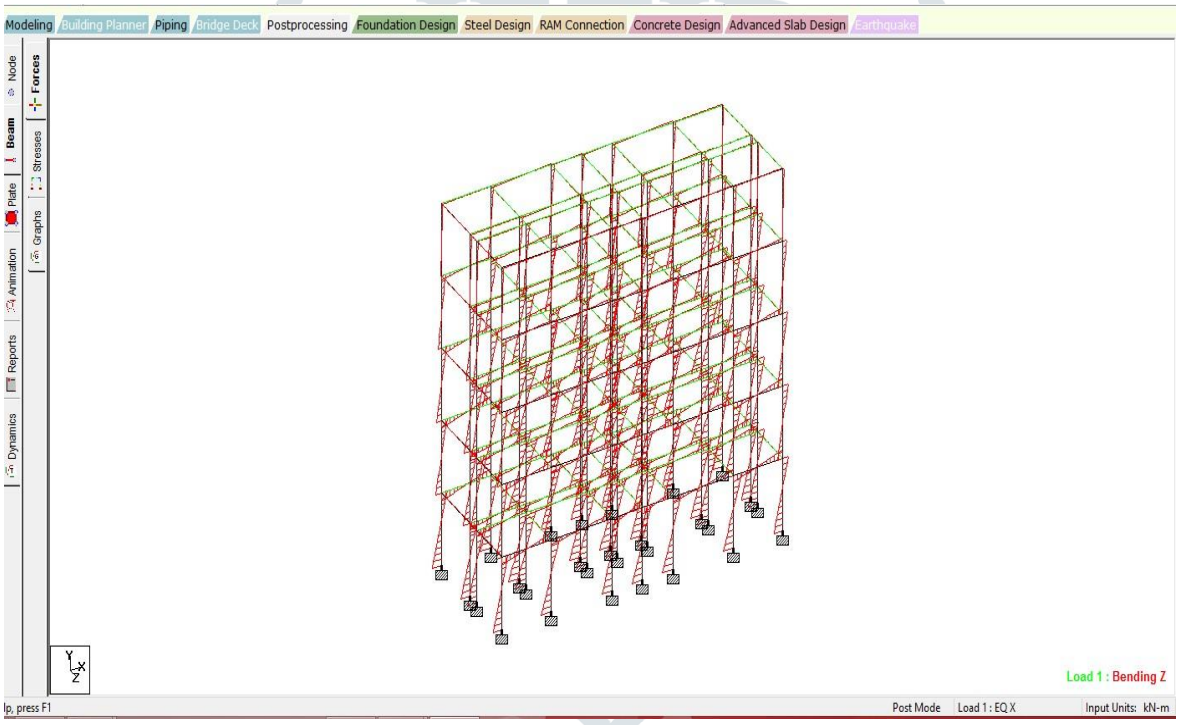


Figure7.2: Beam End moment of Time History Analysis (El Centro)

Figure7.3 (a): Northridge (Acceleration Vs Time Graphiny)

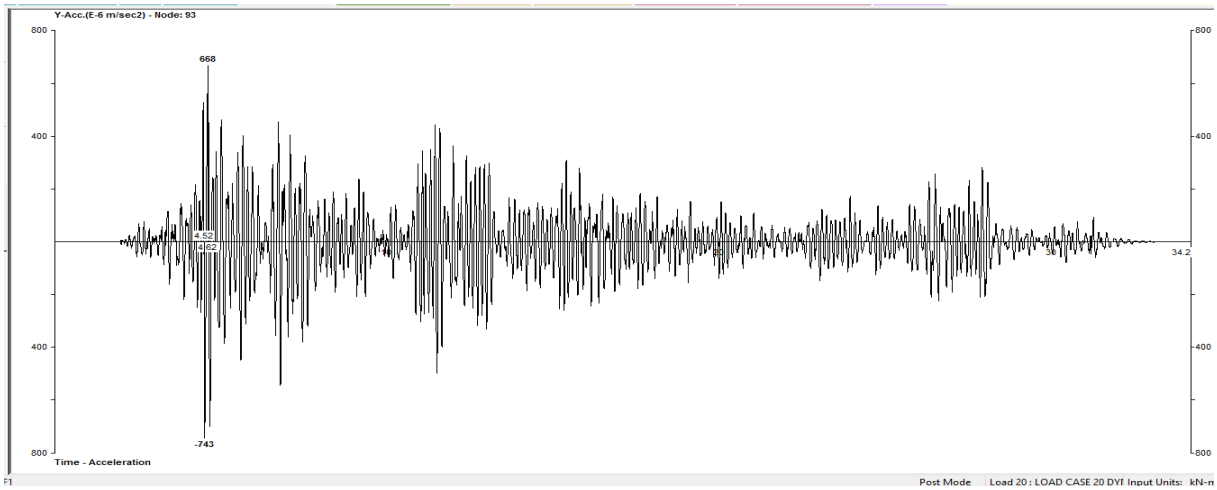
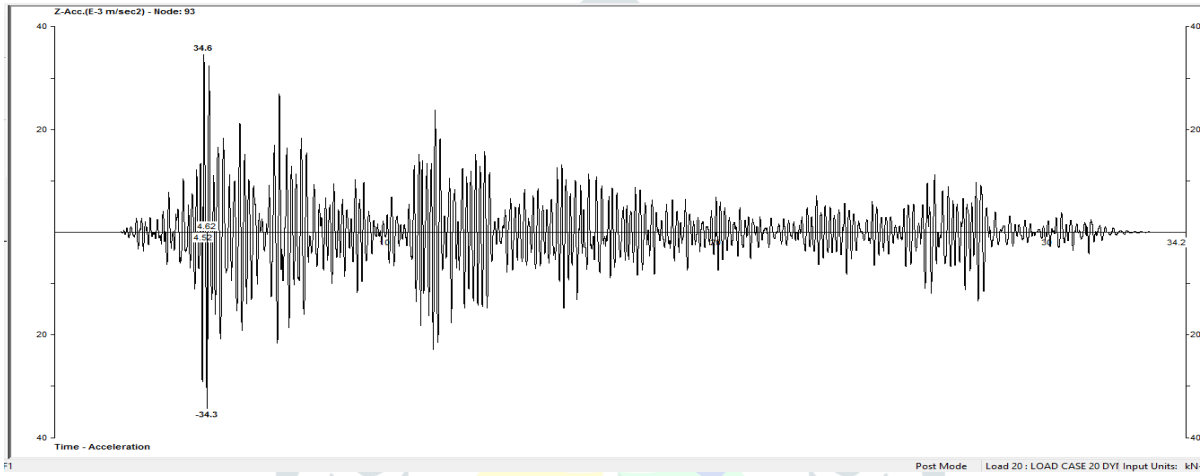


Figure7.3 (b): Northridge (Acceleration Vs Time Graphiny)



Conclusion

The structure is completely investigated for seismic loads by seismic coefficient Method. The structure site lies in Seismic zoneII. 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 cut off points and solid.

References

[1] Bhattacharjee, B. and ASV, N., 2007. Computer aided analysis and design of multi-storeyed buildings (Doctoral dissertation).

[2] Saatcioglu, M. and Humar, J., 2003. Dynamic analysis of buildings for earthquake resistant design. Canadian Journal of Civil Engineering, 30(2), pp.338-359.

[3] Duan, X.N. and Chandler, A.M., 1993. Inelastic seismic response of code-designed multistorey frame buildings with regular asymmetry. Earthquake engineering & structural dynamics, 22(5), pp.431-445.

[4] Fu, F., 2010. 3-D nonlinear dynamic progressive collapse analysis of multistorey steel composite frame buildings—Parametric study. Engineering Structures, 32(12), pp.3974-3980.

[5] Mwafy, A.M. and Elnashai, A.S., 2001. Static pushover versus dynamic collapse analysis of RC buildings. Engineering structures, 23(5), pp.407-424.
[6] Estekanchi, H.E., VAFAEI, A. and SADEGH, A.M., 2004. Endurance time method for seismic analysis and design of structures.
[7] Cassiano, D., DAniello, M., Rebelo, C., Landolfo, R. and da Silva, L.S., 2016. Influence of seismic design rules on the robustness of steel moment resisting frames. Steel and Composite Structures, 21(3), pp.479-500.

[8] Wilkinson, S.M. and Hiley, R.A., 2006. A non-linear response history model for the seismic analysis of high-rise framed buildings. Computers & structures, 84(5-6), pp.318-329.

[9] Naser, M., 2015. Seismic Analysis and Design of Hospital Building by Equivalent Static Analysis (Doctoral dissertation).

[10]Mohammad Adil Dar, Prof (Dr) A.R. Dar , Asim Qureshi ,Jayalakshmi Raju a study on earthquake technique

[11] Jaswant N. Arlekar, Sudhir K. Jain and C.V.R. Murty Seismic response of RC frame Buildings with soft First storeys