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COMPARATIVE STUDY OF STATIC AND DYNAMIC SESIMIC ANALYSIS OF MULTI STORIED BUILDING R.C.C BUILDING BY USING ETABS SOFTWARE

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ABSTRACT

Analysis and design of buildings for static forces is a routine affair these days because of availability of affordable computers and specialized programs which can be used for the analysis. On the other hand, dynamic analysis is a time-consuming process and requires additional input related to mass of the structure, and an understanding of structural dynamics for interpretation of analytical results. reinforced concrete (RC) frame buildings are most common type of constructions in urban India, which are subjected to several types of forces during their lifetime, such as static forces due to dead and live loads and dynamic forces due to earthquake The present study describes the effect of earthquake load which is one of the most important dynamic loads along with its consideration during the analysis of the structure. The principle objective of this project is the comparative study on design and analysis of multistoried building (G+8) by ETABS software's. In this project we analyze the G+8 building for finding the shear forces, bending moments, deflections & reinforcement details for the static and dynamic seismic analysis of multi storied building

I.INTRODUCTION

Structural design of buildings for seismic loads is primarily concerned with structural safety during major ground motions, but serviceability and the potential for economic loss are also of concern. Seismic loading requires an understanding of the structural performance under large inelastic deformations. Behavior under this loading is fundamentally different from wind or gravity loading, requiring much more detailed analysis to assure acceptable seismic performance beyond the elastic range. Some structural damage can be expected when the building experiences design ground motions because almost all building codes allow inelastic energy dissipation in structural systems. The first step in dynamic analysis is to develop a mathematical model of the building, through which estimates of strength, stiffness, mass, and inelastic member properties are assigned. In general, for a multi storey building it is necessary to take into account contributions from more than one mode. have been carried out. In dynamic analysis; Response Spectrum method is used. ETABS stands for Extended Three-dimensional Analysis of Building Systems. ETABS is commonly used to analyse: Skyscrapers, parking garages, steel & concrete structures, low- and high-rise buildings, and portal frame structures.

FRAMES:

This is a frame system of rigid beams subjected to lateral loads where the developed moments in the middle of the columns are not existent. And the shear forces will be distributed proportionally with the moment of inertia of the Columns and the lateral displacements will be proportional to these forces.

SHEAR WALLS:

These systems resist the lateral loads with the shear walls whether these walls are separated or connected by beams. The distribution of shear forces is proportional to the moment of inertia of the cross sections of the walls; the displacements in each floor or level are the result of the Flexural deformations in the walls.

DUAL STRUCTURAL SYSTEMS:

Double structural frameworks despite the fact that utilizing strengthened solid for development may be began in the initial 1900s, the structural framework utilized during that minute might have been those customary beam-column span frameworks. This accepted beam-column framework committed the development of taller structures exceptionally unreasonable What's more monetarily illogical. Due to this scenario, those strengthened solid edifices tallness might have been restricted to main a couple stories in the initial 1950s, new structural frameworks (frame-wall systems) would presented and the utilization of strengthened solid Previously, Flat What's more office edifices Similarly as helter skelter Likewise 30 stories committed could be allowed. This new structural framework is alluded will us double alternately mixture structural framework. It is successful over opposing parallel loads furthermore of the gravity load contrasted with pillar section span framework. Double structural frameworks consolidate those point about their constituent components. Flexible frames, cooperating for walls, could furnish a critical measure from claiming vitality dispersal especially in the upper stories of a building. On the different hand, as bring about shortages of the extensive firmness from claiming walls, handy story float control Throughout an world quake camwood be attained

and the advancement of story instrument directing, including section hinges Concerning illustration in that of delicate stories camwood promptly be avoided. These frameworks would the effect for joining together the two last frameworks will stand up to the parallel load, to these frameworks those state of the deformations will contrast starting with the individuals frames What's more divider systems, the place effecting interacted powers happen Also progress the state of shear What's more minute diagrams. A standout amongst those points of interest of this consolidation may be that the frames help the dividers toward the highest point and control their uprooting. Besides, the dividers help those frames toward the lowest part Furthermore diminish their relocation. For different words, the sheer drive of the frames may be greater toward the Main over it may be at the bottom What's more it dives the opposite lifestyle round to the dividers. By and large couple shear dividers are placed symmetrically in the building want Concerning illustration for every those engineering necessities of the structures need aid moved centrally Likewise center divider should give those parallel load imperviousness What's more parallel firmness needed to breaking point the parallel deformations to worthy levels.

A lot of people decisions exist for different shear dividers or shear divider cores (shear dividers orchestrated done An box sort structure) clinched alongside An tall fabricating for respect to their area On plan, shape, number, and course of action. The essential seismic tremor safe limit over a tall building could be attained Eventually Tom's perusing giving work to sufficient stiffness, quality Also pliability What's more shear divider gives a ideal method for accomplishing those essential criteria from claiming plan shear divider will be an component which go about as a verthandi cantilever utilized by and large in multi storied fabricating to stand up to parallel strengths such as wind, storm, What's more seismic tremor. The individuals dividers would by and large nonstop component beginning starting with the establishment Also try up to those most noteworthy perspective. Of the fabricating. However, it might additionally a chance to be curtailed at intermediate tallness. Shear divider has the capacity to oppose mix for shear, minute and pivotal load prompted by parallel load Also gravity load exchanged to it through other structural parts. To structures In 30 stories, shear divider need been a crucial component to guarantee economy Also minimize the parallel redirection At shear divider will be utilization daylong with minute opposing outline in a structure it may be known as double structural framework What's more in this framework those loads need aid resisted by divider over opposing overturning moments, story shear drives Also story shear relies upon geometric configuration, materials used, introduction What's more area inside the plane of the building shear divider might make arranged under different sorts such as short alternately tall divider Also thin alternately squat divider on the premise about angle ratio; reinforced, steel plate, plywood, mid ply alternately masonite shear divider on the premise about utilized material; profound straight walls, what's to come for U formed dividers or box formed dividers on the premise about state.

SESIMIC ZONES OF INDIA:

The term tremor can be utilized to depict any sort of seismic occasion which might be either common or started by people, which produces seismic waves. Tremors are caused regularly by burst of topographical deficiencies; yet they can likewise be activated by different occasions like volcanic action, mine impacts, avalanches and atomic tests. . The perceptions from a seismometer are utilized to quantify tremor. Seismic tremors more prominent than around 5 are for the most part given an account of the size of minute extent. Those littler than greatness 5, which are more in number, as detailed by the national seismological observatories are for the most part estimated on the nearby extent scale, which is otherwise called the Richter scale. There are numerous structures that have essential auxiliary framework, which don't meet the current seismic prerequisites and endure broad harm amid the quake. The structures at vizag were composed by essential auxiliary framework and the explanation for this is Rourkela lies in ZONE II of Seismic Zone Map of 2002 i.e. as per Seismic Zoning Map of IS: 1893- 2002, which says the area is minimum plausible for earth shakes. The organization building is a four Storey building outlined without considering the plan components of IS: 1893-2002. At introduce time the techniques for seismic assessment of seismically lacking or quake harmed structures are not yet completely created. The structures which don't satisfy the prerequisites of seismic plan, may endure broad harm or crumple if shaken by an extreme ground movement. The seismic assessment mirrors the seismic limit of quake powerless structures for the future utilize. As indicated by the Seismic Zoning Map of IS: 1893-2002, India is separated into four zones based on seismic exercises. They are Zone II, Zone III, Zone IV and Zone V. Hyderabad lies in Zone II Cataclysmic events are inescapable and it isn't conceivable to deal with them.

II.LITERATURE REVIEW

Bhagwat Mayuri [1] An investigation was completed to decide ideal arrangement of a multi storied working by changing the shear divider area. Two instances of shear divider area for a 20 storied building was examined. Examination was completed by space outline framework exposed to gravity and sidelong loads. Configuration by agreeing centroid and mass focus is perfect.

Anyway on numerous events, structure must be founded on the off kilter concerning focal point of mass. These cases result in intemperate worries in most auxiliary individuals, undesirable torsional minute Beam minutes: At extraordinary lattice bowing minute expanded with increment in flightiness for lower levels and for more elevated amounts, twisting minute diminished with increment in erraticism.

Kalyan chowdary Shaik Kamal Mohammed Azam [2] This examination shows the technique for seismic execution estimation of elevated structures dependent on an idea of the limit range strategy. In 3D investigative model of thirty storied structures have been produced for symmetric structures Models and examined utilizing auxiliary examination device ETABS. The scientific model of the building incorporates immensely essential segments that impact the mass, quality, firmness and deformability of the structure. To contemplate the impact of solid center divider and shear divider at various positions amid quake, seismic examination utilizing both direct static, straight unique and non-straight static technique has been performed.

III.METHODOLOGY

An earthquake causes shaking of the ground. So a building resisting on it will experience motion at its base. Instantaneously, however, the acceleration of the ground causes the building to move sideways at the base causing a lateral load on the building and a shear force at the base .As the building moves, the forces applied to it either transmitted through the structure to the foundation, absorbed by the building components, or released in other ways such as the collapse of structural elements. The goal of seismic design is to build a structure that can safely

PLAN

The auto creep plotting no.1 speaks to the arrangement of a g+8 building. The arrangement obviously demonstrates that it is a blend of five condos. We can see there is a mix among every single condo. The Apartments are situated at gachibouli which is encompassed by numerous lofts. In each square the whole floor comprises of a three bed room house which involves whole floor of a square. It speaks to a rich region with immense territories for each house. It is a g+8 proposed building.

The arrangement demonstrates the subtleties of measurements of every single room and the kind of room and introduction of the diverse rooms like bed room, restroom, kitchen, corridor and so on.. All the five condos have comparative room game plan. The whole arrangement zone is around 1100 sq.m. There is some space left around the working for leaving of autos. The arrangement gives subtleties of game plan of different furniture like couch and so forth. The arrangement additionally gives the subtleties of area of stair cases in various squares. we have 2 stair cases for each square and planning of stair case.

AutoCAD plot no.3 In the center we have a little development which comprises of four lifts and the individuals who need to fly through lift can utilize this office and we know for a working with more than g+4 floors should necessary have lift and the charges for the offices is gathered by every one of the individuals. At that intersection we have a club for our pleasure and charges are gathered by all the building tenants each month. So these speak to the arrangement of our building and point by point clarification of residual parts like rises and structuring is conveyed in the following areas.

Elevation

AutoCAD plot no.2 speaks to the proposed height of building. It demonstrates the height of a g+8 building speaking to the front view which gives the review of a building square. The figure speaks to the site image of our structure which are taken at the site .the building is in reality under developments and all the investigation and configuration work is finished before the start of the task. Each floor comprises of stature 3m which is taken according to GHMC rules for private structures.

The building isn't intended for expanding the quantity of floors in future.so the quantity of floors is settled for future likewise for this working because of inaccessibility of the authorizations of separate experts. Likewise exceptional materials like fly fiery remains and self-compacted cement were additionally utilized so as to decrease the dead burden and increment life of the structure and furthermore enhance economy.

Centre line plan

The above figure speaks to the inside line chart of our working in staad professional. Each help speaks to the area of various segments in the structure. This structure is utilized in producing the whole structure utilizing an instrument called transitional rehash and connection steps. In the wake of utilizing the device the structure that is made can be broke down in staad professional under different stacking cases. Underneath figure speaks to the skeletal structure of the building which is utilized to do the examination of our building. Every one of the loadings are followed up on this skeletal structure to complete the investigation of our building. This isn't the genuine structure yet just speaks to the diagram of the working in staad master. A work is naturally made for the examination of these building.

Footings, Columns & Beams Construction

This is regularly called as "skeleton development". The floor pieces, segments, outside dividers and so forth are altogether upheld by a system of steel bars and segments. This sort of skeleton structure can be raised effectively prompting exceptionally tall

structures. In such a shaft and section development, the casing more often than not comprises of segments dispersed 6 - 10 m separated, with pillars and supports surrounded into them from the two headings at each floor level. A case of skeleton development is appeared beneath.

For the most part segments utilized in the structure are hot-moved I-segments or cement encased steel segments. They give unhindered access for pillar associations through either the rib or the web. Where the stacking necessities surpass the limit of accessible area, extra plates are welded to the segment. The determination of bar areas relies on the range, stacking and restrictions on in general profundity from headroom contemplations. Straightforward bars with precast floors or composite metal deck floors are probably going to be the most practical for littler ranges. For bigger ranges, plate-braces or plated-pillars are utilized.

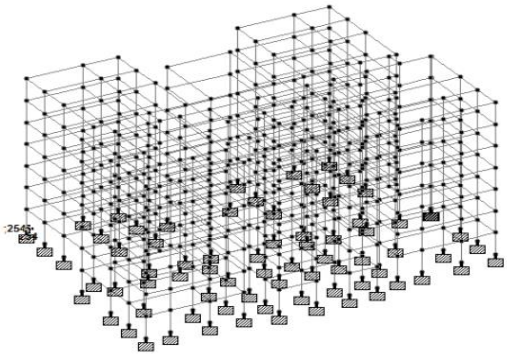


Figure: shows the design of multi-storeyed building using E-TABS

Load Conditions and Structural System Response:

The ideas introduced in this segment give a review of building loads and their impact on the auxiliary reaction of ordinary wood-surrounded homes. As appeared Table, building burdens can be isolated into sorts dependent on the introduction of the basic activity or powers that they prompt: vertical and flat (i.e., horizontal) loads.

Building Loads Categorized by Orientation:

Types of loads on a hypothetical building are as follows. ¾ Vertical Loads ¾ Dead (gravity) ¾ Live (gravity) ¾ Snow (gravity) ¾ Wind (uplift on roof) ¾ Seismic and wind (overturning) ¾ Seismic (vertical ground motion)

Horizontal (Lateral) Loads:

Direction of loads is horizontal w.r.t to the building. ¾ Wind ¾ Seismic(horizontal ground motion) ¾ Flood(static and dynamic hydraulic forces ¾ Soil(active lateral pressure)

Vertical Loads:

Gravity loads act indistinguishable way from gravity (i.e., descending or vertically) and incorporate dead, live, and snow loads. They are commonly static in nature and normally considered a consistently dispersed or thought burden. In this manner, deciding a gravity load on a pillar or segment is a moderately basic exercise that utilizes the idea of tributary territories to allocate burdens to auxiliary components, including the dead burden (i.e., load of the development) and any connected loads(i.e., live burden).

For instance, the tributary gravity load on a story joist would incorporate the uniform floor load(dead and live) connected to the zone of floor bolstered by the individual joist. The auxiliary planner at that point chooses a standard shaft or section model to dissect bearing association powers (i.e., responses) interior anxieties (i.e., bowing burdens, shear stresses, and hub stresses) and dependability of the basic part or framework a for pillar conditions.

The choice of a fitting explanatory model is, anyway no minor issue, particularly if the auxiliary framework withdraws fundamentally from customary designing suspicions are especially important to the basic frameworks that include numerous parts of a house, yet to differing degrees. Wind elevate powers are created by negative (suction) weights acting an outward way from the outside of the rooftop because of the optimal design of wind streaming over and around the building.

Lateral Loads:

The essential loads that create parallel powers on structures are inferable from powers related with wind, seismic ground movement, floods, and soil. Wind and seismic horizontal burdens apply to the whole building. Horizontal powers from wind are produced by positive breeze weights on the windward substance of the building and by negative weights on the leeward essence of the building, making a consolidated push and-draw impact. Seismic horizontal powers are created by a structure's dynamic inertial reaction to cyclic ground development.

The size of the seismic shear (i.e., lateral)load relies upon the greatness of the ground movement, the structures mass, and the dynamic basic reaction characteristics(i.e., hosing, flexibility ,common time of vibration ,etc).for houses and other comparative low ascent structures, a rearranged seismic burden investigation utilizes identical static powers dependent on essential Newtonian mechanics(F=ma) with to some degree subjective(i.e., experience-based) acclimations to represent inelastic, pliable reaction qualities of different building frameworks.

Flood loads are commonly limited by hoisting the structure on an appropriately planned establishment or stayed away from by not working in a flood plain. Horizontal burdens from moving flood waters and static water powered weight are significant. Soil parallel burdens apply explicitly to establishment divider structure, chiefly as an "out-of-plane" twisting burden on the divider. Horizontal loads additionally create a toppling

minute that must be balanced by the dead burden and associations of the building.

Consequently, upsetting powers on associations intended to control segments from turning or the working from toppling must be considered. Since wind is fit for the creating concurrent rooftop inspire and horizontal loads, the elevate part of the breeze load intensifies the upsetting pressure powers because of the sidelong segment of the breeze load. Then again the dead burden might be adequate to counterbalance the toppling and elevate powers similar to the case in lower configuration wind conditions and in numerous seismic structure conditions.

IV.STRUCTURAL SYSTEMS

As far back as 1948,it was resolved that "traditions all in all utilization for wood, steel and solid structures are not extremely supportive for planning houses since few are applicable"(NBS,1948).More explicitly, the NBS report empowers the utilization of further developed strategies for basic investigation for homes. Sadly the investigation being referred to and every single ensuing examination tending to the point of framework execution in lodging have not prompted the advancement or use of any huge enhancement in the systematized structure practice as connected to lodging frameworks.

This absence of utilization is mostly because of traditionalist nature of the building procedure and somewhat because of trouble of deciphering the aftereffects of barely centered basic frameworks concentrates to general structure applications. Since this archive is barely checked to address private development, applicable framework Based examinations and plan data for lodging are talked about, referenced, and connected as suitable. In the event that a basic part will be a piece of framework, as it ordinarily the case in light edge private development, its reaction is adjusted by the quality and solidness attributes of the framework all in all.

All in all, framework execution incorporates two fundamental ideas known as burden sharing and composite activity. Burden sharing is found in dull part systems(i.e., wood encircling) and mirrors the capacity of the heap on one part to be shared by another or, on account of a uniform burden, the capacity of a portion of the heap on a more fragile part to be conveyed by adjoining individuals.

Design loads for residential buildings:

General Loads are an essential thought in any building plan since they characterize the nature and size of dangers are outside powers that a building must oppose to give a sensible performance(i.e., wellbeing and workableness)all through the structure's helpful life. The foreseen burdens are impacted by a building's proposed use (inhabitance and capacity), arrangement (estimate and shape)and location(climate and site conditions).Ultimately, the sort and extent of configuration loads influence basic choices, for example, material gathering, development subtleties and engineering design.

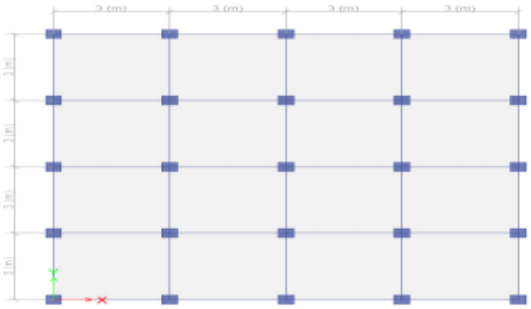


Figure: plan of g+ 8 structures

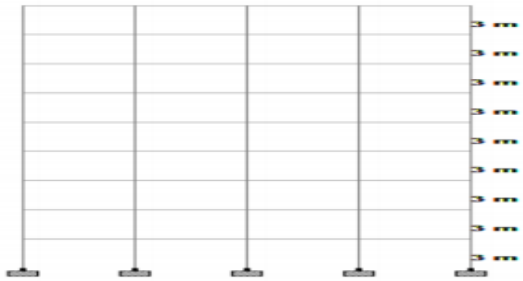


Figure: regular structure

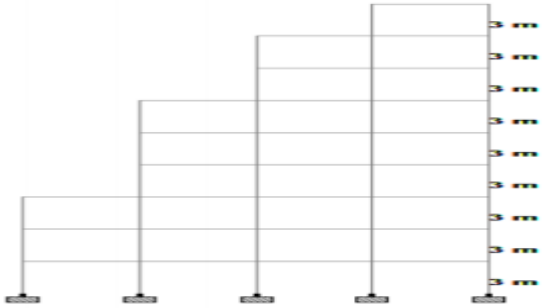


Figure: irregular structure

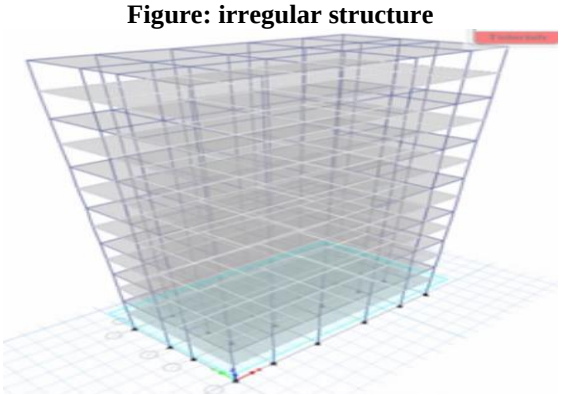


Figure shows the 3-D design of the G+8 multistore building

Dead Loads:

Dead loads comprise of the lasting development material burdens compacting the rooftop, floor, divider, and establishment frameworks, including claddings completes and settled hardware. Dead burden is the absolute heap of the majority of the segments of the parts of the building that for the most part don't change after some time, for

example, the steel sections, solid floors, blocks, roofing material and so forth. In staad professional task of dead burden is naturally done by giving the property of the part. In burden case we have choice called self-weight which consequently ascertains loads utilizing the properties of material i.e., thickness and after task of dead burden the skeletal structure looks red in shading as appeared in the figure.

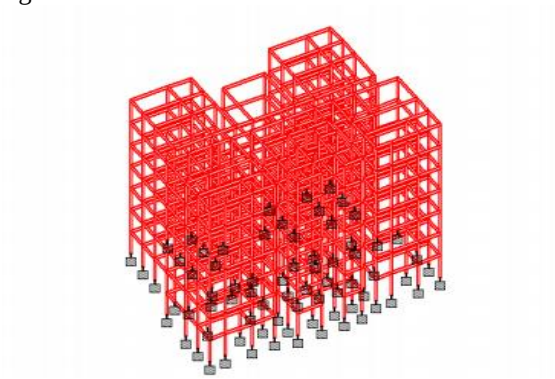


Figure shows the dead load on G+8 building

Live Loads:

Live loads are delivered by the utilization and inhabitance of a building. Burdens incorporate those from human tenants, decorations, no settled gear, stockpiling, and development and support exercises. As required to sufficiently characterize the stacking condition, loads are introduced as far as uniform zone loads, concentrated loads, and uniform line loads. The uniform and thought live loads ought not be connected at the same time n an auxiliary assessment.

Concentrated burdens ought to be connected to a little territory or surface steady with the application and ought to be found or coordinated to give the greatest burden impact conceivable in endues conditions. For instance The stair heap of 300 pounds ought to be connected to the focal point of the stair track between backings.

In staad we assign live load in terms of U.D.L .we has to create a load case for live load and select all the beams to carry such load. After the assignment of the live load the structure appears as shown below For our structure live load is taken as 25 N/mm for design.

Live loads are calculated as per IS 875 part 2

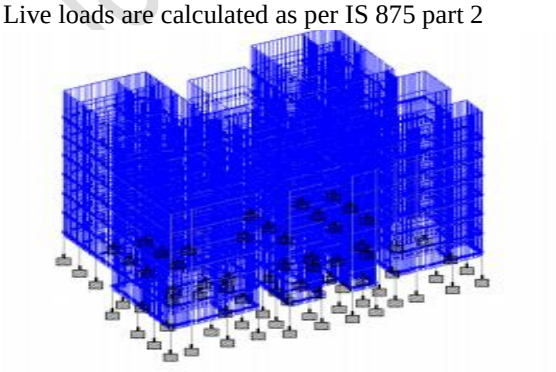


Figure: shows the live load on G+8 building

Wind loads:

In the rundown of burdens we can see wind load is available both in vertical and level burdens. This is on the grounds that breeze load causes elevate of the rooftop by making a negative(suction) weight on the highest point of the roof wind produces non static loads on a structure at exceedingly factor sizes. the variety in weights at various areas on a building is mind boggling to the point that weights may turn out to be excessively diagnostically escalated for exact thought in structure. In this way, wind load details endeavor to enhance the structure issue by considering essential static weight zones on a building illustrative of pinnacle stacks that are probably going to be experienced. The pinnacle weights in a single zone for provided breeze guidance may not, However, happen at the same time in different zones.

4.6.Load combinations:

All the heap cases are tried by taking burden factors and breaking down the working in various burden mix according to IS456 and broke down the working for all the heap mixes and results are taken and most extreme burden blend is chosen for the plan

Live load	Dead load	Wind load
1.5	1.5	0
1.2	1.2	1.2
0.9	0.9	0.9

At the point when the building is intended for both breeze and seismic burdens limit of both is taken. Since wind and seismic don't come at same time according to code Structure is investigated by taking all the above blends.

V.BEAMS DESIGN

Shafts exchange load from pieces to segments .bars are intended for bowing. By and large we have two sorts of bar: single and twofold. Like sections geometry and edges of the shafts are alloted. Configuration bar direction is alloted and investigation is done, presently fortification subtleties are taken.

Beam design:

A strengthened solid bar ought to almost certainly oppose tractable, compressive and shear pressure actuated in it by burdens on the bar. There are three sorts of rein forced solid bars

1.) single reinforced beams
2.) double reinforced concrete
3.) flanged beams

Singly reinforced beams:

In separately strengthened essentially bolstered shafts steel bars are set close to the base of the bar where they are increasingly successful in opposing in the pliable twisting pressure. I cantilever pillars fortifying bars set close to the highest point of the

bar, for indistinguishable reason from on account of just bolstered shaft.

Doubly reinforced concrete beams:

It is strengthened under pressure strain districts. The need of steel of pressure locale emerges because of two reasons. At the point when profundity of bar is limited The quality accessibility separately strengthened shaft is in sufficient.

At a help of consistent bar where bowing minute changes sign, for example, circumstance may likewise emerge in structure of a bar roundabout in plan. Figure demonstrates the base and best fortification subtleties at three distinct areas. These computations are deciphered physically.

METHODS OF ANALYSIS

The analysis can be performed on the basis of external action, the behavior of structure or structural materials, and the type of structural model selected. Based on the type of external action and behavior of structure, the analysis can be further classified as:

Equivalent static analysis:

All design against seismic loads must consider the dynamic nature of the load. However, for simple regular structures, analysis by equivalent linear static methods is sufficient. This is permitted in most codes of practice for regular, low- to medium-rise buildings. This procedure does not require dynamic analysis, however, it account for the dynamics of building in an approximate manner. The static method is the simplest one as it requires less computational efforts and is based on formulates given in the code of practice. First, the design base shear is computed for the whole building, and it is then distributed along the height of the building. The lateral forces at each floor levels thus obtained are distributed to individuals lateral load resisting elements.The main objective of structural analysis is to determine internal forces, stresses and deformation of structures under various load effect.

Dynamic Analysis:

Dynamic analysis of structure is a part of structural analysis in which behavior of flexible structure subjected to dynamic loading is studied. Dynamic load always changes with time. Dynamic load comprises of wind, live load, earthquake load etc. Thus in general we can say almost all the real life problems can be studied dynamically. If dynamic loads changes gradually the structures response may be approximately calculated by a static analysis in which inertia forces can be neglected. But if the dynamic load changes quickly, the response must be determined with the help of dynamic analysis in which we cannot neglect inertial force which is equal to mass time of acceleration

Response Spectrum Analysis:

Response spectrum method is the linear dynamic analysis method. This method is applicable for those structures where modes other than the fundamental one affect significantly the response of the structure. In this method the peak responses of a structure during an earthquake is obtained directly from the earthquake responses (or design) spectrum. The response of Multi- Degree- of Freedom (MDOF) system is expressed as the superposition of modal response, each modal response being determined from the spectral analysis of Single – Degree- of Freedom (SDOF) system, which are then combined to compute the total response. Modal analysis leads to the response history of the structure to a specified ground motion; however, the method is usually used in conjunction with a response spectrum. The maximum response is plotted against the undamped natural period and for various damping values, and can be expressed in terms of maximum relative velocity or maximum relative displacement.

Time History Method:

Time History analysis is a step by step analysis of the dynamic response of the structure at each increment of time when its base is subjected to specific ground motion time history. To perform such an analysis a representative earthquake time history is required for a structure being evaluated. It is used to determine the seismic response of a structure under dynamic loading of representative earthquake.

A linear time history analysis overcomes all the disadvantages of modal response spectrum analysis, provided non-linear behavior is not involved. This method requires greater computational efforts for calculating the response at discrete time. One interesting advantage of such procedure is that the relative signs of response qualities are preserved in the response histories. This is important when interaction effects are considered in design among stress resultants.

Here dynamic response of the plane frame is modeled to specified time history compatible to IS code spectrum and Sumatra earthquake.

STRUCTURAL MODELING AND ANALYSIS

The behaviors of the multi storey building with and without floating column have been carried out under earthquake excitation. The building is modelled for Sumatra earthquake and response spectrum analysis.

The building considered here consists of fifteen storeys, i.e.G+8. The building is modeled using the software ETABS 9. The analytical models of the building include all the component that influence the mass, strength, stiffness and deformability of structure. The building structural system consists of beam, column, slab, wall, foundation, retaining wall, elevator, and staircase. The non-structural elements that do not significantly influence the

building behavior are not modeled. Beams and columns are modeled as two nodded beams. The floor slabs are assumed to act as diaphragms, which ensure integral action of all vertical load resisting elements. The wall load is uniformly distributed over beams. Walls are considered to be rigidly connected to beams and columns. In the modeling, material is considered as an isotropic material. The 3D building model generated in ETABS 9 is shown in figure

ETABS:

ETABS is the present-day leading design software in the market. Many design company's use this software for their project design purpose. The innovative and revolutionary new ETABS is the ultimate integrated software package for the structural analysis and design of buildings. Incorporating 40 years of continuous research and development, this latest ETABS offers unmatched 3D object based modeling and visualization tools, blazingly fast linear and nonlinear analytical power, sophisticated and comprehensive design capabilities for a wide-range of materials, and insightful graphic displays, reports, and schematic drawings that allow users to quickly and easily decipher and understand analysis and design results. From the start of design conception through the production of schematic drawings, ETABS integrates every aspect of the engineering design process. Creation of models has never been easier - intuitive drawing commands allow for the rapid.

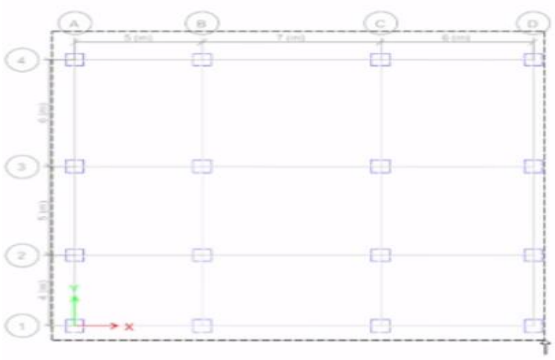


FIGURE 4.1 BASE STRUCTURE OF DUAL STORY BUILDING

FIGURE 4.2 SHOWS THAT PLANE SURFACE OF SHEAR GENERAL WALL

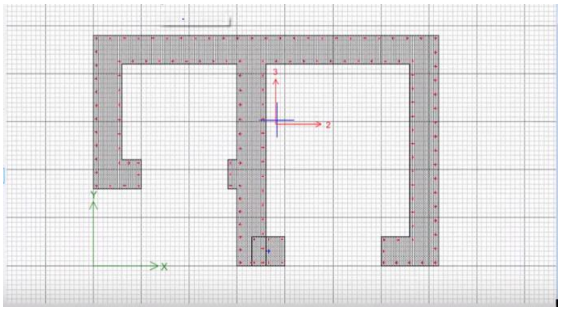
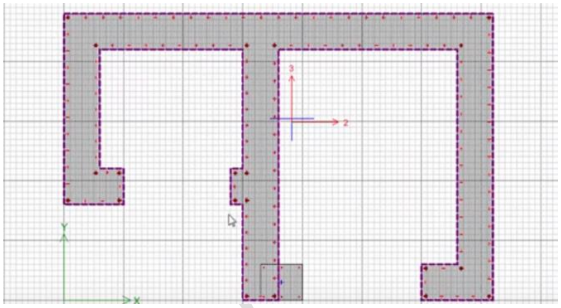


FIG 4.3 SHOWS THAT PLANE SURFACE OF SHEAR 3D GENERAL WALL



THE FIG 4.4 SHOWS THAT 3D VIEW PAIR LONGTUTUDINAL REIN FORCING AREA

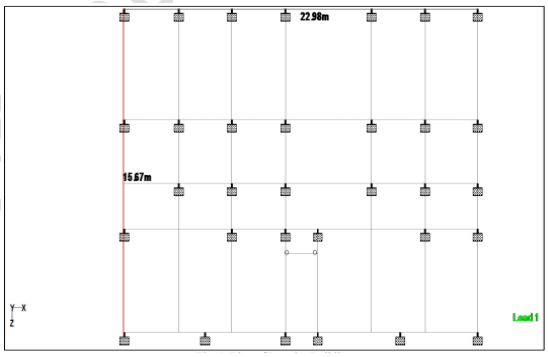


Figure: Plan of Regular multi stored Building

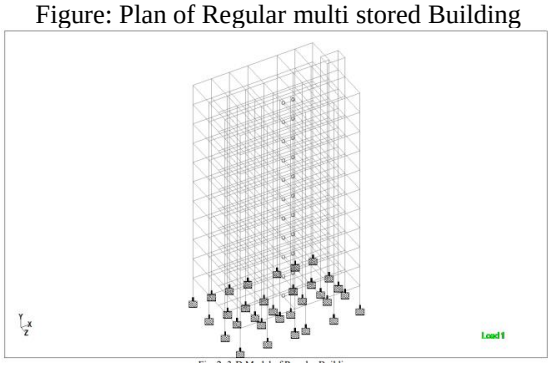
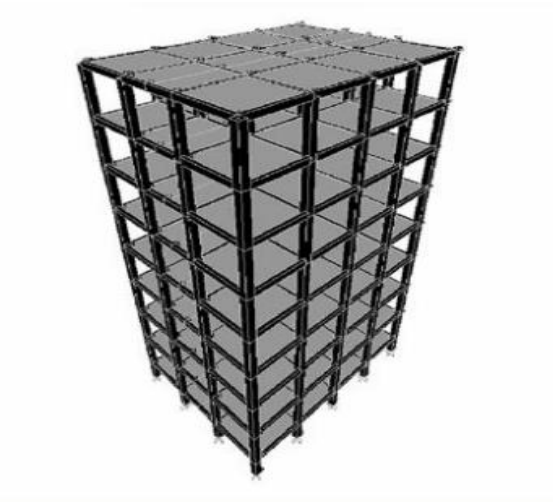
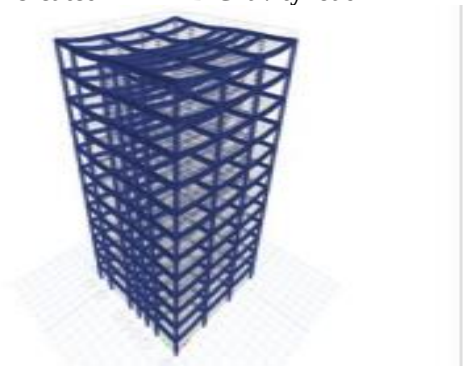


Fig. 2: 3-D Model of Regular multi stored Building



3-D view of the eight storey building (G+8) created in ETAB Gravity load



Column and beam reinforcement details

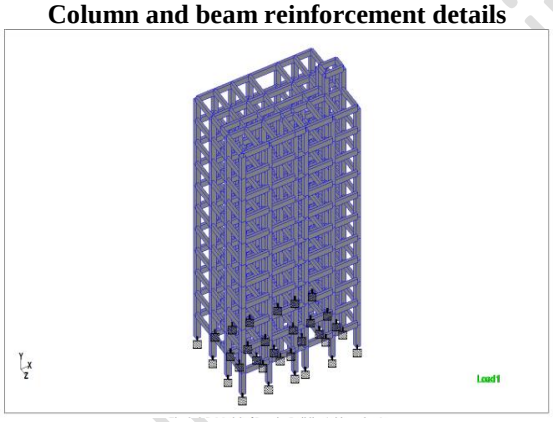


Figure: 3-D Model of Regular multi stored Building (with sections)

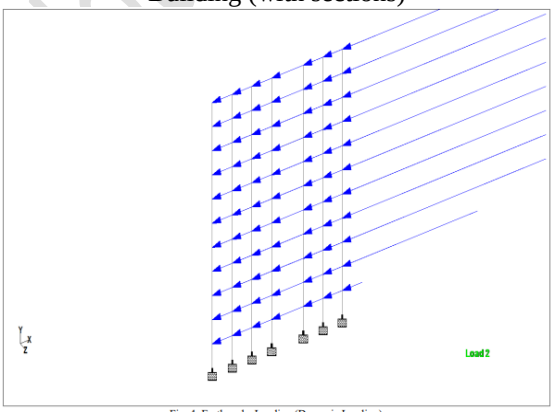


Fig: Earthquake Loading (Dynamic Loading)

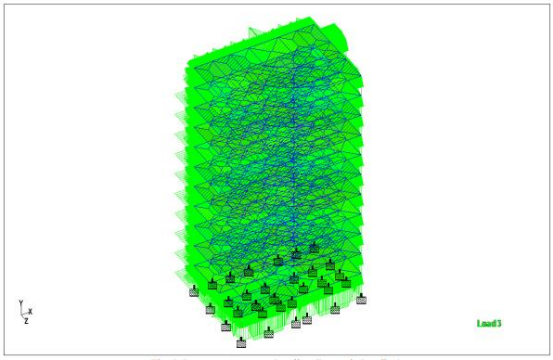


Figure: Response Spectrum Loading (Dynamic Loading)

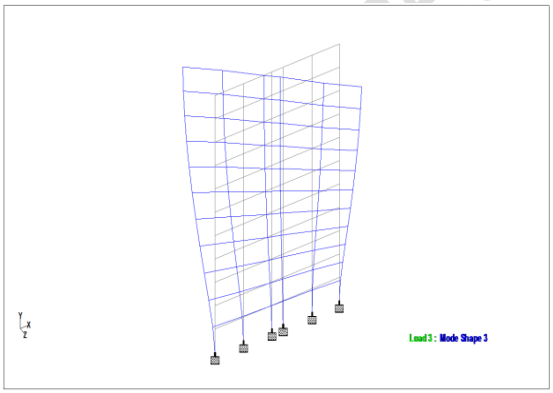


Figure: Response Spectrum Loading (Mode Shape)

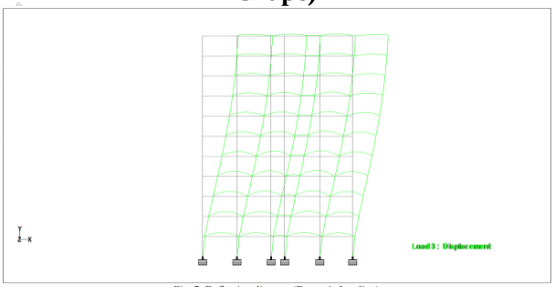


Figure: Deflection diagram (Dynamic Loading)

The above RCC frame structure is analysed both statically and dynamically and the results are compared for the following three categories namely Beam Stresses, Axial Forces, Torsion, Displacements and Moment at different nodes and beams and the results are tabulated as a shown below.

Table 4.1 Comparison of Moment for Vertical Members:

Column number	L/C	Static analysis (KN-M)	L/C	Dynamic analysis (kn-m)
949	9	204.49	10	313.6
917	9	292.37	10	433.17
885	9	371.82	10	574.08
853	9	426.2	10	691.36
821	9	462.21	10	787.2
789	9	484.15	10	862.07

Table 4.2 Comparison of Axial Forces for Vertical Members:

Column Number	L/C	Static Analysis (Kn)	L/C	Dynamic Analysis (Kn)
9947	9	119.9	10	127.3
915	9	295.5	10	305.5
883	9	468.8	10	479.7
851	9	639.1	10	649.6
819	9	806.7	10	815.03
787	9	971.647	10	976.007

Table 4.3 Comparison of Torsion for Vertical Members:

Column number	L/c	Static analysis (kn-m)	L/c	Dynamic analysis (kn-m)
946	EQ+X	-6.036	RE	17.347
914	EQ+X	-7.936	RE	30.23
882	EQ+X	-8.47	RE	35.247
850	EQ+X	-8.642	RE	54.816
818	EQ+X	-8.65	RE	65.58
786	EQ+X	-8.48	RE	74.72

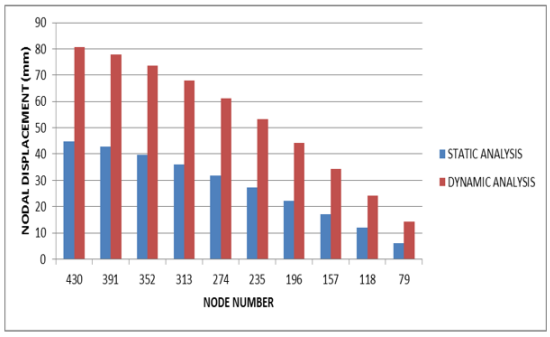
EQ+X = Earthquake Loading in X-Direction (+).
RE = Response Spectrum Loading.

Table 4.4 Comparison of Displacements for Vertical Members:

Column Number	L/C	Static Analysis (Mm)	L/C	Dynamic Analysis (Mm)
949	9	41.56	10	70.892
917	9	39.715	10	68.33
885	9	37.138	10	64.62
853	9	33.848	10	59.72
821	9	29.959	10	53.67
789	9	25.617	10	46.6

Table 4.4 Comparison of Nodal-Displacements in Z-Direction;

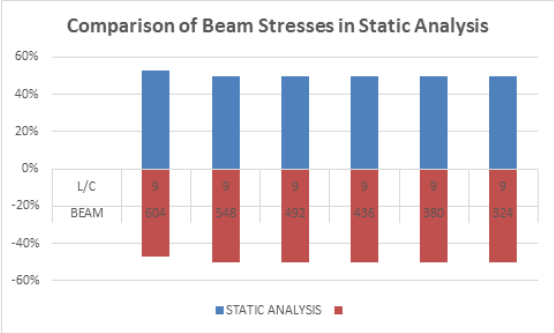
Node number	L/C	Static analysis (mm)	L/C	Dynamic analysis (mm)
430	9	44.7	10	80.6
391	9	42.7	10	77.8
352	9	39.8	10	73.6
313	9	36.1	10	68.07
274	9	31.8	10	61.2
235	9	27.1	10	53.1
196	9	22.2	10	44.1
157	9	17.06	10	34.4
118	9	11.8	10	24.2
79	9	6.9	10	14.1



Nodal-Displacements in Z-Direction

Table: 4.5 Comparison of Beam Stresses in Static Analysis

		STATIC ANALYSIS	
BEAM	L/C	MAX COMPRESSIVE STRESS (N/mm²)	MAX TENSILE STRESS (N/mm²)
604	9	6.49	-5.82
548	9	9.1	-9.09
492	9	10.82	-10.84
436	9	12.24	-12.25
380	9	13.27	-13.29
324	9	13.93	-13.95



Graph: Comparison of Beam Stresses in Static Analysis

Table: 4.6 Comparison of Beam Stresses in Dynamic Analysis

		DYNAMIC ANALYSIS	
BEAM	L/C	MAX COMPRESSIVE STRESS (N/mm²)	MAX TENSILE STRESS (N/mm²)
604	10	10.95	-10.44
548	10	13.67	-13.6
492	10	16.01	-15.98
436	10	18.27	-18.24
380	10	20.23	-20.2
324	10	21.78	-21.76

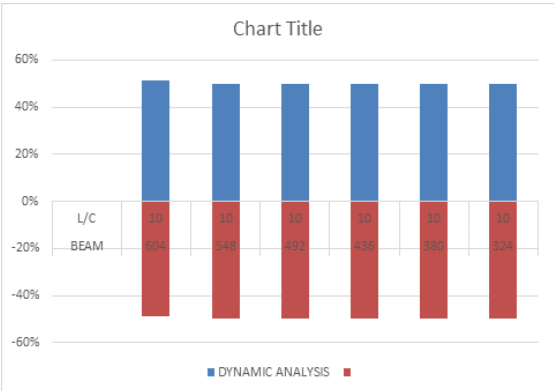


Figure: Beam Stresses in Dynamic Analysis

As per the results in Table No 4.1 We can see that the values for Moments are 35 to 45 % higher for Dynamic analysis than the values obtained for Static analysis.

As per the results in Table No 4.2We can see that there is not much difference in the values of Axial Forces as obtained by Static and Dynamic Analysis of the RCC Structure.

As per the results in Table No 4.3 We can see that the values of Torsion of columns are negative for Static analysis and for Dynamic analysis the values of torsion are positive.

As per the results in Table No 4.4 We can see that the values for Displacements of columns are 40 to 45% higher for Dynamic analysis than the values obtained for Static analysis.

VI.CONCLUSION

Static procedures are appropriate when higher mode effects are not significant. This is generally true for short, regular buildings. Therefore, for all buildings, buildings with torsional irregularities, or non-orthogonal systems, a dynamic procedure is required. The seismic input is modeled using either modal spectral analysis or time history analysis but in both cases, the corresponding internal forces and displacement are determined using linear elastic analysis. The advantage of these linear dynamic procedures with respect to linear static procedures is that higher modes can be considered. However, they are based on linear elastic response and hence the applicability decreases with increasing nonlinear behavior, which is approximated by global force reduction factor. Different types of investigation techniques accessible for examination of multi-story structures which are Response spectrum method, Equivalent lateral force method, Time history method and code provision technique. Many authors tried to study analysis of multi-story building one or more method. There is no consensus on the particular method being best one. The most popular among them method are asseismic coefficient method and response spectrum method. This comparative study is defined as the reviewing some of research reports on analysis of multi-story building using Equivalent Lateral Force Method and Response Spectrum Method. The results obtained from the structure presented herein have shown that the torsional irregularity in a structure subjected to seismic loading may be influenced by the direction of seismic loading as well the loading approach and strongly lead to analyzing irregular buildings for torsion. Even though the dynamic RS analysis method of seismic design is the prefered method due to the computional advantage in predicting response of structural systems where it involves the calculation of only the maximum values of the induced response in each mode. However, The ESF analysis method is used as a benchmark to scale the design base shear obtained by the dynamic RS analysis before the distribution of the lateral seismic forces over the height of the structure under the dynamic RS base shear.

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