Brief Study of Multi-storey Residential Building under Earth Quake Zone and Normal Zone in Staad Pro (G+50)

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Abstract: An earthquake is a natural phenomenon where there is a dislocation of the earth's segment takes places. This results in failure of the structure. The main reasons for these failures are insufficient lateral stiffness and also irregularities. In this paper, an attempt is made to study the behavior of structure under earthquake zone and the normal zone at hard soil. In present work, the comparison between multi storied residential building under earthquake zone and at normal zone of G+50 storey at different earthquake zones like zone II, zone V. The modeling of the building is done using the software STAAD PRO v8i and analysis of the structure is carried out. AUTO CAD also used for planning the structure. And for designing of footings we use STAAD FOUNDATIONS. The parameters analyzed were bending moments, Shear force.

Key words: Beams, Columns, Shear force, bending moments, STAAD PRO software.

1. Introduction

Building construction is that the engineering offers with the development of constructing akin to residential buildings in a really effortless constructing will probably be outline as an enclose area via partitions with roof, food, fabric and accordingly the basic desires of contributors. Inside the early earlier interval people lived in caves, over bushes or beneath bushes, to safeguard themselves from wild animals, rain, sun, etc. Because the occasions handed as people being started dwelling in huts created from trees branches. The shelters of these previous are developed at the moment into wonderful residences. Rich individuals reside in sophisticated houses.

Structures are the primary indicator of social growth of the county. Every human has wished to possess cozy houses on an average most commonly one spends his two-third life occasions within the houses. The protection civic feel of the responsibility, These are the few motives which are accountable that the man or woman do utmost effort and pay tough-earned saving in owning houses.

These days the condominium building is essential work of the social progress of the county. Day-to-day new techniques are being developed for the development of residences economically, speedily and pleasing the requirements of the group engineers and designers do the seam work, planning and layout, etc, of the constructions. Trained employees are dependable for doing the drawing works of building as for the path of engineers and designers. The trained worker will have to apprehend his job and could also be competent to comply with the instruction of the engineer and could also be able to attract the desired drawing of the building, website plans and layout plans and many others, as for the necessities.

A constructing body consists of variety of bays and story. A multi-storey, multi-paneled body would be a tricky statically intermediate structure. A design of R.C building of G+6 flooring body work is preoccupied. The constructing in arrange (40×28) consists of columns designed monolithically forming a community. The scale of constructing is 40x28m. The amounts of columns are eighty five. It is residential advanced.

2. Design of Multi Storied Residential building

COMMON:

A constitution might be outlined as a body which could resist the utilized masses at the same time not considerable deformations. Civil engineering structures are created to serve some unique functions like human habitation, transportation, bridges, storage and so forth. Throughout a reliable and in your price range method, a constitution is an assemblage of man or woman accessories like mounted accessories (truss factors), beam factor, column, shear wall slab cable or arch. Structural engineering worries with the design, designing and the development of buildings.

Constitution evaluation entails the choice of the forces and displacements of the structures or accessories of a constitution. Design system involves
the choice and description of the factors that constitution the structural system. The predominant object of concrete design is to understand a structure that allows you to end in a comfortable within your budget resolution.

The target of the seem is
1. Footing design
2. Column design
3. Beam design
4. Slab design

3. Limit State Process

The article of design supported the limit state notion is to understand an acceptableness that a structure will not turn out to be unserviceable in its life time for the utilization that it is supposed i.e., it will no longer attain a limit state. During this limit state method all critical states must be suggestion of in design to verify a measure of safeguard and utility.

Limit state:
The acceptable limit for the security and utility requirements before failure occurs is named a restrict state.

Limit state of fall down:
That is corresponds to the utmost load carrying potential. Violation of crumple limit state implies failures within the give that a evidently outlined limit state of structural utility has been exceeded. But it surely doesn't mean whole fall down.

This limit state corresponds to:
   a. Flexural
   b. Compression
   c. Shear
   d. Torsion

Limit state of survivability:
This state corresponds to progress of excessive deformation and is employed for checking member in the course of which magnitude of deformations could restrict the expand of the constitution of its components.
   a. Deflection
   b. Cracking
   c. Vibration

4. Loads acting on the structure
   Load Conditions and Structural System Response

The ideas given during this section give a summary of building loads and their effect on the structural response of typical wood-framed houses. As shown in Table, building loads will be divided into varieties supported the orientation of the structural action or forces that they induce: vertical and horizontal (i.e., lateral) loads. Classifications of loads are represented within the following sections.

Building Loads Categorized By Orientation

Types of loads on an hypothetic building are as follows.

Horizontal (Lateral) Loads

Direction of loads is horizontal with respect to the building.

Vertical Loads

Gravity loads act within the same direction as gravity (i.e., downward or vertically) and include dead, live, and snow loads. They usually static in nature and frequently thought of a uniformly distributed or concentrated load. Thus, crucial a gravity load on a beam or column could be a comparatively easy exercise that uses the idea of tributary areas to assign loads to structural components, as well as the dead load (i.e., weight of the construction) and any applied loads(i.e., live load). To illustrate, the tributary gravity load on a joist would come with the uniform floor load (dead and live) applied to the world of floor supported by the individual beam.

The structural designer then selects a regular beam or column model to investigate bearing connection forces (i.e., reactions) internal stresses (i.e., bending stresses, shear stresses, and axial stresses) and stability of the support or system a for beam equations. The selection of an acceptable analytic model is, but no trivial matter, particularly if the structural system departs considerably from ancient engineering assumptions are notably relevant to the structural systems that comprise several components of a house, however to varied degrees.

Wind uplift forces are generated by negative (suction) pressures acting in an outward direction from the surface of the roof in response to the aerodynamics of wind flowing over and around the building.

As with gravity loads, the influence of land up carry pressures on a structure or assembly (i.e., roof) are analyzed by victimization the idea of tributary areas and uniformly distributed loads. The major distinction is that wind pressures act perpendicular to the building surface (not within the direction of gravity) which pressures vary consistent with the scale of the tributary space and its location on the building, notably proximity to changes in geometry (e.g., eaves, corners, and ridges).Even though the wind loads are dynamic and extremely variable, the look approach is based on a most static load (i.e., pressure) equivalent. Vertical forces are created by
overturning reactions because of wind and seismic lateral loads engaged on the general building and its lateral force resisting systems. Earthquakes conjointly manufacture vertical ground motions or accelerations which increase the impact of gravity loads. However, Vertical earthquake loads are sometimes considered to be implicitly addressed within the gravity load analysis of a light-frame building.

Lateral Loads

The primary loads that manufacture lateral forces on buildings are as a result of forces associated with wind, seismic ground motion, floods, and soil. Wind and seismic lateral loads apply to the complete building. Lateral forces from wind are generated by positive wind pressures on the windward face of the building and by negative pressures on the leeward face of the building, making a combined push and pull impact. Seismic lateral forces are generated by a structure’s dynamic mechanical phenomenon response to cyclic ground movement.

The magnitude of the seismic shear (i.e., lateral) load depends on the magnitude of the ground motion, the building’s mass, and therefore the dynamic structural response characteristics (i.e., dampening, ductility, natural amount of vibration, etc.) for houses and different similar low rise structures, a simplified seismic load analysis employs equivalent static forces supported fundamental Newtonian mechanics ($F = ma$) with somewhat subjective (i.e., experience-based) adjustments to account for inelastic, ductile response characteristics of varied building systems.

Flood loads are usually reduced by elevating the structure on a properly designed foundation or avoided by not building during a flood plain. Lateral loads from moving flood waters and static hydraulic pressure are substantial. Soil lateral loads apply specifically to foundation wall design, in the main as an "out of plane" bending load on the wall. Lateral loads conjointly manufacture an overturning moment that has got to be offset by the dead load and connections of the building. Therefore, overturning forces on connections designed to restrain elements from rotating or the building from overturning should be considered.

Since wind is capable of the generating co-occurring roof uplift and lateral loads, the uplift component of the wind load exacerbates the overturning tension forces because of the lateral component of the wind load. Conversely the dead load is also recent to offset the overturning and uplift forces as is that the case in lower design wind conditions and in several seismic design conditions.

Design Loads for Residential Buildings

Dead Loads

Dead loads comprises the permanent construction material loads press the roof, floor, wall, and foundation systems, as well as claddings, finishes and stuck instrumentality. Dead load is that the total load of all of the elements of the elements of the building that usually do not modification over time, cherish the steel columns, concrete floors, bricks, building material etc.

In staad pro assignment of dead load is mechanically done by giving the property of the member. In load case we've got possibility referred to as self weight that mechanically calculates weights victimization the properties of fabric i.e., density and when assignment of dead load the body structure appearance red in color as shown within the figure.

Example for calculation of dead load

Dead load calculation

Weight = Volume × Density

Self weight floor finish = 0.12×25+1 = 3KN/m²

The higher than example shows a sample calculation of dead load.

Dead load is calculated as per IS 875 part 1

Live Loads

Live loads are created by the utilization and occupancy of a building. Loads embrace those from human occupants, furnishings, no fastened instrumentality, storage, and construction and maintenance activities. As needed to adequately outline the dead load condition, loads are presented in terms of uniform space loads, concentrated loads, and uniform line loads. The uniform and concentrated live loads shouldn't be applied at the same time in a structural evaluation. Concentrated loads ought to be applied to a low space or surface in keeping with the application and may be placed or
directed to allow the utmost load impact attainable in enduse conditions. To illustrate. The support load of 300 pounds ought to be applied to the middle of the stair tread between supports.

In staad we have a tendency to assign live load in terms of U.D.L .we has got to produce a load case for live load and select all the beams to hold such load. When the assignment of the live load the structure seems 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

Diagram of live load

Wind Loads

In the list of loads we will see wind load is gift each in vertical and horizontal loads. This is as a result of wind load causes uplift of the roof by making a negative (suction) pressure on the top of the roof.

Fig.6 a diagram of wind load

Wind produces non static loads on a structure at highly variable magnitudes. The variation in pressures at totally different locations on a building is advanced to the purpose that pressures might become too analytically intensive for precise thought in design. Therefore, wind load specifications attempt to amplify the look drawback by considering basic static pressure zones on a building representative of peak loads that are probably to be experienced. The peak pressures in one zone for a given wind direction might not, However, occur at the same time in different zones. For some pressure zones, the peak pressure depends on an arrow vary of wind direction. Therefore, the wind directionality impact should even be factored into crucial risk consistent wind loads on buildings.

In fact, most recent wind load specifications realize of wind load radial asymmetry and different effects in crucial nominal design loads in some simplified form(sbcci,1999; ASCe,1999).this section any simplifies wind load design specifications to provide an easy however effective approach for planning typical residential buildings. As a result of they vary substantially over the surface of a building. Wind load star thought of at 2 totally different scales. On large scale, the load created on the general building are on major structural systems that sustain wind loads from over one surface of building, are thought of the most wind force resisting systems (MWFRS).the MWFRS of a home includes the shear walls, Diaphragms that create the lateral force resisting systems (LFRS).As well because the structural systems cherish trusses that experience loads from two surfaces are regimes of the building. The wind loads applied to the MWFRS account for the big affects of your time varied wind pressures on the surface are surfaces of the building. On a Smaller scale, pressures are somewhat greater on localized expanse of the building, notably close to abrupt changes in building geometry (i.e., eaves, ridges, and corners). These higher wind pressures occur on smaller areas, particularly touching the loads borne by elements and protective covering (e.g., sheathing, windows, doors, purling, and studs). Wind produces non static loads on a structure at extremely variable magnitudes. The variation in the elements and protective covering (C&C) transfer localized time-varying loads to the MWFRS, at that purpose the loads average out each spatially and temporally since, at a given time, some elements might beat close to peak loads whereas others are at well lower than peak. The next section presents a simplified method for crucial each MWFRS and C&C wind loads.

Century, modernism morphed into the international vogue, an aesthetic epitomized in many ways by the dual Towers of latest York's world trade center. Many architects resisted modernism, finding it destitute of the ornamental richness of ornamented designs. Nevertheless because the movement lost influence within the late Nineteen Seventies, genre
developed as a reaction against the austerity of Modernism. Parliamentarian ventures' rivalry that a "decorated shed" (an standard building that is functionally designed within and embellished on the outside) was higher than a "Duck" (a building during which the entire kind and it's perform are tied together) provides a plan of this approach. Assignment of wind speed is sort of totally different compared to remaining loads. We have to outline a load case before assignment.

After planning wind load will be allotted in 2 ways that

1. Aggregation the quality values of load intensities for a selected heights and distribution of the loads for various height.

2. Calculation of wind load as per IS 875 part 3.

We designed our structure victimization second method that involves the calculation of wind load using wind speed.

In Hyderabad we've got a wind speed of forty five kmph for 10 m height and this worth is employed in calculation.

After the assignment of wind load the structure appearance as shown in figure

4.4.3.1 Basic Wind Speed
Gives basic wind speed of India, as applicable to 1m height higher than suggests that ground level for different zones of the country. Basic wind speed is predicated on peak simply speed averaged over a short measure of regarding three seconds And corresponds to mean heights higher than ground level in an open tract.

The wind speed for a few vital cities/towns is given table below.

4.4.3.2 Design Wind Speed
The basic wind speed \( V_b \) for any web site shall be obtained the subsequent effects to induce design wind velocity at any height \( V_z \) for the chosen structure. Risk level

a. Terrain roughness, height and size of the structure and
b. Local topography

It will be mathematically expressed as follows:

\[
V_z = V_b \times K_1 \times K_2 \times K_3
\]

Where

\[
V_z \quad \text{Design wind speed at any height Z in m/s}
\]

\[
K_1 \quad \text{Probability factor (risk coefficient)}
\]

\[
K_2 \quad \text{Terrain height and structure size factor and}
\]

\[
K_3 \quad \text{Topography factor}
\]

Floor Load
Floor load is calculated supported the load on the slabs. Assignment of floor load is finished by making a load case for floor load. When the assignment of floor load our structure appearance as shown within the below figure.

The intensity of the floor load taken is: 0.0035 N/mm² -ve sign indicates that floor load is acting downwardly.

4.4.5 Load Combinations
All the load cases are tested by taking load factors and analyzing the building in numerous load combinations as per IS456 and analyzed the building for all the load combos and results are taken and most load combination is chosen for the look

<table>
<thead>
<tr>
<th>Load factors as per IS456-2000</th>
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<tr>
<td>Live load</td>
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<tr>
<td>1.2</td>
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<td>0.9</td>
</tr>
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</table>

When the building is intended for each wind and seismic loads most of each is taken.
Because wind and seismic don't return at same time as per code. Structure is analyzed by taking all the higher than combos.

5. RESULT AND DISCUSSION:
6. COMPARISON OF STRUCTURE

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<tr>
<th>SOIL TYPE</th>
<th>ZONE</th>
<th>TIME PERIOD(Sec)</th>
<th>Sa/g</th>
<th>BASE SHEAR(KN)</th>
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HARD SOIL FOR DIFFERENT ZONES for EQX

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BASE SHEAR FOR HARD SOIL

HARD SOIL FOR DIFFERENT ZONES for EQZ

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BASE SHEAR FOR MEDIUM SOIL

MEDIUM SOIL FOR DIFFERENT ZONES for EQX

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<th>SOIL TYPE</th>
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BEAM END FORCES
CONCLUSION

The behavior of high rise structure for both the scheme is studied in present paper. In this paper we got the results from mathematical model for model I and model II. The graph clearly shows the story drift, lateral displacement and time period is more in model I as compared to model II. It is also observed that the results are more conservative in Static analysis as compared to the dynamic method resulting uneconomical structure. From all the results it is found that model II is very effective in resisting the lateral forces induced by Earthquake. Because of the Box effect of modular type scheme, it is increasing overall stiffness of the building thus, reducing the sway problem in the structure. As building is in irregular the behavior in both directions is not similar.

Further, the comparison between regular and modular type indicates the overall feasibility of the scheme without affecting its stability in gravity as well as lateral loads

1. Designing victimization Software’s like Staad reduces lot of your time in design work.

2. Details of every and each member will be obtained victimization staad pro.

3. All the List of unsuccessful beams will be obtained and conjointly higher Section is given by the software.

4. Accuracy is improved by victimization software.

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