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SEISMIC ANALYSIS AND UPGRADATION OF STRUCTURES USING LATERAL SYSTEMS

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ABSTRACT

The basic principles of design for vertical and lateral loads (wind & seismic) are the same for low, medium and the high rise building. And building gets high both vertical load & lateral loads become controlling factors. Vertical loads are directly proportion with the increase in floor area with the number of floors. In this contrast, the effect of lateral forces on a building is not linear and increase rapidly with rise in height. Lateral loads and moments on steel components will be very much high. Bracing reduces moments

In the present analysis, a residential building with 12 floors is analyzed with columns; columns with V bracings at different locations were for all the cases. And Moments, Base Shear, Displacement, storey shear were compared for all the cases. The deflection was reduced by providing the bracings.

Earthquake load is becoming a great concern in our country as because not a single zone can be designated as earthquake resistant zone. The most important point is to construct a building structure that can resist the seismic loads efficiently or not. Research Study has been made on the different structural arrangement to find out the most optimized solution to produce an efficient safe earthquake resistant building.

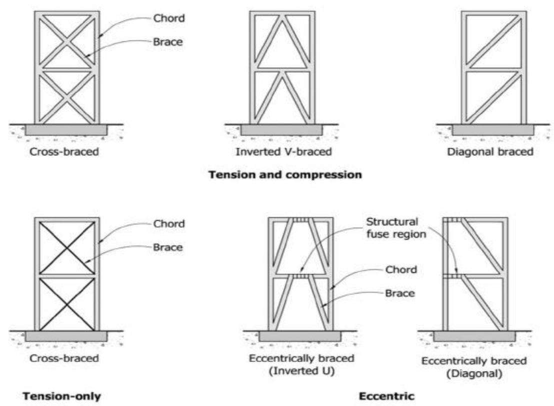
A commercial package ETABS has been utilized for analyzing high-rise building of 36m height. Result has been compared by using tables & graph to find out the most optimum solution. Conclusion has been made on the basis of this analysis & comparison

KEYWORDS: Lateral loading, high rise buildings, Moments, Base Shear, Displacement, Drift, storey shear, bracings,ETABS.

INTRODUCTION

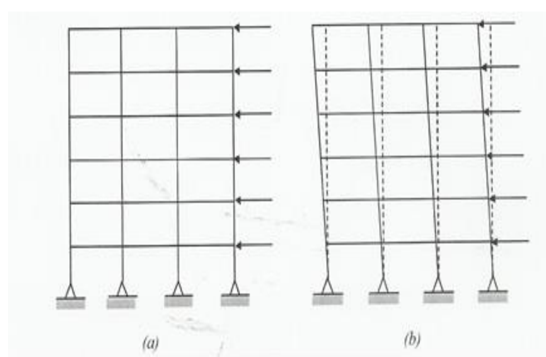
Braced-frame structures:

In braced frame structures the diagonal members act together with the girders to form the 'web' of the vertical truss, with the columns acting as the 'chords'. The horizontal shear on the building is resisted by the horizontal components by means of axial tensile or compressive actions in the web members. In resisting lateral loads bracing systems are highly efficient. Bracing is usually regarded as an exclusively steel system since the diagonals are mainly subjected to tension in one or the other directions of lateral loading. Concrete bracings of double diagonal form are also used with each diagonal designed as a compression member to cart the full external shear.



The conventional use of bracings has been in bay width modules and storey height that are fully concealed in the finished building. More recently external large scale bracings, extending over many stories and bays has been used to produce not only aesthetical attractive buildings but also highly efficient structures. The bracings are highly efficient in being able to produce very stiff structures laterally for a minimum of additional material. Thus makes it an economical structural form for any height of building. An extra advantage of fully triangulated bracing is that the girders usually participate minimally in the lateral bracing action making the floor frame deign is independent of its level in the structure, therefore, can be repetitive up the height of the building with obvious economy in fabrication and design. The main disadvantage of diagonal bracing is that it obstructs the internal planning and the location of windows and doors. To overcome this disadvantage braced bents are incorporated internally along wall and partition lines, and especially along the stair case, elevator and service shafts. The other drawback of diagonal bracing is that the diagonal connections are costly and erect

Lateral loading systems
A multi-storey building with no lateral bracing is shown in figure. When the beams and columns shown are connected with simple beam connections, the frame would have practically no resistance to the lateral forces and become geometrically unstable. The frame would be laterally deflect as shown in the below figure even under a small lateral loa



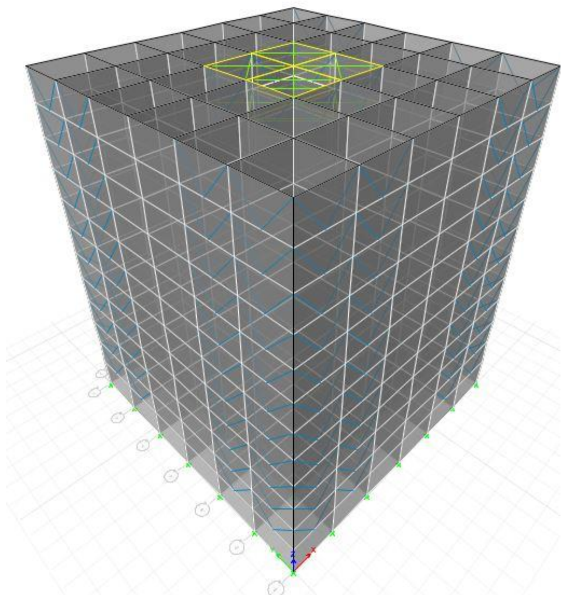
multi storey frame with out lateral bracing

Loading on tall buildings is different from low-rise buildings in many ways such as large accumulation of gravity loads on the floors from top to bottom, increased significance of wind loading and greater importance of dynamic effects. Thus, multi-storied structures need correct assessment of loads for safe and economical design.

Excepting dead loads, the assessment of loads cannot be done accurately. Live loads can be anticipated approximately from a combination of experience and the previous field observations. But, wind and earthquake loads are random in nature. It is difficult to predict them exactly. These are estimated based on probabilistic approach.

DETAILS OF THE STRUCTURE

Our project deals with the earthquake resistant multistoried building, here the multistoried building is of earthquake resistant .For analysis we have to use software which is known as E-TABS. Through E-TABS, is used to analyze the columns and beam of multistoried building , here through E-TABS , we designed a multistoried building of G+12 floors buildings which is known as G +12 multistoried buildings. In the G + 4 multistoried buildings design a lift section in both the corner side of the storey



3d view of 12 storey building with v bracings

The plan of multistoried building is 33 x 25 m, here 33 is the length of the plan and 25 is the width of the plan and have a lift section design in the building. There are 6 flats in the ground floor and it is similar in the upper most part of the building and in the entry of the building one hall is have and in that hall we have given a lift section from bottom to upper part of the building.

SIZE OF STRUCTURAL MEMBERS

MATERIALS

Concrete grade : M30
All steel grades : Fe415 grade

Column Size:
From ground floor to fifth floor: 1100 mm X 1300 mm
From sixth floor to twelveth floor: 900 mm X 1200 mm

Beam Size: 400 mm X 600 mm

Slab Thickness: 120 mm

Brace Members Size: 230 mm X 230 mm
Grade of Concrete and Steel: M40; Fe 415 Steel

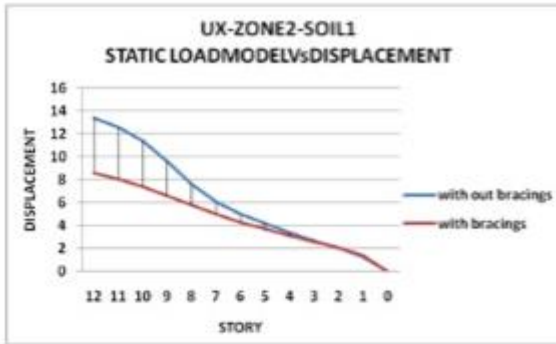
RESULTS AND DISCUSSIONS

GENERAL:

Results obtained from the analysis are lateral displacement, shear, and moment. Base shear and base moment. These results are shown for static, dynamic analysis.

RESULTS

For the purpose of study the top floor displacements 12storey building is collected for three soils with respect to zones factors (Z3 and Z5) and for different kind of structural systems (bracings and without bracings) with reference to the different loading conditions.



STOREY	with out bracings	with bracings
12	13.4	8.6
11	12.6	8.1
10	11.4	7.4
9	9.6	6.6
8	7.6	5.8
7	6.1	5
6	5	4.3
5	4.2	3.7
4	3.4	3.1
3	2.7	2.6
2	2.1	2.1
1	1.3	1.4
0	0	0

DISCUSSIONS

Case-1

Variation of Displacement for different zones & soils:

In this case the reduction of Displacement is observed when the lateral systems i.e. when bracings are provided in both directions UX & UY. The displacement for 12 storey building along UX direction is compared with zone 3 & each soil i.e. zone factor on X axis & displacement on Y axis, is to be noted that displacement of 40% is reduced from Z-2 to Z-5.Displacement in Y direction from it is to be noted that displacement of 45 % is reduced from Z-2 to Z-5.

Case-2

Variation of Shear for different Zones & Soils:

In this case the reduction of Shear is observed when the lateral systems i.e. when bracings under static load for both directions UX &UY. The Storey Shear for 23 storey building along UX direction is compared with each zone & each soil i.e. zone factor on X axis &Storey Shear on Y axis, from is to be noted that Storey Shear of 31% is reduced from Z-2 to Z-5. Storey Shear in Y direction it is to be noted that Storey Shear of 50% is reduced from Z-2 to Z-5.

Case-3

Variation of Moment for different Zones & Soils:

In this case Moment is analyzed in dynamic load and it is observed that Moment is increases with increase in zone factor. Taking different soils on X- axis & Moment on Y-axis and analyzed for each zone from Graph it is to be noted that Moment is decreased 30% from Z-2 to Z-5. Moment along Y from it is to be noted that Moment is increased 36% from Z-2 to Z-5.

Case-4

Variation of Base shear for different Zones & Soils:

In this case Moment is analyzed in dynamic load and it is observed that Moment is increases with increase in zone factor. Taking different soils on X- axis & Moment on Y-axis and analyzed for each zone from Graph it is to be noted that Moment is decreased 30% from Z-3 to Z-5.

Case-5

Variation of Base Moment for different Zones & Soils:

In this case Moment is analyzed in dynamic load and it is observed that Moment is decreases with increase in zone factor. Taking different soils on X- axis & Moment on Y-axis and analyzed for each zone from Graph it is to be noted that Moment is decreased 25% from Z-3 to Z-5.

SUMMARY:

In this the results obtained from the package ETABS 2013 i.e. displacement, shear, moment, base shear & Moment are shown in graphs with different zones & different soil and the behavior of this are discussed in this chapter.

CONCLUSIONS

Based on the analysis

1. The structural performance is analyzed in two different models i.e. Without bracings, with bracings the variation of displacement is minimum only when the lateral systems are provided.
2. By providing the bracings the stiffness of the structure is increased and storey shear is decreased with increase in height of structure.
3. Time History analysis is performed for all the models i.e. without bracings & with bracings. Base Shear is increased with respect to time for the models with bracings.
4. Time History analysis is performed for all the models i.e. without bracings & with bracings. Moment is increased with respect to time for the models with bracings.
5. By providing lateral systems in the framed structures the reduction in the displacement, drift, storey shear, thereby increasing the stiffness of the structure for resisting lateral loads due to earth quakes.

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