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STRUCTURAL BEHAVIOR OF RCC AND STEEL BULDING WITH AND WITHOUT BRACING

[1]Srihari S & [2]Pradeep A R
[1]M. Tech Student & [2]Assistant Professor
[1]Department of Civil Engineering
[1]Sri Siddhartha Institute of Technology, Tumakuru, India

Abstract: The structural engineering is going to carry out the analysis and load bearing capacity of the building through RCC structure. For the implementation the ten-storage building is modelled in the E-tabs software, in order to improve the seismic risk, wind and live load bearing capacity by placing the bracing to the conventional RCC and the steel structure. The performance of the building is evaluated by considering crossed X, V type. The result shows that the crossed X bracing provides the greater support to the building during high wind speed, during earthquakes.

IndexTerms **- Structural Behavior, RCC, Steel, E-Tabs.**

I.INTRODUCTION

In multistorey structures, one of the structural solutions that is used to withstand lateral stresses is called a steel braced frame. Steel bracing is more cost-effective than other types of bracing, is simpler to install, takes up less space, and may be designed with more flexibility to satisfy the desired level of strength and stiffness. Braced frames are often utilised because of their ability to withstand lateral stresses; nevertheless, braces might interfere with the functionality of other architectural aspects. Typically, the steel bracing will be installed in spans that are oriented vertically. This technique makes it possible to acquire a significant increase in stiffness with only a little increase in weight; as a result, it is highly useful for enhancing the performance of an existing structure in which inadequate lateral stiffness is the primary issue. In most cases, bracings are installed in order to drastically limit the amount of lateral movement that the structure experiences, in addition to increasing its stiffness and stability when subjected to lateral pressure.

Existing structures are given a seismic upgrade using an external bracing system by having a local or global steel bracing system attached to the outer frames of the building. The technique of internal bracing involves installing a bracing system within the various bays of the RC frames in order to provide additional support for the structures. The bracing are members of the structural system, and depending on their orientation, they may be eccentric or concentric. The bracing is considered to be concentric if it is united at the centre of the beam with either a column beam junction or a direct column beam connection. On the other hand, it is said to be eccentric if any of the conditions stated above are not met. The primary objective of the study effort has been to determine the kind of bracing that results in the least amount of storey displacement and, as a result, contributes the most to increasing the structure's lateral stiffness. The structural behaviour of steel buildings, both braced and unbraced, subjected to static loads and lateral loading will be investigated as part of this study. This report contains both a presentation of the methodology of analysis as well as a discussion of the technique. At long last, comparison research has been put together to determine whether RCC building has the highest structural performance when subjected to lateral loads.

The types of the bracing are forward, background, V-type, inverted V and X type bracings.

The diagonal bracings are the kind that include the forward bracing systems. In this form of diagonal bracing, the bracing system is linked to the end points in a diagonal way. See the model of the front bracing system below in the image that has been provided; it consists of four end points that are numbered 1, 2, 3, and 4. From the first end point to the fourth end point, the steel bracing system is connected together. The forward bracing system, which falls under the group of diagonal types, often contributes to a reduction in the storey drift values in either the X or Y directions, depending on the lateral loading actions (wind load and seismic load values).

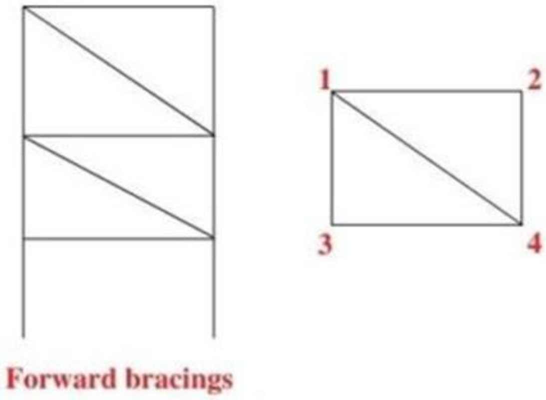


Figure 1: Forward bracing

The second form of diagonal bracings is known as the backwards bracing system. This type falls within the diagonal bracings category. The fundamental idea is similar to that of the forward bracing system, with the key difference being that the storey drift value decreases in the opposite direction to what it does with forward bracings. The figure that follows shows the entire kind of backward bracings, which once again consists of four end points for the bay frame. The bracing system has connections made to the second and third end points of the structure. When the building is subjected to lateral loading action, this kind of bracings system is helpful in reducing the storey drift values in either the negative X or negative Y direction.

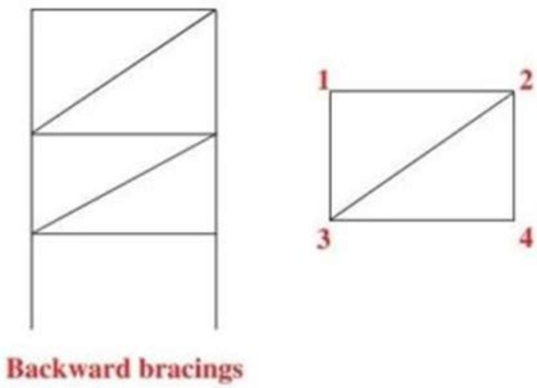
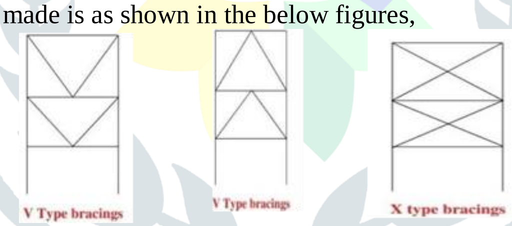


Figure 2: Backward bracing

The V, inverted V and X-type structure made is as shown in the below figures,



a) b) c)

Figure 3: V shaped, Inverted V and X bracing.

II. Modeling Details

The need of the model is to analyse the strength of building against earthquake, strong wind when bracing was employed. The effective bracing model will withstand the displacement or drift of the building. The Ground floor and the ten-storey building model is designed along with braces using the E- Tabs software.

The details of the materials employed for the building is given in the below table,

Materials	Details		Building slab	0.14m
Building dimensions	25mx25m		Stair slab	0.25m
Storey height	3m		Steel brace	ISNB-150Hmm
Number of floors	10 storey		Steel	ISMB 500 & 600
Plinth height	2m		Concrete	M30 cement
Beam size	0.23 m x 0.45m		Steel grade	Fe500
Thickness of wall	0.23m		Density of cement concrete	25 kN/m2
Size of column	0.3mx0.5m		Density of brick masonry	19 kN/m3

Roof Slab thickness	0.120m			

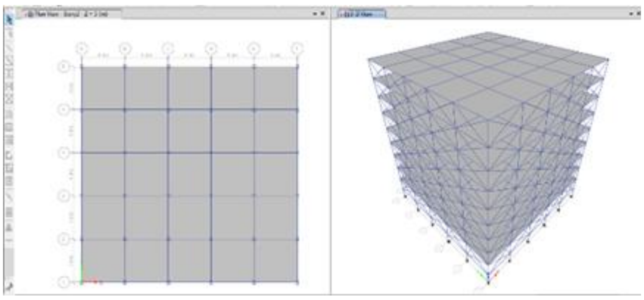


Figure 4: 2D and 3D view of the Steel bracing

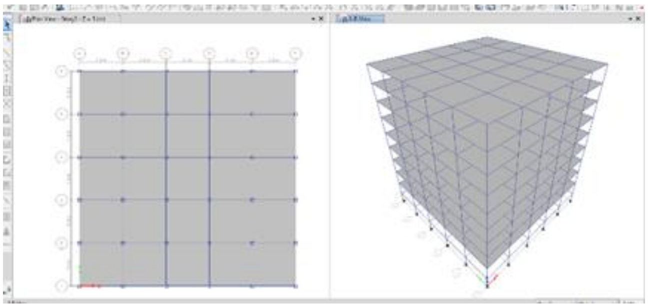


Figure 5: 2D and 3D view of the Conventional steel

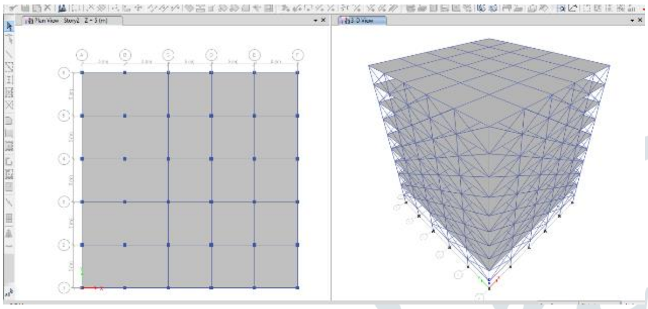


Figure 6: RCC bracing 2d and 3d view.

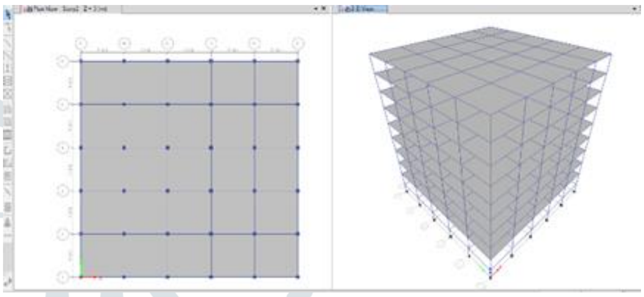
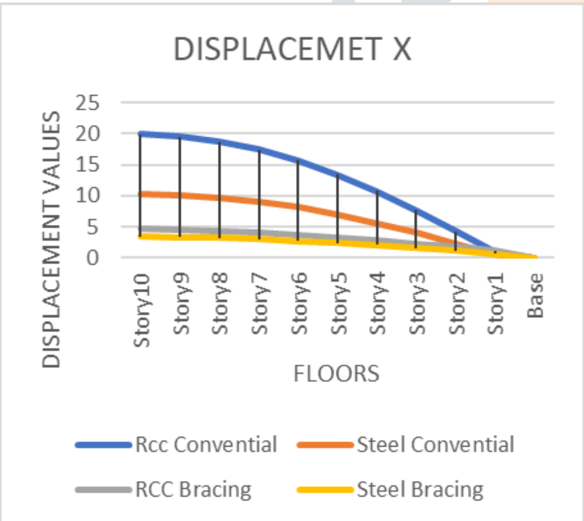
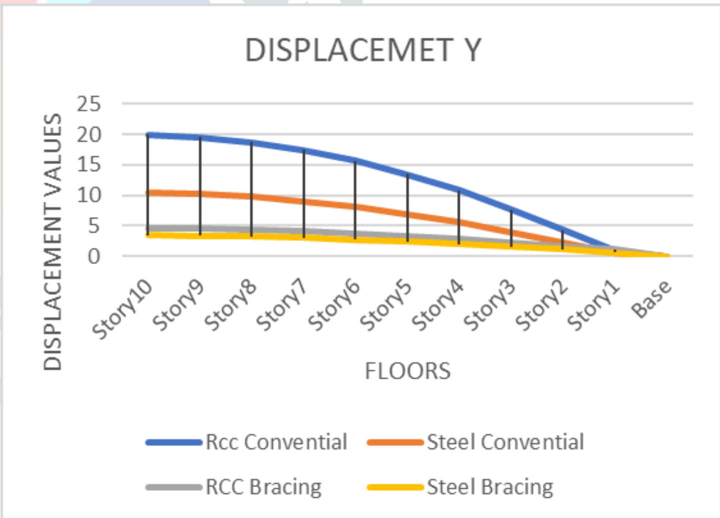
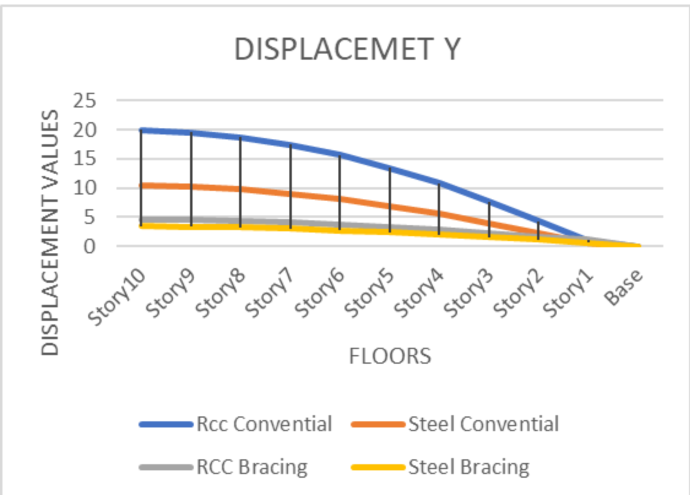


Figure 7: Conventional RCC structure.

III. RESULT AND DISCUSSION







The building is tested against the following data, the seismic zone 4 values are simulated to the structure for observing the changes. The factor of seismic zone is 0.24, the type of the soil is made as medium type 2. The three for ordinary moment resisting frames and four for concentrically braced frames are employed to resist the seismic waves.

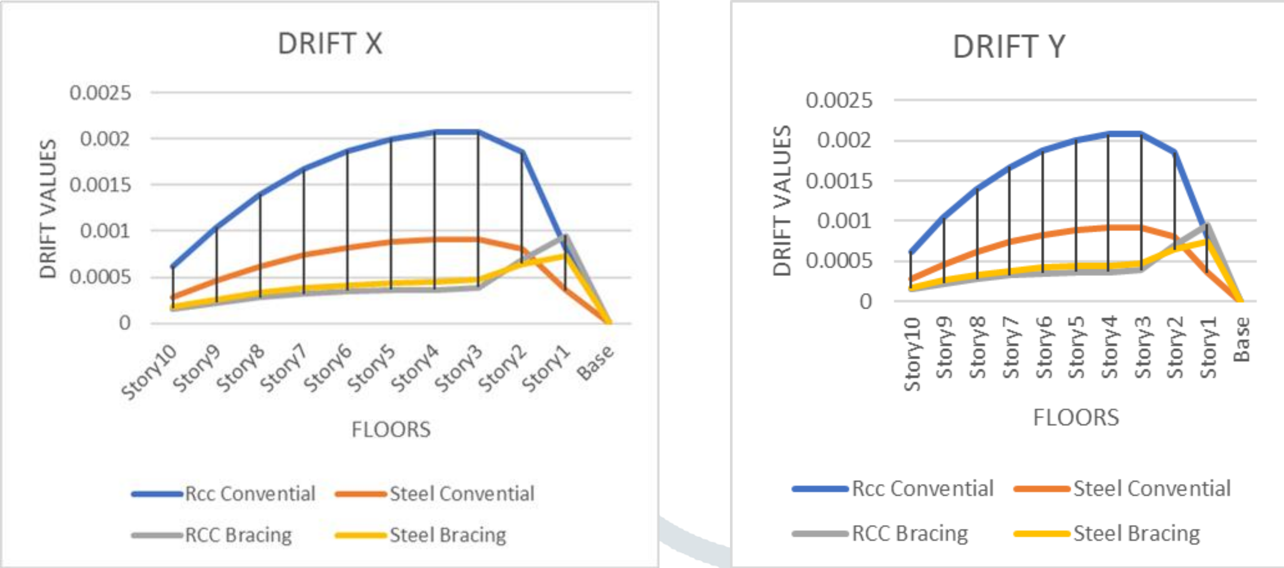


Figure 8: Drift values for the building both RCC and Steel with and without bracings.

The structural stability can be achieved by employing the bracing inside the building. The seismic waves is going to generate a inertial force which harm the structure of the building. It provides the base shear to the structure of the building. Base shear is going to be distributed all over the floors horizontal and vertically which displaces the building in x and y direction. Due to the towing loading, the long storey building often generates the lateral displacement. The disastrous force is generated by the earthquake and it is dangerous than towing loading which provides the more impact on structural damage. During these cases the bracing provides the great support to the building as it distributes the force into beams and columns which reduces the effect of earthquake. Have implemented the X-braced system as shown in the above figure (fig 4-6) which provides the comparative study between the RCC and steel conventional with the RCC and steel bracing system. The X bracing type is employed for the building structure.

IV. CONCLUSION

The forces are distributed on the beams by the bracing structure. The analysis is carried out by considering the X-type bracing on the ten storey building by considering the steel ISNB-500,600 with the conventional RCC structure to find the displacement of structure in x,y directions. By introducing the steel structure for the existing and newly constructing building is more advantageous to avoid the failure of the structure due to natural factors. The bracing follows the axial load mechanism to push the shear load to lateral loads instead of loading on beams and columns. The results shows that the shears forces can be reduced to upto 80% (for the last storey floor) by introducing the steel bracing to the existing structure.

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