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ANALYSIS OF A TALL STRUCTURE WITH X-TYPE BRACINGS CONSIDERING SEISMIC LOAD USING ANALYSIS TOOL STADD.PRO

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ABSTRACT

Multistory structures are for the most part influenced by tremor compel in seismic inclined zone. The real worry in the plan of multistory building is the structure mostly to have enough horizontal solidness to oppose sidelong powers and to control the parallel float of the structures. The steel supporting framework in strengthened solid edges is suitable for opposing horizontal powers, steel propping is anything but difficult to erect involves less space and has adaptability in structure for meeting the required quality and firmness.

In this examination we are preparing a relative report on a G+20 tall structure. In this structure we will contrast exposed casing and edges having X-type bracings at the corners. A three dimensional structure is taken, 20 stories is taken with story tallness of 3m. The bars and segments are intended to withstand dead and live load only. Seismic tremor loads are taken by bracings. The bracings are given just on the fringe sections. Here auxiliary displaying and examination is finished utilizing investigation programming Staad.pro which is a limited component based programming apparatus.

KEYWORDS: Structural analysis, staad, displacement, bracing system, forces, support reactions.

1. INTRODUCTION

To oppose lateral earthquake loads, shear dividers are normally utilized in RC confined structures, while, steel propping is the regularly utilized in steel structures. In the previous two decades, various reports have likewise demonstrated the compelling utilization of steel propping in RC outlines. Steel supporting of RC structures began as a retrofitting measure to fortify earthquake-harmed structures or to expand the heap opposing limit of existing structures.

The bracing methods adopted in the past fall into two main categories, namely external bracing and internal bracing. In the external bracing system, existing buildings are retrofitted by attaching a local or global steel bracing system to the exterior frames. In the internal bracing method, the buildings are braced by incorporating a bracing system inside the individual bays of the RC frames. The bracing may be attached to the RC frame either indirectly or directly.

2. LITERATURE REVIEW

Madhusudan et al. (2014) had studied on the effect of a provision of concentric bracings on the seismic performance of the steel frames and in the study they considered the two different types of concentric bracings (viz. X and inverted-V type bracing) for the different story levels.

Nauman Mohammed et al. (2013) studied on Behavior of Multistory RCC Structure with Different Type of Bracing System (A Software Approach). They aims to evaluate the response of braced and unbraced structure subjected to seismic loads and to identify the suitable bracing system for resisting the seismic load efficiently. A G+14 floors building were analyzed using STAAD V8i software for special moment resisting frame situated in zone 4.The RCC G+14 structure was analyzed for both without bracings and with different types of bracings system. For all type of structural systems i.e. braced and unbraced structural system bending moments, shear

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forces, story shears, story drifts and axial forces was compared. They had been concluded that the displacement of the structure decreased after the application of the bracing system. After the application of cross bracing system the maximum reduction in the lateral displacement occurs. In the columns bracing system reduces bending moments and shear forces. The paper also states that the execution of cross bracing system was better than the other specified bracing systems.

To retrofit the existing structure steel bracings were used. Significantly after the application of the bracings, total weight of the existing structure will not be changed.

Viswanath K.G et al. (2010) studied on seismic analysis of steel braced reinforced concrete frames. He studied the seismic performance of reinforced concrete (RC) buildings rehabilitated using concentric steel bracing. For peripheral columns the bracings were provided. A 4story building was analyzed for seismic zone IV as per IS 1893: 2002 using STAAD Pro software in his paper. It was examined the effectiveness of various types of steel bracing in rehabilitating a 4story study. The seismic performance of the rehabilitated building was studied on the effect of the distribution of the steel bracing along the height of the RC frame. In terms of global and story drifts the performance of the building was evaluated. His result shows the reduction of percentage in the lateral displacement. Then he concluded that the X type of steel bracing significantly contributed to the structural stiffness and reduces the maximum inter story drift of the frames.

3. OBJECTIVES

1) Comparative examination for various kinds of concentrically set lateral load opposing frameworks (steel supporting framework) at corners.
2) To consider the seismic conduct of RC working by performing straight static investigation with various propping frameworks.
3) To think about different parametric outcomes, for example, lateral story dislodging, Story float and Story powers for various kinds of propping frameworks of supported RC outlines all together that reasonable sorts might be proposed for various seismic plan and retrofit needs.
4) To realize the better seismic load opposing steel propping framework as for down to earth use.
Proposed work:

Here we are considering eight cases for comparison:

- First case is of bare frame without bracings for same loading conditions with seismic zone II.
- Second case is frame with X brace at the corners of the structure in seismic zone II.
- Third case is of frame without bracings at seismic zone III.
- Fourth case is of frame with bracings at the corners in seismic zone III.
- Fifth case is of frame without bracings at the corners in seismic zone IV.
- Sixth case is of frame with bracings at the corners in seismic zone IV.
- Seventh case is of frame without bracings at the seismic zone V.
- Eighth case is of frame with bracings at the seismic zone V.

4. METHODOLOGY

Step 1: the design lateral force shall be first computed for the building as a whole
Step 2: this design lateral force shall then be distributed to the various floor levels
Step 3: the overall design seismic force thus obtained at each floor level shall then be distributed to individual lateral load resisting elements depending on the floor diaphragm action.
In this study lateral force method (Equivalent Static Force Method) is used, the analysis of the structure is made for seismic loads using Equivalent Static Force Method because of symmetry of the structure, both in geometry and in mass.

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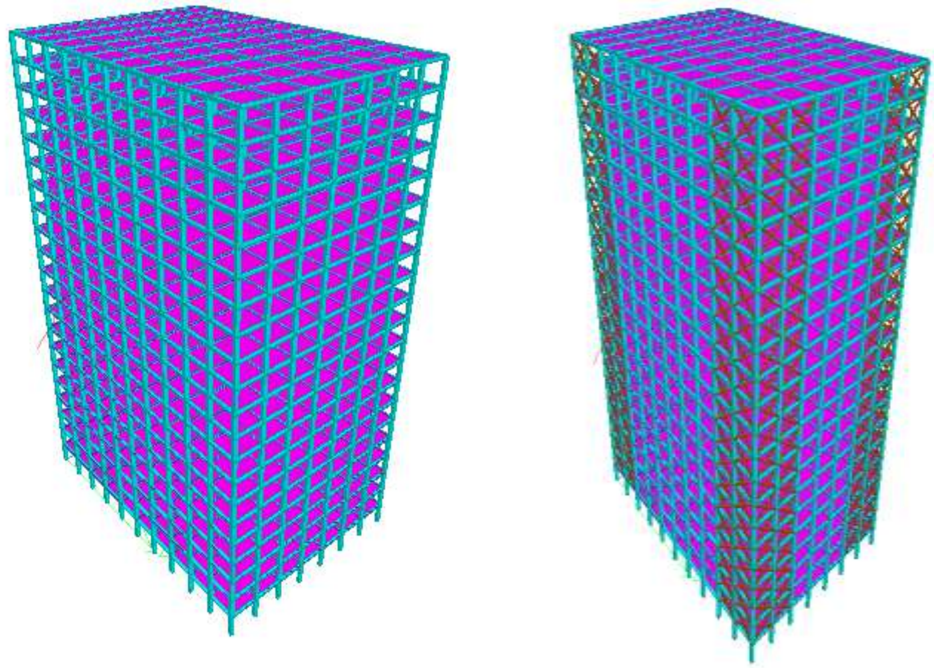

Fig 1: Bare frame and X bracing frame

Table 1: material properties

Material property	Values
Grade of concrete	M-25
Young's modulus of concrete, E_c	$2.17x10^4$ N/mm^2
Poisson ratio,	0.17
Tensile Strength, Ultimate steel	505 MPa
Tensile Strength, Yield steel	215 MPa
Elongation at Break steel	70 %
Modulus of Elasticity steel	193 - 200 GPa

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Table 2: Geometrical data

Description	Values
Number of storey	Twenty
Number of bays in X direction	Seven
Number of bays in Z direction	Ten
Height of each storey	3.50 m
Bay width in X direction	4 m
Bay width in Z direction	4 m
Size of beam	250 x 350 mm
Size of column	350 x 350 mm
Thickness of R.C.C. slab	125 mm
Steel Bracings	Angel section

5. LOADINGS

(a) **Dead Loads**: as per IS: 875 (part-1) -1987.

(b) **Live Loads**: as per IS: 875 (part-2) 1987.
Live Load on typical floors = 3.00kN/m^2
Live Load for seismic calculation as per I.S. code 1893-part1 = 0.75 kN/m^2

(c) **Earth Quake Loads**: All frames are analyzed for (IV) earthquake zone.
The seismic load calculation are as per IS: 1893 (part-1)-2002.

Soil-Structure Interaction is a trying multidisciplinary subject which covers a couple of regions of Civil Designing. In every practical sense every advancement is connected with the ground and the cooperation between the old irregularity and the foundation medium might impact essentially both the superstructure and the foundation soil.

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6. ANALYSIS RESULT

Maximum Bending moment:

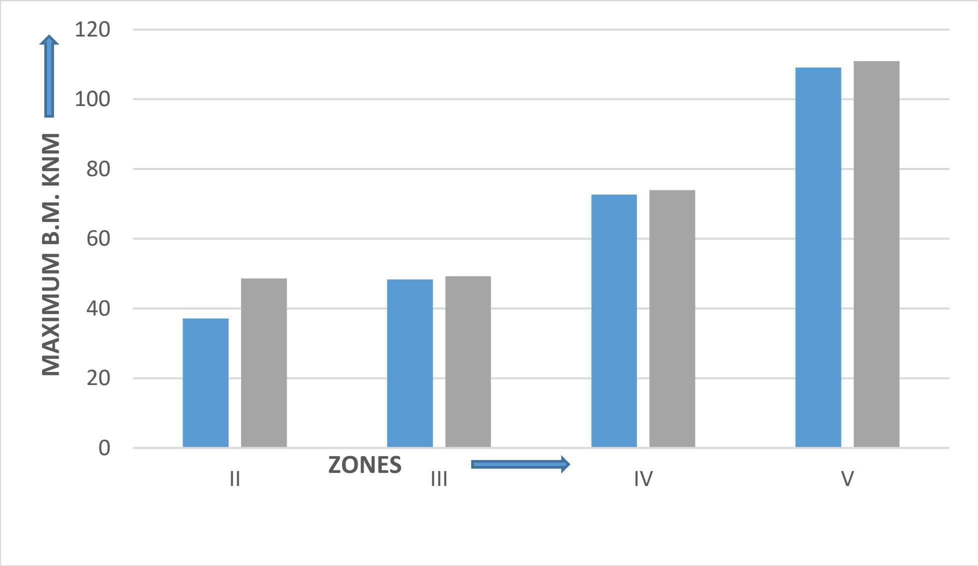

Fig 2: Bending moment

Maximum Shear Force:

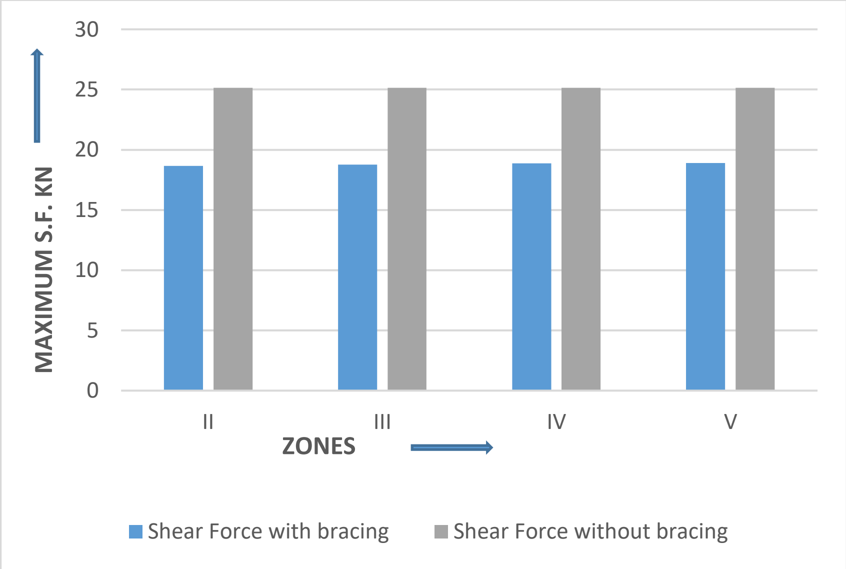

Fig 3: Shear force

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Axial Force

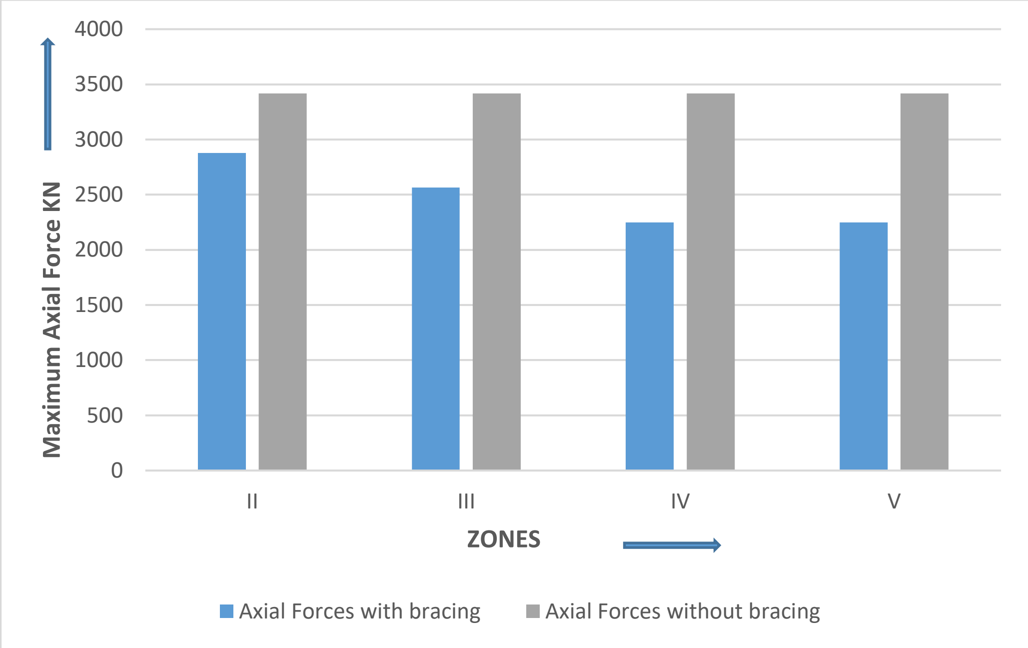

Fig 4: Axial force

Support Reaction:

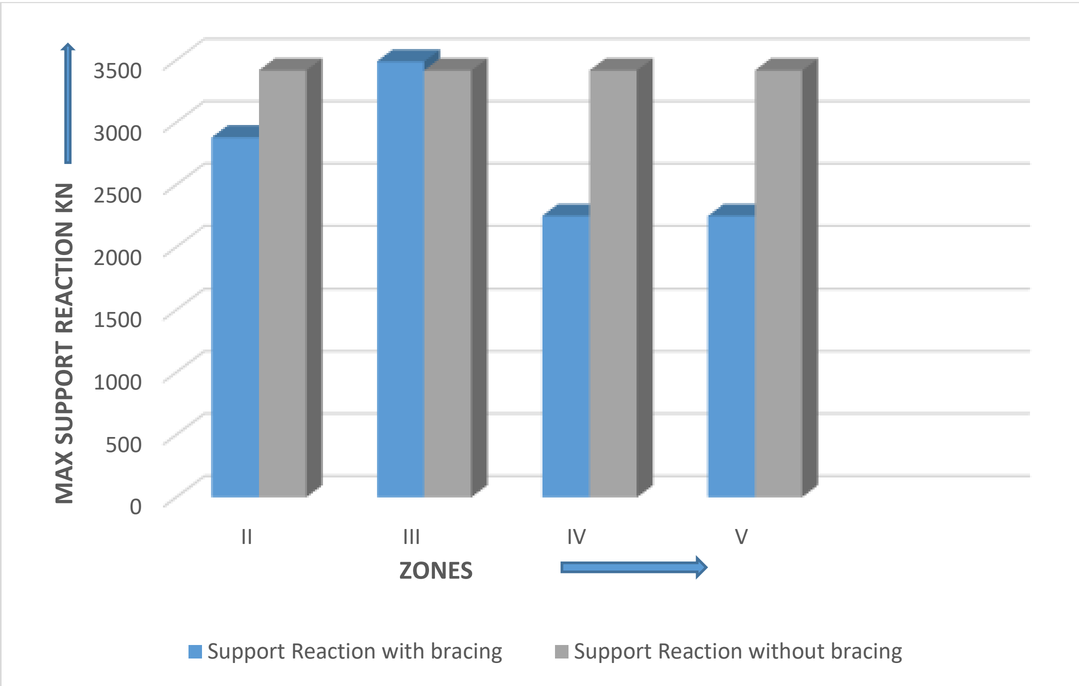

Fig 5: Support reaction

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Displacement Node

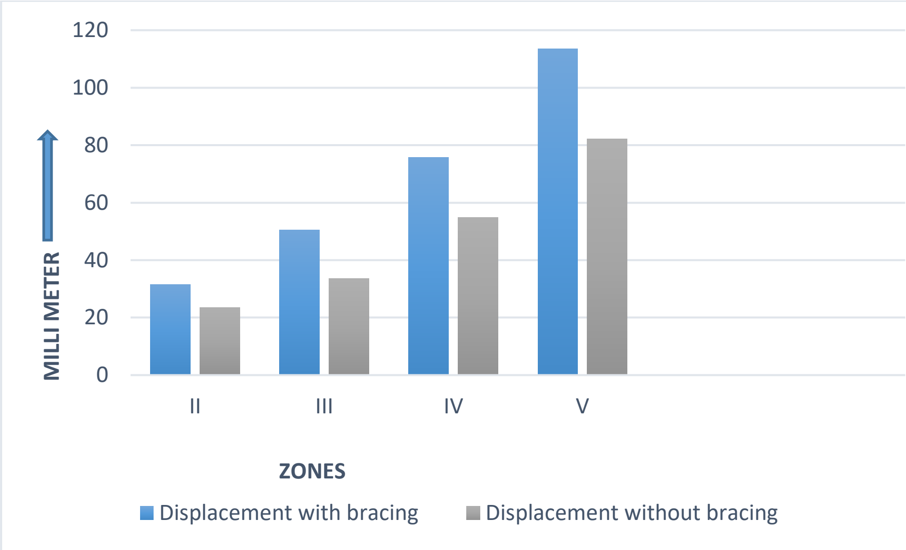

Fig 6: Displacement at nodes

Storey displacement:

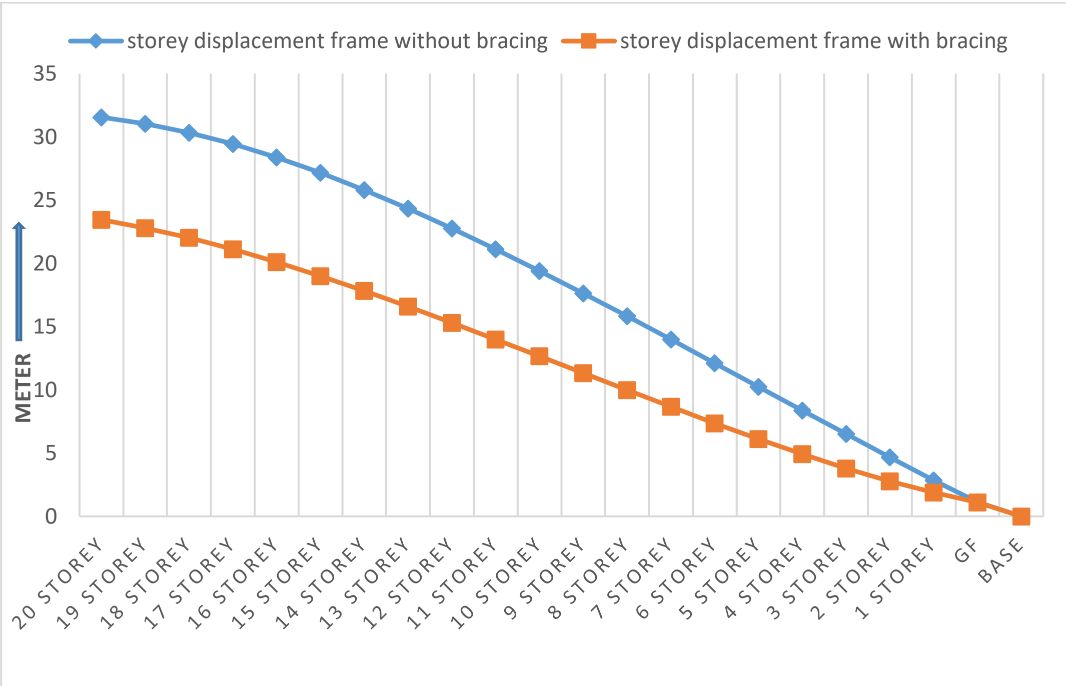

Fig 7: Storey displacement

7. CONCLUSION

The steel bracing system has not only improved displacement capacity of reinforced concrete structures, but also the lateral stiffness and strength capacity of the structures by increasing its shear capacity.

X-bracing of steel bracing types has found in the most efficient in terms of story displacement and story drift reduction when bracing is provided on two parallel sides of the building.

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Story drift should be limited because deflection must be limited during the earth quake to protect the damage of structural elements, especially nonstructural elements, and hence the provisions of steel bracing for the RC structure give adequate stiffness for the structure and among the used bracing X-bracing types have been given better result in reduction of story drift.

The base shear capacity of steel braced frame is increased as compared to bare frame (without bracing) building which indicates that the stiffness of building has increased.

X-bracing type is found most efficient in increasing the shear capacity of RC frame building which indicates X-brace type of steel bracing significantly contributes to the structural stiffness.

The base overturning moment of RC frame has increased after the application of all bracing systems.

Finally we can conclude that both X-bracing system may be used to new design or retrofit for damage level earthquake, however, X-bracing system is more suitable to use The corner bracing configuration is better lateral displacement reduction arrangement from the other bay wise arrangement of steel braced reinforced concrete structures.

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