Analysis of Effect of Bracing Systems on Seismic Behavior of Typical RC Tall Building

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Abstract - *Many buildings have been severely affected by earthquakes in areas prone to earthquakes. Of particular concern to the construction of the multi-storey building is the building, especially for adequate lateral stability to withstand lateral forces and to control the rotation of buildings in the background. The steel frame for reinforced concrete frames works with resistance to side forces, the steel binding is easy to set up takes up little space and is flexible in the construction to meet the strength and durability required.*

In this study we are preparing a comparative study on a tall G + 20 structure. In this structure we will compare a blank frame with frames with X-shaped angles in the corners. Taken up in three dimensions, 20 stories are taken with a 3m storey height. Beams and columns are designed to withstand a dead and living load. Earthquake loads are carried by bracings. Bracings are only provided for peripheral columns. Here modeling and structural analysis is done using Staad.pro analysis software which is a tool for end-to-end program.

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

INTRODUCTION

The size and forces of quakes shifts from place to put making low serious damaging forces on designed properties and also offering ascend to incredible financial misfortunes and life danger. Steel supporting of RC outlines has gotten some consideration as of late both as a retrofitting measure to expand the shear limit of existing RC structures and as a shear opposing component in the seismic plan of new structures. Prior examiners concentrated on the retrofitting part of propping and concentrated outer supporting of structures and additionally inner roundabout propping of individual narrows of the RC outlines. Lately, the immediate supporting of RC outlines has pulled in more consideration since it is less exorbitant and can be embraced for retrofitting purposes, practical contrasting option to RC shear dividers at pre-development configuration level. Exploratory works, and also scientific examinations have contemplated the capacities of the immediate propping arrangement of RC outlines with empowering comes about.

To oppose horizontal seismic tremor loads, shear dividers are usually used as a piece of RC encircled structures, while, steel supporting is the frequently used as a piece of steel structures. In the previous two decades, various reports have likewise shown the compelling utilization of steel supporting in RC outlines. Steel propping of RC structures began as a retrofitting measure to fortify seismic tremor harmed structures or to expand the heap opposing limit of existing structures.

The propping strategies received in the past fall into two primary classifications, to be specific outer supporting and interior supporting. In the outside supporting framework, existing structures are retrofitted by connecting a nearby or worldwide steel propping framework to the outside edges. In the interior supporting technique, the structures are propped by joining a propping framework inside the individual straights of the RC outlines. The propping might be appended to the RC outline either in a roundabout way or straightforwardly.

LITERATURE REVIEW

D.K. paul et. al. (2012) [1] presented a practical implementation on a earthquake resistance building to resist non linear (pushover) lateral seismic forces. Retrofitting is introduced in which chevron bracing and aluminium shear link as a beam is introduced to improve its performance and concluded that with the use of bracing and shear link building becomes more responsive and capable of bearing lateral forces.

Dipti r. Sahoo et. al. (2010) [2] presented an experimental study is conducted on a reduced- scale non-ductile RC frame to investigate the effectiveness of the strengthening system under constant gravity loading and gradually increasing reversed cyclic lateral displacements. The strengthened specimen exhibited enhanced lateral strength, stiffness and energy-dissipation potential as compared to the RC (bare) frame. Lateral load on the frame is allowed to transfer to the shear link through a load-transferring system consisting of a shear collector beam and chevron braces so as to cause shear yielding of aluminum plates. No extensive strengthening of the existing RC columns is carried out in the proposed technique. He concluded that the energy-dissipation and damping potential of the shear link significantly reduced the damage levels in the existing RC members of the strengthened specimen up to 3.5% drift level.

K. moon (2009) [3] compared different stories tall structure of 60 and 80 storey heights with same lateral geometric aspects and loadings with considering diagrids of 63o, 69o and 73 o and determine that The structural efficiency of dia-grids for tall buildings can be maximized by configuring them to have optimum grid geometries. Though the construction of a dia grid structure is challenging due to its complicated nodes, its con- structure ability can be enhanced by appropriate prefabrication methods.

Kyoung-sun moon (2007) [4] presented a comparative study on tall structures ranging from 20 to 60 stories. And compare bracings and diagrid works in terms of forces and economical sections, presenting diagrid range from 65 to 75 degrees and concluded that diagrid structure is more economical and resisting as also removing the requirement vertical columns at the outer side.

OBJECTIVES OF STUDIES

The main objectives are:

- To assess and look at the viability of steel propped strengthened solid structure for various storied RC structures by various kinds of seismic zones under delicate soil.
- To recognize the most productive and reasonable horizontal burdens safe X-type steel supporting which give the base sidelong relocations, least story float and which increment shear limit of RC outline from the chose gatherings of bracings types.
- To propose the higher fortified and retrofitting different for reinforced solid structure define arrange for seismic load resistance.

STRUCTURAL MODELING

Building frame is modeled in analysis tool staad pro in which steel ANGEL-shape X-type bracings are presented at the edges of a structure and seismic lateral forces are applied as per I.S. 1893 part-1 2002, dead load as per 875 part-1 and superimposed live load according to 875 part-2 is calculated and applied.

Following material properties has been considered in modeling:-

Material property	Values
Grade of concrete	M-25
Young's modulus of concrete	2.17×10^4 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

Following geometric properties has been considered in modeling:-

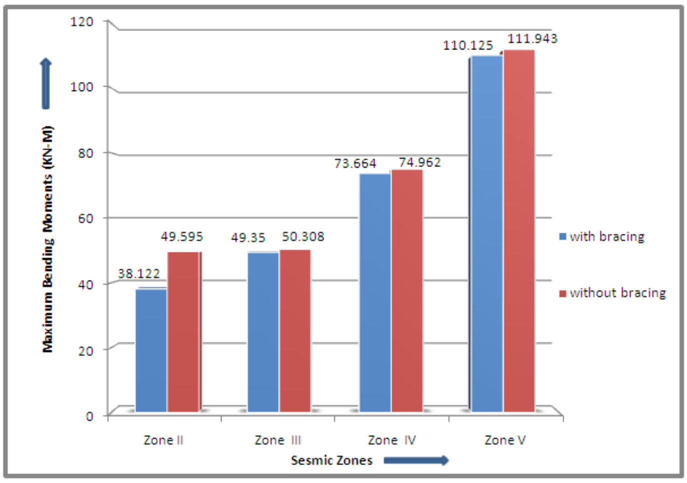
Description	Values
Number of storey	Twenty
Number of bays in X direction	Seven
Number of bays in Z direction	Ten
Height of each storey	3.50 m
Bay width in X direction	4 m
Bay width in Z direction	4 m
Size of beam	250 x 350 mm
Size of column	350 x 350 mm
Thickness of R.C.C. slab	125 mm
Steel Bracings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

RESULT AND INFERENCES

Following results and graphs are obtained on comparison with or without bracings.

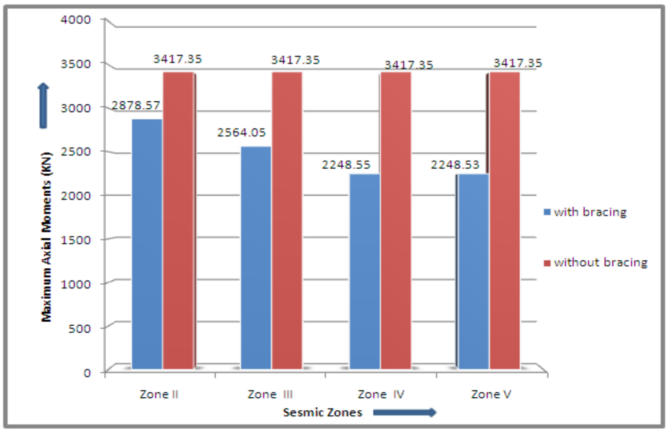
a) Maximum Bending Moment: As results demonstrating beneath bowing minute is diminishing in every one of the instances of propping framework in all the particular zones which demonstrates that there will be lessening in support prerequisite in propping case as compared to bare frame, Section with bracing system results in economical one.

Bending Moment (KN-M)		
Seismic Zone	with bracing	without bracing
Zone II	38.122	49.595
Zone III	49.35	50.308
Zone IV	73.664	74.962
Zone V	110.125	111.943



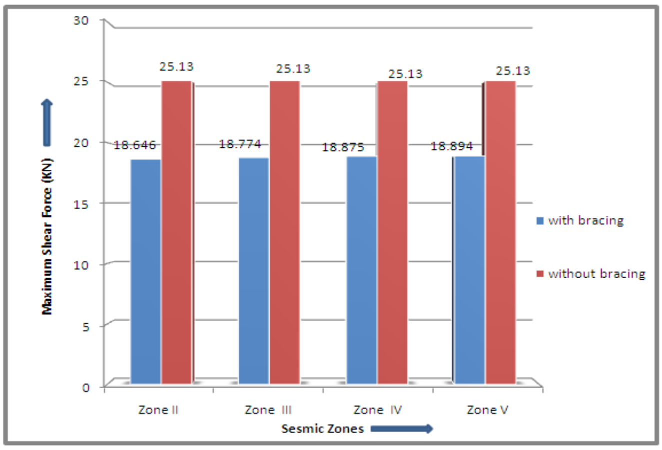
b) Maximum Axial Force: As comparative results are shown in below It is unmistakably noticeable that if there should arise an occurrence of supporting framework hub powers diminishing, hub drive is the pressure or strain power of the part, they are the internal forces of a structure therefore in bracing system forces are reducing.

Axial Forces (KN)		
Seismic Zone	with bracing	without bracing
Zone II	2878.57	3417.35
Zone III	2564.05	3417.35
Zone IV	2248.55	3417.35
Zone V	2248.53	3417.35



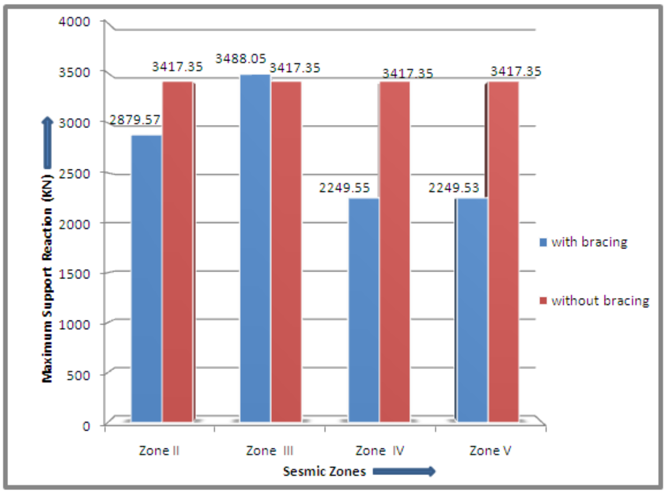
c) **Maximum Shear force:** Shear force are the unbalance forces which are reducing in bracing system which shows that bracing system is reducing unbalanced forces, results shows that bracing system will increase its stability.

Shear Forces (KN)		
Seismic Zone	with bracing	without bracing
Zone II	18.646	25.13
Zone III	18.774	25.13
Zone IV	18.875	25.13
Zone V	18.894	25.13



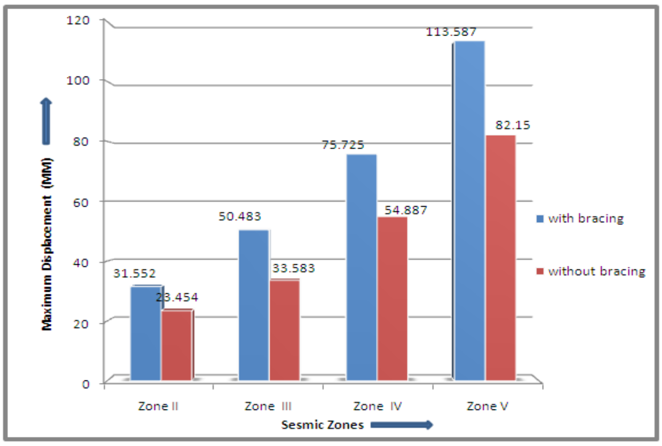
d) **Maximum Support Reaction:** As appeared in figure below 5.4, results shows that in case of bracing system support reaction values are less that implies its minimum load distribution at supports.

Support Reaction (KN)		
Seismic Zone	with bracing	without bracing
Zone II	2879.57	3417.35
Zone III	3488.05	3417.35
Zone IV	2249.55	3417.35
Zone V	2249.53	3417.35



e) **Maximum Displacement:** Figure below shows that displacement in structure with bracing shows more as comparing to without bracing structure.

Displacement (MM)		
Seismic Zone	with bracing	without bracing
Zone II	31.552	23.454
Zone III	50.483	33.583
Zone IV	75.725	54.887
Zone V	113.587	82.15



CONCLUSIONS

• The steel reinforcement system not only improves the relocation capacity of reinforced concrete structures, but also the horizontal strength and quality of buildings by increasing their shear capacity.

• X-reinforcement of the types of steel straps has been found to be very effective in terms of breaking and reducing the flow of the material when providing binding to the two opposite sides of the structure.

• Transmission should be limited because deviations should be limited during earthquakes to prevent damage to buildings, especially non-structural materials, which is why the RC frame material provides adequate structural strength and intermediate bond X Types of bracing are given the best effect to reduce erosion.

• The shear capacity of the used steel frame is extended compared to the hollow frame (other than the binding) which indicates that the strength of the structure has increased.

• The X-bracing type is found to be very effective in increasing the shear limit of the RC frame structure which shows the X-brace type of steel which basically supports the basic stiffness.

• The basis for the overthrow of the RC framework has increased after the implementation of all binding systems.

• Finally we can conclude that the X-bracing system can be used to design new or rehabilitate destructive earthquakes, however, the X-bracing system is best suited to use Corn bracing configuration is better lateral displacement reductionization from the other bay wise metal structure strong solid structure

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