



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 12, December 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Comparative Analysis & Design of g+10r.C.C Building with Retrofitting Technique with X-Bracings & without X-Bracings in Various Seismic Zones using E-Tabs

B.Sharanya¹, CH.Durga Rao²

P.G. Student, Department of Civil Engineering, VNR Engineering College, Ponnur, Guntur, AP, India¹

Associate Professor, Department of Civil Engineering, VNR Engineering College, Ponnur, Guntur, AP, India²

ABSTRACT: Multi-story structures are currently frequently damaged by earthquakes, which is a serious problem. When retrofitting techniques like X-Bracings are used, it is possible to meet the functional needs of the buildings while also improving the structure's ductility and shear resistance. This helps the structure withstand earthquakes and prevents major multi-story building accidents. The seismic performance of the R.C.C. structure is compared in this dissertation with X-Bracings that are introduced in various boundaries of the structure and the following can be found: story drifts, story displacement, base shear, and axial forces. ETABS programming is used to assess the structure using seismic zones II, III, IV, and V. The X-Bracings in this construction are set in numerous locations at varying stories that are taken into consideration for the analysis.

This exposition's main comparison between R.C.C. structures with and without X-bracings examines how the former responds to earthquakes in various zones.

KEYWORDS: Base shear and X-bracings.

I. INTRODUCTION

One of the most devastating threats that is typically present is seismic tremor. The primary goal is to prevent earthquakes and minimize casualties and property damage. Seismic burdens are haphazardly very in the nature and they are to be displayed securely to evaluate the constant conduct of the structure. Basically, the seismic plan of the structures has been founded on the strength standards. In the plan utilizing flexible codes, the harm quantum is extremely high on the grounds that the seismic structure versatile strategy has neglected to give knowledge into how the plan plays during tremors. There is a continual transition from "Strength Direction" to "Performance Based," with the understanding that doing so will improve security or reduce harm. The interests in examining how to work during solid ground movements to reduce property damage and death toll have resolved on execution-based structure that is becoming a more widely accepted conclusion by engineers.

BRACINGS:

An effort has been made in recent years to develop and improve structure control devices in order to lessen the seismic influence on buildings and scaffolds. Full-scale implementation of dynamic control systems is challenging because it is expensive and unreliable. Latent supplemental damping systems, such as tuned mass dampers and base detachment viscoelastic dampers, are frequently used in structures to reduce dynamic reactivity. Semi-dynamic damping frameworks, such as factor hole liquid dampers, controlled grinding tools, and variable stiffness tools, are more effective than dynamic and detached damping frameworks at reducing dynamic reaction. During a quake, seismic vitality is contribution to the structure which brings about expanded vibrational reaction. Mechanical devices, such as dampers, are provided across the height of the structure to improve the damping as a result.



Fig 1.1: Bracings are placing in the building

STUDY OBJECTIVES OF X-BRACINGS:

- The venture point is to assessing the reaction of supported and unbraced plan exposed to seismic burdens.
- The relocations and story floats are thought about for different sorts of propping frameworks.
- To separate the variety in most extreme horizontal removal for various sort of supporting frameworks.
- To differentiate the rate decreases in parallel removal for propped casing to that of unbraced casing.
- To locate the appropriate propping framework for opposing the seismic burden proficiently.
- Study the conduct of structure on impact of different sort of supporting frameworks gave at the fringe sections of the structure.

II. LITERATURE REVIEW

Nitin Bhojkar and Mahesh Bagade (2015): "Seismic Evaluation of Tall Structures Using Steel Bracings," This study investigates the dynamic analysis of solid reinforced structures for various supporting types. Using STAAD PRO programming, a G+10 buildings investigation for seismic zone-III was completed in accordance with IS1893:2002. Parallel relocations, story drift, axial forces, and base shear are the main boundaries taken into consideration in this project when thinking about the seismic evaluation of structures. Here, we discovered that the X kind of steel bracings greatly increases auxiliary firmness and decreases the largest story float of buildings' edges. The bracings increase the structure's sidelong quality and solidity limit as well as its relocation limit.

Naman Mohammed, Islam Nazrul (2015): "Observed of multi-story buildings in various bracing types. A seismic assessed the reaction of propped and unbraced structures exposed to the dynamic examination and to recognize the appropriate supporting framework for opposes the dynamic burden efficiently. After the investigation of working with different kinds of basic frameworks, henceforth reasoned that uprooting of the structure diminishes after the utilization of supporting framework. The most extreme decrease in the story drifts, displacements happens after the use of the cross-supporting system. Bracings framework diminishes the bowing minutes and shear powers in the columns. The horizontal burdens are moved from the establishment through the hub area of the structure. Cross bracing framework execution is superior to that of the other predetermined propping system. For the purposes of retrofitting already-existing structures, steel bracings are also used. The extension of bracings won't substantially alter the overall weight of the existing structure.

M.D. Kevadkar and P.B. Kodag (2017): By performing a horizontal burden study of the R.C.C. structure (G+14), considered three confined models' structures. Out of this first model is without supporting and shear dividers, second model with various shear divider framework at the chose individuals from the structures. propping frameworks in the models. The investigation is conveyed by utilizing E-tabs to discover the impacts parallel burdens on the structure during the seismic burdens in the high seismic zone areas. The execution of the structure is assessed as far as sidelong relocation, story drifts, storey shear, base shear and Demand capacity.

III. DESIGN PROGRAMMING

Here, the fundamental steps in the investigation of the behaviour of RCC multi-storey structures with and without X-bracings are engaged. It is done in the Civil Engineering Department's Computer Laboratory. VNR COLLEGE OF ENGINEERING. ETABS is the programme utilised in this analysis of the behaviour of Storey displacements, Base shear, and Storey drift.



Analysis of R.C.C multi storey building without X-bracings & with X-bracings is carried out by using ETABS 2016 software. Comparing both structures which will be the effective one for seismic zoning conditions can be suggested. Indian standard codes are used for the R.C.C structure (IS1893:2002). In India seismic zones are divided into five categories initially and later they are reduced to four zones. The first code provisions for seismic zoning is carried out in 1962 with Indian standard code (IS 1893 part 1), later on, it is revised for five times the latest we are using is the fifth version which is revised in the year 2002. Both the R.C.C. structure with X-bracings and the R.C.C. structure without X-bracings have similar data. Here, an X-braced R.C.C. structure is assessed for several seismic procedures, which are shown below. Here similar data as been taken as given below table

| Particulars | Dimensions of RCC structure With X-bracings/With X-bracings |
|----------------------------------|---|
| Building Dimension | 14mx59m |
| Number of floors | G+10 |
| Complete height of the structure | 33.5 m |
| Floor height | 3 m |
| Height of parapet | 1.3 m |
| Size of beams | 300mmx450mm |
| Size of columns | 300mmx600mm |
| Thickness of walls | 1 1/2 brick, 1 brick thickness |
| Interior wall loads | 3kN/m ² |
| Exterior wall loads | 12kN/m ² |
| Seismic zone | 2,3,4,5 |
| Floor finish | 1.5kN/m ² |
| Live load at all floors | 6kN/m ² |
| Unit weight of concrete | 25kN/m ³ |
| Unit weight of brick | 20kN/m ³ |
| Unit weight of steel | 7850kg/m ³ |
| Design mix of concrete | M40 |
| Grade of reinforcing steel | Fe415 |
| Soil condition | Hard, Medium, Soft condition Depending upon Zone |
| Response reduction factor | 5 |
| Importance factor | 1.5 |
| X-Bracings | 2000mmx 500mm ISHB 200 |

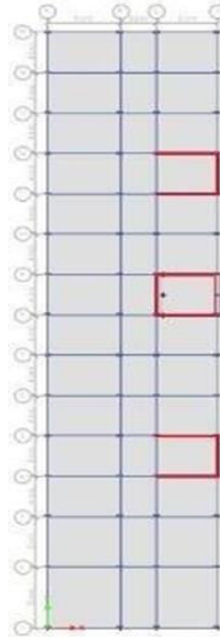


Fig no:-3-1 View of R.C.C structure

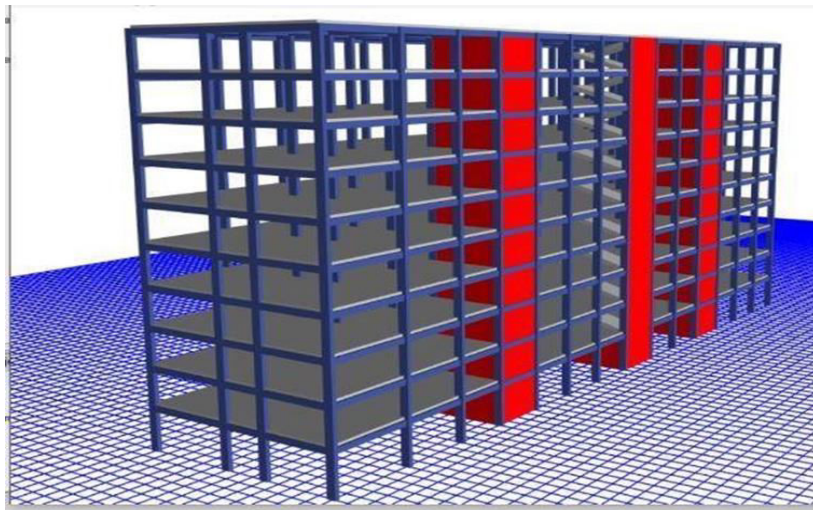


Fig no:-3.2 Showing full R.C.C Structure

Analysis of R.C.C structure:

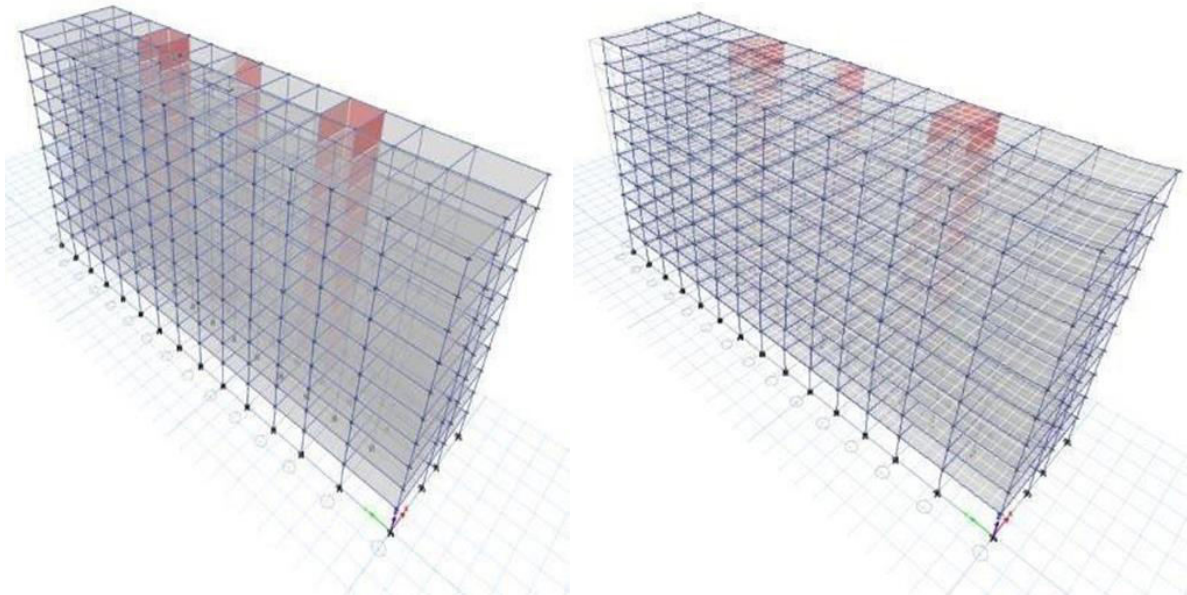


Fig No:-3.3 Showing seismic analysis

Analysis of R.C.C building with X-bracings:

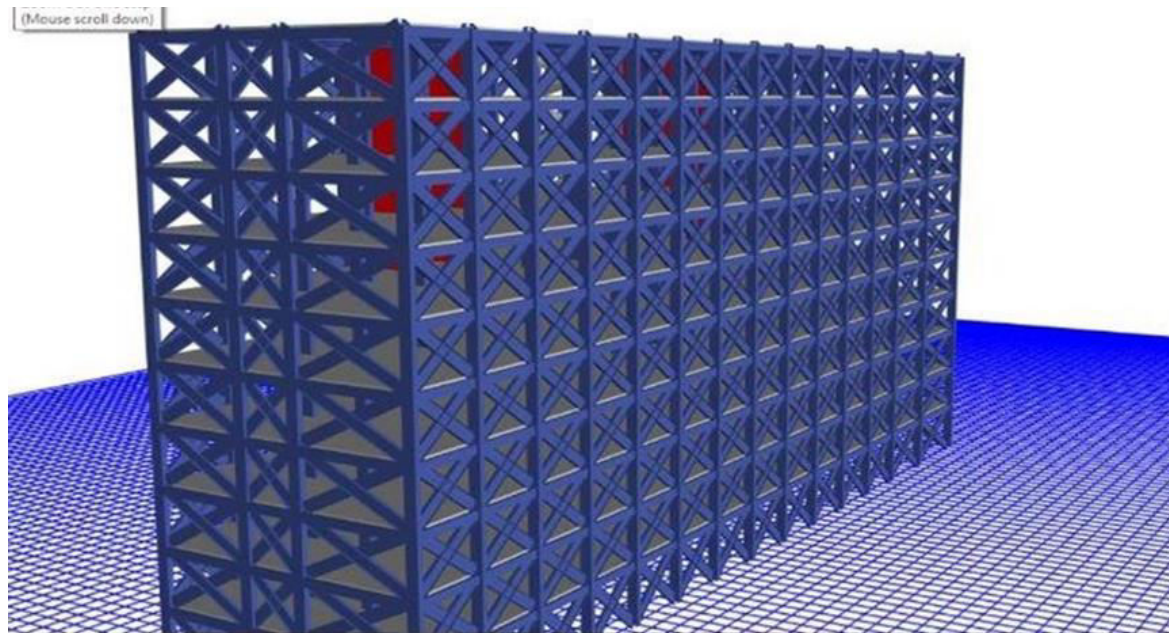


Fig No:-3.4 Complete view of R.C.C structure with X-bracings

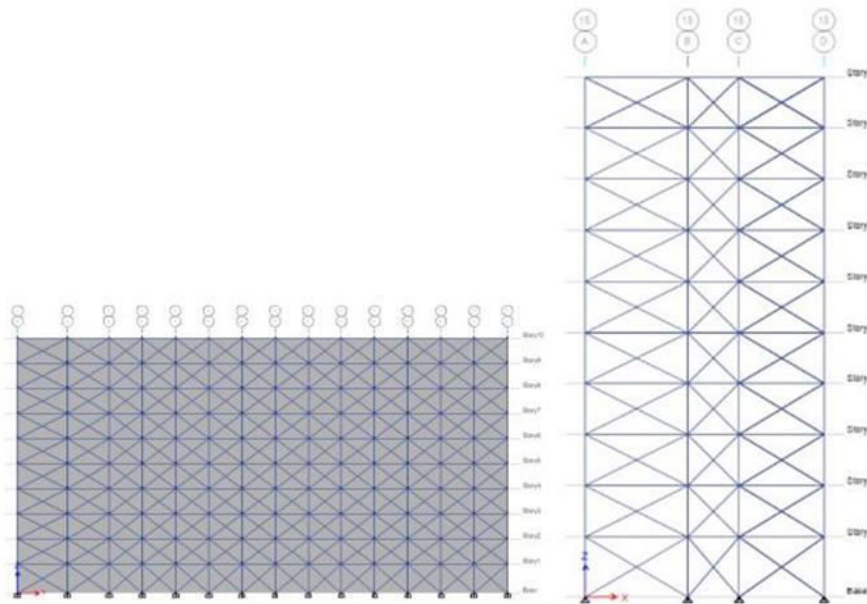


Fig No:-3.5 Complete view of R.C.C structure with X-bracings

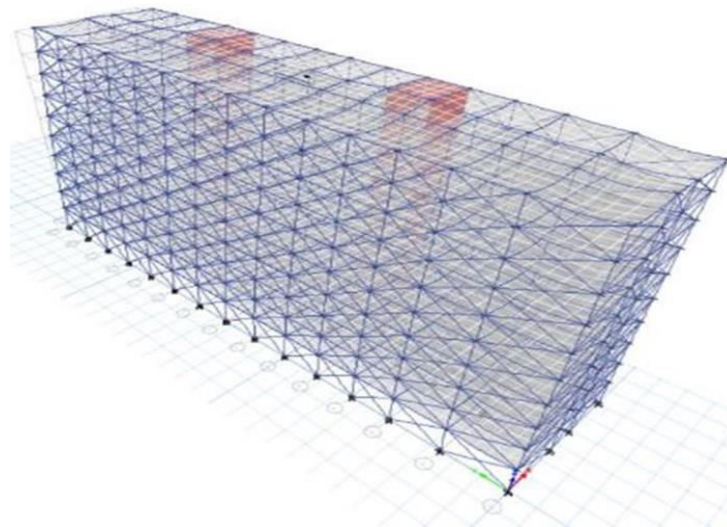


Fig No:-3.6 Deformations of R.C.C structure with X-bracings in earthquake zones

IV.RESULTS & DISCUSSIONS

Comparison tables of reinforced cement concrete structures with and without X-bracings are compared for displacements, drift, and seismic loading about it. The difference is represented in graphs and tables.



| Comparison Property(Seis mic Base Shear) | RCC structure without X- bracings | RCC structure with X- bracings |
|--|-----------------------------------|--------------------------------|
| Max.Shear Force(kN) | 2706.72 | 2142.60 |

| Storey no | RCC structure without X- bracings | RCC structure with X-bracings |
|------------|-----------------------------------|-------------------------------|
| 10(x-axis) | 0.000877 | 0.000233 |
| (y-axis) | 0.000879 | 0.000490 |
| 9(x-axis) | 0.000890 | 0.000276 |
| (y-axis) | 0.000902 | 0.000510 |
| 8(x-axis) | 0.000890 | 0.000311 |
| (y-axis) | 0.000910 | 0.000490 |
| 7(x-axis) | 0.000871 | 0.000335 |
| (y-axis) | 0.000901 | 0.000302 |
| 6(x-axis) | 0.000830 | 0.000349 |
| (y-axis) | 0.000868 | 0.000289 |
| 5(x-axis) | 0.000764 | 0.000350 |
| (y-axis) | 0.000810 | 0.000245 |
| 4(x-axis) | 0.000670 | 0.000340 |
| (y-axis) | 0.000722 | 0.000269 |
| 3(x-axis) | 0.000545 | 0.000318 |
| (y-axis) | 0.000603 | 0.000168 |
| 2(x-axis) | 0.000390 | 0.000282 |
| (y-axis) | 0.000449 | 0.000165 |
| 1(x-axis) | 0.000367 | 0.000227 |
| (y-axis) | 0.000219 | 0.000140 |

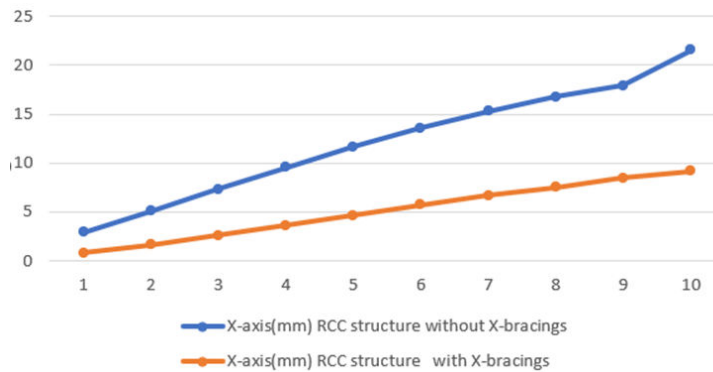
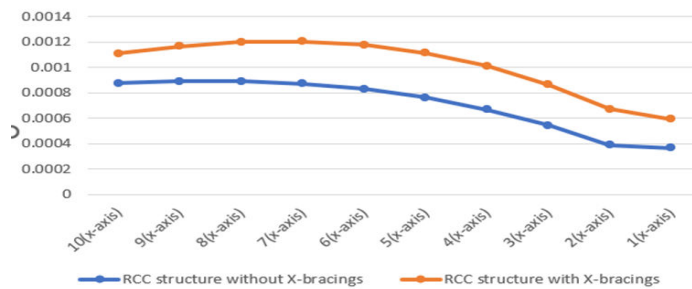
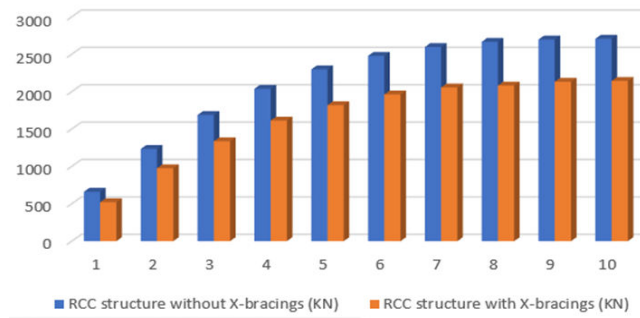
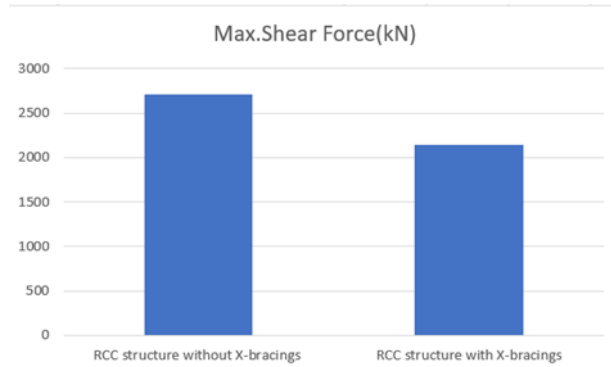
| Storey no | X-axis(mm) | | Y-axis(mm) | |
|-----------|----------------------------------|-------------------------------|----------------------------------|-------------------------------|
| | RCC structure without X-bracings | RCC structure with X-bracings | RCC structure without X-bracings | RCC structure with X-bracings |
| 10 | 21.55 | 9.17 | 5.62 | 4.06 |
| 9 | 17.94 | 8.47 | 5.53 | 3.91 |
| 8 | 16.74 | 7.54 | 5.04 | 2.70 |
| 7 | 15.32 | 6.71 | 4.45 | 2.53 |
| 6 | 13.61 | 5.71 | 3.78 | 2.12 |
| 5 | 11.66 | 4.66 | 3.06 | 1.79 |
| 4 | 9.54 | 3.61 | 2.32 | 1.44 |
| 3 | 7.32 | 2.59 | 1.61 | 1.08 |
| 2 | 5.09 | 1.64 | 0.94 | 0.73 |
| 1 | 2.90 | 0.79 | 0.38 | 0.33 |

Similar vales are compared with all types of seismic zones



Comparative results zonal wise

For Zone-II seismic zone





V.CONCLUSIONS

1. When compared to R.C.C. buildings without X-bracings, the analysis of R.C.C. structures with X-bracings reveals that the axial force, base shear, storey displacements, and storey drifts of the structure are quite high.
2. Given that X-bracings are quite expensive, we can thus conclude that a R.C.C. structure without them is more cost-effective than a traditional R.C.C. structure with them.
3. As a result, the values for Storey displacement and Storey drift for R.C.C. structures with X-bracings are 60% lower than for R.C.C. structures without X-bracings.
4. When earthquakes are taken into account, R.C.C. structures with X-bracings perform better than R.C.C. structures without X-bracings because to their ductility characteristics.
5. X-bracings are a different technology that can be utilised to adapt structures.
6. When compared to R.C.C. structures without X-bracings in Zones II, III, IV, and V, it is found that the base shear of the former is 62%, 73%, 77%, and 80% higher.
7. We found that the Storey drift of a R.C.C. structure with X-bracings in Zones II, III, IV, and V is 37%, 46%, 62%, and 78% higher than that of a R.C.C. structure without X-bracings in same zones.
8. We noticed that the R.C.C. structure with X-bracings in Zone-II,III,IV&V has a Storey displacement that is 27%,42%,52%, and 66% higher than the R.C.C. structure without X-bracings in Zone-II,III,IV&V.
9. As we saw from this study, storey drift and storey displacement of the building are less than comparing to storey drift and storey displacement as per zone V regions, which are extremely susceptible to earthquake intensity places. IS 1893:2002

REFERENCES

- [1] James O. Jirsa and Marc Badoux (1990). "RC Frame Steel Bracing for Seismic Retrofitting." J. Struct. Eng., 10.1061/(ASCE)0733-9445(1990) 116:1(55), pp. 55–74.
- [2] Nitin Bhojkar, Mahesh Bagade, and(2) "Seismic Evaluation of High-rising Structure by Steel Bracing System."
- [3] "Seismic Response of RC Frame Buildings with Soft First Stories," Proceedings of the CBRI Golden Jubilee Conference on Natural Hazards in Urban Habitat, New Delhi, 1997. Arlekar, N.J., Jain, K.S., and Murthy, C.V.R.
- [4] Mahmoud Reza Sahebi Maheri "Use of supporting steel in reenergized strong edges"
- [5] Nauman Mohammed and Islam Nazrul The lead of a multi-story RCC structure with various bracing systems (a software approach)
- [6] "Seismic Analysis of Steel Braced Reinforced Concrete Frames" by Viswanath K.G., Prakash K.B., and Anant Desai
- [7] Bureau of Indian Standards, New Delhi, IS: 1893 (Part-I) (2002): Criteria for Earthquake Resistant Design of Structures, Part-I General Provisions and Buildings.
- [8] L. D. Sarano and A. S. Elnashai Supporting Systems for Seismic Retrofitting of Steel Frames, Thirteenth World Conference on Earthquake Engineering, Vancouver, British Columbia, Canada, 2004, Paper No. 3351
- [9.] Eberhard and Sozen, 1993; Kabeyasawa, 1993 "The Concrete Core Wall's Effect."
- [10.] An A. Rutenberg and E. Nsieri (2006). Bulletin of Earthquake Engineering, 4, 1-21, "The seismic shear requirement in flexible cantilever divider structures and the EC8 game plan"



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details