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Determination of Optimum Offset Floor Level in Re-Entrant Corner Structure under Seismic Zone III

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Abstract: ***The Multistoried buildings structures are in very fascinated use for almost all urban part of living areas such as in metro cities. In this type the making of irregular shaped buildings have become more often now a day. In these study buildings of multistoried structure is taken for different cases. This paper presents the modeling of 10 cases in which irregular building has been considered for analysis such as by making offset at different floors including first, third, fifth, seventh, ninth , eleventh, thirteenth, fifteenth, seventeenth and nineteenth floors respectively in re-entrant corner of building. The comparative analysis of different parameters have been done to carry out research by software approach including parameters such as Base shear, maximum displacement, axial force ,shear force and Bending moment, maximum stresses etc. Structural Stability IRS Case 2 then after IRS case 1 to IRS case 3 may observed and obtained as economical and satisfied as per Indian Standards.***
Keywords: Concrete Grade, Dual system, Irregular Structure, Optimization, Re-entrant Corners, Shear Wall.

I. INTRODUCTION

The earthquake as natural disaster is one of the most common occurring disasters in particular areas taking to the categories of zonal region. To overcome the effect of these disasters some of particular behaviours of buildings should be required to be taken into consideration so that providing all the necessary warning for the structure before any collapse or failure of a building. Different parameters which are reason for behaviour of earthquake on buildings are such as lateral stiffness, lateral displacement, storey drift etc. There is very less damage in irregular configurations made structures as compared to regular buildings structure during occurrence of a natural disaster such as earthquake. The irregular plan building structures are more taken to as priority now a days to build by our engineers and architects which makes all people to be satisfy needs in an urban areas.

II. LITERATURE SURVEY

The objective of this research is to analyse the seismic effect of the building of geometrical plan configurations and compare the analysis on various parameters i.e. axial forces, displacement, base shear, bending moment, shear force, etc. For this analysis response spectrum method has been used and it is analysed by using software approach. The study has been carried out to examine the effect on the stability of the building under seismic analysis and to make easiness in the selection of the shape of the building in the seismic zone. (Mohd. Shadab khan, 2018). Also, a review has also been done to include the live load changing factor due to making distance of live load due to corona virus disease. Coronavirus has affected several millions of people causing cardiovascular issues, and other health problems, which has caused the economy to slow down, increasing mortality rate. (Ravi Manne et. al.) The authors in this work put emphasis on the usage of wall belt supported system used in multistoried building. This work compares the various possibilities of the demand and supply of stability enhancement system, since review has done. The lateral load handling capacity has evolved as the main criteria in this work. In this, they pointed out if the width and thickness were kept fixed and if the height at which the shear strip behaves effective will be their optimum case (Neeraj Patel et. al.).

III. PROCEDURE AND 3D MODELING OF THE STRUCTURE

Earthquake analysis is carried out using a G+19 Storey building by software approach. The total 10 models are created on the software. The model 1 to 10 were made in the software in which all irregular buildings were considered along with offsets being provided on first , third, fifth floor and so on respectively from model 1 to 10.. The analysis part consist of the effect on building under the different loads such as dead load, live load and lateral loads (earthquake and wind) etc into it based on software mechanism. The seismic data is taken as per the IS 1893(PART1):2016. The response spectrum analysis method is adopted for analysis of building.

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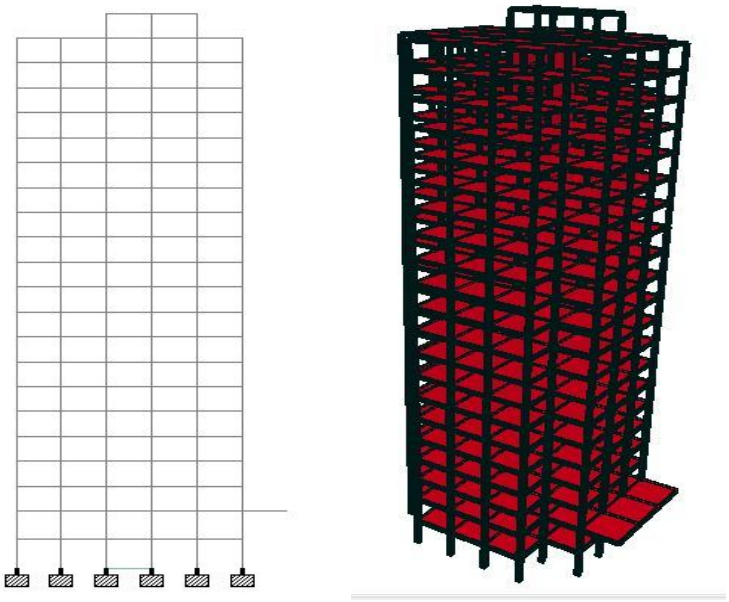
Table 1: Model Description

Models	Description
IRS Case 1	Offset on first floor in re-entrant corner building.
IRS Case 2	Offset on third floor in re-entrant corner building.
IRS Case 3	Offset on fifth floor in re-entrant corner building.
IRS Case 4	Offset on seventh floor in re-entrant corner building.
IRS Case 5	Offset on ninth floor in re-entrant corner building.
IRS Case 6	Offset on eleventh floor in re-entrant corner building.
IRS Case 7	Offset on thirteenth floor in re-entrant corner building.
IRS Case 8	Offset on fifteenth floor in re-entrant corner building.
IRS Case 9	Offset on seventeenth floor in re-entrant corner building.
IRS Case 10	Offset on nineteenth floor in re-entrant corner building.

G + 19 storey's irregular building are taken into consideration for study by providing offset at different floors on re-entrant corner. There were different 10 cases were modelled in the software having offset at different floor such as at first , third, fifth floor and so on respectively from model 1 to 10 with bay of 5m in X-direction as well as of 5m in Z-direction also. Different model cases were designed using M-30 grade of concrete and Fe-500 reinforcing steel used for main reinforcement and Fe-415 for distribution reinforcement. The model description that have been tabulated in table 1 are as follows for different plan



(A)Front view (B) 3-D View

Fig 1: IRS Case 1- G+19 Storey Irregular Building with Offset on first floor in re-entrant corner building

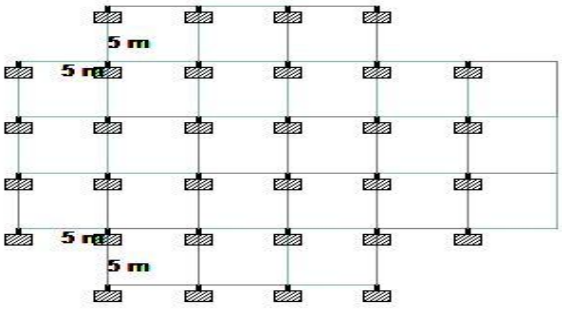


Fig 2: Typical floor plan

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IV. RESULTS ANALYSIS

The result parameters obtained by the application of loads and their combinations on various cases of the multistorey building as per Indian Standard 1893: 2016 code of practice.

Result of each parameter has discussed with its representation in graphical form below:-

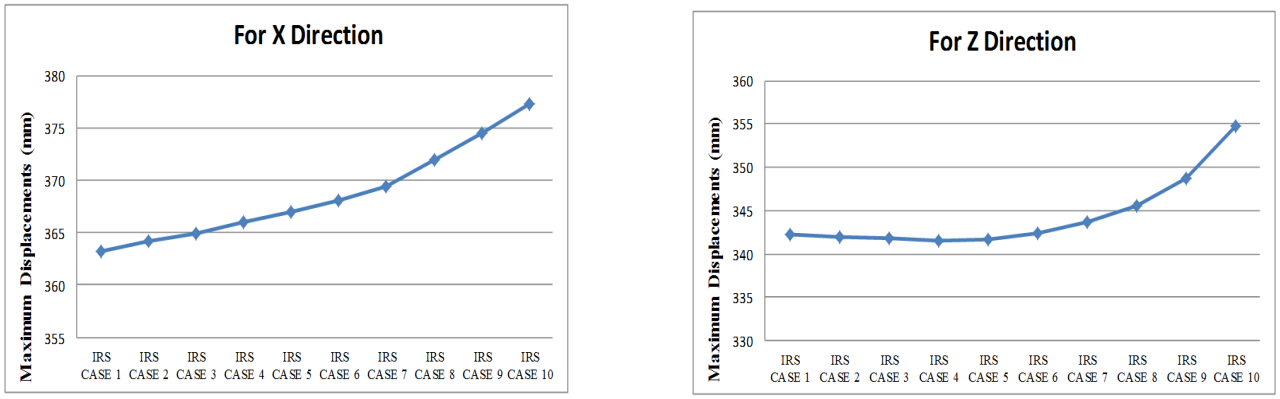

Fig. 3: Graphical Representation of Maximum Displacement in X and Z direction for offset on all re-entrant corner Structural Stability Cases

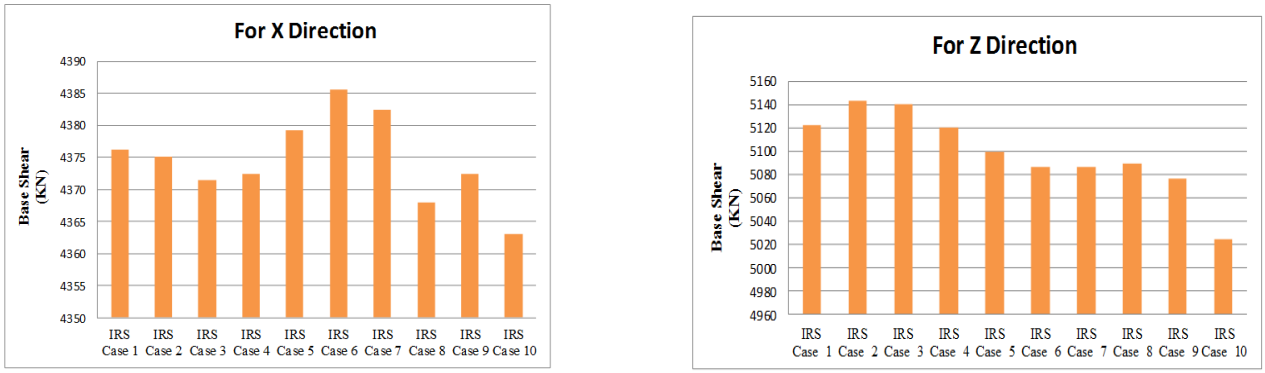

Fig. 4: Graphical Representation of Base Shear in both X and Z direction for offset on all re-entrant corner Structural Stability Cases

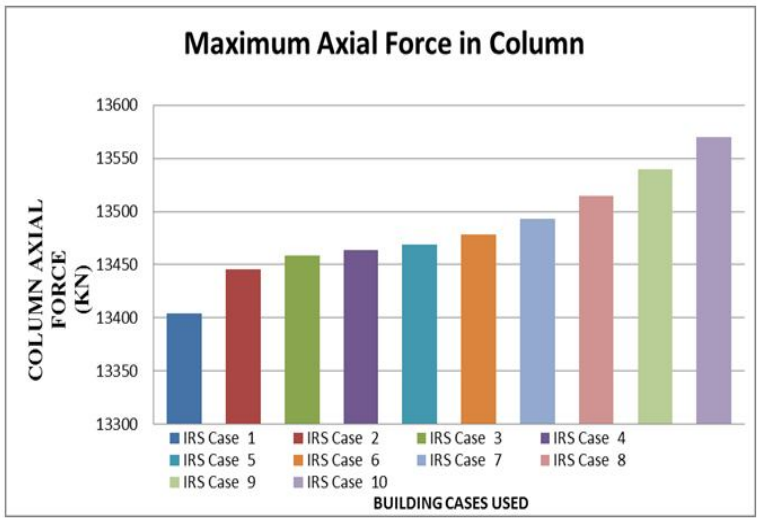

Fig. 5: Graphical Representation of Maximum Axial Forces in Column for offset on all re-entrant corner Structural Stability Cases

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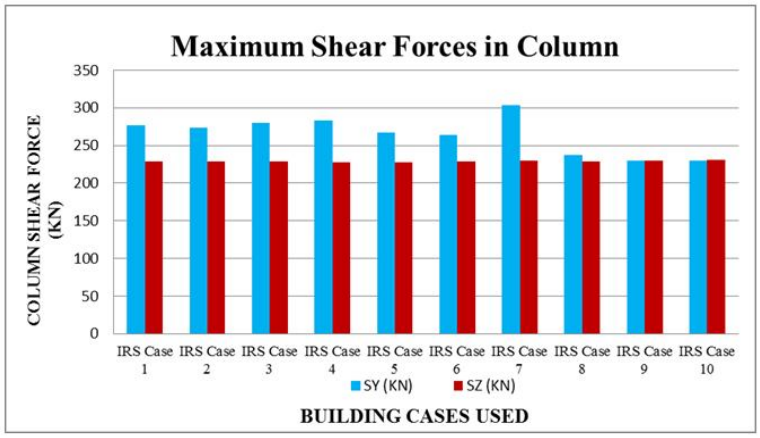

Fig. 6: Graphical Representation of Maximum Shear Force in Column for offset on all re-entrant corner Structural Stability Cases

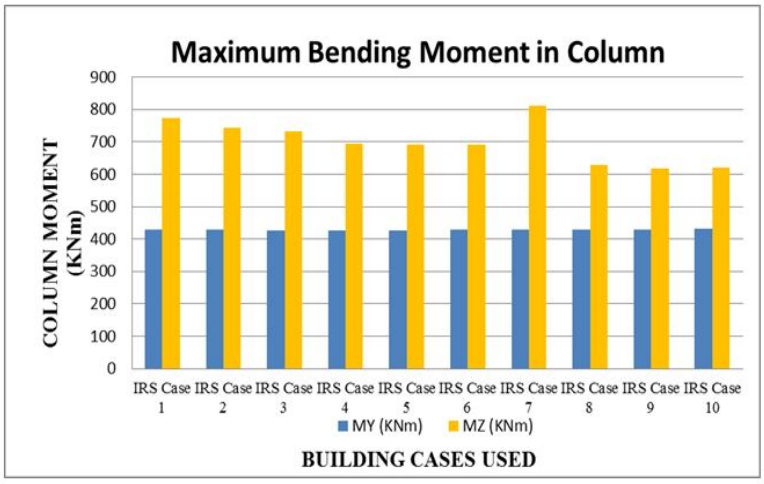

Fig. 7: Graphical Representation of Maximum Bending Moment in Column for offset on all re-entrant corner Structural Stability Cases

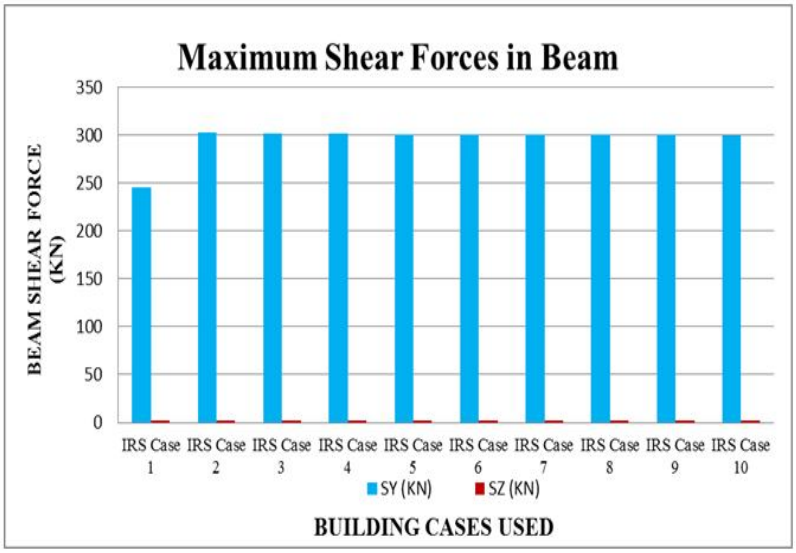

Fig. 8: Graphical Representation of Maximum Shear Force in Beam for offset on all re-entrant corner Structural Stability Cases

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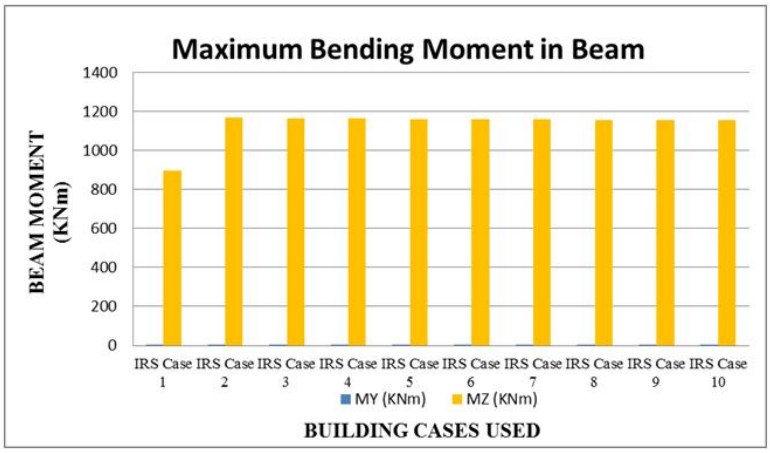

Fig. 9: Graphical Representation of Maximum Bending Moment in Beam for offset on all re-entrant corner Structural Stability Cases

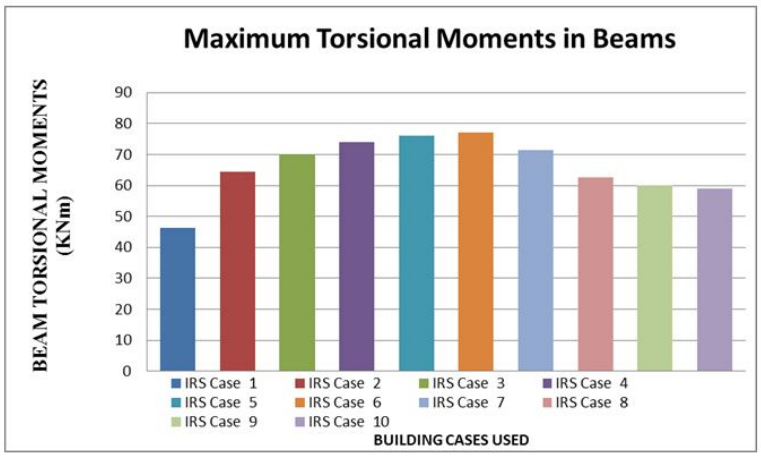

Fig. 10: Graphical Representation of Maximum Torsional Moments in Beam for offset on all re-entrant corner Structural Stability Cases

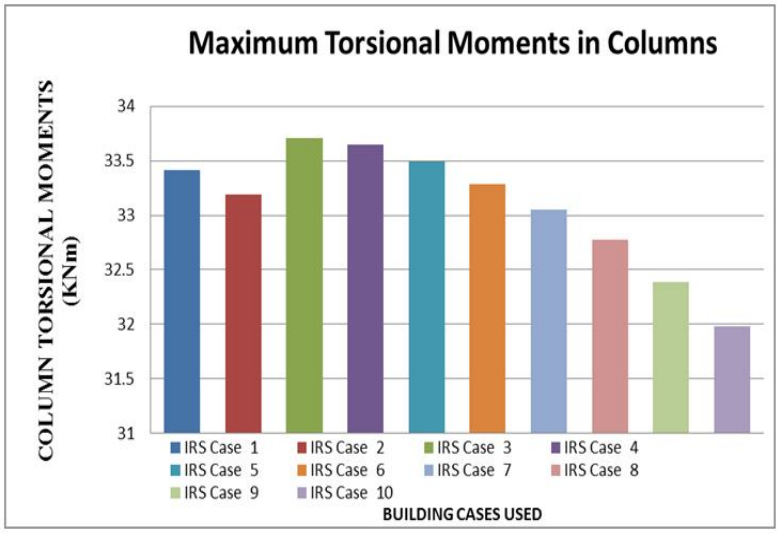

Fig. 11: Graphical Representation of Maximum Torsional Moments in Columns for offset on all re-entrant corner Structural Stability Cases

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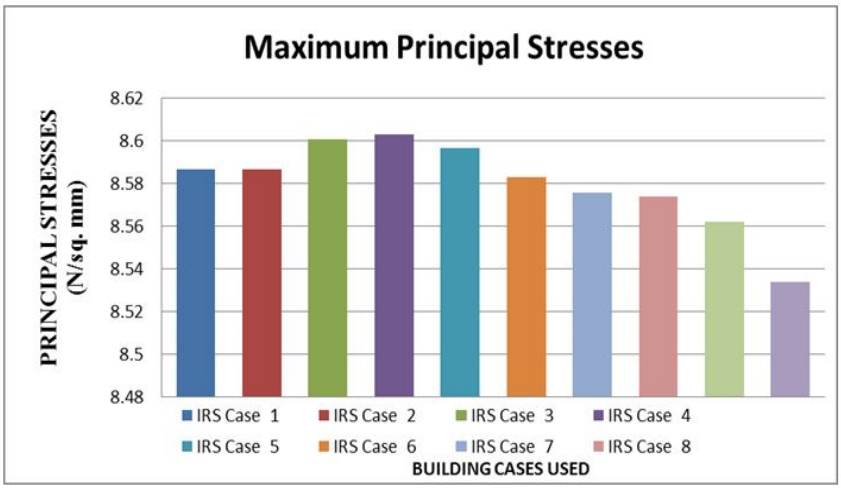

Fig. 12: Graphical Representation of Maximum Principal Stresses for offset on all re-entrant corner Structural Stability Cases

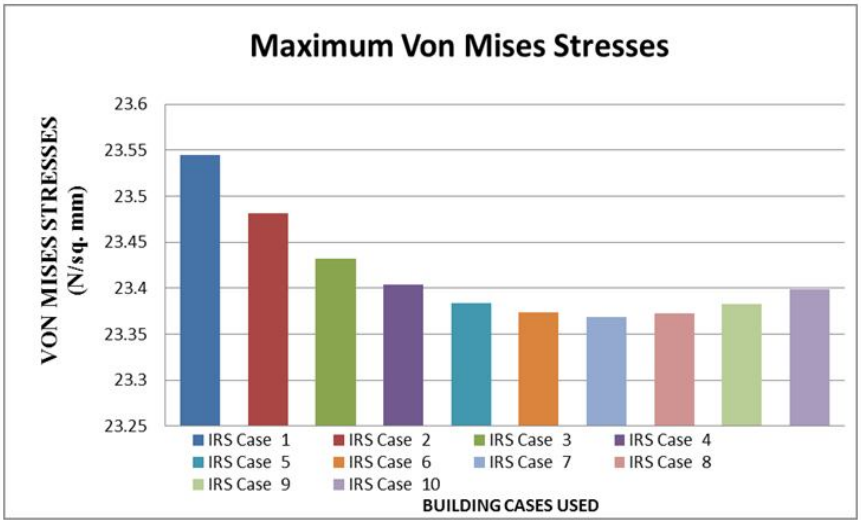

Fig. 13: Graphical Representation of Maximum Von Mises Stresses for offset on all re-entrant corner Structural Stability Cases

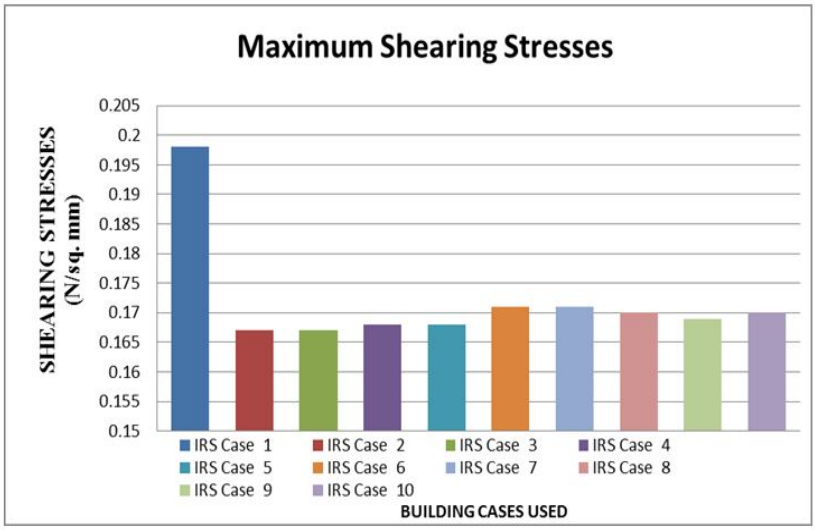

Fig. 14: Graphical Representation of Maximum Shearing Stresses for offset on all re-entrant corner Structural Stability Cases

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V. CONCLUSIONS

Attractive result has been found when comparing offset in re-entrant corner building system and after analysis of numerous parameters, the conclusion can be pointed out are as follows:-

1) There is minimum value of Maximum displacement in X direction will obtain in IRS case 1(Value = 363.224 mm) offset in reentrant corner building as compeer to other IRS case 2 to IRS case 10.as well as minimum value of maximum displacement in Z direction is comes in IRS case 4 (Value = 341.526 mm) when compare to other IRS case 1 to IRS case 3 and IRS case 5 to IRS case 10.

2) In the X direction Minimum base shear occur IRS case 10 (Value = 4363.09 KN) in the offset in reentrant corner building in as compare to other cases in the analysis and Z direction same as above written IRS case 10(Value = 5024.950 KN) in minimum base shear performed.

3) IRS case 10(Value = 13570.382 KN) is maximum column axial force occur when compare to other IRS case 1 to IRS case 9 for in offset in reentrant corner building.

4) For column shear force in Y direction IRS case 9 perform minimum value as compare to other cases similarly in the Z direction IRS case 4 perform minimum value in the analysis.

5) For column bending moment about Y direction IRS case 5 (Value = 427.417 KNM) comes minimum value when compare to other IRS cases or in the Z direction the value of bending moment in IRS case 10 (Value = 427.417 KNM) in compare from IRS case 01 to IRS case 9.

6) Now the beam shear force along Y direction show minimum value in IRS case 1 as compare to other IRS case 1 to IRS case 9. or as well as along Z direction minimum value in IRS case 1 to other IRS case 1 to IRS case 9.

7) The beam bending moment minimum value occur in IRS case 5 and IRS case 6 (Value = 4.575 KNM) along Y direction and minimum value in IRS case 1 (value =899.257 KNM) as compare to other IRS cases

8) The beam torsional moment minimum value comes at IRS case 1 (value =46.357 KNM) when compare all IRS cases, IRS case 2 to IRS case 6 increase the torsional moment and IRS case 7 to IRS case 10 decreases torsional moment.

9) Now column torsional moment minimum value comes at IRS case 10 (value= 31.984 KNM) when IRS case 1 to IRS case 9 decreases the torsional moment.

10) Minimum value of the maximum principal stresses at top in the IRS case 10 (value= 8.534 N/mm sq.).

11) Minimum value of the maximum Von Mises stresses at top in the IRS case 7 (value=23.369 N/mm sq.) when compare to other IRS cases.

12) Minimum value of the shear stresses in the IRS case 2 and IRS case 3 (value=23.369 N/mm sq.) when compare to other IRS cases..

Observing all the parameters, the main theme of this work has achieved with increasing stability by offset in reentrant corner in Semi Commercial Building, (G+19) multistoried building under seismic loading. Structural Stability IRS Case 2 then after IRS case 1 to IRS case 3 may observed and obtained as economical and satisfied IS 1893-2016 (part 1)or IS 456-2000,IS 13920 efficient case and should be recommended when this type of approach will be adopted in earthquake zone III.

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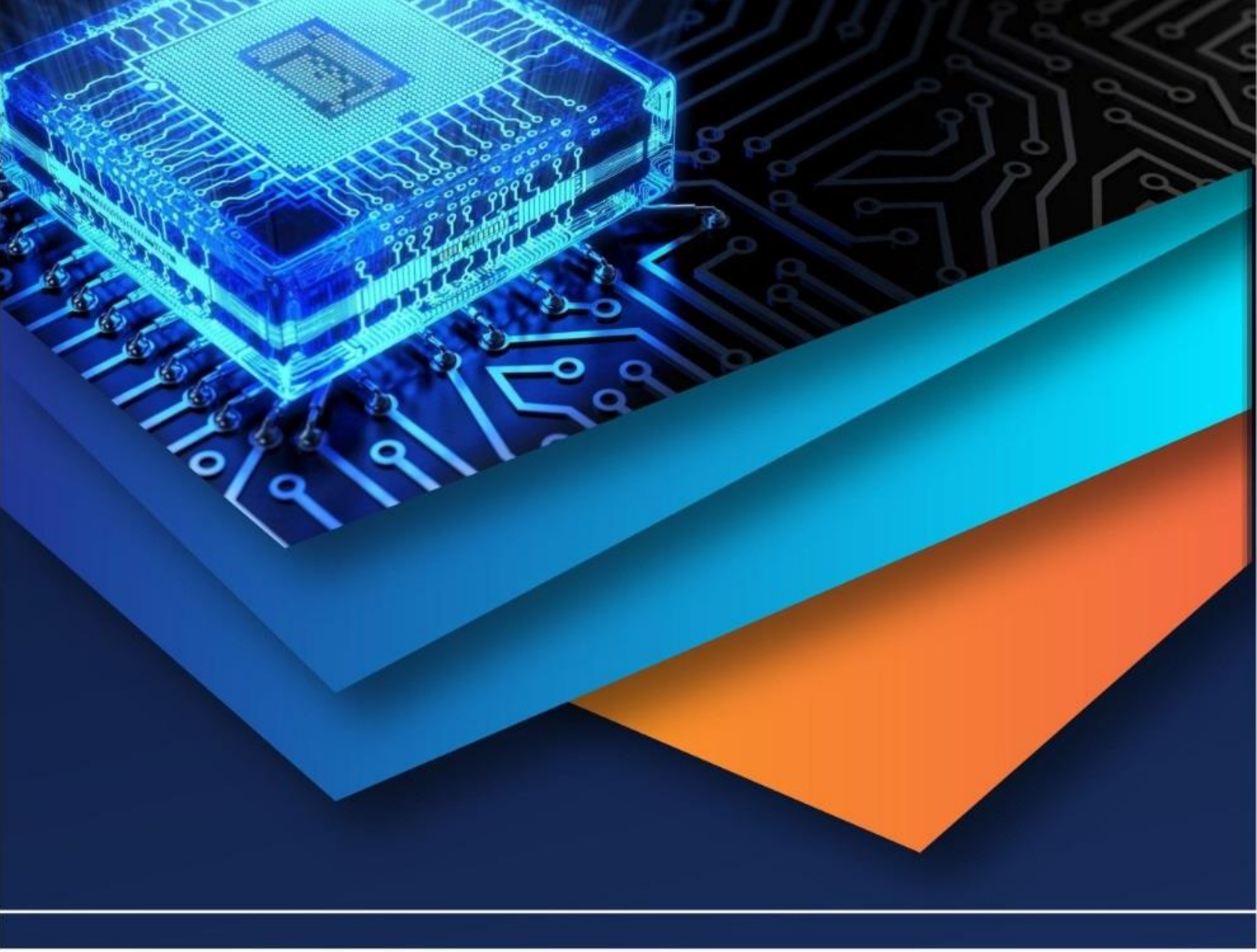

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