International Journal for Modern Trends in Science and Technology, 8(06): 141-146, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0806021
Available online at: http://www.ijmtst.com/vol8issue06.html

Performance Based Evaluation of RCC Structure with Crescent Braces

Myla Mohith Kumar[1], Dr.E. Arunakanthi[2]

[1]PG Scholar (Computer aided Structural Engineering), Department of Civil Engineering, JNTU College of Engineering, Anantapuramu.515002, India.
[2]Professor of Civil Engineering, JNTUA College of EngineeringAnantapuramu.515002, India.

To Cite this Article
Myla Mohith Kumar and Dr.E. Arunakanthi. Performance Based Evaluation of RCC Structure with Crescent Braces. International Journal for Modern Trends in Science and Technology 2022, 8(06), pp. 141-146. https://doi.org/10.46501/IJMTST0806021

Article Info
Received: 02 May 2022; Accepted: 03 June 2022; Published: 06 June 2022.

ABSTRACT

Earthquake is extremely common in all parts of the world Geographical statistics from India show that almost 55% of the land is susceptible to disasters. A performance-based analysis is designed to control structural damage based on accurate estimates of appropriate response parameters. The performance seismic design specifically assesses how a building is likely to perform, given its potential hazard, in view of uncertainties related to the quantification of potential hazards and unsafety in the assessment of the real response of the building.The process begins with the choice of performance targets, followed by the development of a preliminary design, assesses whether the design is or not fulfilling the performance targets, and then redesigns and re-evaluates if necessary to achieve the desired level of performance. Performance based seismic design is an elastic design methodology based on the relationship of non-linear stress to building performance under the various lateral forces.The CSB is a one-of-a-kind hysteretic lateral resisting device that gives frame constructions more design flexibility. The vertical resisting system for a single structure is often built for static loads and is unlikely to have a lateral force–displacement curve that is near to the ideal seismic "objective curve." As a result, a specialised bracing system should be implemented to transform the desired "objective curve" into the actual structural response, capable of independently matching the requisite qualities in terms of stiffness, strength, and ductility. Common bracing devices (such as concentric stiff diagonal components) do not normally allow for the construction of these three qualities individually. Even though several research have been conducted on certain types of steel bracing components,The current study looks at Pushover for RCC buildings with G+10 and G+20 storeys with crescent braces that are believed to be in Zone IV, to better understand the building's seismic behaviour and performance. A Pushover curve depicting the building component performance levels and maximum building load capacity is the outcome of Pushover study. As a result, from point B to C, the demand curve overlaps the capacity curve. As a result, all the stories have some residual strength and rigidity. Most of the damage was in the beams, with a few in the columns.

KEYWORDS:performance-based design, crescent brace, pushover analysis, sap2000

1. INTRODUCTION

Steel structures have played a significant part in the building sector in recent decades. It is vital to build a construction that can withstand earthquakes. Steel bracings can be used in the structural system to boost the structure's shear capacity. Bracings can also be utilised as a retrofit. Steel bracings may be arranged in an infinite number of ways. Eccentric bracings of the D, K, and V types, for example. To operate effectively under seismic stresses, the design of such a structure should have a high ductility property. Push over analysis is used to assess ductility and other attributes for each eccentric bracing.A approach for performance-based design of building frames vulnerable to seismic loads is a basic computer-based push-over analysis. Because of its simplicity and efficacy, push over analysis has gained a lot of traction in recent decades. The current work presents a response spectrum analysis and ductility behaviour for various eccentric steel frames constructed according to IS-800 (2007).

A braced frame is a type of structural system that is widely employed in constructions that are subjected to lateral loads like wind and seismic pressure. A braced frame's members are usually built of structural steel, which can act in both tension and compression.Vertical loads are carried by the frame's beams and columns, while lateral loads are carried by the bracing system. Brace placement, on the other hand, might be troublesome since it can interfere with the façade's design and the placement of openings. Bracing has been expressed as an interior or external design component in buildings with high-tech or post-modernist designs.The study's main goals are to learn about building seismic behaviour using IS 1893:2002, design an earthquake-resistant structure using steel bracings in zone, compare the results of lateral load, shear, bending, torsion, base shear, time period, and frequency values, and study multi-story buildings in SAP 2000 V19 using response spectrum analysis.

2. METHODOLOGY USED

Response spectrum analysis

In engineering, the term spectrum refers to the reaction of structures across a wide variety of time periods that may be described in a single graph. For a structure produced at a project site, this procedure should be executed using the design spectrum stated in code or a site-specific design spectrum. For the purposes of dynamic analysis of steel and reinforce concrete buildings, damping values of 2 and 5% of the critical can be used. Inelastic reaction is predicted in most structures during a big earthquake, meaning that an inelastic analysis is more appropriate for design.

Even though nonlinear inelastic programmes are available, they are not commonly employed in design because:

1. Proper utilisation necessitates an understanding of their underlying workings and philosophies. Design criteria
2. The results obtained are difficult to comprehend and relate to traditional design criteria
3. The calculations required are costly.
4. As a result, linear elastic processes based on the response spectrum approach are commonly used in practice. Because it is simpler to apply, response spectrum analysis is the favoured approach.

3.BUILDING SPECIFICATIONS AND MODELS IN SAP 2000

In the present study, analysis of G+10 and G+20 multi-story building in Zone V seismic zones is carried out.

Basic parameters considered for the analysis are

1. Utility of building : Residential building
2. Number of stories : G+10and G+20
3. Shape of building : Rectangular
4. Geometric details

a. Ground floor : 3m

b. floor to floor height : 3m

5. Material details

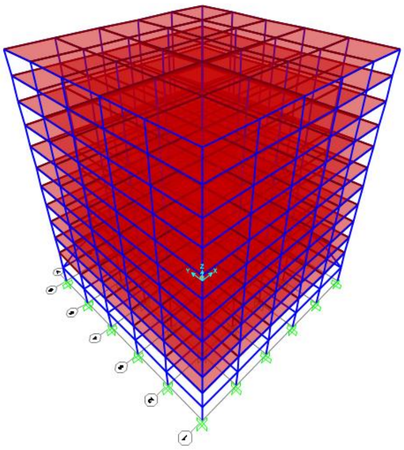
a. Concrete Grade : M30

b. All Steel Grades : HYSD reinforcement of Grade Fe415

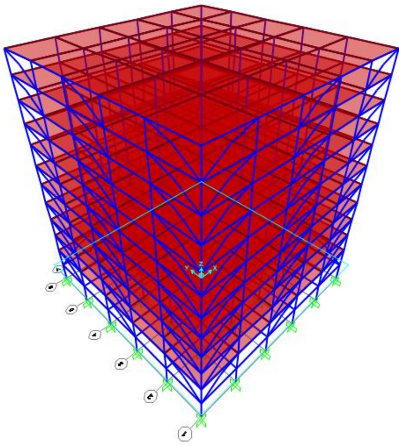
c. Bearing Capacity of Soil : 200 KN/m^2

6. Type Of Construction :R.C.C FRAMED structure
7. Column : 0.8m X 0.8m
8. Beams : 0.8m X 0.46m
9. Bracings : ISMB 200
10. Slab : 0.15m
11. Seismic Zone : V
12. Seismic design code :IS 1893:2016
13. Wind design code :IS875:2015-Part3
14. RCC code :IS 456-2000

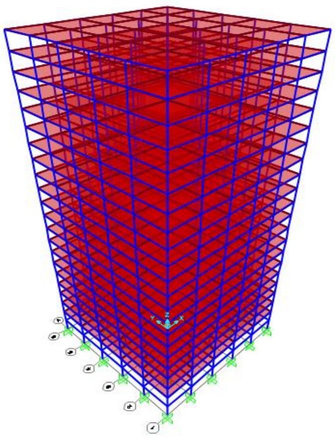
Models in ETABS Software



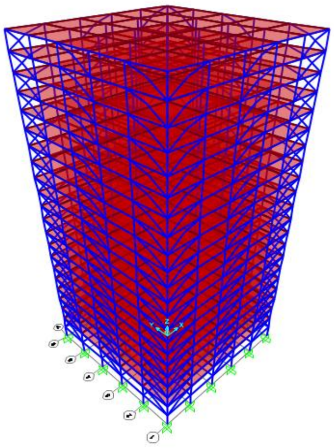
G+10 building without bracings



G+10 building with bracings



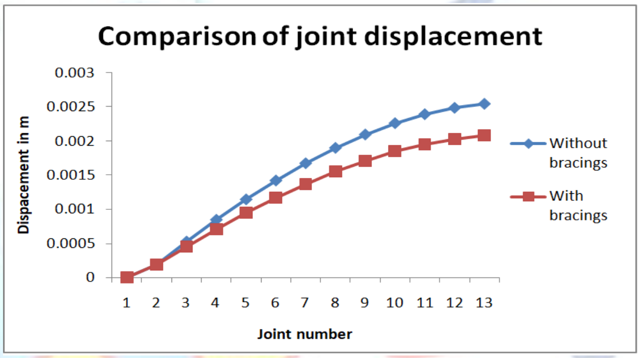
G+20 building without bracings



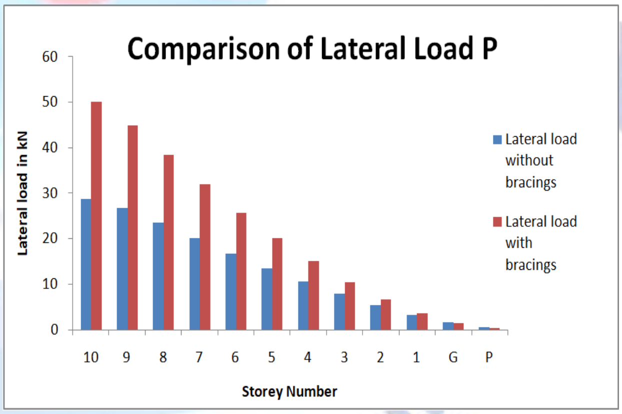
G+20 building without bracings

4. RESULTS AND ANALYSIS

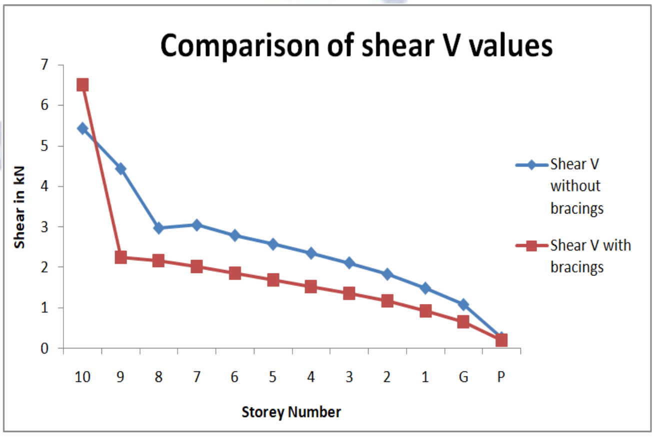
G+10 BuildingJoint displacement



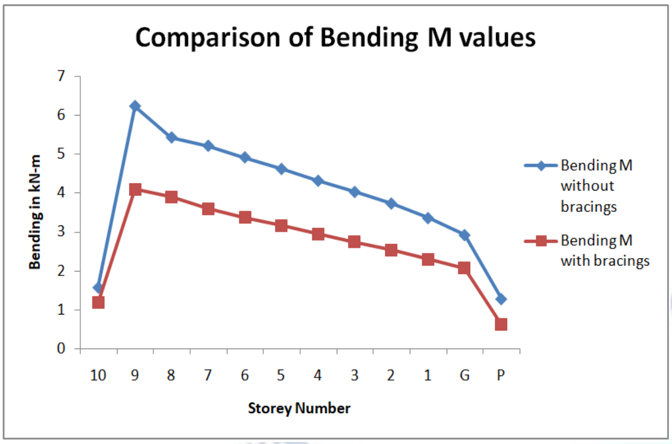
Lateral load P



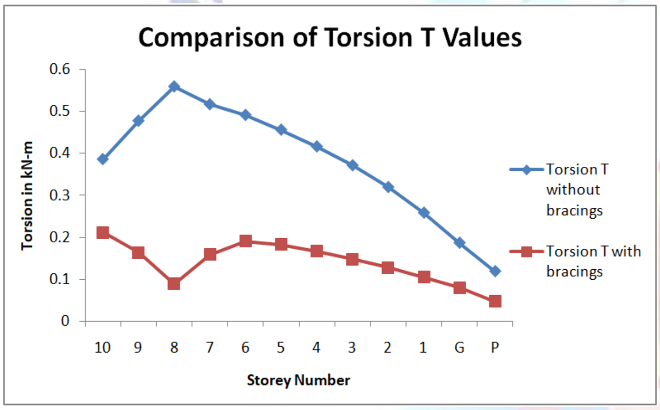
Shear V



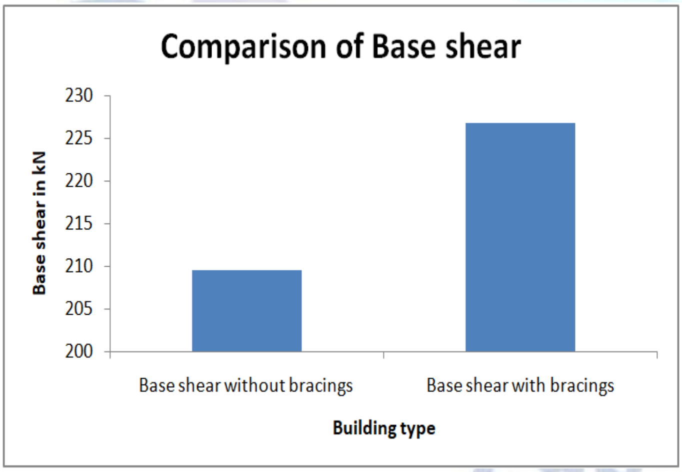
Bending M



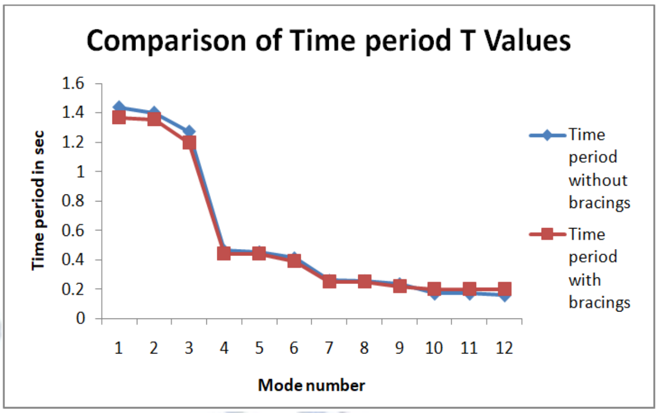
Torsion T



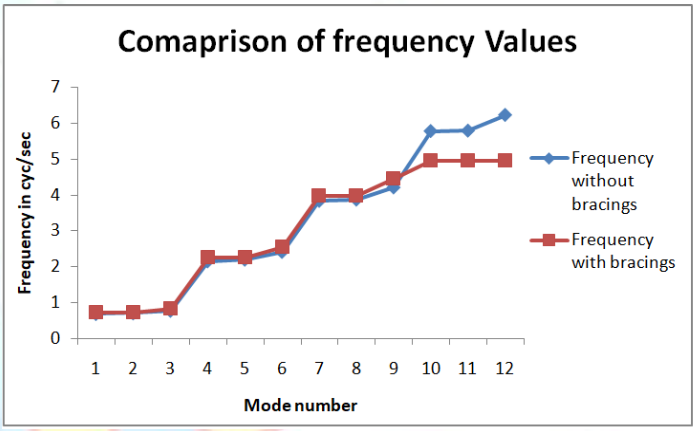
Base shear



Time period T

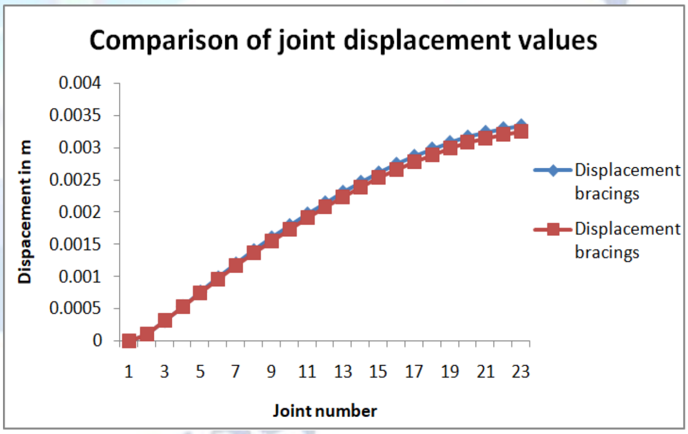


Frequency

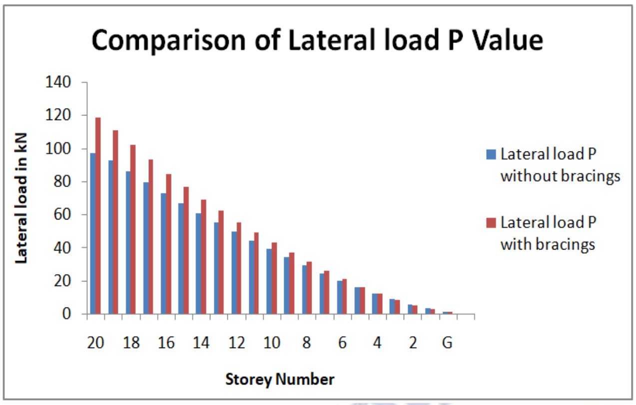


G+20 building

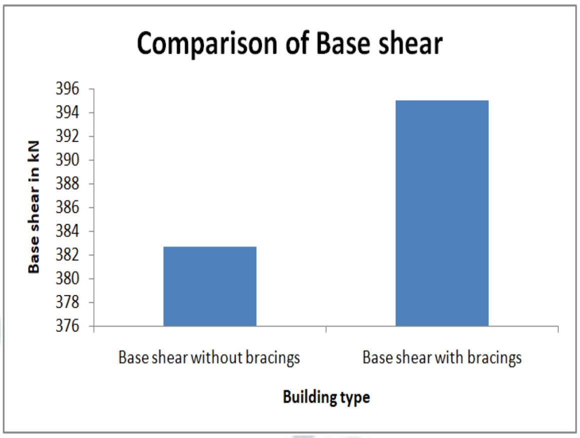
Joint displacement



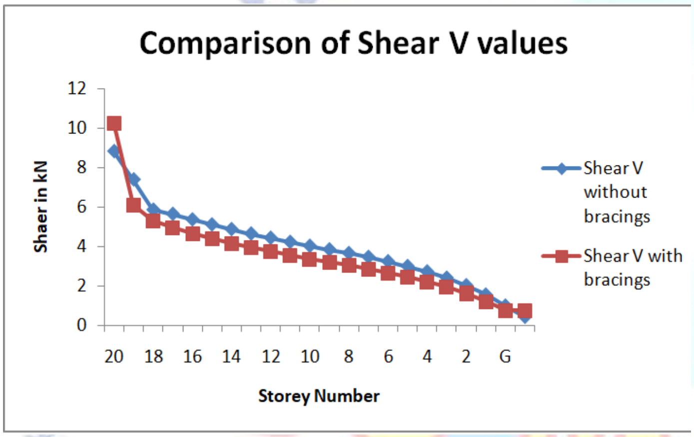
Lateral load P



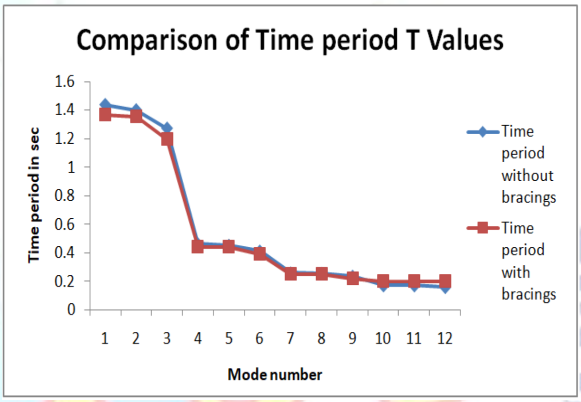
Base shear



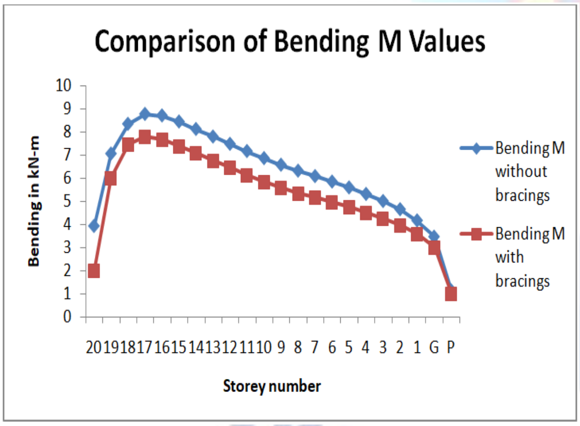
Shear V



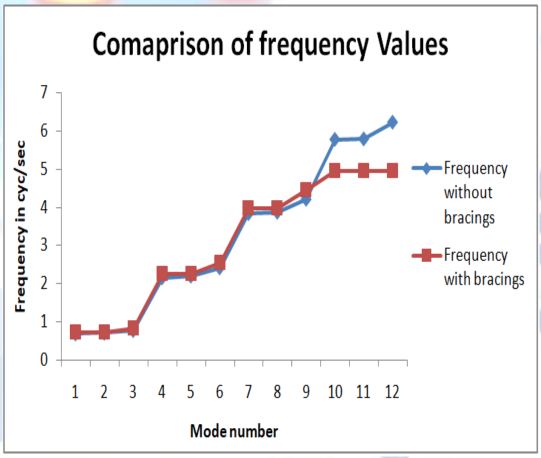
Time period T



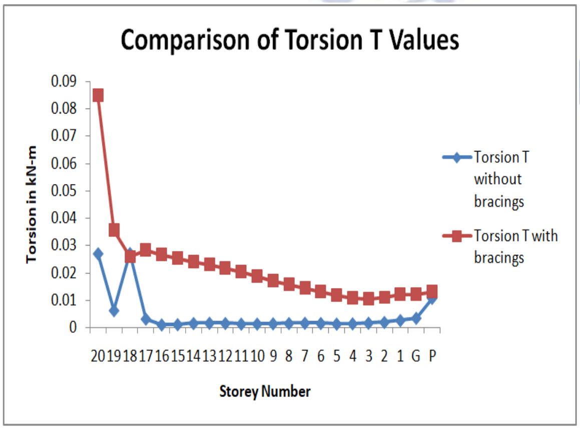
Bending M



Frequency



Torsion T



5. CONCLUSIONS

From the above study the following conclusions were made

1. By providing bracing for G+10 and G+20 buildings we can reduce the seismic load action on building, and we can design the earth quack resistant structure.
2. The value of displacement in both the G+10 and G+20structure is obtained less values by providing

crescent bracing systems when we compared without bracings case.

3. The value of axial load decreases from top storey to bottom storey in both buildings (G+10 and G+20). Less intensity of axial load is seen in without bracings systems, due to the presents of extra load from the bracings the lateral load increases.
4. The intensity of shear values in both the building models of G+10and G+20 decreases from top storey to the bottom storey and the less intensity values are seen in case of crescent bracing systems when we compared without bracings case.
5. The values of bending in both the building models of G+10and G+20 decreases from top storey to the bottom storey and the less intensity values are seen in case of crescent bracing systems when we compared without bracings case.
6. The intensity of torsion in both the building models of G+10and G+20 decreases from top storey to the bottom storey and the less intensity values are seen in case of crescent bracing systems when we compared without bracings case.
7. The base shear values are obtained maximum in case of the model made with bracing systems when we compared without bracings models.
8. The value of time perioddecreases from node point 1 to node point 12. The maximum value is observed for building without bracings.
9. The value of frequency increase from node point 1 to node point 12. The less value is observed for building without bracings.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

References

[1] Prince Kaley1, Mirza Aamir Baig2, et al.,(2017), "Pushover Analysis of Steel Framed Building", Journal of Civil Engineering and Environmental Technology p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 4, Issue 3; April-June, 2017, pp. 301-306.

[2] Jayaram Nayak B1, Kiran Kamath2, Avinash A R3 et al.,(2018), "PUSHOVER ANALYSIS OF THREE DIMENSIONAL STEEL BRACED STRUCTURE WITH VARYING BRACING HEIGHTS",International Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 4, April 2018, pp. 265–274, Article ID: IJCIET_09_04_029.

[3] Mohd Mubeen1, Khalid Nayaz Khan2, Mohammed Idrees Khan3, et al.,(2015), "SEISMIC ANALYSIS OF STEEL FRAMES WITH ECCENTRIC BRACINGS USING PUSHOVER ANALYSIS", International Journal of Advanced Technology in Engineering and Science www.ijates.com, Volume No.03, Issue No. 06, June 2015 ISSN (online): 2348 – 7550.

[4] Santosh shet1, Dr.Akshatha shetty2, et al.,(2017), "PUSHOVER ANALYSIS OF STEEL STRUCTURE",INTERNATIONAL JOURNAL OF CURRENT ENGINEERING AND SCIENTIFIC RESEARCH (IJCESR), ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-4, ISSUE-5, 2017.

[5] Ms. Pallavi B. Gadge1, Mr. Gajanan D. Dhawale2, Miss. Rutuja K. Kakpure3, et al.,(2018), " Study of Behaviour of Steel Structure by Push Over Analysis", International Advanced Research Journal in Science, Engineering and Technology ISO 3297:2007 Certified Vol. 5, Issue 5, May 2018.

[6] Shaik Kamal Mohammed Azam, Vinod Hosur, "Seismic Performance Evaluation of Multistoried RC Framed Buildings with Shear Wall", International Journal of Scientific & Engineering Research, Volume 4, Issue 1, January 2013.

[7] C.V.R Murthy, Rupen Goswami, A.R.Vijaynarayanan, Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Gujrat State Disaster Management Authority, Government of Gujrat.

[8] Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures" (PHI Learning Private Limited, New Delhi, India).

[9] Dr. Vinod Hosur, "Earthquake Resistant Design of Building Structures" (Wiley India Pvt. Ltd, New Delhi, India).

[10] Bryan Stafford Smith, Alex Coull, "Tall Building Structures Analysis and Design" (John Wiley and Sons, Inc).