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Comparative Study Of Different Bracing Systems On G+29 Steel Frame Building

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Abstract *—The resistance to the lateral loads from wind or from an earthquake is the reason for the evolution of various structural systems. Bracing system is one such structural system which forms an integral part of the frame. Such a structure has to be analysed before arriving at the best type or effective arrangement of bracing. This project is about the efficiency of using different types of bracings and with different steel profiles for bracing members for multi-storey steel frames. ETABS software is used to obtain the design of frames and bracing systems with appropriate steel section selection for beams, columns and bracing members from the standard set of steel sections. A three dimensional structure is taken with 5 horizontal bays of width 5 meters, and 30 stories is taken with storey height of 3.5m. The beams and columns are designed to withstand dead and live load only. Wind load and Earthquake loads are taken by bracings. The bracings are provided only on the peripheral columns. Maximum of 4 bracings are used in a storey for economic purposes. In this study, an attempt has been made to study the effects of various types of bracing systems with respect to displacement.*

Keywords- *G+29 Steel Frame Building; Bracings; ETABS 2015; Wind load; Earthquake load; Load combinations; Displacement*

I. INTRODUCTION

The high cost of land, the desire to avoid a continuous urban sprawl and need to preserve important agricultural production have all contributed to drive the residential buildings upward. To accommodate the continuous urban sprawl, there is a need to construct tall buildings. A tall building may be defined as a building whose design is governed by the lateral forces induced due to wind and earthquake. A braced frame is designed primarily to resist wind and earthquake forces in and a structural system. Bracings are provided to increase stiffness and stability of the structure under lateral loading and also to reduce lateral displacement significantly.

II. STRUCTURAL DETAIL

- No of bay in X-direction : 5
- No of bay in Y-direction : 5
- Width of bay in X-direction : 5 m
- Width of bay in Y-direction : 5 m
- Number of storey : 30
- Height of building : 105 m
- Story height : 3.5 m
- Beam section : ISMB 350
- Column section : ISMB 400
- Brace section : ISLB 250

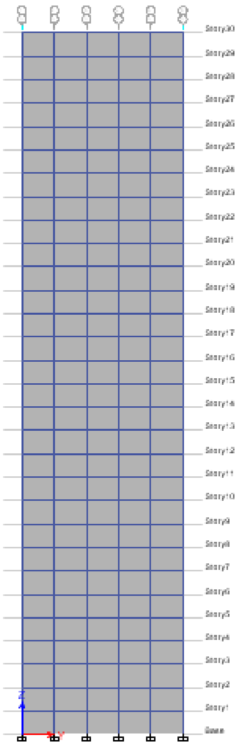
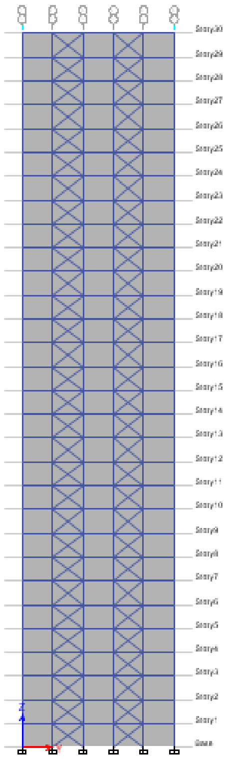
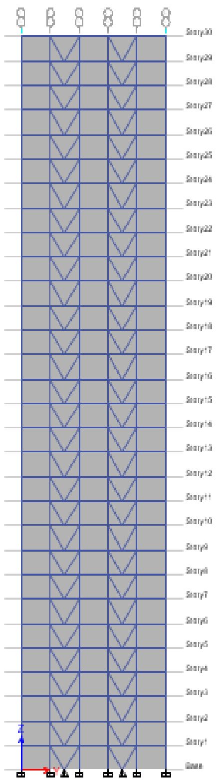
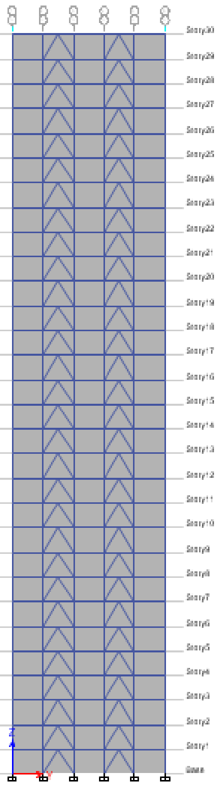
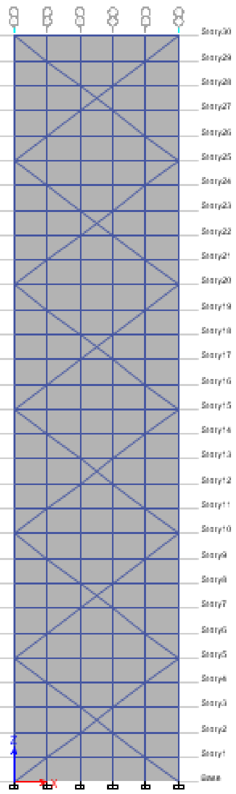

Fig 2.1 Without bracing *Fig 2.2 X-bracing* *Fig 2.3 V-bracing* *Fig 2.4 InvV-bracing* *Fig 2.5 Diagonal bracing*

III. LOAD CALCULATIONS

3.1. Gravity Loading:

- Dead load
  1. Self weight : As per programme calculated
  2. Floor Finish : 1 kN/m2
  3. Cladding : 1 kN/m
- Live Load : 3 kN/m2

3.2. Wind Loading:

- Terrain category : 2
- Class : B
- K1 : 1
- K2 : Depending upon the variation of height.
- K3 : 1.0(flat topography)
- Wind speed: As per locations
  1. Jaipur: 47 m/s
  2. Rajkot: 39 m/s
  3. Delhi: 47 m/s
  4. Bhuj: 50 m/s

3.3. Earthquake Loading:

- Importance Factor : 1
- Response Reduction Factor : 5
- Soil type : Medium Soil
- Damping Coefficient : 0.05
- Zone Factor : As per locations
  1. Jaipur: 0.10
  2. Rajkot: 0.16
  3. Delhi: 0.24
  4. Bhuj: 0.36

IV. RESULTS

4.1. LOCATION : JAIPUR

Sr. No.	Types of bracing	Max. Displacement due to wind in X-direction	Max. Displacement due to wind in Y-direction	Max. Displacement due to earthquake in X-direction	Max. Displacement due to earthquake in Y-direction
1.	Without bracing	259.2	7907.5	154	1140
2.	X-bracing	267	564.7	110.4	235.7
3.	V-bracing	277.5	598.2	69	149.8
4.	Inverted V-bracing	265.7	555.1	66.7	140.7
5.	Single diagonal bracing	110.3	535.9	68.3	82.8

4.2. LOCATION : RAJKOT

Sr. No.	Types of bracing	Max. Displacement due to wind in X-direction	Max. Displacement due to wind in Y-direction	Max. Displacement due to earthquake in X-direction	Max. Displacement due to earthquake in Y-direction
1.	Without bracing	267.7	2041.8	246.4	1824
2.	X-bracing	183.9	388.9	107.3	229
3.	V-bracing	189	409.2	180	392.6
4.	Inverted V-bracing	183	382.2	106.7	225.2
5.	Single diagonal bracing	113.9	138.8	109.1	132.1

4.3. LOCATION : DELHI

Sr. No.	Types of bracing	Max. Displacement due to wind in X-direction	Max. Displacement due to wind in Y-direction	Max. Displacement due to earthquake in X-direction	Max. Displacement due to earthquake in Y-direction
1.	Without bracing	388.7	2965.4	369.6	2736
2.	X-bracing	267	564.7	160.9	343.5
3.	V-bracing	277.5	598.2	272.9	592.9
4.	Inverted V-bracing	265.7	555.1	263.9	556.9
5.	Single diagonal bracing	165.3	201.3	163.5	197.9

4.4. LOCATION : BHUJ

Sr. No.	Types of bracing	Max. Displacement due to wind in X-direction	Max. Displacement due to wind in Y-direction	Max. Displacement due to earthquake in X-direction	Max. Displacement due to earthquake in Y-direction
1.	Without bracing	439.9	3356	554.3	4103.9
2.	X-bracing	302.2	639.1	397.3	848.5
3.	V-bracing	314.1	677	409.3	889.3
4.	Inverted V-bracing	300.7	628.2	395.8	835.4
5.	Single diagonal bracing	187.1	227.8	245.2	296.6

V. CONCLUSION

- The concept of using steel bracing is one of the advantageous concepts which can be used to strengthen or retrofit the existing structures.
- After analysis results shows that Diagonal bracing is more effective in most of cases.
- Displacement due to lateral loads can be reduce upto 93% by using single diagonal bracing

VI. REFERENCES

- Jagadish J. S, Tejas D. Doshi “A Study On Bracing Systems On High Rise Steel Structures” International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 7, July - 2013
- Amol S. Rajas, Dr. N. L. Shelke “Wind Analysis of High Rise Building with Different Bracing Systems” International Journal of Advanced Research in Science, Engineering and Technology, Vol. 3, Issue 4 , April 2016

- Adithya M, Swathi rani K. S, Shruthi H K, Dr. Ramesh B.R. "Study On Effective Bracing Systems for High Rise Steel Structures" SSRG International Journal of Civil Engineering , volume 2 Issue 2 February 2015
- Nitin Bhojkar and Mahesh Bagade "Seismic Evaluation of High-rise Structure by Using Steel Bracing System " International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 3, March 2015.
- Y.U.Kulkarni and Prof. P. K. Joshi "Analysis and Design of various bracing systems in high-rise steel structures." International Journal of Advance Research In Science And Engineering, Vol. No.3, Issue No.11, November 2014
- Z.A. Siddiqi, Rashid Hameed and Usman Akmal "Comparison of Different Bracing Systems for Tall Buildings "Pak. J. Engg. & Appl. Sci. Vol. 14, Jan., 2014 (p. 17-26)