Analytical Study of Seismic Resistance Building

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Abstract- This Project is about analytical study of G+10 Steel building situated at Bhuj, Gujarat, India. Study is carried out by Bentley Staad Pro. V8i by comparing structure without bracings and structure with application of bracings. After comparison of model the structural aspects like maximum relative displacement and maximum axial forces acting on model are calculated. After calculating maximum relative displacement and maximum axial forces of different model, they are compared with each other. Then we have concluded result i.e. which bracings are appropriate for G+10 steel building in Bhuj, Gujarat. Also, overall weight of structure is calculated.

Index Terms- Earthquake, Seismic Resisting Building, Bracing System, Relative Displacement, Axial Force.

I. INTRODUCTION

As we know that earthquake is dangerous for any tall structure, to reduce effect of seismic wave, resisting elements are use full. In city like Bhuj, to construct any structure is challenging work. In Bhuj earthquake frequently occurs, so in this project we have used bracings as resisting element against lateral forces. A G+10 building is made with steel is considered and analysed with the help of Bentley Staad Pro. V8i.Several Bracings are used are Chevron Bracings-Bracings and X or Cross Bracings. Here we have done analysis of structure by Bentley Staad Pro. V8i. After analysis, the relative displacement of structure is noted and compared with structure having bracings.

II. BRACING SYSTEM

- Bracings are member designed to resist lateral forces like Wind Forces and Seismic Forces.

- There are mainly two types of Bracings,
  1. Horizontal Bracings
  2. Vertical Bracings

a) Horizontal Bracing System

- The purpose of horizontal bracing is to transfer the horizontal forces from the column at the perimeter of the structure to the planes of vertical bracings.

b) Vertical Bracing System

- Vertical bracings transfer horizontal load as well as withstands overall sway of the structure.

- Function of Bracing system

  - Mainly bracing system transfers forces by vertical and horizontal bracings.
  - It works as a part of building and eliminate soft story effect.
  - Bracing System work as lateral force resisting element.
  - Bracing System work as soak absorbers in bridges.

III. PURPOSE OF BRACING SYSTEM

a) Lateral deformation is less compared to unbraced building.
b) To reduce damages due to earthquake.
c) To reduce the lateral displacement.
d) To resist lateral forces.
e) At top stories, by application of bracing axial forces are reduces.
f) Vibrations due to any reason are transferred by vertical bracings and horizontal bracings and make building durable.

IV. DESIGN CONSIDERATION

A. CODES USED ARE

- IS-1893-2016 CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES (PART 1 GENERAL PROVISIONS).
- IS-875 (PART 2) IMPOSED LOAD.
- IS-800 GENERAL CONSTRUCTION IS STEEL-CODE OF PRACTICE.

B. LOADS AND DESIGN PARAMETERS

a) Loads

- Dead Load
  (Total Self Weight of Building) = 33411.672 KN.
- Live Load = 4.0 KN/M
- Earthquake Load = As per IS-1893(2016)

b) Seismic Parameters

Zone Factor	= 0.36
Importance Factor (I)	= 1.5
Response Reduction Factor (RF)	= 5
Period In X-Direction	= 1 sec
Period In Y-Direction	= 1.09 sec
Depth of Foundation	= 1 m

C. STRUCTURAL DATA

- Beam Size = 0.26x0.18 m
- Column Size = 0.25x0.25 m
- Plate Thickness = 0.125x0.125 m
- Bracings = ISMC250 Double Angle

V. MODEL

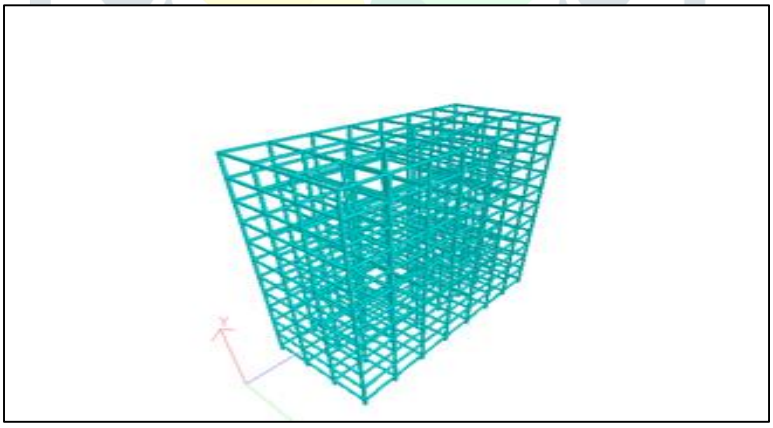


Fig.1 Model Without Bracings

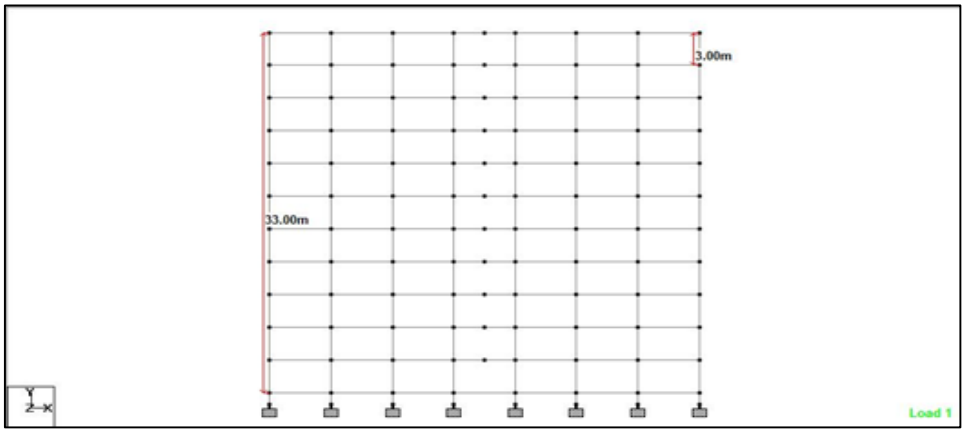


Fig.2 Front View

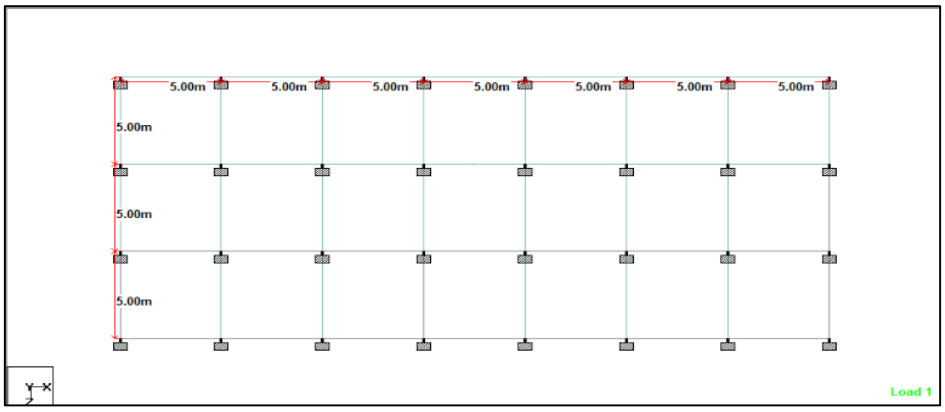


Fig.3 Top view

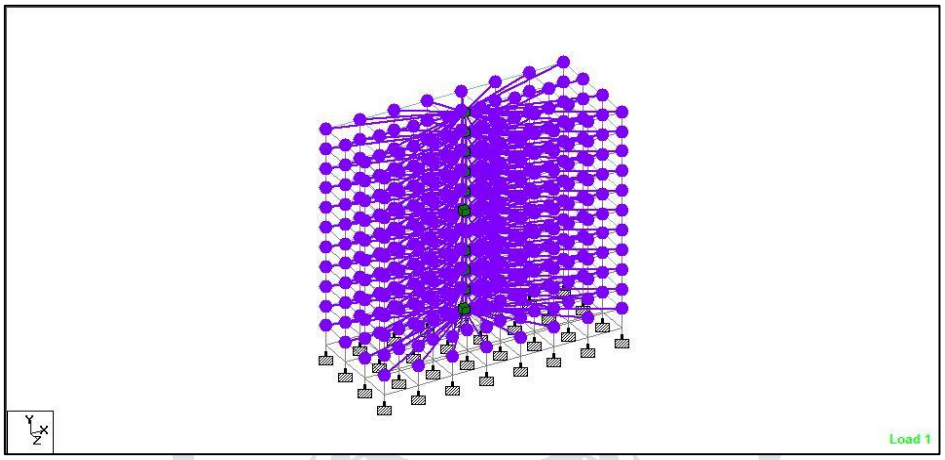


Fig.4Master slave commanded model

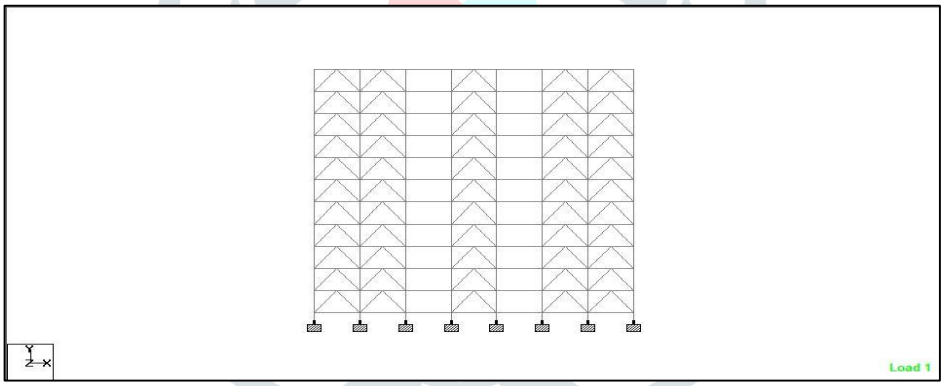


Fig.5 Chevron Braced Model

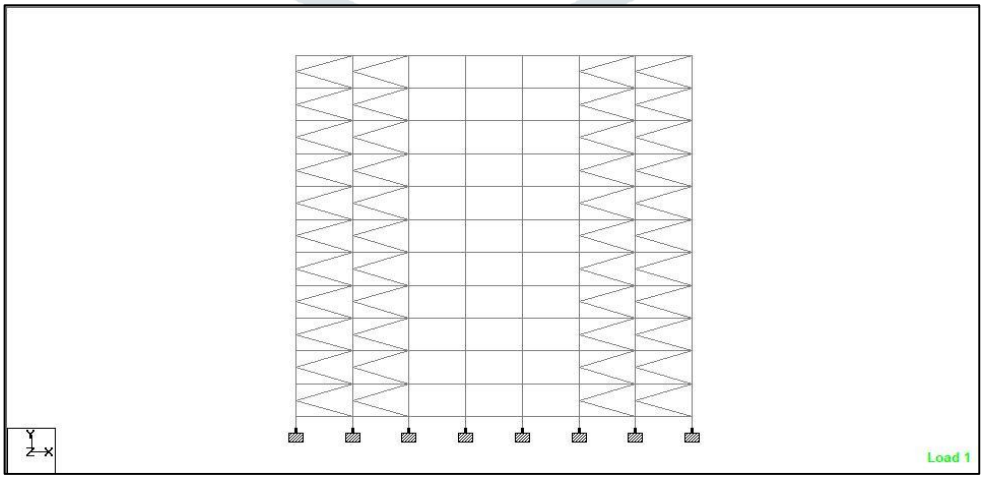


Fig.6 K Braced Model

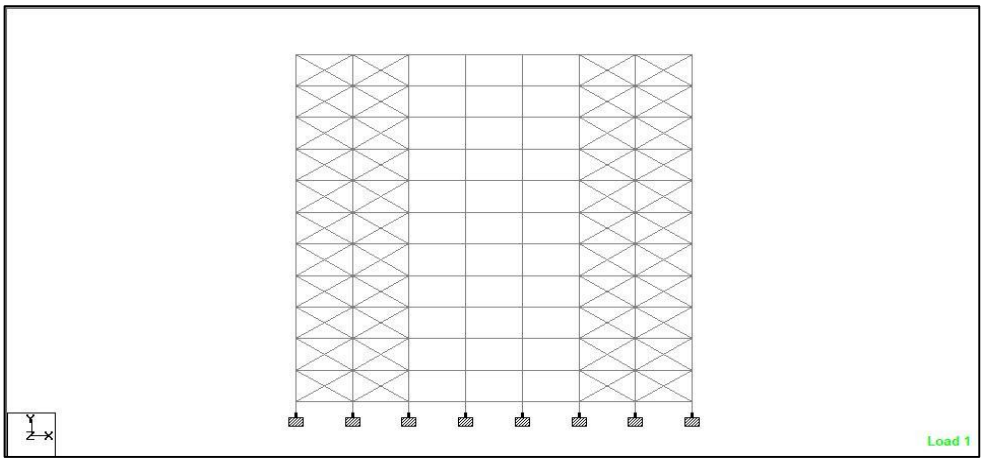


Fig.7 X Braced Model

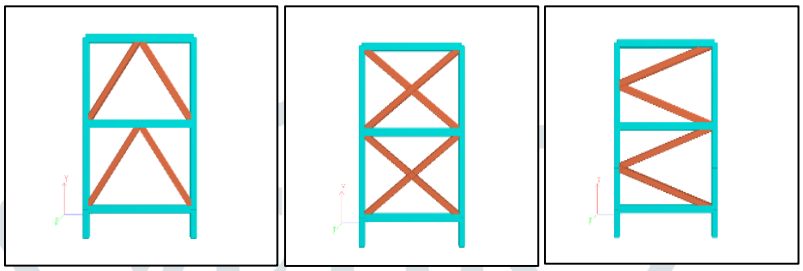
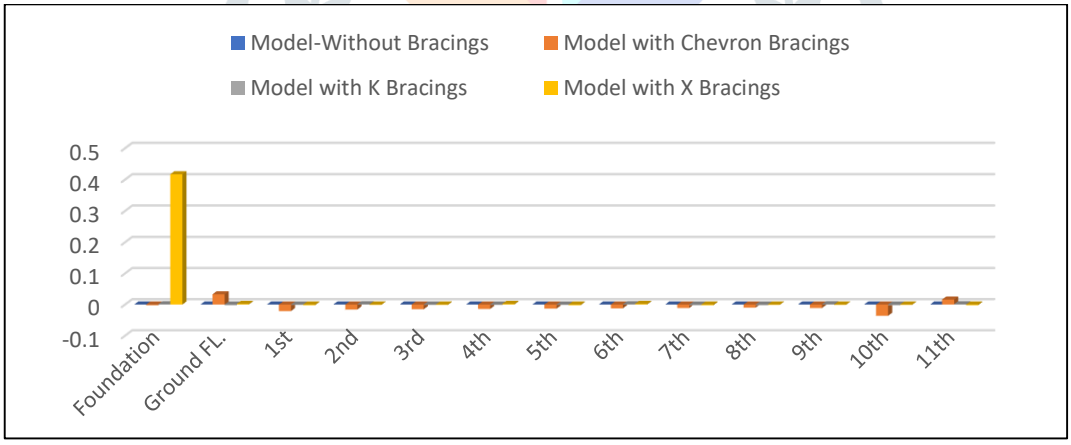


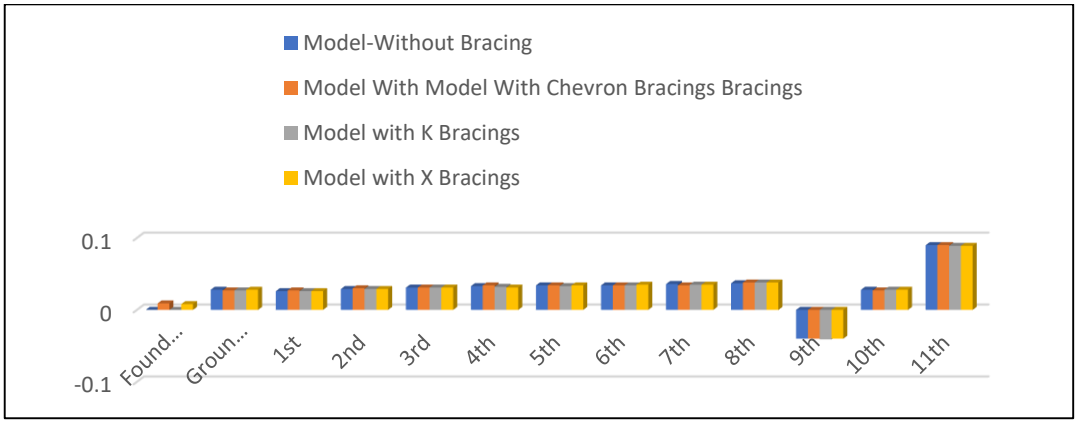
Fig.8 Chevron, K and X Bracings

VI. RESULT AND ANALYSIS

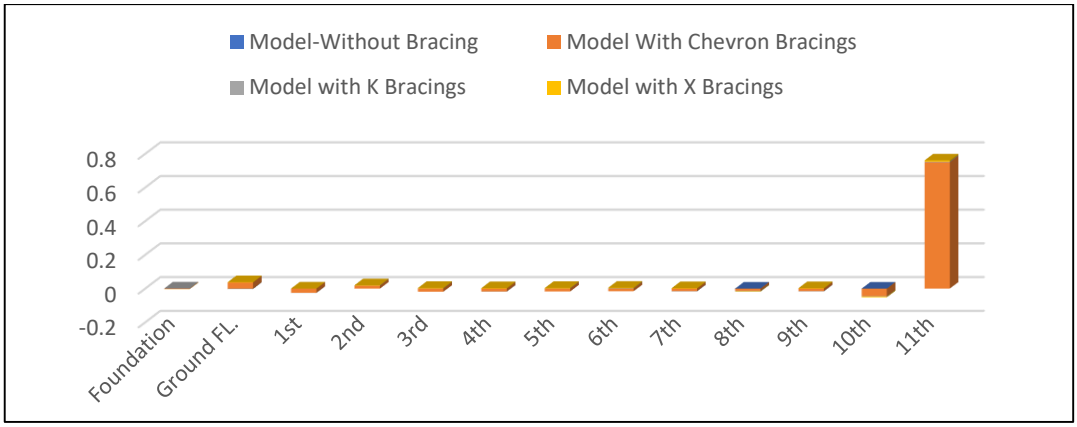
a) Maximum Relative Displacement in X- Direction for Earthquake in X-Direction.



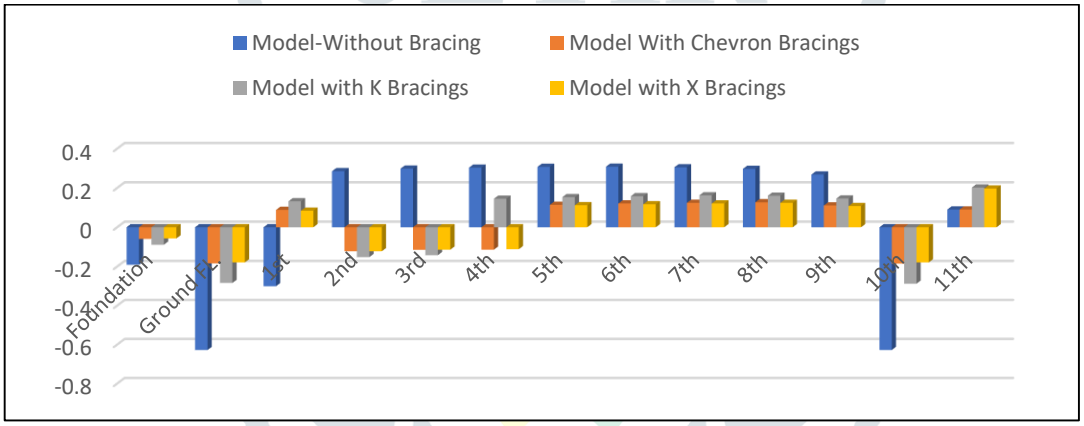
b) Maximum Relative Displacement in Z-Direction for Earthquake in X-Direction.



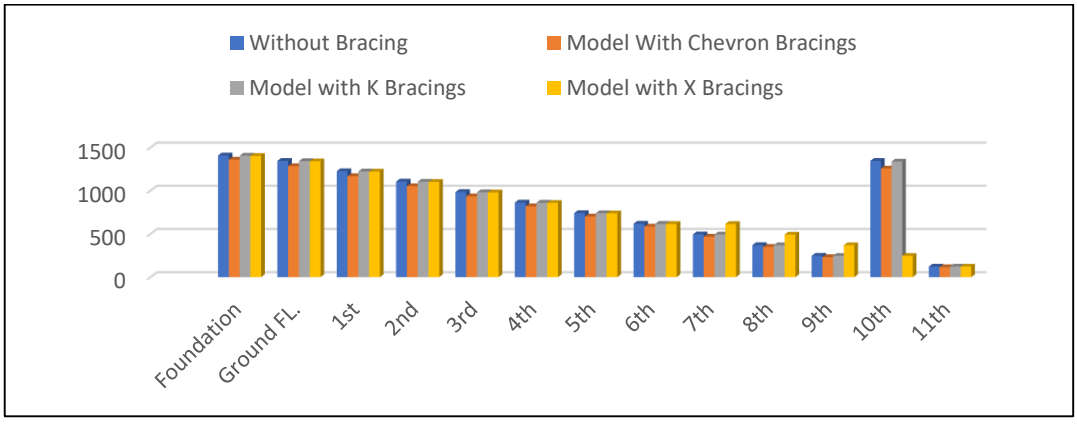
c) Maximum Relative Displacement in X-Direction for Earthquake in Z-Direction.



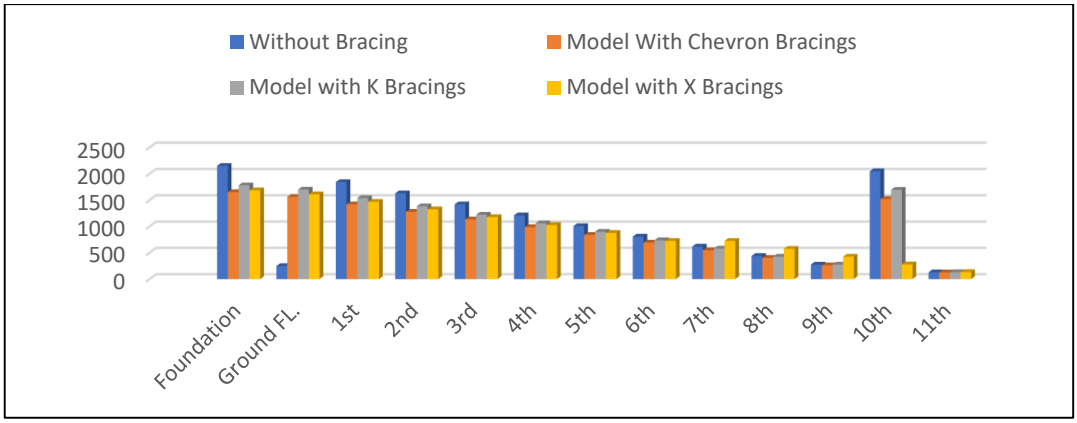
d) Maximum Relative Displacement in Z-Direction for Earthquake in Z-Direction.



e) Maximum Axial Force for Earthquake in X-Direction.



f) Maximum Axial Force for Earthquake in Z-Direction.



VII. CONCLUSION

1. For given G+10 building when earthquake is acting on X-direction, relative displacement in Z-direction is more compare to X-direction.
2. For Z-direction (when earthquake is acting on X-direction), effective bracings are K-Bracings and X-Bracings.
3. When earthquake is acting on Z-direction relative displacement in Z-direction is less in Chevron Bracings and X Bracings.
4. For given building Maximum Axial Force is Less in Chevron Bracing, When earthquake acts on X-direction as well as in Z-direction.
5. Overall weight of structure is increases, compare to structure without bracings, weight of structure with Chevron bracings increases 102%, structure with K bracings increases 101%, structure with X bracings increases 103%.

VIII. REFERENCES

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