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Analysis of Braced Frame Multi Storied Structure with Different Angles as Per Indian Standards

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Abstract - A Bracing is a system that is provided to minimize the lateral deflection of structure. The members of a braced frame are subjected to tension and compression, so that they are provided to take these forces similar to a truss. The present study assesses the seismic response of steel structure with different angle of bracing system. A 15 storey steel moment resisting frame was analyzed for zone II of soil type-II (medium). The analyses were carried out to assess the structural performance under earthquake ground motions. These models are compared in different aspects such as storey drift, storey displacement and storey shear.

Key Words: Bracing, Etabs.

1. INTRODUCTION

During earthquake motions, deformations take position across the elements of the weight-bearing method as a result of the response of constructions to the ground motion. Because of these deformations, interior forces boost across the factors of the load-bearing approach and displacement behavior seems across the building. The consequent displacement demand varies relying on the stiffness and mass of the constructing. As a rule, buildings with higher stiffness and diminish mass have smaller horizontal displacements demands. On the contrary, displacement needs are to increase. Then again, every building has a specific displacement potential. In different words, the quantity of horizontal displacement that a building can have the funds for without collapsing is restricted. The reason of strengthening ways is to ensure that the displacement demand of a constructing is to be kept beneath its displacement potential. It will most commonly be finished by means of decreasing anticipated displacement demand of the constitution for the period of the strong motion or improving the displacement ability of the constitution.

1.1 Steel Bracing systems

Braced-frames virtually eliminate the columns and girder bending factors and thus improve the efficiency of the pure rigid frame actions. By the addition of truss members such as diagonals (between the floor systems) this can be achieved effectively. These diagonals carry the lateral loads and transfers the axial loads to the columns, which is an effective structural system. Finally, complete content and organizational.

1.2 Steel Bracing systems

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2. Structural Details

A G+15 storey Steel building with bracing provided on various positions in the building are analyzed for earthquake loading. The method of seismic analysis used in this present study is seismic coefficient method which is a linear static approach. Building is designed according to IS: 456-2008 and earthquake loading is applied as per the recommendation of IS: 1893-2002. Building is located in seismic zone II of India and rest on medium soil condition. Following seismic parameters considered for the present study.

- The floor to floor height = 3.5m
- The live load = 3 kN/m2 for all floors.
- Floor finish load is 1 kN/m2.
- Thickness of slab = 0.2 m.
- Number of floors = 15
- Column to column distance =5m
- The area of all the buildings = 625 m2.
- The unit weight of concrete = 24.99kN/m3
- The compressive strength of concrete = 25 N/mm2
- Characteristic compressive strength of steel = 415 N/mm2.
- The modulus of elasticity of concrete 27386.13 MPa
- The modulus of elasticity of steel = 2×10^5 N/mm2
- The steel bracing used is Composite circular bracing with 100mm diameter.
- Located in seismic region II sub-soil type 2g(medium).
- Importance factor = 1

- Seismic analysis is carried out on building models using the software ETAB's
- The load cases considered in the seismic analysis are as per IS 1893 – 2002 and IS 456.

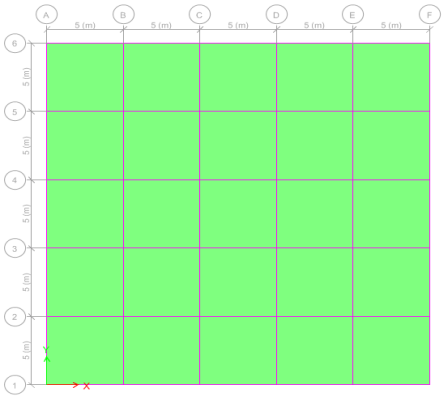

Fig-1: Structural Plan

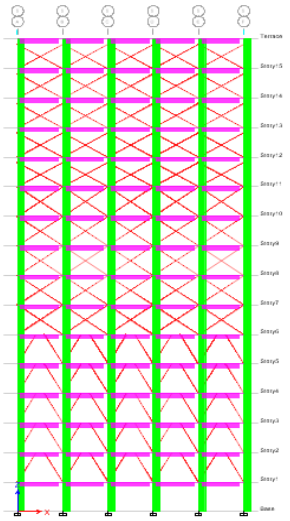

Fig-2: Elevation of modal- Combined all degrees

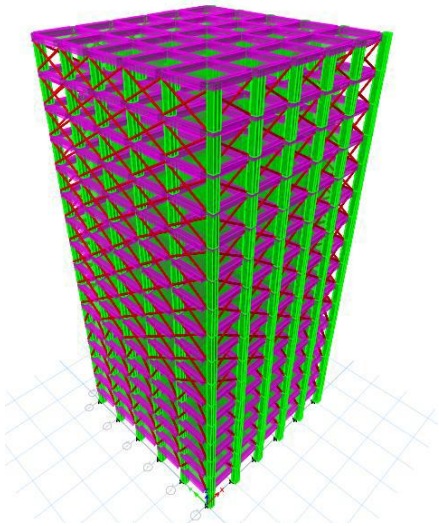

Fig-3: 3D modal- Combined all degrees

2.1 Section properties

Table 1. Sections & Earthquake Force Detail

Types of madals	Column type	Column size	Beam size	Bracing type	Beam size	Slab
Type 1 Type 2 Type 3 Type 4	Composite column	750 by750mm	600 by 600mm	Composite circular bracing	with 100mm diameter	200mm thick

2.3 Structural Modeling& Analysis

Bracing provided on various positions in the constructing are analyzed for earthquake loading. The procedure of seismic evaluation used in this present study is seismic coefficient approach which is a linear static approach. Constructing is designed according to IS: 456-2008 and earthquake loading is utilized as per the advice of IS: 1893-2002. Building is thought to be placed in seismic zone II of India and rest on medium soil.

Table 2: Seismic Loading Zone As Per Is:1893

DETAIL	VALUE
R	3
I	1
Z	II
Sa/g	0.88

The structures are demonstrated by utilizing computer programming ETAB's The floor load is taken as 4.75kN/m^2including floor finishing load as 1 kN/m^2 . The live load is taken as 3kN/m^2 . Load combinations are applied as per the recommendation of Indian standard codes.

Table3: Load Patterns

Name	Type	Self Weight Multiplier	Auto Load
Dead	Dead	1	-
Live	Live	0	-
SDL	Super Dead	0	-
FF	Super Dead	0	-
EQX	Seismic	0	IS1893 2002
EQY	Seismic	0	IS1893 2002
WIND X	Wind	0	Indian IS875:1987
WIND Y	Wind	0	Indian IS875:1987

3. CONCLUSIONS

1) Maximum lateral displacement:

After the analysis of the structure with unique preparations of bracing strategies, it has been concluded that the

displacement of the structure decreases after the applying of bracing method. Displacement is more in 60 degree modal and less in 45 degree modal from earthquake loads.

- Displacement is more in 60 degree modal and less in 45 degree modal from wind loads.
- Displacement is more in 60 degree modal and less in 45 degree modal from response spectrum analysis.

2) Story drift:

- Storey drift is more and almost equal in both combined and 60 degree modal and less in 45 degree modal from earthquake loads.
- Storey drift is more and almost equal in both combined and 60 degree modal and less in 45 degree modal from wind loads.
- Storey drift is more in combined modal and less in 45 degree modal from response spectrum analysis.

3) Story share:

- Story share is almost same in all modals except 45 degree modal from earthquake loads.
- Story share is almost same in all models from wind loads.
- Story share is more in 45 degree modal and almost same in other types of modals from response spectrum analysis.
- Fundamental natural period: The essential normal interval of a targeted structure rises in 60 measure modal.
- The primary ordinary period of a unique structure decreases in 45 measure modal.

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