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SEISMIC ANALYSIS OF BUILDING STRUCTURE WITH BUCKLING RESTRAINED BRACE

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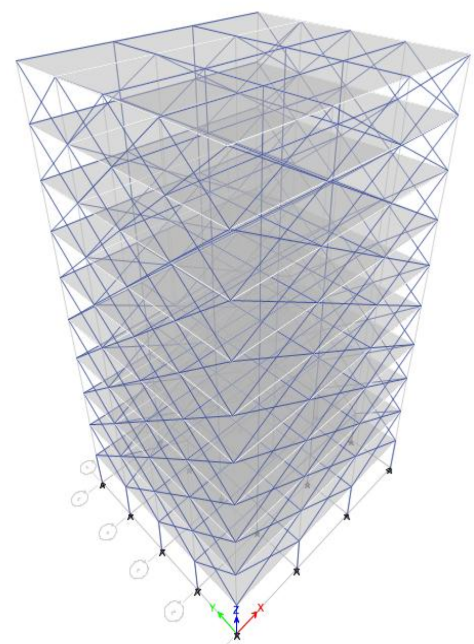
ABSTRACT- *Conventional braces have limited deformation ductility capacity, and exhibit unsymmetrical hysteretic cycles, with marked strength deterioration when loaded in compression. To overcome the above mentioned problems, a new type of brace was developed in Japan called as buckling restrained braces, designated as BRB's. These braces are designed such that buckling is inhibited to occur, exhibiting adequate behavior and symmetrical hysteretic curves under the action of both tensile and compressive cycles, produced by the action of seismic and wind forces. Nonlinear time history analysis, response spectrum method and pushover analysis of 10-story 2D frame is carried using software, ETAB. The response parameters used to evaluate structural performance are natural time period, story displacement, inter story drift, story shear and axial forces.*

Key Words: **Seismic Analysis,Building structure, Buckling, Restrained brace,Time History**

INTRODUCTION

As the population of our country is increasing and land area remains constant, engineers have no option other than going for vertical growth of buildings. As these vertical structures become slender and slender, the effect of earthquake on these structure became atmost important. These structures are susceptible to collapse or large lateral displacements due to earthquake ground motions and require special attention to limit this displacement. This ductile behavior can be achieved by the stable plastic deformation of structural members. To control this lateral displacement, different engineers have used different-different techniques. Lateral displacements on structural buildings have been of great concerns for engineers. In order to minimize the effect of earthquake and wind forces, special diagonal members, called braces, have been used successfully. However, these members when subjected to compressive forces exhibit buckling deformation and show unsymmetrical hysteretic behavior in tension and compression. If buckling of steel brace is restrained and the same strength is ensured both in tension and compression.



The energy absorption of the brace will be markedly increased and the hysteretic property will be simplified. These requirements motivate researchers and engineers to develop a new type of brace, the buckling-restrained brace (BRB). The concept of the BRB is simple, restraining the buckling of the brace so that the brace exhibits the same behavior in both tension and compression.

SCOPE AND OBJECTIVE

SCOPE

Buckling-restrained braced frames (BRBF) are expected to withstand significant inelastic deformations when subjected to the forces resulting from the motions of the design earthquake. The present study deals with nonlinear time history analysis of frame structure with buckling restrained brace using the software E-TAB.

OBJECTIVE

- To conduct time history analysis of building structure with buckling restrained braces.
- To conduct pushover analysis of building structure with buckling restrained braces
- To analyse the seismic performance of structure with buckling restrained brace.

METHODOLOGY

- Literature review.
- ETABS software is used.
- The grid of the plan is prepared.
- IS456-2000 is defined to models.
- ISMB450 section is used
- Material properties are assigned
- Define the static load cases and apply them to slab and beams
- Assign the support condition as a fixed support to the bottom
- Time history analysis is performed.

ANALYSIS DATA

This study is concerns about comparative study between two similar buildings with BRB and conventional bracing systems. Building is located in seismic zone IV soil type is considered as of type II. Detailed description about the building and its components is as follows:

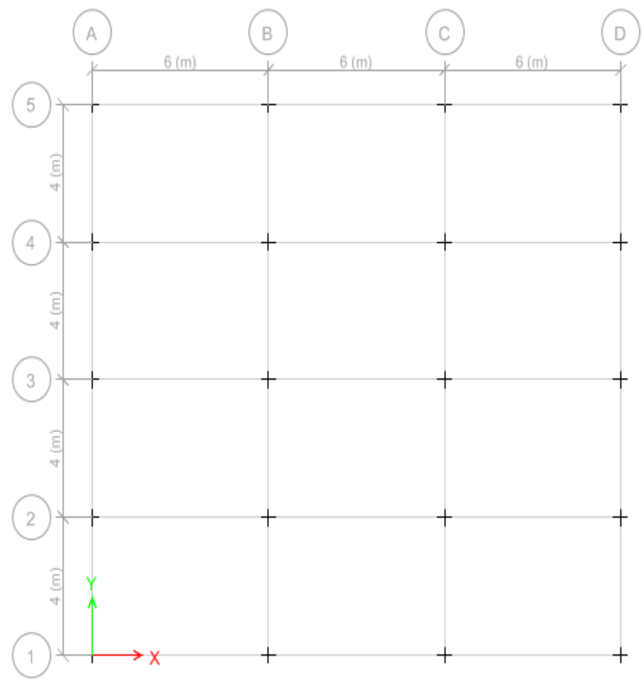
Plan area = 20x20 m Beam size = 0.3x0.45m

Column size = 0.45x0.45m Slab thickness =0.15m

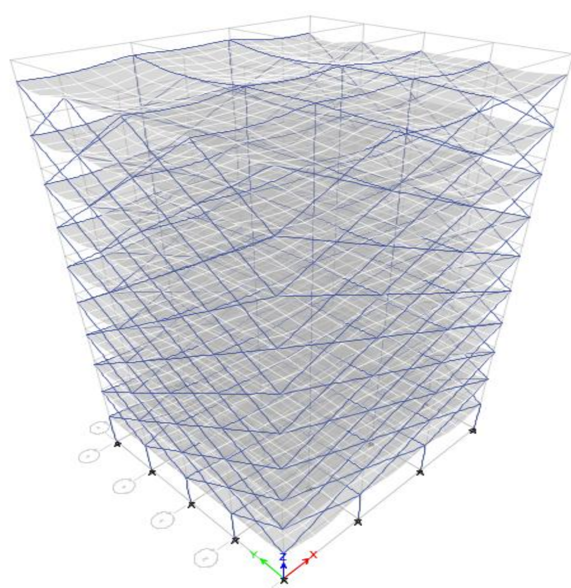
Live load = 2kN/m Floor Finish = 1.5kN/m

Seismic zone IV Steel brace ISMB450

Buckling restrained brace BRB.5
Grades: Fe415, M30, Fe250



ANALYSIS AND RESULT



Deformed shape

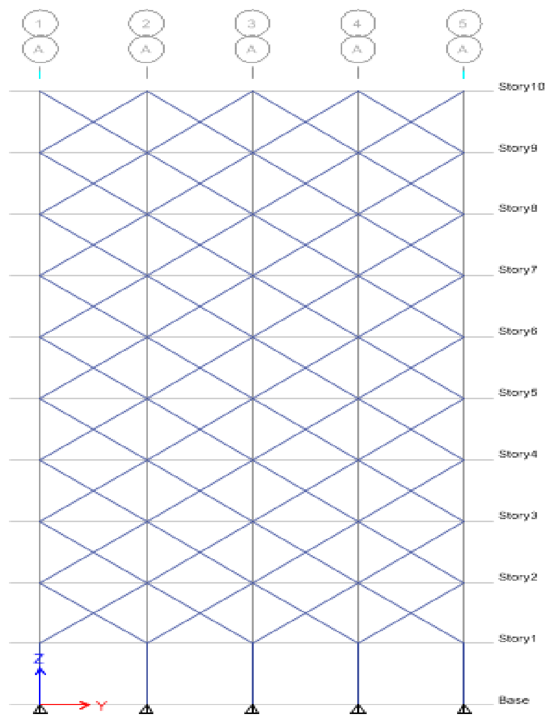
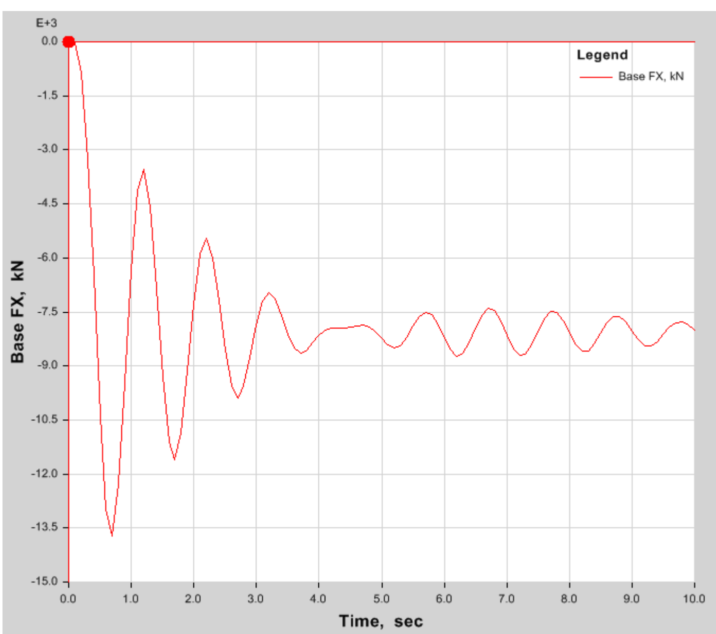


Fig. BRB in X direction

TIME HISTORY



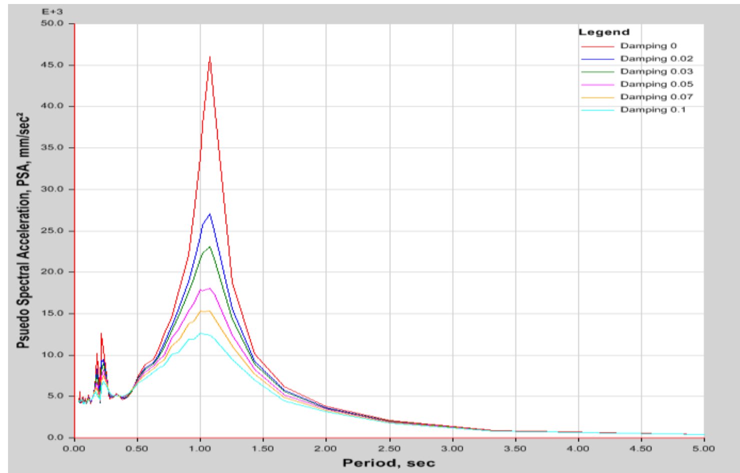
Time	Base FX
Sec	**Kn**
0	0
1	-6369.63
2	-7282.81
3	-7844.04
4	-8156.36
5	-8240.58
6	-8232.4
7	-8149.97
8	-8067.9
9	-8038.99
10	-8003.35

Story Response - Maximum Story Displacement

Story Response Values

Story	Elevation	Location	X-Dir	Y-Dir
	m		mm	mm
Story10	30	Top	16.5	1.6
Story9	27	Top	15.5	1.6
Story8	24	Top	15.1	1.7
Story7	21	Top	14	1.7
Story6	18	Top	14.2	1.7
Story5	15	Top	13.4	1.8
Story4	12	Top	13.3	1.8
Story3	9	Top	13.5	1.9
Story2	6	Top	12.7	1.9
Story1	3	Top	12	2
Base	0	Top	0	0

Response Spectrum from Time History



Response Spectrum Values

Period	Damping 0	Damping 0.02	Damping 0.03	Damping 0.05	Damping 0.07	Damping 0.1
	PSA	PSA	PSA	PSA	PSA	PSA
Sec	mm/sec^2	mm/sec^2	mm/sec^2	mm/sec^2	mm/sec^2	mm/sec^2
1	33874.40	24287.17	21653.24	17923.65	15313.65	12640.25
2	7299.79	7153.51	7067.41	6926.96	6764.58	6546.06
3	5312.57	5234.78	5183.89	5150.58	5134.34	5112.71
4	7575.47	7309.15	7174.68	6914.72	6664.03	6349.76
6	7476.57	7033.15	6817.95	6405.09	6049.14	5567.24
8	4146.84	4320.1	4375.16	4468.48	4530.06	4525.68
12	4763.64	4533.03	4477.79	4385.15	4348.59	4309.57
14	4955.2	4705.84	4582.91	4411.97	4296.18	4169.92
18	4339.59	4482.19	4528	4553.71	4558.35	4520.79
22	4632.99	4481.55	4448.51	4423.63	4415.39	4411.91
28	4380.17	4539.92	4513.04	4530.98	4515.0	4477.44
33	4413.5	4405.28	4409.57	4429.45	4431.48	4430.26

CONCLUSION

From the comparative study between both the buildings and from the analysis of results of various parameters, it is concluded that in the seismic events, the buckling restrained brace building shows better performance over the building with conventional bracing. BRB reduces the story forces in the building which provides the stability of the building. Hence the use of BRB is considered safer than the conventional bracing in the building.

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