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Seismic analysis of Braced RCC structures using ETABS software

Safvana P
safvanakanz@gmail.com
AWH Engineering College, Kozhikode, Kerala

Anila S
anila.s2614@gmail.com
AWH Engineering College, Kozhikode, Kerala

ABSTRACT

Steel braced frame is one of the structural systems used to resist earthquake loads in multistoried buildings. Many existing reinforced concrete buildings need retrofit to overcome deficiencies to resist seismic loads. The use of steel bracing systems for strengthening or retrofitting seismically inadequate reinforced concrete frames is a viable solution for enhancing earthquake resistance. Steel bracing is economical, easy to erect, occupies less space and has the flexibility to design for meeting the required strength and stiffness. In the present study, the seismic study of conventional x brace, zipper brace, and SBS in RCC structures using ETABS software is investigated. The bracing is provided at each corner. a g+6, g+12 and g+18 story with 6 bay in the x-direction and 3 bay in the y-direction is analyzed using ETABS.. The effectiveness of various types of steel bracing is examined. The effect of the distribution of the steel bracing along the height of the RCC structure on the seismic performance of the rehabilitated building is studied. Provision of conventional x braced, zipper braced and SBS is provided in each stories. The percentage reduction in lateral displacement is found out. It is found that the SBS of steel bracing significantly contributes to the reduction in displacement and story shear compared to conventional x bracings.

Keywords: *X Brace, Zipper Brace, Spring Back System, ETABS 2016, Time History Analysis.*

1. INTRODUCTION

Steel framed construction is a new concept in which Lateral loads are better resisted by bracings. Buckling in braces can be restrained by ZIPPER AND STRONG BACK SYSTEM (SBS). The main advantages of braces are higher strength, Stiffness, economy, occupies less space and less weight. Steel bracing is a highly efficient and economical method of resisting horizontal forces in a frame structure. A bracing system improves the seismic performance of the frame by increasing its lateral stiffness and capacity.

- Through the addition of the bracing system, the load could be transferred out of the frame and into the braces, bypassing the weak columns while increasing strength. Steel bracing is a highly efficient and economical method of resisting horizontal forces in a frame structure.
- A bracing system improves the seismic performance of the frame by increasing its lateral stiffness and capacity.
- Through the addition of the bracing system, the load could be transferred out of the frame and into the braces, bypassing the weak columns while increasing strength.

The static and dynamic analysis is done using ETABS 2016 software.

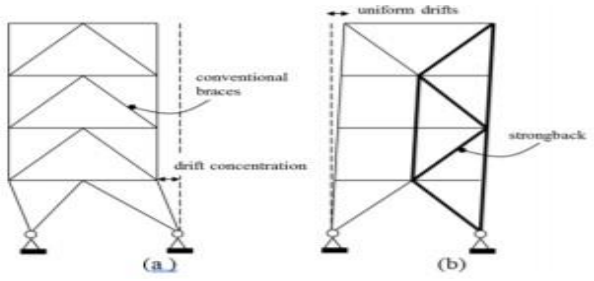

Figure 1. Conventional and SBS bracing

2. METHODOLOGY

Modeling of G+6 story steel structure providing;
I. Without bracing (WB)
II. With x bracing (XB)
III. With zipper bracing (ZB)
IV. with SBS (1.Typical double-story X (DS X)

2. Intermittent chevron (IC)

3. Shifted double-story X (S DS X)

4. Tied-to-ground with single spring (SS)

5. Tied-to-ground with double spring (DS))

Modeling of G+12 story steel structure providing:

1. With zipper bracing (ZB)
2. Tied-to-ground with double spring (DS)
3. With x bracing (XB)

Modeling of G+18 story steel structure providing:

1. With zipper bracing (ZB)
2. Tied-to-ground with double spring (DS)
3. With x bracing (XB)

Static and dynamic analysis of steel structures.

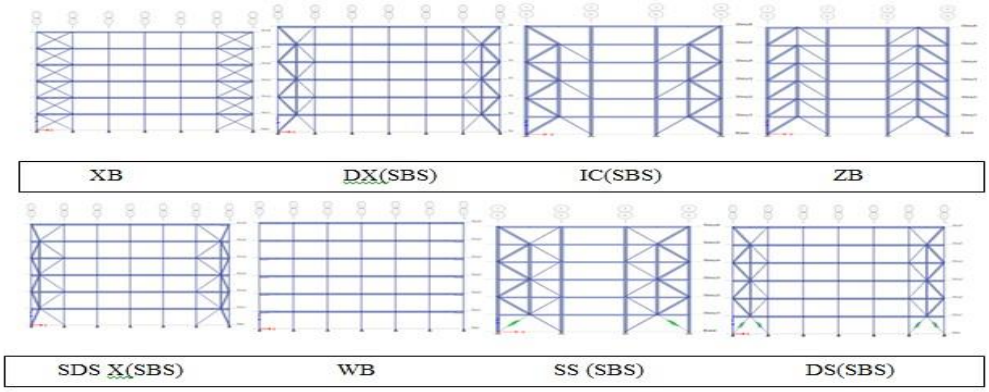

Figure 1: Eight different models of RCC structures for G+6 storey provided with their names are shown

3. EXPERIMENTAL RESULT

Table 1: G+6 Storey RCC Structures

G+6 STOREY RCC STRUCTURES					
SNO	MODELS	DISPLACEMENT(mm)		BASE SHEAR (kN)	
		X DIRECTION	Y DIRECTION	X DIRECTION	Y DIRECTION
1	D X	10.508	10.55	1114.65	1113.29
2	IC	9.38	9.26	1005.79	998.46
3	ZB	9.51	9.538	1156.19	1154.15
4	SDS X	9.50	9.414	1017.44	1014.99
5	XB	10.408	10.44	1047.501	1046.99
6	WB	16.208	17.27	409.980	399.700
7	SS	8.96	8.45	1014.88	1007.87
8	DS	7.64	7.65	792.715	789.92

4. CONCLUSIONS

- The double spring SBS bracing with increased stiffness was found to be an excellent seismic control device for controlling forced responses such as base shear, roof displacement and storey drift for a lower rise, medium rise, and high rise steel structures.
- Base shear decreased in double spring SBS up to 24.55% compared to X braced structure.
- Roof displacement in SBS braced decreased up to 26.59% compared to X braced structure.
- Value of drift as per IS 1893:2002 should not be greater than 0.004 times the storey height which is within the limit.
- As the stiffness is increased, soft storey effect is minimized and also the displacement is reduced.
- As moving from lower rise structure to high rise structure, maximum roof displacement is reduced in case of double spring SBS. So for high rise structures (G+18), it is better to provide these bracings.
- As moving from lower rise structure to high rise structure, maximum roof displacement is increased in case of zipper braced. So for lower rise (G+6) structures, it is better to provide these bracings.
- As moving from lower rise structure to high rise structure, maximum base shear is decreased in all case of braced structures.
- So it is better option for providing SBS with double spring bracings to high rise buildings for RCC structures.

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