In the Name of God

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Certificate

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Comparison Performance Level of Frame Eight-Story Steel with Increase X-Bracing (with and without Base Isolation)

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Abstract

The purpose of this paper is to describe effect of stiffness in performance level and behavior of eight-story steel frame with increase x-bracing (with and without base Isolation). This frame has x-braced. Total profiles used in this structure are in kind of s275 and s355 of European standard. Capacity curve and target displacement and performance of structure (are mentioned above) are calculated by SAP2000 program and displacement coefficient method and with nonlinear static analysis. Existence of base Isolation in structure cause to create increasing of period and displacement and decreasing of earthquake force and base shear and etc.

Keywords:
Capacity curve, Target Displacement, Period.

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1. INTRODUCTION

Performance base design is a new method of design. More scientists are done their study in case this matter. Existence Code are made according to force, therefore are suitable for structure design in range of elastic, But some Levels of performance that accept damage, furthermore force criteria are dependent on displacement criteria. New method of structure design is based in strength method [1].

2. Seismic design in based on performance level

Behavior of structure in range of inelastic is investigated by dynamic nonlinear and static nonlinear.
That in paper, we did this study with static nonlinear because this is simple and no time-consuming.
Simple methods for this analysis are [2]:
1- Secant method;
2- Displacement method;
3- Capacity spectrum method.

New method of structure design is strength method and guesstimate base shear in structure and distribution in height and determine necessary strength in element of structure against this load. This method is enabled designers that design structures that their performance is predicted. The essential goal of seismic design are based in performance, it is client participation in risk calibration selection for desirable design in different of earthquakes [1].

3. Studying frame analysis

In this paper, we investigate eight-story steel frame with increase bracing that is two kind of with and within base Isolation. Frame height is 33.5 meters and has x-bracing (see in under figure).

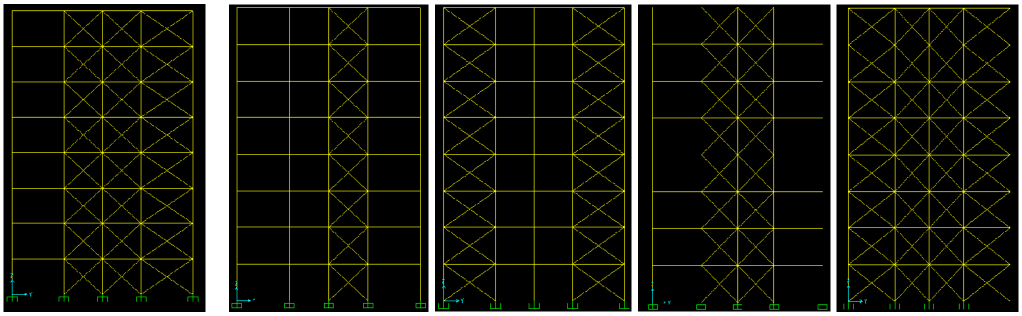

Figure 1. Frame with different kinds in number of bracing

Furthermore connections of beams and columns are hinge. This frame is one of elements of Cardington structure [3]. Dimension of beams and columns are described in [4]. Forced loads in frame are Dead loads and Live loads. Nonlinear static analysis is done with SAP2000. Design of Base Isolation is based on assumption in [5]. With nonlinear static analysis according to Code 360and frame is subjected by 1.1(DL+LL), 0.9DL. Each one of this loading is under two kind of pattern of lateral load:

1. Distribution of lateral load in linear static method;
2. Distribution of uniform load according to floors weight in Y direct [6].

Note, that we reach to frame performance point coordinate in each one of the loading, in according to ATC 40, target displacement by FEMA 356 formulations and Software data.

Pushover curves of these loadings and without using Base Isolation in Y direct represent in under figures.

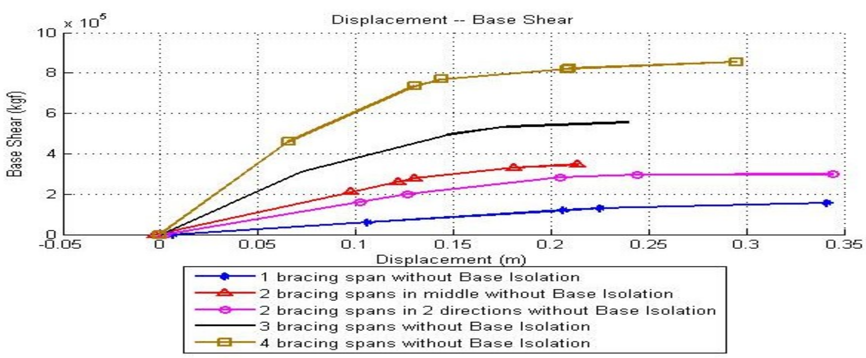

Figure2. Displacement-Base shear curve in loading 1.1(DL+LL) and under distribution of uniform load according to floors weight

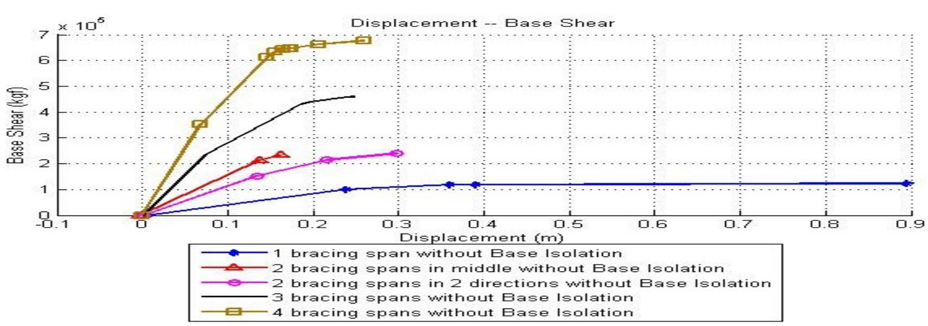

Figure3. Displacement-Base shear curve in loading 1.1(DL+LL) and under distribution of lateral load in linear static method

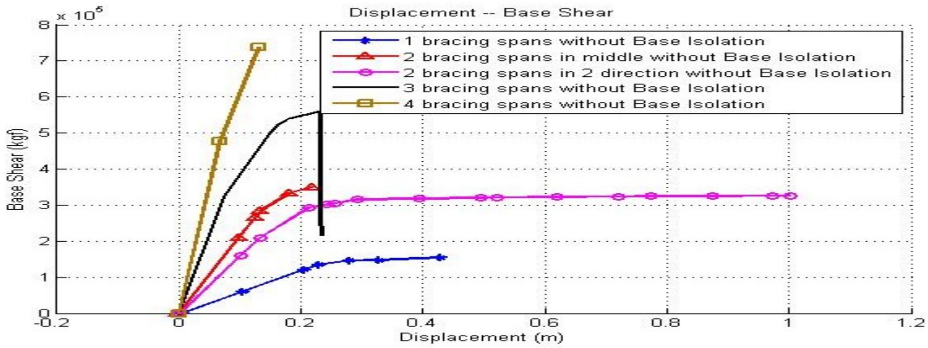

Figure4. Displacement-Base shear curve in loading 0.9 DL and under distribution of uniform load according to floors weight

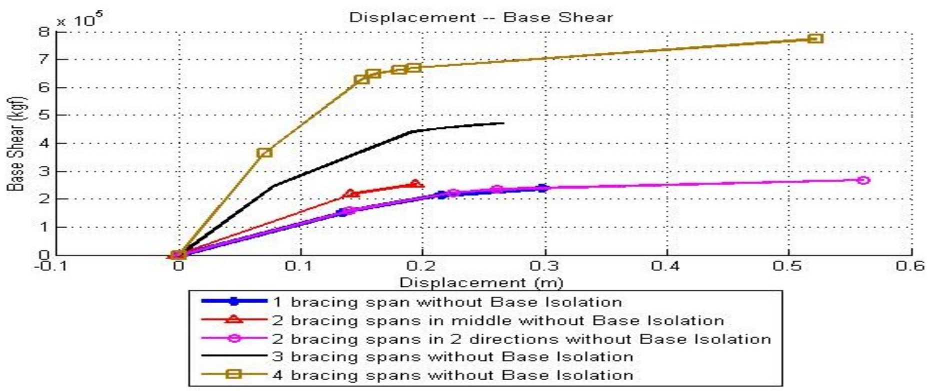

Figure5. Displacement-Base shear curve in loading 0.9 DL and under distribution of lateral load in linear static method

Curves pushover of this loadings and with using Base Isolation in Y direct represent in under figures.

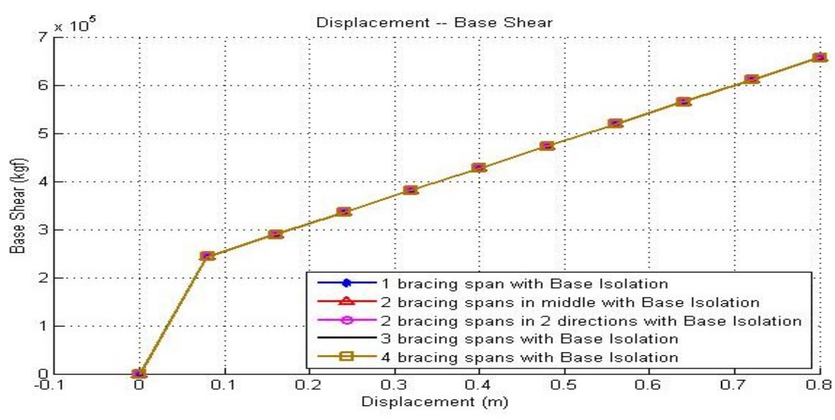

Figure6. Displacement-Base shear curve in different loadings in Y direct

Coordinate of frame performance point in each one of loadings and target displacement are represented in table 1.

Table 1- Performance point of frame for different loadings

descriptions	range of performance point in pushover curve (frame without Base Isolation)	Performance point of frame without Base Isolation (V,D)	Performance point of frame with Base Isolation (V,D)
1bracing span in figure2 loadings	IO to LS (between Immediate occupancy and Life safety)	(	(
2 bracing spans in middle in figure2 loadings	B to IO (between Elastic range and Immediate occupancy)		(
2 bracing spans in 2 directions in figure2 loadings	D to E	(	(
3 bracing spans in figure2 loadings	B to IO (between Elastic range and Immediate occupancy)	(	(
4 bracing spans in figure2 loadings	B to IO (between Elastic range and Immediate occupancy)	(	(
1bracing span in figure3 loadings	D to E (Collapse Prevention)	(	(
2 bracing spans in middle in figure3 loadings	B to IO (between Elastic range and Immediate occupancy)	(	(
2 bracing spans in 2 directions in figure 3 loadings	D to E (Collapse Prevention)	(	(
3 bracing spans in figure 3 loadings	B to IO (between Elastic range and Immediate occupancy)	(	(
4 bracing spans in figure3 loadings	B to IO (between Elastic range and Immediate occupancy)	(	(
1bracing span in figure4 loadings	D to E (Collapse Prevention)	(146782.11 , 0.308)	(
2 bracing spans in middle in figure3 loadings	B to IO (between Elastic range and Immediate occupancy)	(214227.78 , 0.1)	(
2 bracing spans in 2 directions in figure 4 loadings	B to IO (between Elastic range and Immediate occupancy)	(208201.46 , 0.132)	(
3 bracing spans in figure 4 loadings	B to IO (between Elastic range and Immediate occupancy)	(224897.65 , 0.052)	(
4 bracing spans in figure4 loadings	B to IO (between Elastic range and Immediate occupancy)	(232611.22 , 0.033)	(
1bracing span in figure5 loadings	D to E (Collapse Prevention)	(119898.55 , 0.378)	(
2 bracing spans in middle in figure5 loadings	B to IO (between Elastic range and Immediate occupancy)	(206294.11 , 0.134)	(
2 bracing spans in 2 directions in figure 5 loadings	D to E (Collapse Prevention)	(185902.01 , 0.176)	(
3 bracing spans in figure 5 loadings	B to IO (between Elastic range and Immediate occupancy)	(215846.91, 0.068)	(
4 bracing spans in figure5 loadings	B to IO (between Elastic range and Immediate occupancy)	(223008.71 , 0.043)	(

Note that performance points in pushover curves in total frames with Base Isolation are situated in range A to B.

4. CONCLUSIONS

Existence of Base Isolation in frame is cased to behavior of frame main in range elastic and increase of x-bracing and gain frame stiffness is not affected in performance and behavior of frame. If bracing spans is situated near frame center of mass, behavior of frame is better and damage in structure is low and structure behavior is middle of elastic range and Immediate Occupancy performance level. Base Isolation is made necessary load for create target displacement is increased. But it cause to in frame with more stiffness target displacement is increased reverse frame with low stiffness. If Base Isolation is used, Stiffness superstructure is not more affected in target displacement and performance point coordinates of structure.

5. REFERENCES

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