

The Impact of Geometric Arrange of BRBs on the dynamic Analysis of Structure

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ABSTRACT :

In this research the impact of different arranges and geometric forms of braces on general response of BRB frames has been investigated under the conditions corresponding to the results of acceleration record of six supposed earthquakes. And also the structures with difference number of stories, designed based on available codes have been analyzed dynamically by opensees software affected by the acceleration record of supposed earthquakes which met the Iranian 2800 earthquake code.

Comparison of the results demonstrated more ductile and better response of double diagonal arrange rather than chevron arrange, so that the maximum displacements of different structures with double diagonal arrange are less than those of the chevron arrange for the same structures.

KEYWORDS:

BRB, chevron, Buckling restrained braces, diagonal arrange, dynamic analysis, acceleration record, opensees



1-Introduction

Braces , or diagonal elements are used as element to withstand lateral forces, but when opposed to rather large axial forces, they buck and let the structure undergo large displacements. To overcome this problem, anew type of braces are used for which the buckling against the axial forces is restrained. Therefore in the mentioned system, because of restraining the buckling of the brace, the brace has the same response in both tension and compression and the same amount of energy is absorbed and dissipated in both cases of loading , and also the stability and high energy absorption if the structure is improved.



Figure 1: General response of typical brace and BRB comparison of the response of BRB with double diagonal arrange and chevron under dynamic analysis :

To investigate the impact of the BRB arranges on the general response of the including structure, chevron arrange and double diagonal arrange have been studied and three bays structures were selected with three and five stories. also the acceleration record use in this research are including : Tabas ,Sanfernando , Cobe , Kocali, Imperial , Erzincan(fig 2& 3)

with the impact time of 21 and 42 seconds



Fig 3: records of Kucali, Imperial, ERzincan



Fig 2:records of Cobe, Sanfernando, Tabas

Three spans - three stories frame with chevron arrange .

For this structure , after the impact of the supposed acceleration records the maximum drift gained 70 cm for Kucali: earthquake (fig 4)

And the maximum plastic deformation was for Erzincan earthquake





Figure 4: drift of chevron three stories structure.

Three spans- three stories frame with double diagonal arrange the maximum drift gained for Kucali: earthquake for this structure too , and was 64 cm related to the 2nd secondary of vibration (fig 5)



Figure 5: drift of double diagonal arrange- three stories structure

Three spans- five stories frame with chevron arrange for 5 stories structure, the maximum drift gained for Erzincan earthquake, equal to 120 cm (fig 6), and the maximum plastic deformation was related to Cobe earthquake.





Fig 6: drift of chevron arrange – 5 stories structure three spans – five stories frame with double diagonal 1 arrange.

The maximum drift gained for Erzincan earthquake for this structure, equal to 110 (fig 7), and the maximum plastic deformation was related to Sanfernando earthquake.



Figure7: drift of five stories structure with double diagonal arrange.

Now, if we evaluate the impacts of the mentioned earthquake one- by- one on the supposed structures , between the Tabas, Sanfernado and Cobe earthquakes which have the same duration , Tabas earthquake shows the most displacement and story drift, which if we replace the chevron arrange with the double diagonal arrange, we will result about 7% and 8% decrease in story drift for the three stories structure and the five stories. Respectively(fig 8).





Fig 8: impact of Tabas earthquake on chevron arranged and double diagonal arrange structures.

Also the impact of this replacement on the decrease of plastic deformation which ... maximum amount was for Sanfernado earthquake , was 21% and 28% for three stories and five stories structure respectively (fig 9)



Fig 9: Impact of Sanfernado earthquake on structure with chevron and double diagonal arranges.

For the acceleration records of Erzincan, Imperial and Kucali which have the same duration, the replacement of chevron arrange with double diagonal arrange results 3% and 16% reduction in displacement in three stories and five stories structure respectively and also 5% and 32% reduction in plastic deformation for 3 stories and 5 stories structures respectively rather than Erzincan earthquake which has the most displacement and plastic deformation(fig10)





Fig 10: impact of Erzincan earthquake on structure with chevron and double diagonal arranges

Conclusion:

Using double diagonal arrange instead of chevron arrange results in improvement of general response and stability of structures reduction in displacement and story drifts, and reduction in plastic deformation of the system, so that increasing in the story numbers and height of the structure, shows the more desirable impact of this replacement on the structure.

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