AN INVESTIGATION ON THE TORSIONAL EFFECTS OF ASYMMETRICALLY DISTRIBUTED SHEAR WALLS

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In Mexico earthquake1985, more than forty percent of the buildings were damaged due to torsion occurring in asymmetric structures. In general, the torsion is caused from eccentricity of mass with respect of centres of rigidity and strength. By investigating the governing relationships of the torsion and comparing them with the specified regulations in codes, it revealed that twisting phenomenon is much more complicated than what has been said in related codes. It was also shown that relationships of the codes have substantial erros in comparison with the reality in terms of structural displacement.

Technical reports of earthquakes in the past 20 years show that shear wall structures have been shown to behave differently than other structures in past earthquakes. For example, some of them experienced several strong earthquakes with no damage, but others have been numerous failures despite the overall good behaviour that is due to the existence of short columns in the structures. According to above descriptions, it is suggested that applying shear walls in order to counteract torsions, regardless of complexity of the other solutions proposed to deal with twisting, it has a good performance as well.

General belief that shear walls is brittle has lead number of existing codes to consider lower ductility factor for structures with shear walls than moment frame structures. This issue has caused engineers to be more inclined to use the moment frame systems. Structures with shear walls have better seismic behaviour than moment frame structure, while the use of shear walls in the structures make's the torsional arm larger than where there is not any shear walls.

To illustrate the above subjects, two six-story structures are used. One of them has a moment frame system and is perfectly symmetrical, but the other one equipped with shear wall in a way that the largest possible torsional arm be created. Then Tabas earthquake is applied to the models and the dynamic response of structures are calculated and shown in figure one. The figure well shows the huge difference between the displacement responses of two structures. Figure one also shows that irregular structures with shear walls have better seismic behaviour than regular moment frame, although the use of shear walls led to substantial increases in the torsion arm.

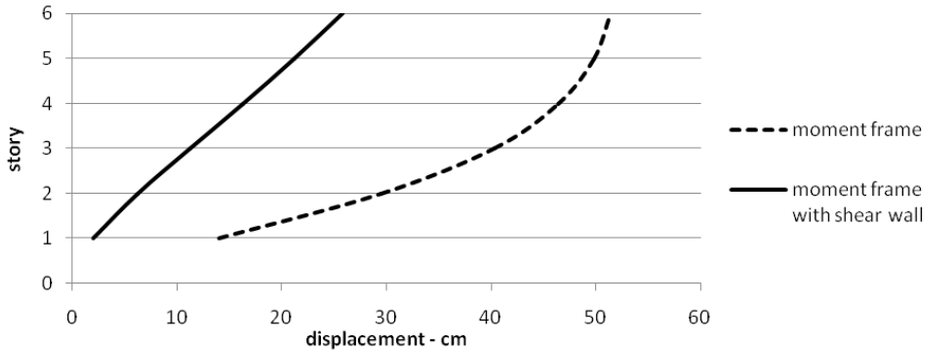

Figure 1. The displacement of moment frame structure with shear walls and without shear walls in Tabas earthquake

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