# INVESTIGATING THE EFFECT OF MASONRY INFILL WALLS ON THE PERFORMANCE OF STEEL RESISTING MOMENT FRAMES BY USING SEISMIC FRAGILITY CURVES

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Due to their ductility, high energy absorption capacity, and low construction time, steel structures exhibit better performance and are more cost-effective than other types of structures. Besides, since steel components possess high strength and their strength to weight ratio is larger than that of reinforced concrete, they are widely used in large wide-span frames and high-rise buildings.

In most steel or RC structures, masonry infill walls are used to parcel out the internal space of the structure and also to separate the interior of the building from the external space. Masonry infills are made up of bricks and mortar, which together act as a monolithic whole. The discontinuous nature of the masonry infill causes it to usually exhibit a brittle behavior.

Masonry infills influence the seismic performance of structural frames. The stiffness increase brought about by the infill can significantly alter the dynamic response of the structure and increase its seismic force abruption capacity. The brittleness of the infill may also result in its premature collapse in the initial loading cycles, which drastically decreases the lateral load-bearing capacity of the structure (El-Dakhakhni et al., 2003; Asteris et al., 2011).

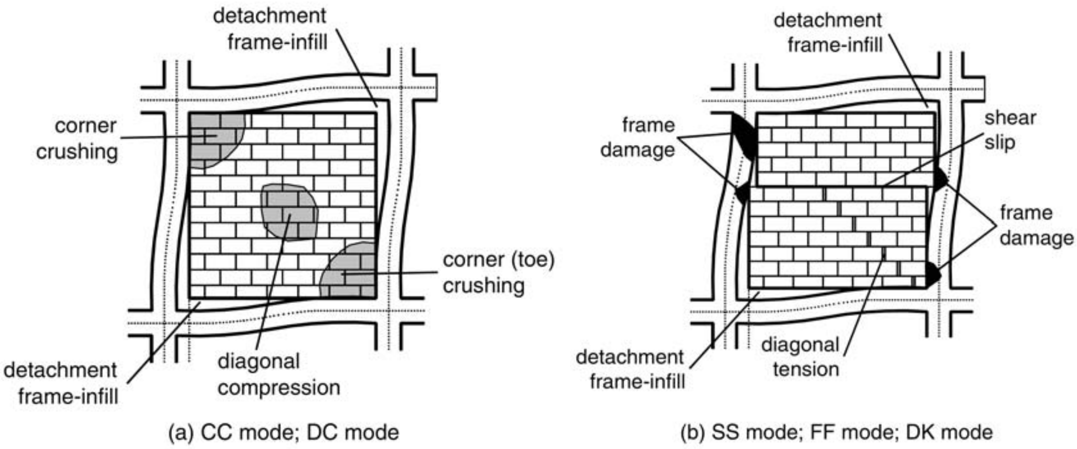


*Figure 1. Failure modes in the masonry infill walls (Asteris et al., 2011).*

Moreover, the presence of infill walls can lead to effects such as an increase in the force applied to the connections of the frame, the short column phenomenon due the wall between the columns being shorter than height of the story, irregularity along the height of the building, and soft story (or contortion) in the building due to the asymmetric distribution of walls.

Investigating the previous earthquakes shows that the presence of infills causes a meaningful change in the behavior of steel structures (Kahrizi, 2019). Therefore, probing the performance of these structures under earthquake using dynamic analysis methods and estimating the seismic fragility curves can provide an acceptable estimation of the role of these walls in steel structures.

In this study, the performance and the seismic vulnerability of steel structures with masonry infill walls have been investigated. For this, six steel moments resisting frames with constant spans and varying numbers of stories have been investigated. The frames were modeled using the SAP 2000 software. The nonlinear time-history dynamic analysis was employed. Ten near-field and ten far-field earthquake records were selected for the analysis. The models recommended by the ASCE 41–13 (2013) were used to model the masonry infill (Figure 2).

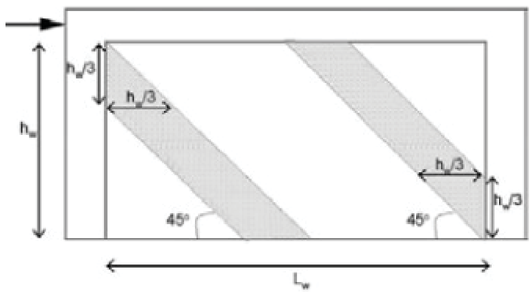


*Figure 2. Compression Strut model for the masonry infill wall (ASCE 41–13, 2013).*

The lateral displacement criterion given by the ASCE 41–13 (2013) standard at the IO and LS performance levels was taken as the failure criterion. For each of these failure criteria, assuming normal logarithmic distribution, the fragility curves were drawn.

The results show that masonry infills cause considerable changes in the dynamic response of a steel structures.

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