THE EFFECTS OF MASS ECCENTRICITY SCENARIO ON THE SEISMIC TORSIONAL BEHAVIOUR OF RC/MR BUILDINGS

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For asymmetric structures subjected to seismic excitation, rotational response is expected to occur. As a result displacement demands on the elements at a particular floor level of structure is no longer uniform (Beyer et al., 2008). For this reason stress and strain concentration is happened at the edge element of the structures prone to torsion which causes sever damage due to seismic excitation. Different example of this type of damage has been reported during the past earthquakes. Torsional behaviour of the asymmetric buildings due to inelastic response has been the focus of many different researches. In this regard, different design procedures have been developed for considering torsional response of asymmetric buildings. A large number of parameters affect inelastic response of asymmetric buildings. One of the most important ones which affects dynamic inelastic behaviour is mass moment of inertia (MMI). This parameter directly depends on the mass distribution scenario which produces the eccentricity in layout. Considering constant mass, corresponding to a given mass eccentricity, probably there are infinite mass distribution scenarios. Therefore for a known mass eccentricity a range of MMI is expected.

In this study the effect of different mass eccentricity scenarios on the dynamic torsional behaviour of an 8-story RC moment resistant building has been investigated. Firstly, to determine the range of the MMI variation due to different mass distribution scenarios, 3 different scenarios which produce eccentricity were considered. These scenarios were applied to the plan of prototype structure shown in Figure 1. Afterward, expressions were established to correlate MMI and mass eccentricity for each scenario. The correlation between mass eccentricity and normalized MMI with reference to corresponding symmetric structure is shown in Figure 2. For slight eccentricities the variation of the MMI is negligible but as eccentricity is increased the range of the variation is extended.

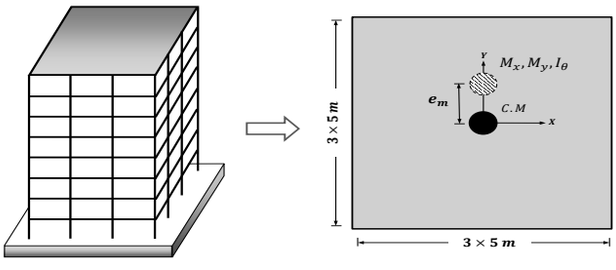

Figure 1. Typical 8-story mass eccentric building considered (Izadi-Z, 2014)

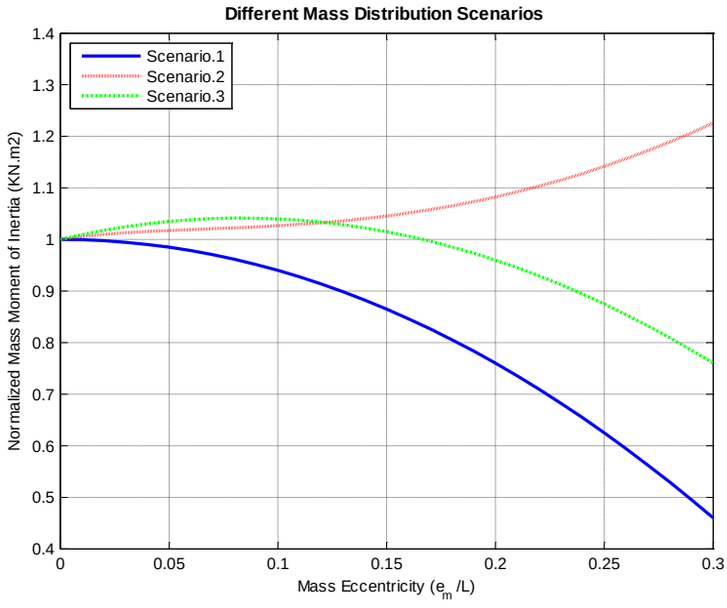

Figure 2. The effect of different mass eccentricity scenarios on the normalized MMI (Izadi-Z, 2014)

At the second part of this study, sensitivity analyses have been carried out for determining the effects of MMI on the torsional response of structure. 8-Story RC moment resistant building shown in Figure1 was designed according to the Iranian seismic code (Standard No. 2800, 3rd Edition). For the purpose of the seismic evaluation, a series of analytical study based on finite element method and inelastic time history analysis was performed on the designed structure with different mass eccentricity and MMI. Torsional response of the structure in terms of maximum displacement demands, maximum rotation, maximum nominal relative displacement and maximum nominal rotation is presented. The effects of the variation of MMI on the torsional response of the structure at 2 level of mass eccentricity including slight and severe is investigated and described in detail.

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