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EVALUATION OF LATERAL STIFFNESS OF RC MOMENT FRAMES AFFECTED BY INFILLS AND OPENINGS

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Shear deformations in a frame structure can be significant and thus can be of particular importance in the design of behavior analysis of the structure. Many design codes did not consider masonry infills as structural elements inside moment resisting frames. Therefore, their presence is not assumed in the analysis and design process. While, in reality, they could affect strength, energy dissipation, ductility, stiffness and many other features of moment frames. The presence of masonry infills could also change the reaction of frames exposed to lateral loads like an earthquake. Mostly two common structural damages observed caused by masonry infill walls in earthquakes, i.e. soft stories and short columns. This issue becomes more important if the built frame was placed in seismically active region. Despite advances in the computer analysis of frame buildings for lateral loads, there remains a need for simple models that provide accurate estimates of response. A quick method for estimating the lateral stiffness of building structures, including regular and irregular moment frames, as well as frames with shear walls can be used for preliminary analysis and especially final check purposes. The method can be utilized for the calculation of the building displacement at different levels under lateral loads. Lateral deflections that occur during earthquakes should be limited to prevent distress in structural members and architectural components. Nonload-bearing infills, external wall panels, and window glazing should be designed with sufficient clearance or with flexible supports to accommodate the anticipated movements. In this paper, an investigation and comparison of approximate and numerical methods for calculation of stiffness in concrete frames in two and three dimensions are studied. Parameters such as the presence of infills or masonry walls, openings, the effect of the type of support, the effect of the number of floors and spans on the lateral stiffness are discussed. In this paper, the effects of the mentioned factors on concrete frames have been compared by using finite element modelling in the framework of the Abaqus software and theoretical analysis. This study examines the previous literature on the calculation of lateral stiffness through comparisons with results obtained from numerical models. In the current study, the effects of opening location and its percentage were evaluated. To this purpose, by using simplified micro-modelling, numerical modelling performed. Subsequently, sensitivity analyses were done to survey the effects of opening ratio on the lateral behavior of RC moment frames. In all of the numerical specimens by an increase in opening percentage, the lateral strength was decreased. It is shown that the lateral stiffness and ultimate strength are dependent on the relative stiffness of the column and infill, but practically independent of the beam stiffness.

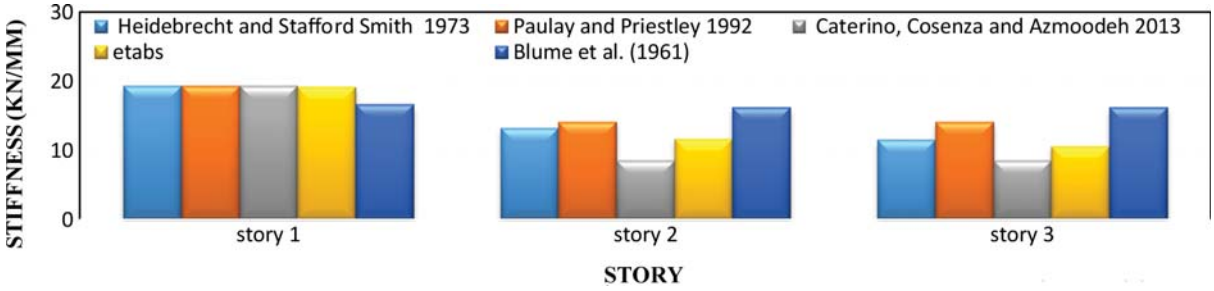

Figure 1. Story stiffness of a 3-floor RC building with two spans.

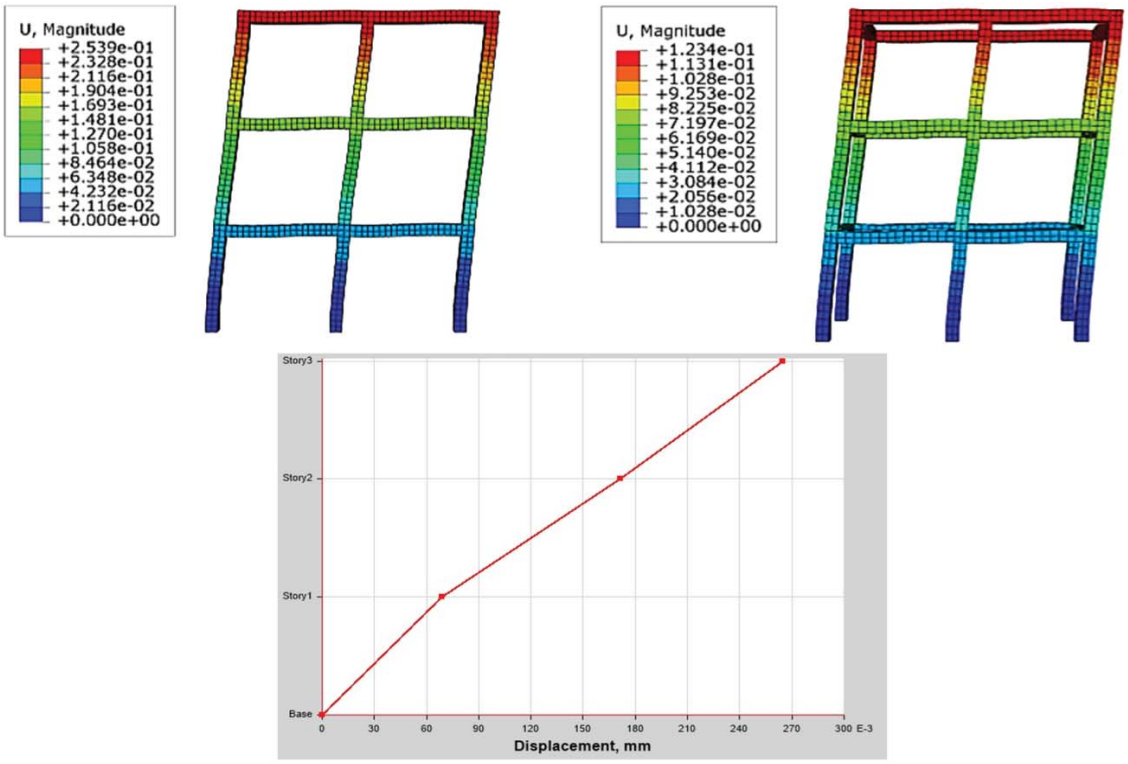

Figure 2. Displacement caused by a 1 kN-force acting at the third floor of 2D model (left) and 3D model (right).

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