ABSTRACT

Masonry infilled panels are normally used as partitions or as architectural elements in Reinforced Concrete (RC) structures. While placing windows or ventilators, the infill cannot be completely filled in the panels of RC frames, thus forms only a partial infill. If the infill panel is built shorter with a gap, the adjacent columns are unable to flex under the lateral loads during an earthquake due to in-plane stiffness of the infills. They behave as short columns and can be seriously damaged during an earthquake due to excessive shear force. This behaviour is called Captive Column Effect. RC framed buildings with infill walls are usually analysed and designed as bare frames without considering the strength and stiffness contributions of the infills. On the other hand, the real behaviour of the structure with partial infill walls during an earthquake is different. In locations where short columns cannot be avoided, the shear force in the columns may lead to collapse of the building and hence needs some remedial measures.

To avoid failure due to captive column failure in the existing RC frame building with partial infill, ‘masonry inserts’ were provided as a remedy to obtain diagonal strut behaviour in the masonry and make the shear flow smooth. “Masonry Insert” means closing of brick masonry opening in the
partial infill for a sufficient width from the column face so that entire column face is supported by brick masonry infill. Provision of this masonry insert in the existing RC framed opening has shown increased lateral shear carrying capacity than the original structure.

An experimental investigation was carried out in ‘2D’ & ‘3D’ modelled RC frames to study the effect of this captive column effect and to reduce this effect by introducing brick inserts adjacent to the column faces. A two bay two storied ‘2D’ & ‘3D’ frames analysed and designed for gravity loading. As per the laws of similitude, reduced scale models were derived for testing. In testing of both ‘2D’ & ‘3D’ frames, one frame with a full opening in partial infill wall and another frame with a brick insert in partial infill wall was casted and tested. The unidirectional lateral loading was applied incrementally in ‘2D’ frame and push pull lateral loading was applied incrementally in ‘3D’ frame. This study on both ‘2D’ & ‘3D’ frames clearly indicates that with the help of a brick insert, the captive column effect is reduced, and lateral capacity increases thereby preventing critical damage to the structure by the seismic load during earthquake. A comparative study was made between experimental and analytical method by using Ansys 10 and the values were found to be nearly equal. Finally, it is suggested that, the existing columns with short-column mechanism could be strengthened with masonry inserts. By improving building strength with the above methods, the damage can be limited to within repairable limits and a complete collapse of the
building/loss of life can be avoided during an earthquake. The cost effectiveness of providing brick inserts is very much cheaper than the retrofit normally adopted to strengthen the structural elements. Moreover, this suggestion requires only a simple construction method.