ABSTRACT

Moment resisting frames are often desirable in building applications because they allow for maximum floor space utilization and access between bays, especially on the first storey of buildings for automobile parking and pedestrian walkways. The first storey of such building is often taller than the other storeys of the buildings, which make it prone to soft-storey or column side-sway failure mechanisms due to abrupt changes in storey stiffness and strengths. These mechanisms are such that all columns or joints of a storey develop hinges, possibly rendering the structure unstable during further lateral loading. Failures by such mechanisms are well documented around the world, especially in buildings with limited member ductility due to inadequate detailing. Moment resisting frame systems are also complicated by the presence of non-structural elements that can create torsion and stiffness irregularities in the building and also shorten the effective length of members making them prone to brittle shear failures. Due to the complex behaviour of such composite structures, experimental research is great importance to determine the strength, stiffness and dynamic characteristics of such systems at each stage of loading.

Experimental investigations were carried out in this work in three stages. The interface behaviours of brick joints were studied in the first stage to assess the load-displacement behaviour, load carrying capacity and the shear strength of brick joints. In the second stage, one fourth scale model of three bay five storey frame with brick infill in the central bay was tested under lateral cyclic load. In the final stage, a one fifth scale three-dimensional three
bay single storey infilled frame, with infill in the central bay was tested under lateral cyclic loading. The load deflection behaviour, stiffness degradation, ductility characteristics, energy dissipation capacity, moment-curvature relationship, shear strength etc. were studied. Analytical studies were also made using ETABS software to compare the various results.

It was concluded that only brittle failure occurred in brick joints due to shear. In the case of frames, the contribution of brick infill was significant up to breaking and the contribution of infill should be considered as it leads to considerable saving in materials. In three-dimensional frame, the presence of roof slab contributes significant stiffness, load carrying capacity, additional confinement and additional strength.