4. How Earthquake Forces are Resisted in Confined Masonry Buildings

4.1 Background

Confined masonry (CM) buildings resist earthquake forces in the same manner as other buildings with shear wall lateral-load-resisting systems, such as unreinforced masonry buildings or RC shear wall buildings. This chapter discusses the distribution of seismic forces in a CM building up the building height, and also at the floor level. In buildings with rigid diaphragms (e.g., RC floor slabs), applied seismic shear force in a CM wall is proportional to its stiffness relative to the total stiffness of all walls at the same floor level. Shear and flexural failure mechanisms in CM walls under in-plane seismic loading are explained through evidence from past earthquakes and experimental research studies. Seismic behaviour of CM walls subjected to out-of-plane seismic loading is also discussed. Finally, various approaches for modelling CM walls for seismic analysis purposes are presented.

4.2 How CM Buildings Resist Earthquake Forces

Distribution of applied seismic forces up the building height approximately follows an inverse triangular shape (largest forces act at the top), as discussed in Chapter 1. The largest internal seismic shear forces develop at the base of the building (ground-floor level). As a result, maximum earthquake damage occurs at the ground-floor level, as illustrated in Figure 4-1a. (Note that the total internal seismic force acting at the ground-floor level is $Q_1+Q_2+Q_3$, See Figure 4-16).

It was reported after the 2003 Tecoman, Colima, Mexico, earthquake, that a three-storey CM apartment building in Colima experienced significant damage at the ground-floor

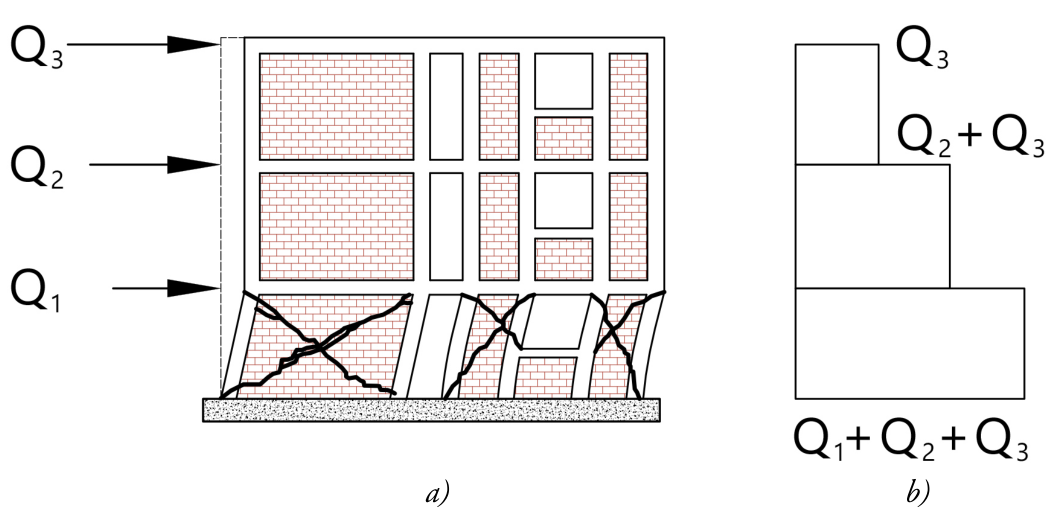

Figure 4-1: Distribution of applied seismic forces and earthquake damage in a multi-storey CM building: a) damage pattern in a CM building tested on the shaking table (Alcocer et al. 2004) and b) internal shear force distribution up the building height