7. Preliminary Seismic Safety Check for CM Buildings

7.1 Background

After the designer has selected the wall layout for a CM building, it is important to check whether the selected layout is suitable from the seismic design perspective. This is primarily the responsibility of a structural engineer, however a preliminary check can be performed by the architect using a simple approach presented in this chapter to confirm that the proposed wall layout is likely to be satisfactory. The check is based on comparing the actual wall index, *WI*, for each direction of the building plan with the required wall index (WI_{req}) for the specific building. The *WI* concept was introduced in Section 4.3 as a key parameter which influences the seismic performance of CM buildings. Two design case studies presented in this chapter illustrate application of the *WI* concept for preliminary seismic design of CM buildings.

7.2 What is the Wall Index?

Wall index per floor, WI_{floor}, is the ratio of the sum of cross-sectional areas of all CM walls in the direction considered for seismic load relative to the ground floor plan area, that is,

$$WI_{floor} = \frac{A_W}{A_P} \qquad (7\text{-}1)$$

where A_W is the cross-sectional area of all confined walls in one direction at the ground floor level. Note that the cross-sectional area of a CM wall is the product of its length (including the RC tie-column and the masonry wall) and thickness. A_P is the plan area for the floor diaphragm (floor slab) at the ground floor level. The area of any cutouts (openings) in the floor slab should be deducted in the A_P calculation.

The required *WI* for a building, WI_{req}, must account for the building height in terms of the number of storeys, as follows

$$WI_{req} \geq n \cdot WI_{floor} \qquad (7\text{-}2)$$

where n is the number of floor/roof levels in a building (e.g. $n = 3$ for a three-storey building). It can be seen from the above equation that the WI_{req} increases in direct proportion with the number of floor/roof levels in a building. For example, WI_{req} for a two-storey building ($n = 2$) will be twice the value for that of a single-storey building ($n = 1$). This can be explained by an increase in the overall applied seismic force at the base of a multi-storey building. (See Figure 4-1 and an explanation in Section 4.1).

Parameters for wall index calculations (equation 7-1) are illustrated in Figure 7-1. Note that the *WI* needs to be calculated for *each* principal direction of the building plan (X and Y). It is