So,

$$F = 1.0\{(4 \times 130)/2 + [0.25 \times (10/3.1) \times 110 \times 4000]/2 \times 10^3\}/1.2$$
$$= 217\,(\text{frame}) + 148\,(\text{wall})$$
$$= 365\,\text{kN}$$

(d) Additional considerations

A lower limiting sliding friction wall strength F_0 is defined for the wall if composite action fails or m_d is very low:

$$F_0 = L\,t f_v/\gamma_{mv}$$

where

$$f_v = 0.35 + 0.6\,g_A\ \text{N/mm}^2 \quad \text{and} \quad f_v < 1.75 \tag{8.20}$$

for mortar designation (i), (ii) and (iii) and

$$f_v = 0.15 + 0.6\,g_A\ \text{N/mm}^2 \quad \text{and} \quad f_v < 1.4 \tag{8.21}$$

for mortar grade (iv) per unit area of wall cross-section due to the vertical dead and imposed load.

For the example given in section 8.2.2 (c), assuming mortar of grade (ii), f_v has a minimum value of 0.35 (for no superimposed load) and a maximum value of 1.75. Therefore taking γ_{mv}=2.5, F_0 has a value between 62 and 308 kN depending on the value of the superimposed load on the top beam.

Design for shear in the columns and beams is based on

$$\text{column shear} = \tfrac{1}{2}(F - F_0)$$
$$\text{beam shear} = \tfrac{1}{2}(h/L)(F - F_0) \tag{8.22}$$

9

Design for accidental damage

9.1 INTRODUCTION

It would be difficult to write about the effects of accidental damage to buildings without reference to the Ronan Point collapse which occurred in 1968. The progressive collapse of a corner of a 23-storey building caused by the accidental explosion of gas which blew out the external loadbearing flank wall and the non-loadbearing face walls of one of the flats on the 18th floor made designers aware that there was a weakness in a section of their design philosophy.

The Ronan Point building was constructed of large precast concrete panels, and much of the initial concern related to structures of this type. However, it was soon realized that buildings constructed with other materials could also be susceptible to such collapse.

A great deal of research on masonry structures was therefore carried out, leading to a better understanding of the problem. Research has been undertaken in many countries, and although differences in suggested methods for dealing with abnormal loadings still exist between countries, there is also a lot of common ground, and acceptable design methods are now possible.

9.2 ACCIDENTAL LOADING

Accidental or abnormal loading can be taken to mean any loading which arises for which the structure is not normally designed. Two main cases can be identified: (1) explosive loads and (2) impact loads; but others could be added such as settlement of foundations or structural alterations without due regard to safety.

Explosions can occur externally or internally and may be due to the detonation of a bomb, the ignition of a gas, or from transportation of an explosive chemical or gas. The pressure-time curves for each of these explosive types are different, and research has been carried out to determine the exact nature of each. However, although the loading caused by an