2. Confined Masonry: Key Components & Worldwide Applications

2.1. Key Components

Over the last 100 years, confined masonry (CM) construction has emerged as a building technology that offers an alternative to both unreinforced masonry and RC frame construction. In fact, CM has features of both these technologies. CM construction consists of masonry walls and horizontal and vertical RC *confining elements* built on all four sides of a masonry wall panel. Vertical elements, called *tie-columns* or *vertical ties*, resemble columns in RC frame construction, except that they tend to be of far smaller cross-sections. Horizontal elements, called *tie-beams* or *horizontal ties*, resemble beams in RC frame construction but they do not function as beams.
The confining elements are effective in

- Enhancing the stability and integrity of masonry walls for in-plane and out-of-plane earthquake loads by confining damaged masonry walls,
- Enhancing the strength of masonry walls under lateral earthquake loads, and
- Enhancing the ductility of masonry walls under earthquake loads and hence improving their earthquake performance.

The structural components of a CM building are (Figure 2-1)

- *Masonry walls* – transfer gravity load from the slab(s) above, down to the foundation. The walls act as bracing panels, which resist horizontal earthquake forces. The walls must be confined by RC tie-beams and tie-columns to ensure satisfactory earthquake performance.
- *Confining elements* (tie-columns and tie-beams) – provide restraint to masonry walls and protect them from complete failure even in major earthquakes. These elements resist gravity loads and have an important role in preserving vertical stability and achieving horizontal resistance of the walls of a building in an earthquake.
- *Floor slabs* – transfer both gravity and lateral loads to the walls. In an earthquake, these slabs behave like horizontal beams and are called diaphragms. RC floor slabs are typically used for CM construction and they act as rigid diaphragms.
- *Roof* – transfers gravity and lateral loads to the walls. CM buildings can have flat roofs (e.g., RC floor slabs) or sloped roofs (timber or steel trusses supporting CGI sheets or clay tiles). In the case of timber or steel roofs, robust RC tie-beams are required at the roof level to provide stiffness in an absence of rigid diaphragms (Figure 1-12).
- *Plinth band* – transfers the load from the walls down to the foundation. It also protects the ground-floor walls from excessive settlement in soft soil conditions.
- *Foundation* – transfers the loads from the structure to the ground.

The term “confined masonry” is used in a general sense for different forms of masonry construction reinforced with additional steel, timber, or concrete elements. However, the focus of this book is on clay brick or concrete block masonry walls “confined” with RC tie-beams and tie-columns.