Chapter

3 Masonry Buildings' Seismic Failures

3.1 Introduction

Masonry structures are probably the most popular and ancient type of buildings all over the world. Easy access of its constitutive materials, which are basically stones, bricks, and mortar (which varies from region to region), makes masonry one of the everlasting construction methods from small residential buildings to the most important ancient and historic monuments. Some of the most significant monuments throughout the world made of masonry are presented in *Fig. 3.1*.

Some masonry buildings have proved to be resistant structures even in seismic prone areas, due to some specific structural characteristics that have been observed throughout the years and after many destructive earthquakes. In this chapter, an effort will be made to refer to and describe the most characteristic deficiencies in unreinforced and reinforced masonry buildings under seismic actions. Design recommendations for new earthquake-resistant structures will follow, and some retrofitting and strengthening strategies for existing masonry buildings will be proposed.

3.2 Unreinforced Masonry Buildings

Unreinforced masonry buildings usually consist of vertical structural elements (walls), which support the horizontal structural elements (floors and roofs), forming a box-type structural system. When unreinforced masonry buildings are carefully constructed, the gravitational loads acting on the floors (performing as horizontal flexural elements) are transferred first to the load-bearing walls (acting as vertical compression elements) and finally to the foundation. Floors and roofs, which should ideally act as rigid diaphragms, additionally transfer earthquake-induced horizontal inertia actions to the walls, resulting in shearing and/or bending effects on the walls. Furthermore, distributed inertia forces are induced by the distributed wall element masses, which may result in the out-of-plane bending of the walls.[1]

DOI: https://doi.org/10.2749/sed016.059