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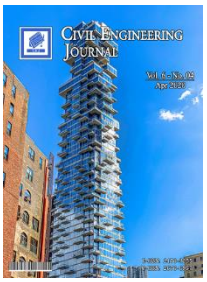

Seismic Performance of Clay Bricks Construction

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Abstract

The extensive use of masonry construction accompanied by the seismic hazard in Iraq requires comprehensive studies to assess the seismic performance of such construction. This study aims to evaluate the seismic performance of URM and CM buildings by their nonlinear time-history responses. ANSYS 18.2 software has been used to perform the nonlinear dynamic analyses. The mechanical properties have been investigated as the first step of the study. A simple mechanical instrument was improvised to determine the tensile strength of masonry directly. Ground motions were chosen in a manner so that their peak ground accelerations and site soils are as similar as possible to those in the South of Iraq. The computer software terminated all the analyses before the ends of the applied earthquake duration because of the solutions did not converge. In the numerical models, severe cracks have been observed in both URM and CM models, indicating their unsafe seismic performance. The minor cracks in confining concrete in the CM model compared to the severe ones in the masonry walls of the same model show the capability of the confinement to prevent the disintegration of collapsed masonry walls, at least in damaging cases like the building state at the solution termination.

Keywords: Masonry; Confined; Earthquake; ANSYS; Cracks.

1. Introduction

Masonry is the oldest construction type used throughout the world. It was used in Mesopotamia about 5000 B.C. [1]. However, the existing Iraqi monuments denote its old usage in construction. It is still widely used in Iraq in the form of URM or CM buildings. Stones besides other building types are used in the northern and western portions of the country, while clay bricks and concrete blocks are used in the middle and southern portions. However, clay bricks masonry is mainly used in the south region. URM structures are reliable for supporting gravity loads, but their resistance is weak under the effect of lateral loads. The post-earthquake observations demonstrate how they are seismically vulnerable and how their collapse causes the majority of casualties if they represent the most buildings in the affected area. Since masonry buildings exist in regions that have effective seismicity, experimental and theoretical studies have been implemented to assess their seismic performance and to propose suitable retrofitting techniques that enhance their seismic response. In this study, the nonlinear time-history response of URM and CM buildings has been investigated by ANSYS 18.2 using the William-Waranke plasticity model to simulate the material nonlinearity. Solid65 has been used for the simulation. This element is capable of cracking in tension and crushing in compression, which is a characteristic of the mechanical behavior of brittle materials such as masonry and concrete. The element has eight nodes with three degrees of freedom at each node.

The analysis with ANSYS Mechanical APDL has three main stages: preprocessor, solution, and postprocessor. In the first stage, the model geometry is built, and the mechanical properties are input. The second stage (solution)

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