Experimental Study on Hybrid Masonry Structure with RC Frame under Lateral Reversed Cyclic Loading

Fei Zhang, Jianxun Ma

Xi'an Jiaotong University, Xi'an, P.R. China

Contact: 490036116@qq.com

Abstract

As a new type of structural system, hybrid masonry (HM) structure with reinforced concrete (RC) frame is constructed of reinforced block masonry wall and reinforced concrete frame. This structural system combines the advantages of reinforced concrete frame structure and reinforced concrete block masonry structure, also overcomes some limitations of them. In order to study the seismic performance of the structural system, the lateral reversed cyclic loading experiment on the HM structure with RC frame was conducted. In the experiment, two specimens that were constructed with different connecting type were designed and tested, in one of them the masonry blocks was separated from the RC frame and only connected with steel keys at the top part of the specimen, while in the other there was no spacing between the RC frame and the masonry blocks. According to the data of the experiment, the paper analyzed the failure process and patterns, hysteretic characteristic, skeleton curve, stiffness degradation and displacement ductility of the structural system, and compared the results of the two specimens. The experimental study indicated that the HM structure with RC frame showed extraordinary good seismic performance during testing, and this form of construction had fairly good displacement ductility and energy dissipation, which would provide a basis for further theoretical analysis and design method.

Keywords: hybrid masonry; lateral reversed cyclic loading; hysteretic characteristic; skeleton curve; stiffness degradation.

1 Introduction

There are many types of structures in civil engineering, including frame structure, shear wall structure, frame-shear wall structure, tube structure, shell structure and other types of structures. Reinforced concrete frame structures with masonry infill walls are one type of the most popular structural systems in the world. In the civil structural systems, masonry infill walls are used as partition walls, and they may affect the strength, stiffness, and displacement ductility of the structures.[1] Some experimental and theoretical researches on the special characteristic of the reinforced concrete frames with masonry infill walls were investigated by many researchers in different parts of the world, although controversial arguments already exist on the role of infill walls modifying the seismic response of reinforced concrete frames.[2,3] According to the Code for Seismic Design of Buildings of China GB50011-2010,[4] masonry infill walls serve as non-structural elements. However, in most cases, when the structures are subjected to earthquakes, they interact with the surrounding reinforced concrete frames, which can result in different

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