

Study on Adding Story and Seismic Strengthening of Old Masonry Buildings

Authors : Youlu Huang, Huanjun Jiang

Abstract : A large number of old masonry buildings built in the last century still remain in the city. It generates the problems of unsafety, obsolescence, and non-habitability. In recent years, many old buildings have been reconstructed through renovating façade, strengthening, and adding floors. However, most projects only provide a solution for a single problem. It is difficult to comprehensively solve problems of poor safety and lack of building functions. Therefore, a comprehensive functional renovation program of adding reinforced concrete frame story at the bottom via integrally lifting the building and then strengthening the building was put forward. Based on field measurement and YJK calculation software, the seismic performance of an actual three-story masonry structure in Shanghai was identified. The results show that the material strength of masonry is low, and the bearing capacity of some masonry walls could not meet the code requirements. The elastoplastic time history analysis of the structure was carried out by using SAP2000 software. The results show that under the 7 degrees rare earthquake, the seismic performance of the structure reaches 'serious damage' performance level. Based on the code requirements of the stiffness ration of the bottom frame (lateral stiffness ration of the transition masonry story and frame story), the bottom frame story was designed. The integral lifting process of the masonry building was introduced based on many engineering examples. The reinforced methods for the bottom frame structure strengthened by the steel-reinforced mesh mortar surface layer (SRMM) and base isolators, respectively, were proposed. The time history analysis of the two kinds of structures, under the frequent earthquake, the fortification earthquake, and the rare earthquake, was conducted by SAP2000 software. For the bottom frame structure, the results show that the seismic response of the masonry floor is significantly reduced after reinforced by the two methods compared to the masonry structure. The previous earthquake disaster indicated that the bottom frame is vulnerable to serious damage under a strong earthquake. The analysis results showed that under the rare earthquake, the inter-story displacement angle of the bottom frame floor meets the 1/100 limit value of the seismic code. The inter-story drift of the masonry floor for the base isolated structure under different levels of earthquakes is similar to that of structure with SRMM, while the base-isolated program is better to protect the bottom frame. Both reinforced methods could significantly improve the seismic performance of the bottom frame structure.

Keywords : old buildings, adding story, seismic strengthening, seismic performance

Conference Title : ICSDEE 2020 : International Conference on Soil Dynamics and Earthquake Engineering

Conference Location : Dublin, Ireland

Conference Dates : June 25-26, 2020