EXPERIMENTAL STUDY OF SEISMIC BEHAVIOR OF SCALED NON-ENGINEERED MASONRY STRUCTURES RETROFITTED BY PP-BAND MESH

Shahid NAZIR[1], Navaratnarajah SATHIPARAN[2], Muneyoshi NUMADA[3] and Kimiro MEGURO[4]

ABSTRACT: Most residential structures in developing countries are masonry structures which are highly vulnerable to earthquake and increase the structural damage and the death toll. This paper discusses the seismic capacity of non-engineered common masonry structures in Pakistan, which having more tendency to collapse due large weight of slab, by experimental approach using 1/12 miniature models. These models were constructed using acryl blocks which can be used several times. This paper also includes the comparison of retrofitted masonry model by PP-band, a method proposed by Meguro Laboratory, IIS, the University of Tokyo, with non-retrofitted one. The PP-band retrofitted masonry model showed almost 4 and 16 times greater seismic capacity than the non-retrofitted one in terms of ground acceleration and arias intensity, respectively.

Key Words: Masonry structure, seismic retrofitting, PP-band meshes, shake table test

INTRODUCTION

Pakistan is one of the developing countries in South Asia where most residential structures are non-engineered masonry structures. The 2005 Kashmir Earthquake of magnitude 7.6 (Mw) (US Geological Survey) caused a significant failure of these masonry structures which yielded a death toll of 79,000 people [1]. These masonry structures are highly vulnerable to earthquake. This vulnerability can be reduced by retrofitting using some locally available, affordable, and easily applicable method like PP-band mesh retrofit proposed by Meguro Lab, IIS, the University of Tokyo [2, 3, 4, 5, 6].

These structures are usually built up by fully or semi burned bricks with RCC (reinforced cement concrete) or BRCC (brick RCC) slab as roof. The clay soil and brick tile are also placed on RCC or BRCC slab for heat isolation and floor finishes, respectively. This concrete slab is usually cast in-situ without any shear connection with walls. The excessive weight of slab and absence of shear connection increase the probability of collapse of these structures during seismic events.

These masonry structures were modeled using 1/12 scaled specimen with acrylic blocks, cement lime sand mortar for experimental studies [5]. These models were prepared under the different scenarios, i) non-retrofitted, ii) retrofitted without shear connection between slab and walls, and iii) retrofitted with shear connection between slab and walls as shown in Figure 1. All three models were constructed under the same conditions of materials, strength and dimensions. The input motion applied to all three structures was also the same. The both retrofitted and non-retrofitted models were tested using shake table to asses their seismic performance. The results obtained from shake table tests were compared with each other and an excellent improvement of seismic capacity of PP-Band retrofitted

[1] Graduate Student
[2] Research fellow, Institute of Industrial Science, University of Tokyo, Japan
[3] Research Associate, Institute of Industrial Science, University of Tokyo, Japan
[4] Director (ICUS) /Professor, Institute of Industrial Science, University of Tokyo, Japan