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Seismic Behavior of Steel-Concrete Composite Columns Under Cyclic Lateral Loading

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ABSTRACT

Lightweight concrete has been used in the construction industry for many years and by the introduction of modern technologies in the construction industry, this type of concrete has been accounted as one of the powerful and reliable materials in the construction industry. The density of lightweight concrete is about 0.56 that of the ordinary concrete. This type of concrete is commonly used as a flooring material in buildings. Thus there is possibility of its corrosion in different climatic conditions. In the present research, we would investigate the compressive strength and durability of the lightweight concrete in the acid environment, so that by specifying the corrosion rate, one could have a better understanding of the behavior of these concretes. For making the lightweight concrete in the present research use has been made of pumice aggregate in the mix design, and the acid used is 1M sulfuric acid. Also, the effect of adding two types of Nanomaterials i.e., Nano silica and Nano clay on the concrete behavior is assessed. The results have shown that in case of keeping the specimens of lightweight concrete in the acid environment for 90 days, their weight reaches 0.56 that of the ordinary specimens. The results of the current research have shown that the use of Nano silica and Nano lime per 10 wt% of cement could result in the increased compressive strength of the lightweight concrete. So that the concrete compressive strength per 10 wt% of Nano lime increases by 1.43%. On the other hand, the concrete durability in the acid solutions reaches the maximum value per addition of 5% Nano silica and 5% Nano lime, and has lost a lower percentage of its weight.

Key words: Composite column, thickness of steel layer, cyclic lateral loading

1. INTRODUCTION

Concrete-filled steel tube (CFST) columns are the box or tube composite steel columns filled with concrete. The steel portion of the section is usually composed of rolled structural boxes or steel tubes, which are produced in Iran on a large scale. The concrete core of the section may utilize ordinary concrete or self-compacting concrete (SCC). Putting the steel around the concrete core creates a composite section. Different types of roof systems and steel beams are used in combination with these columns [1-3]. Various researchers have investigated the use of composite columns. For example, Hajjar et al. (2000) investigated the behavior of circular and rectangular concrete-filled steel tube beam-columns and braces, particularly under the earthquake loading. Also, the column behavior under the cyclic, bending and axial loading was studied and compared with conventional columns [4]. Weng et al. (2005) analyzed the steel beam to steel-concrete column connections under earthquake loading and the results of this study indicated that the composite connection can be effectively used to improve the behavior of the whole column [5]. Liu et al. (2008) studied the behavior of CFT columns under the bending loading. This paper explored the effect of axial load ratio, thickness ratio, concrete compressive