The Effects of Steel Amount of the Concrete Precast 3D Panel Welded Wire Frame on their Nonlinear and Seismic Behaviors

Mohammad Zaman Kabir [1], Amir Homayoon Kosarieh[2].

1- Associated Professor, Dept. of Civil Engineering, Amirkabir University of Technology, Tehran. Iran
2- M.Sc., Dept. of Civil Engineering, Amirkabir University of Technology, Tehran. Iran

Email: ah.kosarieh@aut.ac.ir

Abstract

In the present investigation, the effects of the steel amount of the welded wire space frame of the prefabricated 3D sandwich panel on their nonlinear behavior are described. In order to do this study, numerical analysis of three models of wall system which are consisted of 3D panels with different amounts of steel in panels' steel mesh is performed by ANSYS soft ware under cyclic loading. Through this analysis, maximum tolerable shear force, maximum lateral displacement and ductility factor of the models are estimated. In addition three models of the four-story building by using 3D wall system in three upper floors and using concrete frame system at the parking level, are analyzed under seismic motion in order to determine the effects of the steel amount of welded wire space frame of the 3D panels on the seismic behavior of the models.

Keywords: Nonlinear, Cyclic loading, Precast 3D Panel, Seismic.

1. INTRODUCTION

3D wall panels are used in construction of exterior and interior load-bearing and non-load-bearing walls and floors of buildings of all types of construction. This system consists of a welded wire space frame integrated with a polystyrene insulation core. The wall panel is placed in position and concrete is applied to both sides. Figure 1 shows the details. The wall panel receives its strength and rigidity from the diagonal cross wires welded to the welded-wire fabric on each side. This combination produces a truss behavior, which provides rigidity and shear resistance for full composite behavior investigated by Salmon et al. in 1997 [1]. Nijhawan measured experimentally the interface shear force and designed the shear connectors [2]. In 1995, Einea et al. suggested mathematical solution of semi composite panels by developing differential equations [3], compared the analytical solution with numerical finite element analysis and showed the accuracy of their analytical method. Bush and Stine in 1994 studied the flexural performance of composite pre-cast sandwich panels with diagonal connectors [4]. Bush and Wu, in 1998, presented mathematical solution and finite element model for bending analysis of pre-stressed sandwich panels with truss diagonal shear members [5]. Also a comprehensive experimental research in order to better understand the mechanical characteristics of such hybrid systems are conducted by the second author, Kabir, in 2005 [6]. The compressive strength of sprayed concrete in the form of small cores is measured as a factor of standard cylindrical specimens, by Kabir and Rahbar in 2005 [7]. In this system, the fracture mechanism of concrete wythes and the adequacy of steel bars designed based on ACI 318- 95 and procedure of PCI design handbook [8,9] were studied. PCI published comprehensive report on sandwich panels representing technical information. In an experimental research concerning the response of reinforced concrete panels subjected to in-plane cyclic loading, the behavior of structure reinforced with welded wire mesh fabric is investigated by Paolo and Franchi in 2001 [10]. Also inelastic seismic performance of concrete precast 3D panel system with discontinuous shear walls supported on RC frames is investigated by Kabir and Kosarieh in 2008 [11].

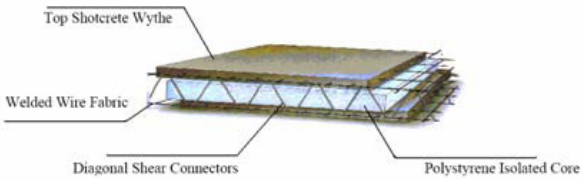

Figure 1. 3D Sandwich panel