



Determination of energy damping upon impact load in reinforced concrete sandwich plates with different core geometries

S. Savaş^a, M. Ülker^b, S. Turgut^a, and D. Bakır^{a,*}

a. Department of Civil Engineering, Faculty of Engineering, Firat University, 23100, Elazığ

b. Department of Civil Engineering, Faculty of Engineering, Turgut Özal University, 44210, Malatya

Received 8 December 2020; received in revised form 9 March 2021; accepted 2 August 2021

KEYWORDS

Sandwich plate;
Impact load;
Impact test;
Impact effect;
Reinforced concrete.

Abstract. It can be challenging to analyze Reinforced Concrete (RC) sandwich plates with hollow structures under impact loads in terms of crushing, punching, cracking, and crack trajectories via static and dynamic equations. In the literature, the finite element solutions were provided after determining the behaviors of the materials based on the test results. Therefore, it is required to test the behaviors of RC plates. To this end, the behaviors of sandwich plates under impact loads were experimentally analyzed in this study. The sandwich plates were manufactured by cutting Polyester Foams (PF) into hexagonal prisms, square prisms, I-type, and S-type and installing them inside the RC plates. The manufactured sandwich plates were 27% lighter than full plates. A weight of 320 kg declined freely from 2.5 m, and the load was implemented at the center of the plate at a velocity of 7.5 m/s. Similar implementations were also conducted for filled plates and the maximum displacements were measured in both types of plate tests. The measurements obtained from each test were compared to determine the sandwich plate with the core geometry which provided the highest absorption and the lowest displacement. In the analyses, the S-type core geometry exhibited greater absorption than other core geometries.

© 2021 Sharif University of Technology. All rights reserved.

1. Introduction

The design of Reinforced Concrete (RC) structures in the face of impact load has long been an area of interest for researchers. Most of the early studies in the literature have been conducted on examining the behavior of RC structures exposed to ballistic

weapons [1]. In addition, a number of variables were used in these experimental studies to examine the behavior of concrete in the face of impact. These variables included the mixing ratios of concrete, reinforcement of concrete with different types of fibers, location and amount of reinforcement, impact velocities and contact surface types of impacting objects, and weight of the impact load.

An experimental study was conducted to investigate the impact behavior of RC plates. Zineddin and Krauthammer [2] used nine RC plates in three types with dimensions of $90 \times 1524 \times 3353$ mm. In their study, the types of specimens were determined by changing the ratio of reinforcement in the concrete.

*. Corresponding author. Tel.: +90 4242370000/5411
E-mail addresses: ssavas@firat.edu.tr (S. Savaş);
mehmet.ulker@ozal.edu.tr (M. Ülker);
sevalcan@hotmail.com (S. Turgut); dbakir@firat.edu.tr (D. Bakır)