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Experimental Research of the Influence of the Ratio of the Longitudinal Reinforcement for Behavior of the Narrow Three-Span Reinforced Concrete Slabs

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Abstract

The paper presents the results of an experimental research of four three–span models of reinforced concrete strips with the dimensions of 7140×500×190 mm. The aim of the research was to demonstrate the influence of the ratio of longitudinal reinforcement on the load-bearing capacity and the mechanism of destruction. The paper contains the description of the experimental stand and models along with the results of experimental tests which were compared with the results of the calculations based on traditional methods.

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Keywords: reinforced concrete structure, slab structures, steel with high ductility, progressive collapse, failure stage

1. Introduction

One of the basic types of structures are skeleton structures, the most common being the slab-column structures of flat monolithic reinforced concrete slabs supported on columns. Because of the small surface of the slab–column connection and the relatively small thickness of the roof slab, these structures are very prone to damage resulting from design faults (e.g. incorrectly determined floor striking time, badly selected steel grade) and construction faults (improper concrete maintenance), as well as improper utilization. The examples of the impact of design and construction faults during the building structures construction have been presented in papers [1,2,3]. The above mentioned faults often lead to emergency situations or collapses. This type of failure occurs most often through

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punching or rupturing of the bottom reinforcement rods located in the centre of the floor slab areas. The experiments discussed in the paper are the continuation of the research presented in papers [4,5].

2. Description of the experimental models

Similarly to paper [4], the test models have been designed as cut-out strips of a typical slab-column floor with unidirectional reinforcement. In order to conduct the tests four identical flat reinforced concrete slabs have been constructed with the dimensions of 7140×500×190 mm (Fig. 1). Similarly to paper [5], it has been assumed that the length of the tested part would exceed the height of the cross-section ca. 30 times. In order to reinforce the models, bars with a diameter of 12 mm and 16 mm were used (no. 1 in Fig. 1), made from class C steel according to [6]. The reinforcement ratio was (Model 1 ρ=1.0%, Model 2 ρ=1.5%, Model 3 ρ=1.77%, Model 4 ρ=2.67%). As a transverse reinforcement, bars with a diameter of 8 mm (no. 2 in Fig. 1) made from class C steel according to [6] were used. After 30 days the models were placed on supports (*R2÷R3* in Fig. 1). After the rectification of models on supports had been performed, the main reinforcement was welded to the steel plates (no. 3 in Fig. 1). In the last stage of the preparatory works steel plates were immobilized in the test stand.

a b c

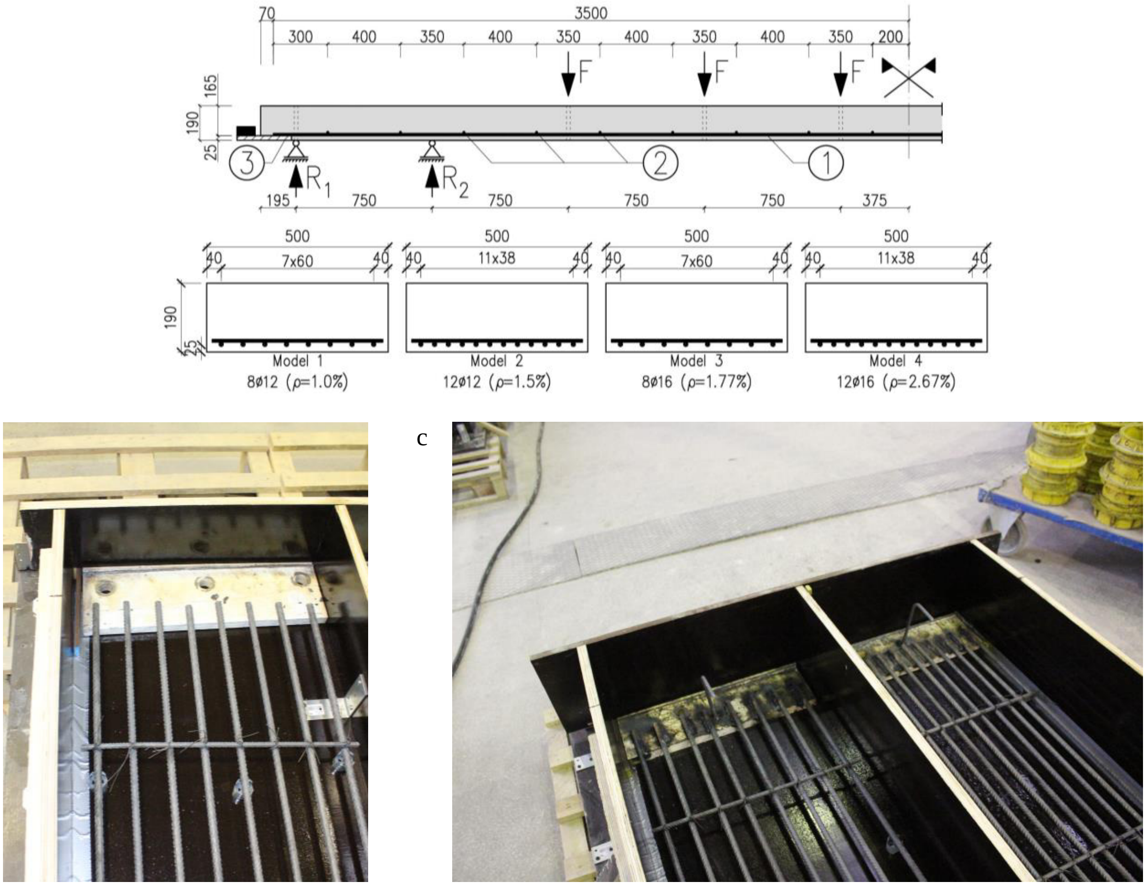

Fig. 1. (a) Model of testing – arrangement of the reinforcement; (b) View reinforcement of Model 1 before welding to steel plates; (c) View reinforcement of Model 1 and Model 2 after welding to steel plates.