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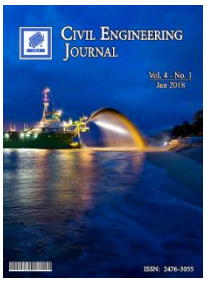

Finite Element Modeling of Post-Tensioned Two-Way Concrete Slabs under Flexural Loading

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Abstract

Post-Tensioned (PT) method is a widely used technique to prevent cracking and to minimize the deflection which is resulted by loads. In this method, stress is applied after concrete placing and reach adequate hardening and strength. This paper investigates the structural behaviour of PT two-way concrete slabs. The main objective of this study involves a detailed flexural behavior analytical investigation of PT concrete two-way slab with the different bonded tendon layout. This will be achieved by non-linear Finite Element (FE) analysis programs method, to choose the most effective and optimum position of tendon layout with different number of tendons and applied load on the concrete two-way slab. A parametric study was conducted to investigate the effect of tendons layout on the overall behavior of post-tensioned two-way concrete slab. The result obtained from finite element analysis showed that the failure load in PT in both directions increased about 89 % as compared with slab PT in one direction.

Keywords: Bonded Tendon; Post Tensioned Concrete; Two-Way Slab; Nonlinear; Finite Element; Computer Modelling.

1. Introduction

Concrete is a structural engineering construction material used by different methods. Although concrete is strong in compression, it is weak in tension. Concrete tensile strength is changing and differs between 8 and 14 percent of its strength in compression. Cracks appear in tension zones after applying loadings, PT techniques are widely used in concrete to prevent cracking and minimize the deflection which is resulted by externally applied load. Stresses are transferred after concrete pouring and reach required hardening and strength. The tendons are placed inside ducts before pouring of concrete, after the hardening of concrete, stressing jacks must be used to stress each tendon to the required load. To ensure the initial-posttensioning forces, all tendons must be anchoraged at the member ends [1].

A 3-D FE analysis is the most used and complete technique, which is used for static and dynamic analyses, controlling all aspects that affect the response of structures. It becomes the numerical method of choice in many engineering and applied science areas [2].

The behaviors of post-tensioned concrete elements were studied experimentally by Williams and Waldron [3], Yang et al. [4], Ranzi et al. [5], Bailey and Ellobody [6, 7] and others. A collection of studies by several researchers explains the FE analysis of the behavior of reinforced concrete structures such as shear failure of slabs, cyclic loading of columns, and the behavior of structure to seismic and bond models between concrete and steel.

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