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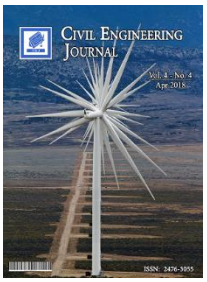

Deformations of R.C.Circular Slabs in Fire Condition

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Abstract

Reinforced concrete slabs are elements in direct contact with superimposed loads, having high surface area and small thickness. Such a condition makes slabs highly vulnerable to fire conditions. Fire results in exaggerated deformations in reinforced concrete slabs, as a result of material deterioration and thermal induced stresses. The main objective of this paper is to deeply investigate how circular R.C. slabs, of different configurations, behave in fire condition. That objective has been achieved through finite element modelling. Thermal-structural finite element models have been prepared, using "Ansys". Finite element models used solid elements to model both thermal and structural slab behaviour. Structural loads had been applied, representing slab operational loads, then thermal loads were applied in accordance with ISO 843 fire curve. Outputs in the form of deflection profile and edge rotation have been extracted out of the models to present slab deformations. A parametric study has been conducted to figure out the significance of various parameters such as; slab depth, slenderness ratio, load ratio, and opening size; regarding slab deformations. It was found that deformational behaviour differs significantly for slabs of thickness equal or below 100 mm, than slabs of thickness equal or above 200 mm. On the other hand considerable changes in slabs behaviour take place after 30 minutes of fire exposure for slabs of thickness equals or below 100 mm, while such changes delay till 60 minutes for slabs of thickness equals or above 200 mm.

Keywords: R.C; Circular Slabs; Fire Load; Structural Deformations.

1. Introduction

The significance of this research arises from its applications. Circular R.C slabs are widely used in silos and tanks, in either upper or lower slabs. Upper slabs are usually solid, in case of side feeding of tanks: while lower ones are usually concentrically opened to allow content discharge. Deformations of both slabs are significant design parameters, due to installed mechanical equipment, especially around openings. This research concentrates on deformations of circular R.C. slabs, when subjected to a fire load simultaneously with superimposed loads.

The structural problem of circular plates is considered one of the classical structural engineering problems. It has been first been expressed by Timoshenco (1959). Through the free body diagram shown in Figure 1. The presented circular plate problem is axisymmetric, so variation in straining actions and deformations takes place along the radial direction only.

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