Ultimate Strength of Reinforced Concrete Cylindrical Shells, Reinforced with Carbon Fiber Sheets under Static Point Load

by

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Abstract

The main purpose of this paper is to investigate, both experimentally and theoretically, the strength of reinforced concrete roof-type circular cylindrical shells with carbon fiber sheets under static load. Carbon fiber sheet reinforcement could be expected not only to improve the strength and mechanical behaviors, but also to retrofit with easy operations. In this study, the effects of the attached area and direction of carbon fiber sheet reinforcement on shell strength were investigated. The shell was subjected to static point load at the center of the shell surface and supported by hinges at four corners.

An experimental study was conducted on reinforced concrete shells with carbon fiber sheets on their bottom surface. Point load was applied perpendicularly on the shell surface to the final failure state. A theoretical study was conducted using material and geometrical nonlinear finite element analyses. The concrete shell strength was significantly influenced by the actual thickness variances of the designed thickness so that nonlinear numerical calculations including discrete shell thickness variances were carried out. The ultimate strength under point load was discussed based on the results of the failure experiments and nonlinear analyses.

Keywords: Concrete Shell, Ultimate Strength, Carbon Fiber Sheet

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