

Shear Behavior of Steel-Fiber-Reinforced Precast/Prestressed Concrete Hollow Core Slabs

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Abstract : Precast/prestressed concrete hollow core (PCHC) slabs, especially ones with depth more than 300 mm, are susceptible to web-shear failure. The reasons lie on the fact that the production process of PCHC slabs, i.e., the extrusion method (the most common method to cast PCHC slabs nowadays), does not allow them to contain any shear reinforcement. Moreover, due to the presence of the longitudinal voids, cross sections of PCHC slabs are reduced. Therefore, the shear capacity of the slabs depends solely on the tensile strength of concrete which is relatively low. Given that shear is a major concern in using hollow-core slabs, this paper investigates the possibility of adopting steel fibers in PCHC slabs produced by the extrusion method to enhance the shear capacity of the slabs. Three full-scale PCHC slabs with and without hooked-steel fibers were cast and tested until failure. Three different volumetric fiber contents of 0, 0.51 and 0.89% were investigated. The test results showed that there were substantial increases in shear capacity and ductility with the use of hooked-steel fibers. Ultimate shear strength increased with fiber content. In addition, while the specimen without steel fibers and the one with the steel-fiber volume fraction of 0.51% failed in web-shear mode, the specimen with the higher fiber content (0.89%) collapsed in flexural-shear mode. However, as the hooked-steel fibers with the fiber content of 0.89% were used, difficulties in concrete consolidation were observed while concrete was being cast. This could lead to a lower ultimate shear capacity due to a poorer bond between the concrete and the steel fibers.

Keywords : hollow-core slabs, shear strength, steel fibers, web-shear failure

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