Interaction diagram and response surface plot of pretensioned inverted T-beam with circular web openings

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ABSTRACT
This paper presents the results of a research project aimed at providing standard circular web openings to the popular precast pretensioned inverted T-beam. Opening diameter and placement and required materials strengths were investigated. In this paper, the non-linear analysis, interaction diagram and deflection response surface plot of simply supported pretensioned inverted T-beam with circular web openings are presented. Two design parameters are varied that is: opening location and numbers of openings. The results from non-linear finite element analysis were substantiated by test results from five pretensioned inverted T-beams with web opening and one solid beam. Good agreement is shown between the theoretical and the experimental results. The effect of openings on the behaviour of such beams at different stages of loading are presented. The test results obtained from this investigation show that the performance of the specimens with web openings was almost identical to that of the specimen without web openings. An algorithm which is written to plot interaction diagram for estimating the cracking load is proposed. Deflection response surface plots using general factorial design are also presented.

KEYWORDS
Interaction diagram; Inverted T-beam; Prestressed concrete; Response surface; Web opening

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