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Finite Element Analysis of Transfer Zone in Pretensioned Concrete Members Using Cohesive Damage Models

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ABSTRACT

The transfer length, defined as the distance over which the strand must bond with concrete to achieve effective prestress, is influenced by numerous variables. This study introduces a finite element modeling approach designed to capture the effects of these variables on the transfer length of prestressed members. The bond between prestressing steel and concrete was defined using the cohesive damage contact condition in a commercial structural analysis program. In this study, the prestressing steel diameter, effective prestress, concrete compressive strength, and cover thickness were set as determinant variables for calculating the transfer length. The results were compared with those from previous studies (Buckner 1995; Lane 1990; Martin and Scott 1976; Mitchell et al. 1993; Zia and Mostafa 1977) and the ACI 318 code equation (ACI Committee 318 2019). The transfer length predictions (pred.) obtained from the finite element analysis model were compared with experimental (exp.) values and those calculated using the ACI 318 code equation, as shown in Fig. 1. The primary variables in this comparison are the nominal diameter of the prestressing steel (d_b), concrete compressive strength (f_{ck}), and cover thickness (c).

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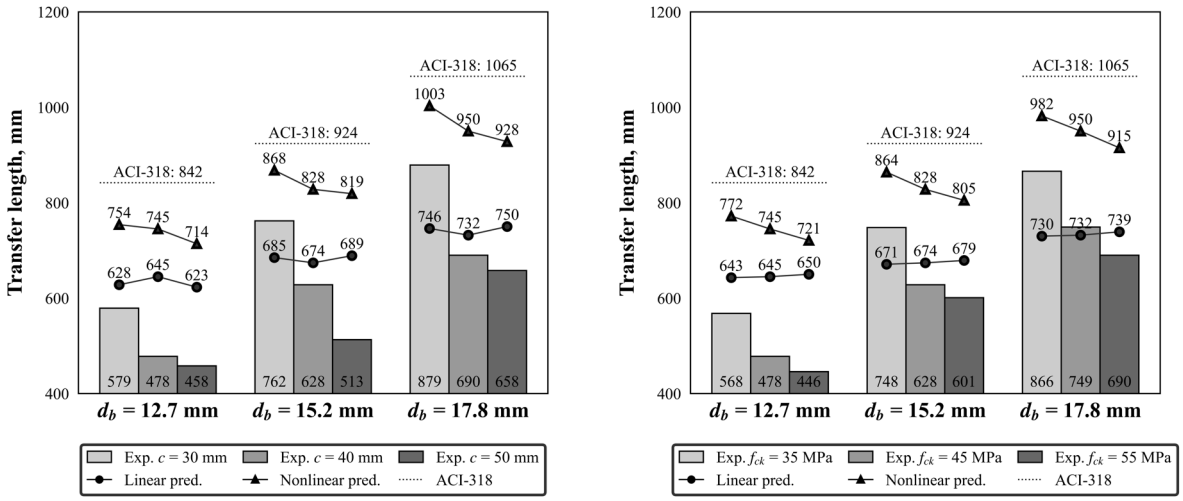

(a) Concrete cover effects (b) Concrete strength effects

Fig. 1 Comparison of transfer lengths based on prestressing strand diameters

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