Repair of Corroded Prestressed Concrete Piles of Harbor Landing Stages.

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Discussion by José R. Martí-Vargas

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The discussed paper presents an interesting study on repairing and strengthening corroded prestressed concrete piles by using carbon fiber-reinforced polymer jacketing. The authors should be complimented for carrying out a careful experimental study. The discusser would like to thank the authors for providing an excellent paper and would also like to offer the following comments and questions, mainly about longitudinal reinforcement, so that the authors can consider them in further analyses and researchs.

1. Based on the test setup capacity, a length scale of 1/2 in relation to the prototype piles was chosen by the authors for the prestressed concrete pile specimens. This fact also affects the actual bending moment. A scale of 1/2 was also applied to the diameter of the specimens. Therefore, the concrete cross-section was 1/4 in relation to the prototype piles, and the second area moment was 1/16. How did the authors account for these different reduced-scale factors? Was the diameter of the longitudinal reinforcement also scaled or did it coincide with the reinforcement diameter of the prototype piles?

2. Longitudinal reinforcement consisted of 18 prestressing high-strength steel bars 7 mm (0.276 in.) in diameter, all pretensioned by a total of 49.0 kN (11.0 kips) axial force. The discusser believes that the manufacturing process of the specimens in the precast plant consisted of three stages[33]: tensioning the prestressing reinforcement; casting the concrete member around the prestressing reinforcement; and releasing the prestressing reinforcement force, which is transferred to the concrete by bond. Afterwards, the reinforcement stress varies from a zero value at the specimen ends to a constant maximum (effective stress) in the central zone of the prestressed specimen. The distance required to develop the effective stress in the prestressing reinforcement is defined as transfer length[34]. Transfer length depends on several parameters (e.g., reinforcement stress and diameter[34], concrete properties[35,36] and composition[33,37]), and can be estimated by using equations based on the equilibrium of forces[36,38] or bond-slip,[39] and can also be experimentally determined[40,41]. Transfer length is important not only after prestress transfer, but also when a bending moment is applied because transfer length remains whitin the required development length at loading[34,42]. As the corrosion simulation was carried out by partial concrete spalling and the concrete cover was removed, reinforcement-concrete bond loss resulted in the specimens. In the case of specimens C4N and C4R, four longitudinal reinforcing bars were cut off to simulate their full corrosion. However, the authors do not provide information on the longitudinal reinforcement stress as regards the transfer lengths and their changes –longitudinal reinforcement stress disminution–, which should be considered in the analyses of the observed behavior of the test specimens. The idealized longitudinal reinforcement stress profiles after simulating corrosion are shown in Fig.15.

3. The disminution of longitudinal reinforcement stress caused by removing the concrete cover could be considered an equivalent prestress loss[43] to a mass loss of this reinforcement. Therefore, this information should be included in Table 1 for specimens C2N-C2R and C3N-C3R.

4. As the concrete cross-section diminishes asymmetrically by removing the concrete cover, an initial excentricity of the axial prestressing force prior to testing appears, which also depends on the

changes in longitudinal reinforcement stress, in addition to possible transfer length changes with time[44].

5. Insignificant effects of different confinement reinforcement levels on transfer length have been stated,[45,46] also on the development length[46]. Do the authors have some information on the effect of the confinement by jacketing on the longitudinal reinforcement stress in the repaired specimens?

6. As transfer length provisions differ from distinct codes and researchers,[36,39,47] it would be interesting to detail the provisions used by the authors to design and manufacture the prestressed concrete pile specimens. Is the applied pretensioned axial force of 49.0 kN (11.0 kips) representative of the current practice in Taiwan from 18 prestressing high-strength steel bars 7 mm (0.276 in.) in diameter?

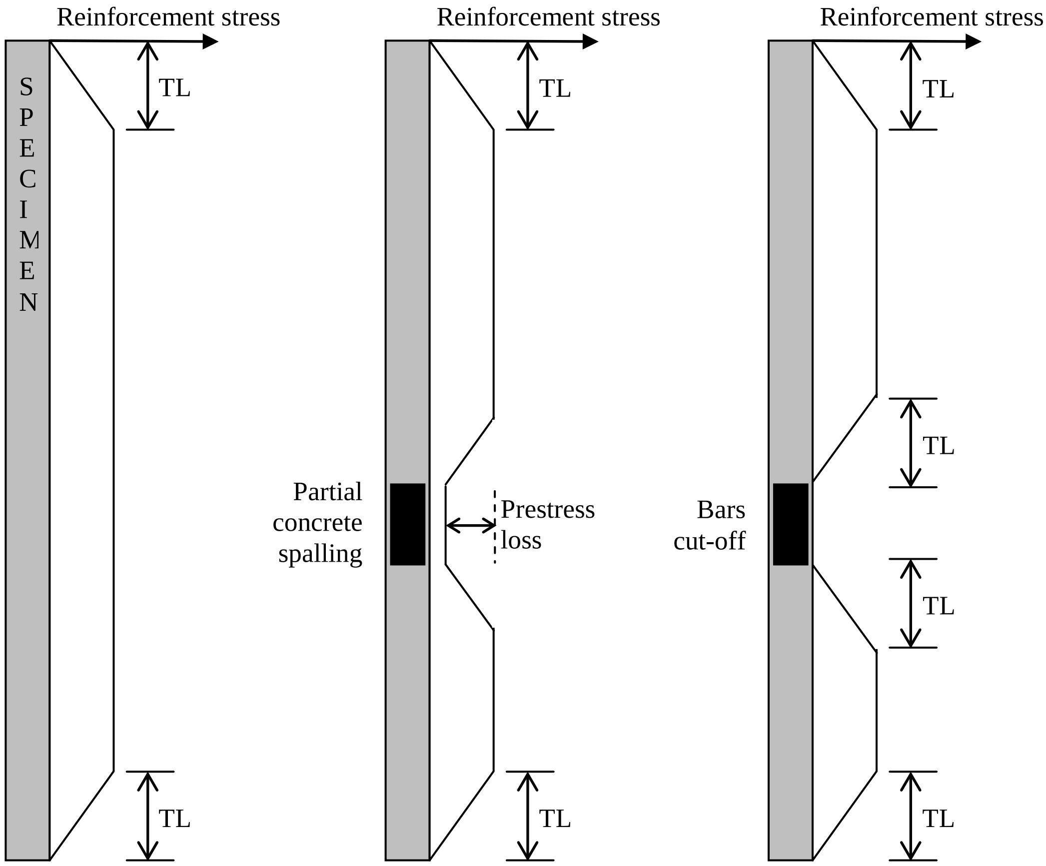

Fig. 15—Idealized longitudinal reinforcement stress profiles (TL = transfer length).

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