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Monitoring and analysis of long-term prestress losses in post-tensioned concrete beams

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Abstract: In order to investigate the long-term prestress losses in post-tensioned concrete beams, time-dependent responses of eight post-tensioned concrete beams were monitored for more than one year. Load cells, vibrating wire strain gauges (VWSGs) and elasto-magnetic (EM) sensors were used jointly to measure the tendon forces at beam ends, the prestress losses due to concrete creep and shrinkage and the total prestress losses along tendons, respectively. In this way, the prestress losses due to different factors and at different locations were observed more accurately. Based on the monitored data, the influence of tendon layout, reinforcement ratio, duct grouting, stress level and jacking sequence, etc., on long-term prestress losses were analyzed. An improved model for predicting the time-dependent prestress losses was thus proposed, in which non-prestressed steel and the interaction among the shrinkage, creep of concrete and steel stress relaxation were taken into account. The proposed model has higher accuracy as compared with existing models in specifications, and the maximum difference between test and predicted results is within 10%.

Keywords: Long-term prestress loss; Post-tensioned concrete beam; Monitoring; Prediction model; Shrinkage; Creep

1. Introduction

Monitoring the long-term behavior of civil structures is of great importance for damage prevention

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