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TIME COMPRESSIVE STRENGTH AND MODULUS OF ELASTICITY OF FLORIDA CONCRETE

PROBLEM STATEMENT

The Florida Department of Transportation (FDOT) requirements for concrete compressive strength may be met through drilled core specimen testing and estimation of an equivalent 28-day compressive strength based on the core strength. The equivalent compressive strengths meeting the specified FDOT requirements are acceptable based on the established correlation; low-strength concrete, based on its structural evaluation, may be accepted with reduced payment. The current FDOT compressive strength correlation equations for pay reduction have been used for many years and may not represent current FDOT concrete.

The current FDOT concrete modulus of elasticity (MOE) empirical model is a function of concrete compressive strength and unit weight. Recent testing shows that this model consistently underestimates the MOE for FDOT concrete. This underestimation may lead to over-prediction of camber and deflection of concrete structural members.

OBJECTIVES

One of the two major objectives of this study was to develop models to accurately reflect the time dependent variation of compressive strength of current Florida concrete. Based on these models, realistic equivalencies for 28-day concrete strengths based on core and cylinder tests and accurate pay reduction relationships can be developed. The other major objective of this study was to develop more accurate equations to predict the MOE for FDOT concrete.

FINDINGS AND CONCLUSIONS

The time-dependent variation of compressive strength in FDOT fly ash concrete was found to be significantly different than in the FDOT slag concrete. Therefore, separate strength models were developed to represent fly ash and slag concrete data.

The prediction models for the MOE of FDOT concrete were developed as functions of compressive strength and unit weight. Density and specific gravity of the coarse aggregate significantly affect the MOE of FDOT concrete. Best fit MOE models for FDOT concrete, with suggested modification factors for various aggregate types, were recommended. Developed models are valid for compressive strengths in the range of 5.92 to 58.1 MPa (859 to 8,432 psi) and unit weights in the range of 2255.4 to 2407.6 kg/m^3 (140.8 to 150.3 pcf).

BENEFITS

This research will help engineers to accurately predict the compressive strengths and MOE values in FDOT concrete at various time intervals. The proper prediction of concrete compressive strength variations will be useful in determining appropriate pay reduction for FDOT concrete. The MOE values at various time intervals are important for predicting the serviceability of FDOT concrete members, especially prestressed members. This fact may result in accurate prediction of deflections and cambers by FDOT design procedures and software. In prestressed concrete members, the behavior at prestress release, at transport of members, and in service is of concern. The prediction models developed through this research will optimize materials used in prestressed elements to insure the intended purpose is met without excessive overdesign or waste of materials.

This research was conducted by Nur Yazdani, Ph.D., of the Florida A & M University – Florida State University College of Engineering. For more information, contact Michael Bergin, Project Manager, at (352) 955-6666, michael.bergin@dot.state.fl.us.