

MODULUS OF ELASTICITY, CREEP AND SHRINKAGE OF CONCRETE

PROBLEM STATEMENT

At present, the modulus of elasticity, creep, and shrinkage properties of concrete that are used in structural design in Florida are based on the available literature or are based on the limited research of the locally available material. There is a great need for comprehensive testing and evaluation of locally available concrete mixes to determine the mechanical and physical properties of Florida normal weight and lightweight concretes, so that correct values for these properties can be used in structural designs.

OBJECTIVES

The main objectives of this study are (1) to design, evaluate, and construct creep test apparatuses that are suitable and effective for performing creep tests on Florida concretes, and (2) to conduct a research testing program to evaluate the compressive strength, indirect tensile strength, elastic modulus, drying shrinkage, and creep characteristics of typical Florida Class II, IV, V and VI concrete mixes made with normal weight and lightweight aggregates. Ten different concrete mixes were evaluated over a course of two years.

FINDINGS AND CONCLUSIONS

A creep test apparatus was designed, and twelve creep test apparatuses were constructed and set up in the State Materials Office laboratory for use in performing the creep tests. The creep test apparatus was evaluated and determined to be working satisfactorily. An effective procedure for the creep test using this apparatus was developed and documented.

This study has generated valuable data and determined general trends on the compressive strength, splitting tensile strength, elastic modulus, drying shrinkage strains, and creep coefficient of typical Florida structural concretes made with normal weight and lightweight aggregates. Five of the ten concrete mixes evaluated appeared to have alarmingly high creep coefficients, which may warrant a modification of present FDOT guidelines on values of creep coefficients to be used in structural designs. However, due to the limited scope of this study, the concrete properties as determined in this study should not be recommended for use in structural designs yet. It is recommended that further testing be conducted, as follows:

- (1) Replicate batches of the ten concrete mixes evaluated in this study should be tested to establish reliability of the findings and to evaluate the variability of the test results.
- (2) The creep tests should be run up to one year, instead of 91 days.

- (3) Structural concretes using other Florida coarse aggregates should also be evaluated.
- (4) The effects of the type and amount of mineral admixtures (fly ash, slag and silica fume), and other admixtures should be evaluated.

BENEFITS

The findings from this study have generated valuable information on the typical compressive strength, splitting tensile strength, elastic modulus, drying shrinkage and creep characteristics of Florida structural concretes made with normal weight and lightweight aggregates. With further testing and verification, the results of this research will lead to more effective specifications and guidelines, which will enable the use of more accurate values of mechanical, creep and shrinkage properties of Florida concretes in structural designs.

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