ABSTRACT

This report is concerned with the prediction of the long-time creep and shrinkage behavior of concrete. It is divided into three main areas.

1. The development of general prediction methods that can be used by a design engineer when specific experimental data are not available.

2. The development of prediction methods based on experimental data. These methods take advantage of equations developed in item 1, and can be used to accurately predict creep and shrinkage after only 28 days of data collection.

3. Experimental verification of items 1 and 2, and the development of specific prediction equations for four sand-lightweight aggregate concretes tested in the experimental program.

The general prediction equations and methods are developed in Chapter II. Standard Equations to estimate the creep of normal weight concrete (Eq. 9), sand-lightweight concrete (Eq. 12), and lightweight concrete (Eq. 15) are recommended. These equations are developed for standard conditions (see Sec. 2.1) and correction factors required to convert creep coefficients obtained from equations 9, 12, and 15 to

valid predictions for other conditions are given in Equations 17 through 23. The correction factors are shown graphically in Figs. 6 through 13.

Similar equations and methods are developed for the prediction of the shrinkage of moist cured normal weight concrete (Eq. 30), moist cured sand-lightweight concrete (Eq. 33), and moist cured lightweight concrete (Eq. 36). For steam cured concrete the equations are Eq. 42 for normal weight concrete, and Eq. 45 for lightweight concrete. Correction factors are given in Equations 47 through 52 and Figs., 18 through 24.

Chapter III summarizes and illustrates, by examples, the prediction methods developed in Chapter II.

Chapters IV and V describe an experimental program in which specific prediction equations are developed for concretes made with Haydite manufactured by Hydraulic Press Brick Co. (Eqs. 53 and 54), Haydite manufactured by Buildex Inc. (Eqs. 55 and 56), Haydite manufactured by The Cater-Waters Corp. (Eqs. 57 and 58), and Idealite manufactured by Idealite Co. (Eqs. 59 and 60). General prediction equations are also developed from the data obtained in the experimental program (Eqs. 61 and 62) and are compared to similar equations developed in Chapter II.

Creep and Shrinkage prediction methods based on 28 day experimental data are developed in Chapter VI. The methods are verified by comparing predicted and measured values of the long-time creep and

shrinkage of specimens tested at the University of Iowa (see Chapters IV and V) and elsewhere. The accuracy obtained is shown to be superior to other similar methods available to the design engineer.