Overview

Prestressed concrete, an ideal combination of concrete and high strength steel, has emerged as an efficient material for modern construction. The construction of prestressed concrete bridges as a standard practice in the United States dates back to 1949 when the Philadelphia Walnut Ave Bridge was constructed. The technical and economical benefits of prestressed concrete permits longer spans and increased girder spacing. Complimenting this, higher performance concrete can feature lower water to cementious materials ratio (w/cm) and the inclusion of supplemental cementious materials that promote a dramatic improvement of concrete quality and durability.

Efficient design of prestress concrete bridges demands an accurate prediction of prestress losses. The prestress losses are defined as the loss oftensile stress in the prestress steel which acts on the concrete component ofthe prestressed concrete section. In pretensioned concrete, the four major sources of prestress losses are elastic shortening (ES), creep (CR), shrinkage (SH) and relaxation (RE). Additionally, prestress losses are further affected by variations in material properties ofthe concrete. Numerous research programs have been conducted and a variety of prestress loss prediction methods have been proposed [NCHRP Report 496 by Tadros et al (2003), Huo, Omashi and Tadros (2001),].

However, accurate determination of prestress losses has always challenged the prestressed concrete industry. Inaccurate predictions oflosses result in excessive camber or deflection ofprestressed concrete bridges. Excessive cam ber or deflection can, in turn, adversely affect the service conditions such as: cracking, ride and overall performance of the bridge. Excessive cracking can even reduce the bridge's durability since cracking can be a route for water borne contaminants to deteriorate the concrete and its reinforcements. The primary objective ofthis research is to review the relevant literature and databases available from prior research programs. This research will also develop design guidelines towards the accurate estimation ofprestress losses, restricted to pre-tensioned concrete. We expect to develop equations for losses from the existing AASHTO LRFD time dependent equations for creep, shrinkage and relaxation. A spreadsheet was developed using the above proposed equations which can be used in design of prestressed concrete bridges. Additionally, some recommendations for design to ODOT will also be made.