HR-333 Design Methodology for Post-Tension Strengthening of Concrete Span Bridges

Key Words: Bridges, Post-Tensioning, Superimposed trusses

ABSTRACT

The need for upgrading a large number of under strength bridges in the United States has been well documented in the literature. This manual presents two methods for strengthening continuous span composite bridges: post-tensioning of the positive moment regions of the bridge stringers and the addition of superimposed trusses at the piers. The use of these two systems is an efficient method of reducing flexural overstresses in undercapacity bridges. Before strengthening a given bridge however, other deficiencies (inadequate shear connection, fatigue problems, extensive corrosion) should be addressed.

Since continuous span composite bridges are indeterminate structures, there is longitudinal and transverse distribution of the strengthening axial forces and moments. This manual basically provides the engineer with a procedure for determining the distribution of strengthening forces and moments throughout the bridge. As a result of the longitudinal and transverse force distribution, the design methodology presented in this manual for continuous span composite bridges is extremely complex. To simplify the procedure, a spreadsheet has been developed for use by practicing engineers. This design aid greatly simplifies the design of a strengthening system for a given bridge in that it eliminates numerous tedious hand calculations, computes the required force and moment fractions, and performs the necessary iterations for determining the required strengthening forces. The force and moment distribution fraction formulas developed in this manual are primarily for the Iowa DOT V12 and V14 three-span, four-stringer bridges. These formulas may be used on other bridges if they are within the limits stated in this manual. Use of the distribution fraction formulas for bridges not within the stated limits is not recommended.