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AUTOMATED DESIGN OF CONTINUOUS BRIDGES WITH PRECAST PRESTRESSED CONCRETE BEAMS

VOLUME I: DESIGN CONSIDERATIONS

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Automated Design of Continuous Bridges With Precast Prestressed Concrete Beams

Volume I: Design Considerations

by

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The continuous precast prestressed bridge differs from conventional simple span prestressed concrete beam and cast-in-place deck construction in that the deck slab is reinforced and continuous over interior supports to resist negative moments arising from continuity. This method of construction affords some economy in design through the reduction of the maximum positive moment that a beam must sustain.

Design of this type of beam requires certain additional considerations which do not arise in the design of simple span prestressed concrete beams. Live load moments and shears must be determined through a statically indeterminate analysis. Concrete bridge structures are subject to time dependent deformations produced by creep of the deck and beam concrete and by differential shrinkage between the deck and beam. In continuous structures, these deformations cannot occur freely due to the restraint of continuity. As a result, additional moments and shears are produced in the beam which must be considered during design. Negative moments are resisted by conventional reinforcing in the deck, which must be computed.

A computer program has been developed to carry out the design of continuous precast prestressed concrete bridge beams. Designs are limited to I-shaped beam cross sections and girders in which precast beams in all spans are of identical shape. The program considers live loads produced by standard AASHTO trucks and lane loadings, by an "axle train" of up to 15 wheels, and by a uniformly distributed load on the continuous beam. Dead load due to beam weight, diaphragms and slab weight are also included.

The program computes for each span of the girder the number of prestressing strands required and their placement, the area of conventional reinforcing needed in the deck to resist negative moment, the area of reinforcing at interior supports to resist positive moments, stirrup spacing and beam concrete release and 28-day strengths.

This report (Volume I) describes the analysis techniques and design calculations used in the program. A separate volume

(Volume II) gives a detailed description of the computer program and its use.

The published version of this report may be obtained by addressing your request as follows:

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