Summary of Final Report, BD545-07
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FIELD VERIFICATION OF CAMBER ESTIMATES FOR PRESTRESSED GIRDERS

PROBLEM STATEMENT

Prestressed concrete girders are used on the majority of Florida's bridges. The location of the prestressed reinforcement in the bottom of the girders produces a significant camber in the beams that must be accounted for in the construction of the bridge deck. Currently, camber is estimated using design equations that have not been field verified on actual FDOT bridge construction. Accurate camber prediction has the potential to reduce changes and delays in construction by eliminating adjustments in build-up or bearings that are otherwise required to arrive at the correct deck profile.

OBJECTIVES

The goal of this project was to obtain a statistically significant amount of camber data in order to evaluate the current design methodology, particularly to verify or improve the present design methodology used by the Department for camber estimation.

Specific objectives of this project included the following:

- Collect a statistically significant number of field camber measurements on a variety of AASHTO girders to compare to the predicted values produced by the design program employed by the FDOT
- Supplement these camber measurements with materials testing data
- Develop conclusions for verification of the current prediction model or recommendations of a different prediction model.

FINDINGS AND CONCLUSIONS

The following are among the findings and conclusions resulting from this study.

- The observed camber increase with time was significantly less than what was estimated for the 162 ft. 78-inch Florida Bulb-Tees and the 91 ft. AASHTO Type IV girders when using the FDOT *LFRD PSBeam v.1.85* design program.

- It is recommended that the FDOT *LFRD PSBeam v.1.85* design program be modified to account for this significant difference in actual camber measurements and predicted camber. One possible approach would be the use of the time-dependent creep coefficient given by Section 5.4.2.3.2 of the *AASHTO LRFD Bridge Design Specification*. This creep coefficient should not only be applied to the camber due to the long-term loading of the prestress force, but it should also be applied to the deflection associated with the long-term loading due to the self-weight of the member. This can be done using the relationship proposed by Nilson in Eq. (2), of the report (Appendix H provides example calculations showing this method). An improvement of the Nilson method presented in Eq. (2) and Appendix H would be to develop a time-dependent relationship for the effective prestressing force rather than assume that the effective prestressing force is determined after all time dependent losses have occurred.

- For the influence of the thermal gradient on camber, there was little difference between the empirically corrected camber measurements and the analytically corrected camber measurements in the majority of cases. Either method is suitable for the correction of camber due to thermal gradient effects.

- Both the AASHTO and the ACI methods for calculating the elastic modulus were fairly accurate for the 78-inch Bulb-Tee specimens for which an FDOT Class VI concrete was used, and also for the AASHTO Type IV and AASHTO Type V specimens for which an FDOT Class IV concrete was used.

- Guidelines for storage of the girders with instruction of the amount of clearance necessary between the ground and bottom flange should be implemented in order to reduce the effect of differential shrinkage in the field.

- Further investigation should be done with reference to the increase in camber from immediately after transfer to when the girders have been relocated to storage. This effect was consistently the most pronounced in heavy girders with a large span to depth ratio.

BENEFITS

This project produced results that will improve the design methodology for estimating camber. Accurate predictions of the time-dependent camber growth can reduce the additional construction costs attributed to changes and delays due to build-up and/or bearing corrections to the bridge superstructure.

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