

AN ABSTRACT OF A THESIS

**EXPERIMENTAL STUDY OF A TWIN BRIDGE WITH NORMAL STRENGTH
AND HIGH STRENGTH CONCRETE BEAMS IN TENNESSEE**

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An experimental study was conducted on a twin bridge in Blount County, Tennessee. High strength concrete (HSC) beams were used in one bridge, and normal strength concrete (NSC) beams were used in the other. The primary objective of this study was to investigate the time-dependent behavior of NSC and HSC bridge beams and cast-in-place deck and diaphragm during various stages of construction and service.

Two prestressed concrete girders in each bridge, portions of cast-in-place deck and diaphragms were instrumented and monitored for the concrete temperatures, strains, and cambers for more than one year. Laboratory experiments were conducted on material properties of NSC and HSC, including compressive strengths, modulus of elasticity, shrinkage, and creep deformation. In addition, live load testing and finite element analysis were performed to investigate the live load moment distribution factors, and the results were compared with three code specified methods.

The field monitoring results showed that the concrete strains of NSC beams increased steadily with time even after 6 months, whereas the concrete strains of HSC beams developed rapidly in the first 40 days and then became stable afterward. The behavior of cast-in-place concrete deck depended on the strain status of supporting precast beams. Smaller differential shrinkage between deck concrete and precast beam concrete would reduce the possibility of having tensile strain in deck. Smaller time-dependent positive moment was observed in the HSC bridge diaphragm. The laboratory experimental results verified the field monitoring results. Based on these results, it is recommended that the HSC beams can be erected after a shorter period of storage time such as 45 days.

The moment distribution factors obtained from the live load test were close to that from the finite element analysis. Compared with AASHTO Standard method and AASHTO LRFD method, the Henry's method had the closest results to the live load test and finite element analysis.