

**AN ABSTRACT OF A THESIS**

**TIME-DEPENDENT BEHAVIOR OF NORMAL STRENGTH AND  
HIGH STRENGTH CONCRETE BRIDGE MEMBERS**

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Prestressed concrete bridge members will undergo different loading stages: prestressing release, beam and slab weight, superimposed dead load, and live load. In a prestressed concrete beam, stresses in the concrete and the prestressing steel vary continually with time due to the effects of creep and shrinkage of the concrete and the relaxation of the prestressing steel. Under a sustained load, the deflections caused by the creep and shrinkage may be several times their instantaneous values.

The objectives of this study were to perform field instrumentation on high strength (HSC) and normal strength (NSC) prestressed concrete bridge girders and cast-in-place deck for the time-dependent deformations and stresses during various stages of construction and service of bridges; to experimentally investigate in laboratory the time-dependent material properties of concrete; and to conduct a comparison study between behaviors of high strength and normal strength concrete members and between the measured and predicted results of time-dependent deformation and stresses.

An experimental study on Pistol Creek Bridge in Blount County, Tennessee, was conducted to monitor the short-term and long-term behavior of the bridge. The left lane is a NSC bridge and the right lane is a HSC bridge. Each bridge lane has five spans and five lines of prestress concrete AASHTO Type III beams. The field instrumentation includes the monitoring of temperatures, strains and cambers. The laboratory experiment involves the measurements of compressive strength, modulus of elasticity of concrete, concrete shrinkage and creep. Several methods were used to predict concrete shrinkage and creep, prestress losses and camber. The field monitoring results showed that the concrete strain of NSC beam increased steadily with time even after 6 months, whereas the concrete strain of HSC beam developed rapidly in the first 30 days and then became stable afterward. The development of cambers for NSC and HSC beams were found to have the same trend as the concrete strain of NSC and HSC beams, respectively. The laboratory experimental results verified with the field monitoring results. Based on these results, it is recommended that the HSC beams can be kept in the storage location for a shorter period of time such as 45 days before shipping to bridge site.