Title: **"Computational and Experimental Analysis of Prestressed Concrete Railroad Ties for Large Deformation (Computational Program Development and Code Verification)"**

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Abstract

Concrete railroad ties have been used in the United States for over 125 years, and prestressed concrete monoblock ties are most commonly used. In monoblock tie design, flexural strength of the prestressed tie is used to predict the tie capacity. Current tie design procedures vary from manufacturer to manufacturer. American Railway Engineering and Maintenance -of-Way Association (AREMA) sets the flexural design standard for all prestressed ties. AREMA also stipulates critical positions for loading and limits concrete crack propagation to the outer layer of reinforcement on the tensile surface of the tie. Considering the complexity of prestressed concrete tie behavior especially post-cracking and varying ballast support conditions for the concrete monoblock ties, a study was conducted to estimate the flexural capacity of monoblock tie under practical load and track system through computational simulation. A computational tool was built and was verified theoretically and validated experimentally. The program focused on performance of prestressed concrete monoblock tie under flexible design assumption. The tie flexural responses (crack propagation, deflection, and slope) were analyzed by utilizing moment-curvature relationship and M/EI diagram incorporating moment-area theory. The computational tool is well suited to analyze varying support conditions and is also naturally parameterized to facilitate Monte Carlo analysis of tie behavior. Thus, it is expected that the major outcome of the proposed research will be an uncertainty-informed analysis of concrete monoblock tie flexural behavior that may, in turn, lead to reliability based concrete monoblock tie design.