Title:	Investigate Live Load Distribution and Stability of Prestressed Concrete Girders During Construction
The Problem:	TxDOT is increasing their use of longer prestressed concrete girder spans. The use of spliced girders, both I-girders and U-girders, has resulted in significant increases in the maximum spans for prestressed concrete girders. While these girder systems have historically not had issues with stability, the stability issues are more likely as increased slenderness results in these girder systems. Currently TxDOT requires full depth diaphragms at splice, anchorage, and interior supports. The reasons TxDOT requires full depth permanent diaphragms are due to the following uncertainties: 1. Potential for lateral instability of the girders during deck casting as the span lengths of these superstructures increase. 2. Potential for the superstructure system to exhibit stability issues when transmitting lateral load to the substructure. 3. Need further investigation to know if the girders are sufficiently connected to transmit live load from the slab to the beams consistent with the methodology in AASHTO LRFD 4.6.2.2 for flexure and shear. 4. To prevent honeycombing or constructability issues at the splices due to the narrow closure pours. The first three uncertainties require a refined analysis that is unfamiliar to designers and could be simplified through research and parameterized as basic geometric guidance. The fourth uncertainty can be accomplished through an end block at the splice locations. There are no TxDOT standard temporary construction bracing details for these types of beams. Moreover, TxDOT practices for shorter span prestressed TxGirder bridges have little or no diaphragms, which lends to the cost effectiveness and constructability of that system.
Technical Objectives:	This research will investigate the different stages of construction for prestressed concrete spliced I-girders and U-girders; and provide guidelines for stability analysis during construction, typical bracing details, and live load distribution factors. To achieve these objectives, the work to be performed shall include: 1. Perform a literature review, including collecting details within and outside of Texas to determine what practices are currently being used. 2. Evaluate lifting stability of U-girder segments. Determine the lifting stability of curved U-girder. Apply loads consistent with AASHTO Guide Specification for Temporary Works during construction. Determine at what geometric constraints different amounts of torsional restraint are sufficient. 3. Perform stability analysis of typical spliced girder sections, both I-girder and U-girder, during erection, deck placement, and when fully composite. Apply loads consistent with AASHTO Guide Specification for Temporary Works during construction and AASHTO LRFD Bridge Design Specifications when fully composite. Determine at what geometric constraints different bracing schema are sufficient. 4. Perform either a finite element model (FEM) or a grillage analysis to determine live load distribution to the girders. Use the live load as per AASHTO LRFD Bridge Design Specifications. Superstructures to be analyzed, as a minimum: 1 span unit - 2 and 3 segments; 2 span units - 2 and 3 segments; 3 span unit - 3 and 5 segments. 1. I-girders: Tx54, Tx62, Tx70 (from TxDOT Bridge Standards); STx7, STx8, STx9 (from TxDOT Drawings of Extended Span Precast I-Girders), with pretensioning in the flanges and post-tensioning in the web. 2. U-girders: U54 (from TxDOT Bridge Standards); U72-9, U84-9, U96-9, U72-10, U84-10, & U96-10 (from Texas DOT Drawings of Extended Span Precast U-Girders) The expectation of the project end product(s) shall attain a Technology Readiness Level of 6.

Anticipated Deliverables:	1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Value of Research (VoR) that includes both qualitative and economic benefits, to be included in the final research report; not a stand-alone deliverable. 4. Research report documenting the findings of the research, including guidelines to identify the evaluation of stability of prestressed concrete girder systems (conventional and spliced girder systems), guidelines for standard construction bracing for prestressed concrete spliced girder systems, and guidelines on appropriate live load distribution factors for prestressed concrete spliced girder systems. 5. Project Summary Report
Proposal Requirements:	1. Utilize the "Proj/Agre" and "PA_Form" templates located at the TxDOT RTI website. 2. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook, which is also located at the RTI website. 3. Proposals should be submitted in PDF format, 1 PDF file per proposal. File name should include project name and university abbreviation. 4. This project will be tracked during the life of the project using a Technology Readiness Level (TRL) scale. For more information about the use of a TRL, click.