Title:	Analyze Shear Capacity of Texas Standard Prestressed Beams from Strut-and-Tie Models of Beam Ends
The Problem:	Strut-and-tie models of prestressed beams are required by AASHTO LRFD when the shear stress exceeds 0.18f'c. This occurs when pushing the span length of a girder. The typical design engineer, when confronted with a shear stress that exceeds this 0.18f'c, often chooses to add a girder line to reduce the shear stress on the beam in lieu of creating a strut-and-tie model. The additional girder line comes at a cost of $120/LF for a Tx54 beam to $350/LF for decked slab beams or X-beams. This shear limit can be exceeded when the beam is used past the economical span length published for that beam, or when additional loads, such as from raised sidewalks, raised median, median rails, or pedestrian separator rails, are used on a span toward the upper limit of the published economical span length for the beam. These strut-and-tie models are difficult to create. For Tx-girders near their span limit, the bulb is nearly full of prestressing, and the web will have harped strands over a significant height. For U-beams, X-beams, decked slab beams, slab beams, and box beams, there will be many debonded strands to different lengths in addition to full length strands.

Technical Objectives:	The researchers shall address the following:
	1. Create strut-and-tie models of the beam ends of all TxDOT standard prestressed beams at their span limits and analyze the shear capacity.
	2. Determine what parameters affect the shear strength, such as beam type, prestressing pattern, span length, and beam spacing.
	3. Present the capacities in such a way that a designer can look up the shear strength of their beam given the aforementioned parameters, without having to do the strut-and-tie model.
	4. Create a table of shear strengths for each TxDOT standard beams:
	  a. Box Beams (4B20, 5B20, 4B28, 5B28, 4B24, 5B24, 4B40, 5B40)
	  b. Slab Beams (4SB12, 5SB12, 4SB15, 5SB15)
	  c. Decked Slab Beams (6DS23, 7DS23, 8DS23, 6DS23, 7DS23, 8DS23)
	  d. X-Beams (4XB20, 5XB20, 4XB28, 5XB28, 4XB34, 5XB34, 4XB40, 5XB40)
	  e. U-Beams (U40, U54)
	  f. Tx-Girders (TX28, TX34, TX40, TX46, TX54, TX62, TX70)
	
	NOTE: Physical testing will not be necessary.
	
	The expectation of this project is that the end product will obtain a TRL level 8.

Desired 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. 4. Research report documenting the findings of the research, including design guidance on modifications to AASHTO LFRD Specifications and the TxDOT Bridge Design Manual. 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.