

**Request for Research Funding for FY 2020-2021**

<b>Requesting Office</b>	CO Structures Office	<b>Priority</b>	6 of 6
<b>Proposed Title</b>	Straight Steel I-Girder Bridges with Skew Index Approaching 0.3		
<b>Justification</b>	This project is a continuation of project BE535, Straight Steel I-Girder Bridges with Skew Index Approaching 0.3. That project has indicated that the FDOT inventory of steel bridges can be separated into four different levels of complexity for the purpose of determining an appropriate analysis method. 26 bridges were analyzed as part of project BE535. This project would add more bridges to that study to confirm that the bridge categories determined based on 26 bridges holds true for a larger study pool. Additional bridges will include bridges with 3 to 5 girders, and staggered cross frame arrangement due to a limited number in the original 26 bridges.		
<b>Impact</b>	The benefit of this research would be a better understanding of the behavior of skewed steel I-girders bridges with a skew index approaching 0.3. This research will potentially result in more simplified analysis and design requirements for skewed steel I-girder bridges. If not completed, designers will potentially use unnecessarily complex and expensive methods for design and analysis of skewed steel I-girder bridges.		
<b>Affected Offices</b>	State Structures Design		
<b>Existing Work</b>	Apart from project BE535, to our knowledge, no prior research has specifically focused on the behavior of straight skewed steel I-girder bridges with skew indices less than but approaching 0.3. Most prior research in this field has focused on the behavior of more severely skewed steel I-girder bridges (skew index greater than 0.3), which make up less than 10% of steel I-girder bridges constructed in Florida from 2000 to 2014.		
<b>Keywords Used In Existing Work Search</b> <b>(Cannot leave blank)</b>	skewed steel bridge analysis		
<b>Related Contracts (Give contract numbers)</b>	BE535		
<b>Funding Request</b>	\$125,000	<b>Anticipated Duration</b>	1 year
<b>Project Manager</b>	Vickie Young	<b>Contracting Method</b>	RFP
<b>Urgency</b>	1	The FDOT Central and District Structures Design Offices agree that this project should be continued.	
<b>Implementability</b>	1	This project can be implemented with a revision to the Structures Design Guidelines.	

**Project Benefits (Succinct, complete explanation)**

The original justification for BE535 is below:

NCHRP Report 725 Guidelines for Analysis Methods and Construction Engineering of Curved and Skewed Steel Girder Bridges (2012) showed that a 1D line girder analysis calculates major axis bending stresses and vertical displacements within 6% of a 3D finite element model for straight skewed steel I-girder bridge with a skew index less than 0.3. The skew angle associated with a skew index of less than 0.3 can be very high depending on span length and bridge width. The cross-frame forces, flange lateral bending stresses and layovers are not provided by a 1D line girder model and could be significant. The FDOT Structures Design Guidelines currently requires a grid or 3D finite element analysis for straight steel bridges with skews greater than 20 degrees. The skew angle is also limited to 50 degrees unless approved by the SDO. The SDO is considering implementing a revised policy that would allow steel I-girder bridges with a skew index less than 0.3 to be designed using a 1D line girder analysis. The magnitude of cross-frame forces, flange lateral bending stresses and layovers for skew indices approaching 0.3 need to be well known prior to implementing this policy. Based on the NBIS database, about 250 steel I-girder bridges were constructed in Florida from years 2000 to 2014, with

over 90% percent having a skew index less than 0.3. Based on current FDOT design policy over one-third of bridges with a skew index less than 0.3 would require a 2D grid and 3D finite element model for design, when 1D line girder models may have sufficed.

Project Benefits (Select all that apply and explain)	Quantifiable Benefits (units, dollars, etc...if applicable)	Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits
<input type="checkbox"/> Materials Enhancement		
<input type="checkbox"/> Materials Savings		
<input type="checkbox"/> Time Savings		Allowing a 1D analysis versus a 3D FEA will save significant design effort.
<input type="checkbox"/> Lives Saved/Injuries Prevented		Better understanding of appropriate steel bridge analysis methods will result in more consistent reliability and ensure safety for the travelling public.
<input type="checkbox"/> Other (Explain)		

\*Comments should explain and support urgency, financial benefit, and implementability scores