Project Information Form

Project Title	**Impact and Feasibility Study of Solutions for Doubling Heavy Vehicles**
University	The University of Alabama at Birmingham
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Funding Source(s) and Amounts Provided (by each agency or organization)	UTC: UAB ($99,261), UCF ($51,000), and FIU ($49,993) Match: ALDOT ($99,261), FDOT ($51,000), FIU ($19,294)
Total Project Cost	$443,648
Agency ID or Contract Number	RC614-G1
Start and End Dates	May 1st, 2012 – October 31th, 2013
Brief Description of Research Project	The objective of this research is to quantify the effect of meeting increasing freight demands with heavier trucks to reduce the growth in the number of trucks on the road; and to compare the effect of heavier trucks to the effect of doubling the number of heavy vehicles under the present legal weight restrictions. Ongoing research tasks includes the following: (1) Development of computer models of vehicle, bridge, and surface roughness (2) Dynamic Analysis of bridge due to moving vehicles (3) Fatigue Life Assessment; and estimating the bridge network costs associated with changes in the limits on legal and permit gross weight, axle weights, or axle configurations (4) Quantification of better or worse bridge durability and longevity when compared to increasing the number of trucks to meet freight demands; (5) Truck configurations that minimize the detrimental effect on bridges. Demonstration of the method will be provided with Alabama Bridge Case Study; (6) Investigate the Florida I-Beam (FIB) Girders under Heavy Vehicle Load (Review Development of Bridges, Loads, Characteristics, Advantages of

	New Bridges under given loads) (7) Development of FE Models of 3 Bridges (w/AASHTO & FIB Girders) (Detailed Model Details, Evaluation, Load Rating Analysis)
Describe Implementation of Research Outcomes (or why not implemented) (Attach Any Photos)	The primary goal of the research is to determine if allowing an increase in truck weight provides better or worse bridge durability and longevity when compared to increasing the number of trucks to meet freight demands. Outcomes includes the following: (1) Development of computer models of vehicle, bridge, and surface roughness (50% complete) - HS20/HL93, H20-44, HS20-44, Type 3, AL Tri-axle (SU4, 75-kip), AL 3S2 (80-kip), AL 3S3 (84-kip), FL SU4 (70-kip), FL C5 with tandem (3S2, 80-kip), and proposed 3S3 truck (97-kip) are adopted as major vehicle models. Other models, such as Type 3S1, Type 2S2, 7 Axle Rocky Mountain Double, 8 Axle B-Train Double, and 9 Axle Turnpike Double are also selected as minor vehicle models. Both simple span steel girder bridges and prestressed concrete bridges with span lengths of 30’, 60’, 90’, 120’ and 140’ have been selected as typical bridge models and designed in accordance with the AASHTO LRFD Design Specifications (2010). The surface roughness model has been developed by using Power Spectral Density (PSD) functions. (2) Dynamic Analysis of bridge due to moving vehicles (5% complete) Dynamic response of both bridges and vehicles will be obtained from dynamic bridge/vehicle modeling analysis based on the different types of bridges, spans of bridges, types of vehicles, configurations of vehicles, and classes of surface roughness. (3) Fatigue Life Assessment (10% complete) According to dynamic stress range, number of stress-range cycles per truck, every number of trucks per day, annual traffic-volume growth rate, and other parameters, the bridge service life based on fatigue life assessment will be determined for both steel girder and concrete deck. (4) FIBs are expected to be more efficient, safer and more economical in comparison to the prestressed beams that were being used. Also, these bridges will be carrying the future heavy transportation loads. Understanding the performance of these bridges will be very important for future design, construction and operation.

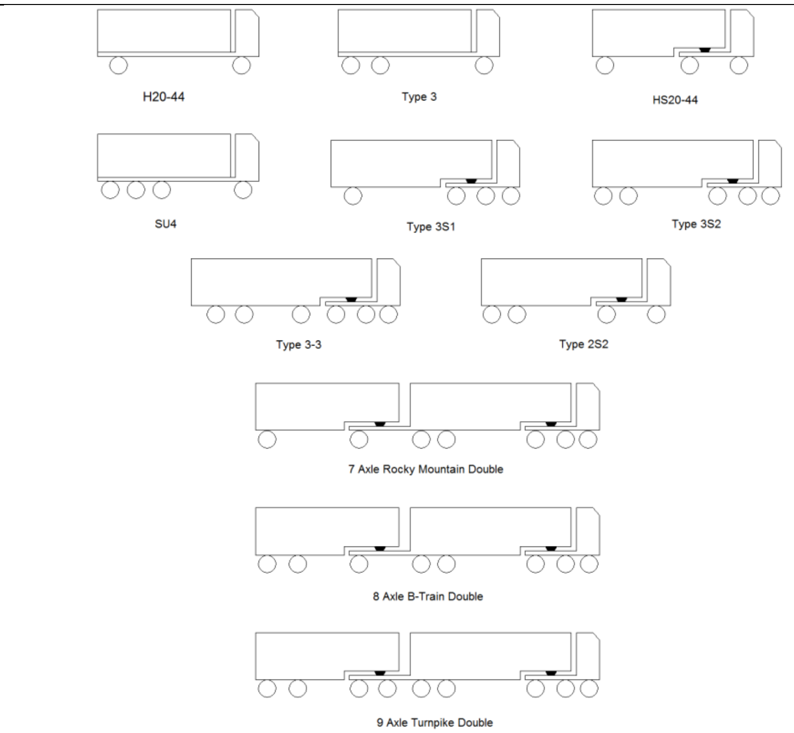


Figure 1: Truck Models

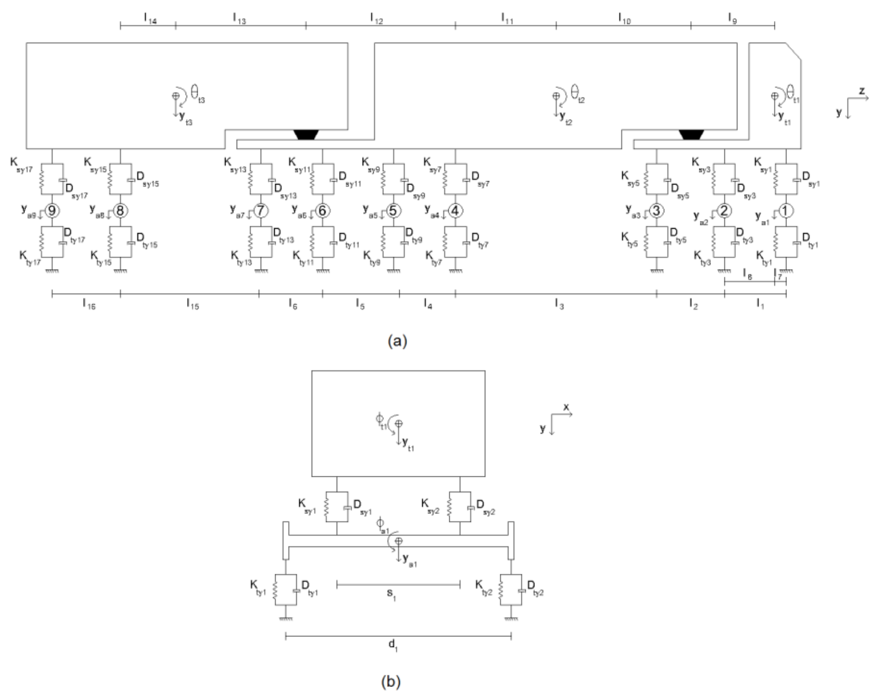


Figure 2: Nine Axle Turnpike Double Dynamic Model
(a) Side View (b) Front View

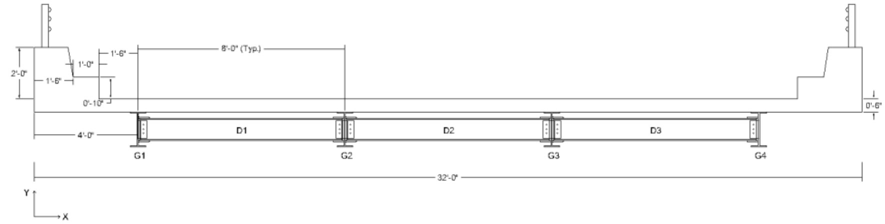


Figure 3: Typical Steel Girder Bridge Cross Section

Figure 4: Typical Prestressed Concrete Bridge Cross Section

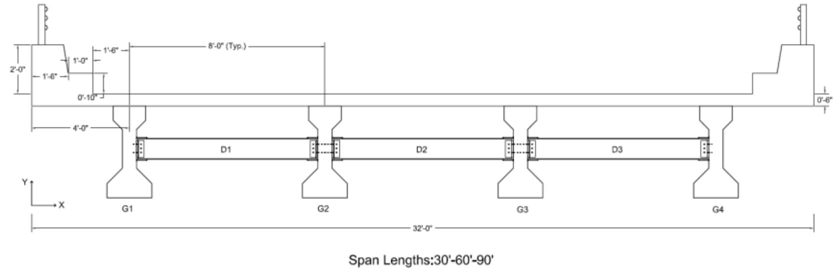


Figure 5: 3D LS DYNA Truck Modeling (top)

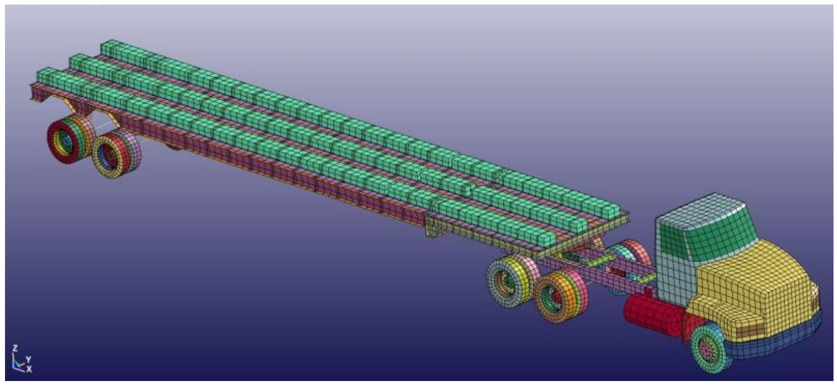


Figure 6: TWHs for Alabama WIM site 915 for each month on both directions (bottom)

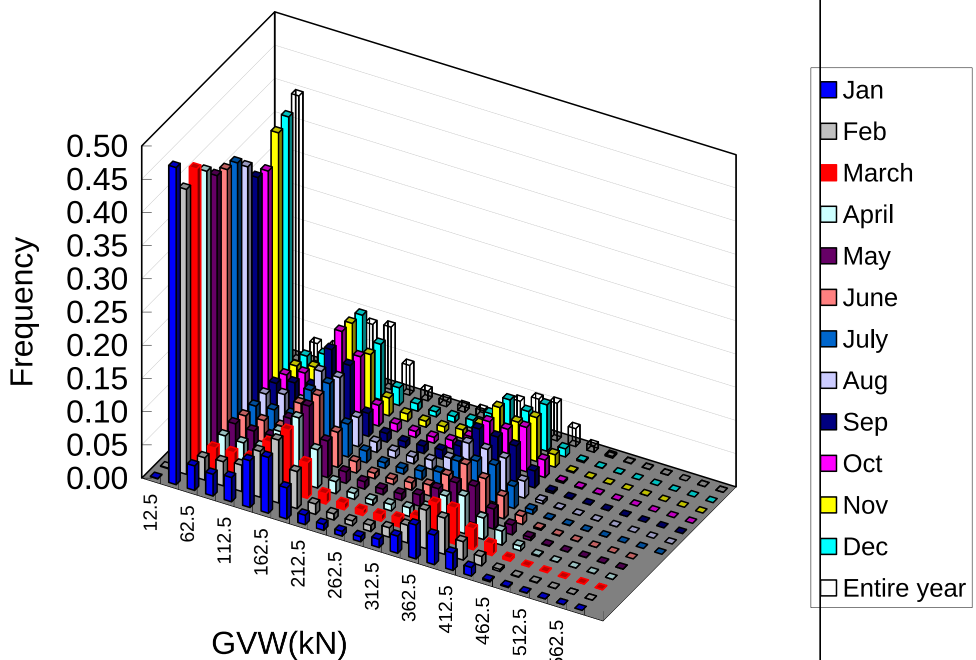
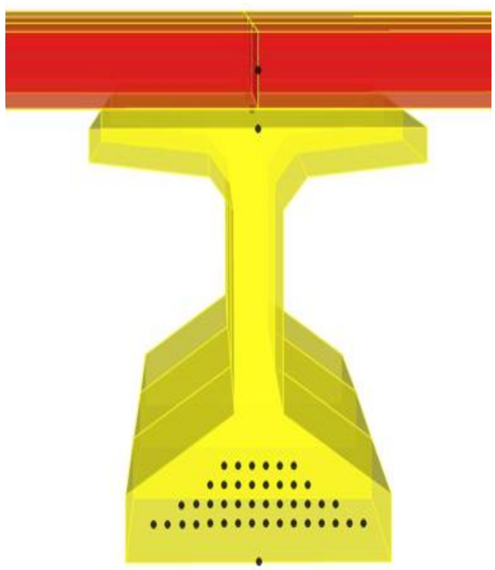


Fig. 7: Florida I-Beam (FIB) Girders under Heavy Vehicle Load	 
Impacts/Benefits of Implementation (actual, not anticipated)	Knowing the relative magnitude of the effect for each choice is extremely important for making long-term programmatic decision regarding truck size and weight that in the best interest of our nation's significant investment in transportation infrastructure. DOT will be greatly benefitted by the research directly impacting safety, economic impact and revenue generation. Consideration is also given to the congressionally proposed 97,000 lbs., six-axle configuration, as well as other configurations of heavy trucks in use in Canada, a NAFTA partner of USA. The state of Alabama and Florida with major ports serving as hubs for surface transportation with heavy vehicles will benefit greatly from

	this research. The FIB bridges are currently replacing AASHTO girder type bridges in Florida because of its higher capacity, fewer girders, safer and more economical, more efficient fabrication. In addition, these bridges will be more stable during fabrication, shipping, and construction due to the wide bottom flange and low center of gravity. Current study will help making better future planning of the use of these bridges under heavy vehicle loads. In addition, design and maintenance can be improved based on the findings of the project.
Web Links • Reports • Project website	In Progress; not ready yet