Truck Industry Forum Material

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_TxDOT Project 0-6817: Review and Evaluation of Current Cross Vehicle Weights and Axle Load Limits_

MARCH 2015; PUBLISHED MARCH 2017

<table>
<thead>
<tr>
<th>Performing Organization:</th>
<th>Sponsoring Organization:</th>
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</table>
| Center for Transportation Research  
The University of Texas at Austin  
1616 Guadalupe, Suite 4.202  
Austin, Texas 78701 | Texas Department of Transportation  
Research and Technology Implementation Office  
P.O. Box 5080  
Austin, Texas 78763-5080 |

Performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.
The following PowerPoint presentation is the draft version of the presentation that will be used for the upcoming half-day Infrastructure-Friendlier Trucks Forum tentatively scheduled for Friday, March 13, 2015. This forum will present a project status update, a presentation by Mr. John Woodroffe (University of Michigan Transportation Research Institute) on the state of the freight industry with respect to the size and weight issue, a review and evaluation of current gross vehicle weights and axle load limits, and a discussion session to attain input from the industry on limitations for non-conventional vehicle configurations as well as potential benefits and costs that may come from changes in the truck size and weight regulations. The invitees for the forum will include research team members from the Center for Transportation Research (CTR) and the University of Texas at San Antonio (UTSA), industry experts, representatives from truck manufacturers and operators, and individuals from the Texas Department of Transportation and the Federal Highway Administration.
Infrastructure-Friendlier Trucks Forum and 0-6817 Project Update

March 13, 2015
0-6817 Project Overview

• Project Reviews and Extends Previous Project Work:
  – Project 0-6736
  – Rider 36 OS/OW Vehicles Permit Fee Structure
• Focus on State, Federal, and International Efforts for the Evaluation of:
  – Single, Tandem, Tridem, and Quad-axle Configurations
  – Bridges and Pavements
• Develop Guidelines for More Infrastructure-Friendly Vehicle Configurations
• Develop Cost Recovery Structure to Fund Repairs to Roads Utilized by Overweight Trucks
  – Methodology Compatible with Proposed Determination of Fees with Oversize/Overweight (OS/OW) Vehicles.
PROJECT STATUS UPDATE
0-6817 Tasks

- Task 1 – Review of Existing Work
  - Similar Work in Texas, the US, and Internationally
- Task 2 – Develop Project Advisory Panel
  - Phone Interviews & Infrastructure-Friendlier Trucks Forum
- Task 3 - Vehicle Configurations to Be Tested
  - 12 Identified Existing and Non-Conventional Alternative Vehicle Configurations
- Task 4 – Pavement Analysis
  - Methodology for the Determination of Equivalent Consumption Factors (EFCs)
- Task 5 – Bridge Analysis
- Task 6 – Comparative Analysis
  - Sensitivity Analysis
- Task 7 – Generalized Benefits/Cost Analysis
• Task 8 - Cost Recovery Structure Development
  – Fund Repairs to Roads Utilized by OW Vehicles
• Task 9 – Workshop
  – Inform and Train Truck Manufacturers and Operators on Study Findings
• Task 10 – Case Study Development
Task 1 – Review of Existing Work

• Previous Work Under 0-6736
  – Add details of effort here

• Efforts in Texas
  – Add details here
Task 1 – Review of Existing Work

- Efforts in US
  - Add details here

- Efforts Internationally
  - Add details here
Task 1 – Review of Existing Work

• Deliverables
  – Technical Memorandum/Literature Review, Delivery Date
  – PowerPoint of Task 1 Summary Results, Delivery Date
  – PMC Presentation, Date
Task 2 – Develop Project Advisory Panel

• Advisory Panel Members:
  – John Woodrooffe, Industry Expert
  – John Billings, Consultant on TS&W and Canadian Truck Technology
  – Tom Kearney, FHWA
  – John Esparza (?), Texas Trucking Association
  – Frito Lay Representative
  – HEB Representative
  – Skip Yeakel, Volvo

• Infrastructure-Friendlier Trucks Forum
Task 2 – Develop Project Advisory Panel

• Deliverables
  – Product 1 Presentation Materials, Delivery Date
  – Attendance Sheet, To be Submitted Tomorrow
  – Activity Log of Identified Manufacturers & Operators Interviewed, Delivery Date
  – PMC Presentation of Results, Delivery Date
Task 3 – Vehicle Configurations to be Tested

• Identified Existing and Non-Conventional Alternative Vehicle Configurations
  – Add Details of Configurations

• Bridge Structures Identified
  – Add Details Here
Task 3 – Vehicle Configurations to be Tested

• Results Here
• Deliverables
  – Tech Memo, Delivery Date
Task 4 – Pavement Analysis

• Define Methodology for the Determination of Equivalent Consumption Factors (EFCs)
• Pavement Analysis for Configurations Identified in Task 3 Results
• Deliverables
  – Tech Memo, Delivery Date
Task 5 – Bridge Analysis

• Detailed Bridge Analysis for Configurations Identified in Task 3
• Summary of Costs for Potential Structural Upgrades for Deficient Bridges
• Georeferenced Database
• Network Level Bridge Analysis
• Deliverables
  – Tech Memo, Delivery Date
Task 6 – Comparative Analysis

• Sensitivity Analysis on Task 4 & 5 Assumptions
  – Compare Consumptions & Efficiencies of Vehicle Configurations Used in Texas to Alternative Configurations from Task 3

• Deliverables
  – Tech Memo, Delivery Date
Task 7 Generalized Benefits/Cost Analysis

• Identify and Quantify Important Benefits and Costs of Operating More Infrastructure-Friendly Trucks (IFTs)

• Conduct a Generalized Benefit Cost Analysis (BCA) on IFTs
  – Consumption of Pavement, Bridges, & Fuel
  – Acquisition/Upgrading of Truck Fleet Costs
  – Payload per Truck
  – Energy Efficiency
  – Emissions
  – Safety
Task 7 Generalized Benefits/Cost Analysis

• Deliverables
  – Tech Memo, Delivery Date
Task 8 – Cost Recovery Structure Development

• Develop Cost Recovery Structure to Fund Repairs to Roads Utilized by OW Vehicles
• Rider 36 Utilized for Quantification of Accelerated Consumption Costs by Alternative Vehicle Configurations
Task 8 - Cost Recovery Structure Development

• Summarize State Used of Weight Distance Tax in US via
  – State Fuel Taxes
  – Truck Registration Fees
  – Truck Sales Tax
  – Truck Tire Sales Taxes
  – Overweight Truck Permit Fees
  – Alternative Tools
Task 8 - Cost Recovery Structure Development

• Explore Other Overweight Truck Recovery Methods
  – Internationally
  – Texas Motor Transportation Association

• Summarize Findings
  – Provide a List of Feasible Options with Benefits, Disbenefits, Technical Challenges, & Assessment of Direct Relationship between Revenue Source and Cost Recovery Method
Task 8 - Cost Recovery Structure Development

• Deliverables
  – Tech Memo, Delivery Date
Task 9 - Workshop

• Objective – To Inform and Train Truck Manufacturers and Operators on Study Findings
• Provide a Survey to Assess the Usefulness of the Workshop and Effectiveness of Presenters
• Deliverables
  – Workshop Presentation
  – Attendance Sheet
  – Completed Surveys
  – Workshop Discussion Notes
  – Research Report
  – Project Summary Report
Task 10 – Case Study Development

• Select Freight Corridor in Texas
  – Selected to Accommodate OS/OW Vehicles
    • Evaluate Potential Regulatory Issues
    • Conduct Economic Analysis of Potential Implementation

• Develop Implementation of the Findings of this Study
  – Guidelines for Implementation of Cost Recovery Fee Schedule From Task 8

• Identify the Main Potential Barriers for Implementation and Provide Potential Solutions/Approaches
Task 10 - Case Study Development

• Deliverables
  – Case Study Guidelines
ADD Project Schedule HERE
Presentation on Trends in Truck Configurations by

MR. JOHN WOODROOFFE
• Mr. Woodrooffe’s Presentation Here
BREAK TIME
INFRASTRUCTURE-FRIENDLIER TRUCKS FORUM
Review and Evaluation of Current Gross Vehicle Weights and Axle Load Limits

TxDOT Project No. 0-6817

Project update

02/27/2015
Contents

- Introduction
- Truck configurations
- Pavement consumption analysis
  - Methodology
  - Mechanistic empirical analysis
- Results and comparative analysis
- Conclusions
Introduction

• Main objectives
  – Identify alternative vehicle configurations
  – Perform mechanistic empirical analysis on selected pavements
  – Compare the pavement consumption of each alternative vehicle with base vehicle configuration
  – Identify infrastructure friendlier vehicles
Truck configurations

• Identified 18 vehicle configurations
  – USDOT study
  – TxDOT LCV study (0-6095)
  – Original contract
• Conventional vehicle configurations
  – Currently used in other countries/states
• Non-conventional vehicle configurations
  – Not commercially available
## Truck configurations

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Veh #No.</th>
<th>Dimensions</th>
<th># Axles</th>
<th>GVW (lbs)</th>
<th>Tractor Steer</th>
<th>Non-steer</th>
<th>Semi-Trailer/Trailer #1</th>
<th>Semi-Trailer/Trailer #2</th>
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<td>26,000 18,000</td>
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<td>11,000</td>
<td>28,000 11,000 28,000 11,000</td>
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</table>
Truck configurations

Scenario: Base vehicle and A (with higher load)

Scenario: B
Truck configurations

Scenario: C

Scenario: D
Truck configurations

Scenario: E & F

Scenario: G

Scenario: H
Pavement consumption analysis

• Employed AASHTO’s ME Design™ Version 2.1 software

• Pavement consumption
  – Number of passes each vehicle require to fully consume the pavement structure at the end of design life
  – Time required by each vehicle to fully consume the pavement structure under design traffic volume
Pavement consumption analysis

• Failure criteria:
  – 0.5 inches of rutting (surface deformation) at the end of the design life;
  – 10% of the cracked area (fatigue cracking associated with load) at the end of the design life;
  – 125 inches/mile of roughness in terms of the International Roughness Index (IRI) at the end of the design life (an initial IRI of 63 inches/mile was used in the analysis).
Pavement consumption analysis

• Equivalent Consumption Factor (ECF)

\[
\frac{\text{Number of single axle passes with 18 kips for full consumption}}{\text{Number of a vehicle for full consumption}}
\]

Or

\[
\frac{\text{Pavement life for } N \text{ passes of vehicle of interest}}{\text{Pavement life for } N \text{ passes of single axle with 18 kips load}}
\]

Where \( N = \text{Total number of passes during design life} \)
Pavement consumption analysis

- Pavement structure does influence the ECF
- Identified more than 100 pavement sections
  - Flexible
  - Concrete
  - Surface treatments
- Randomly selected a pavement section for the preliminary analysis in Task 3
Pavement consumption analysis

- Thickness of the asphalt concrete (Layer 1): 8 inch
- Thickness of the Non-stabilized base (Layer 2): 10 inch
- Thickness of the Subgrade (Layer 3): 10 inch
- Thickness of the Subgrade (Layer 4): Semi-infinite
Results and comparative analysis

• Estimated ECF for experimental vehicles
  – Rutting, cracking, IRI
  – Averaged ECF

• Normalized pavement consumption (ECF) per unit transport load

• Relative normalized ECF with reference to base vehicle
## Results and comparative analysis

<table>
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<th>Scenario</th>
<th>Veh #No.</th>
<th>Dimensions</th>
<th># Axles</th>
<th>GVW (lbs)</th>
<th>ECF: Rutting</th>
<th>ECF: Cracking</th>
<th>ECF: IRI</th>
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<td>ECF</td>
<td>ECF per unit GVW</td>
<td>Relative to base case</td>
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Results and comparative analysis
Results and comparative analysis

Pavement consumption is less than base vehicle

Pavement consumption is more than base vehicle
Conclusions

• Identified 18 vehicle configurations
• Estimated equivalent pavement consumption
• Data suggests that LCV scenarios are pavement friendlier
• Analysis will be extended to other pavement sections in future
THANK YOU!
Infrastructure-Friendlier Trucks Forum

• Goal of Forum – To Attain Input from the Industry on Limitations for Non-Conventional Vehicle Configurations, and Discuss Potential Benefits and Costs Related to Changes in TS&W Regulations

• Layout
  – Present Results of Phone Interview Efforts
  – Group Discussion (4 Questions)
Infrastructure-Friendlier Trucks Forum

• Phone Interview Results
Infrastructure-Friendlier Trucks Forum

Discussion Question #1

What Are Some Limitation of Non-Conventional Vehicle Configurations (i.e., Single, Tandem, Tridem, Quad-Axle)?
Infrastructure-Friendlier Trucks Forum

Discussion Question #2

What Are Some Potential Benefits & Costs Related to Changes in TS&W?
Infrastructure-Friendlier Trucks Forum

Discussion Question #2

What Are Some Potential Benefits & Costs Related to Changes in TS&W?
Infrastructure-Friendly Trucks Forum

Discussion Question #3

What Are Some Overweight/Oversize Load Issues and Challenges?
Infrastructure-Friendlier Trucks Forum

Discussion Question #4

What Are the Next Steps You See for Texas?