Truck Size & Weight Study

TRB Review Panel Perspective
June 25, 2014
Section 32801, Surface Transportation Authorization Statute (2012): perform a COMPREHENSIVE TRUCK SIZE & WEIGHT LIMITS STUDY

Examine effects of large trucks in terms of impact on 1. bridges, 2. pavements, 3. safety, 4. enforcement of truck regulations, and 5. shares of freight traffic carried by trucks and other freight modes, fuel efficiency, the environment (modal shift analysis)

Objective of presentation...
The players (of interest)

- **FHWA**
  - Lead, Tom Kearney; Bridge: Ian Friedland, Phil Yen

- **Contractors (Bridge)**
  - CDM Smith: J. Walrath, Shahin Ariaey–Nejad
  - HNTB: Bala Sivakumar

- **TRB Peer Review**
  - Joe Morris, Steve Godwin, Kathryn Kortum
  - Panel: 14 members incl. Jamie Winebrake, Chair
  - Bridge: Sue Hida, Sandra Larson, Sharon Wood, [Georgene Geary]
Background

- 1956—Fed. limits: 73,280 lb limit, 18k on single axles, 32k on tandems; grandfather
- 1975—limit increased
- 1980’s—“Rocky Mountain Doubles”, etc. vs.
- 1980’s—debate on safety of ‘big’ trucks
- [Hence, variety in State permit practices.]
- 1994–2002: Comprehensive Truck Size and Weight Study, w/tabular comparisons of truck weight, bridge costs, delay costs
April 2013—Contract awarded
Nov. 2013—Lit. Review, Proj. Plans completed
Dec.–Jan.—Peer Review Report completed
Mar. 2014—Peer Review released
TBD—Draft Technical Report completed
TBD—Public Input, Peer Review Mtg in DC
TBD—Peer Review Report written
Nov. 2014—Deadline for submitting report to Congress
From May 5th Public Outreach...

Technical approach updates for the following areas –

Safety Analysis
Pavement Analysis
Bridge Analysis
Compliance Analysis
Modal Shift Analysis
## Configurations Included in Study

<table>
<thead>
<tr>
<th>Configuration</th>
<th># Trailers or Semi-Trailers</th>
<th># Axles</th>
<th>Gross Vehicle Weight (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 5-axle vehicle</td>
<td>1</td>
<td>5</td>
<td>80,000</td>
</tr>
<tr>
<td>2) 6-axle vehicle</td>
<td>1</td>
<td>6</td>
<td>91,000</td>
</tr>
<tr>
<td>3) Tractor plus two 28 or 28 ½ foot trailers</td>
<td>2</td>
<td>5</td>
<td>80,000</td>
</tr>
<tr>
<td>4) Tractor plus twin 33 foot trailers</td>
<td>2</td>
<td>5</td>
<td>80,000</td>
</tr>
<tr>
<td>5) Tractor plus three 28 or 28 ½ foot trailers</td>
<td>3</td>
<td>7</td>
<td>105,500</td>
</tr>
<tr>
<td>6) Tractor plus three 28 or 28 ½ foot trailers</td>
<td>3</td>
<td>9</td>
<td>129,000</td>
</tr>
</tbody>
</table>
Primary Study Tasks:

- The direct structural effects on the bridges.
- The overall damage related bridge costs that would accrue.
- Use of NCHRP 575 ‘Legal Truck Loads for AASHTO Posting’ vs. NCHRP 495 ‘Effect of Truck Weight on Bridge Network Costs’

Sub-tasks:

- The Relative Structural Damage Risk Levels to Bridges in terms of the resulting quantity and cost of potential bridge strengthening or replacement.
- Bridge Posting Assessment.
- Assessment of Fatigue Related Effects.
- Bridge Deck Repair, Replacement Costs. (~60% of $$$?)
- Bridge Deck Preservation & Preventive Maintenance Costs.
Purpose:
- Estimate the bridge structural impacts related to the introduction of alternative truck configurations to the fleet.
- Determine the percentage of bridges that will require load posting, strengthening or replacement as a result of the new configurations.
- Estimate/Address costs associated with the predicted strengthening or replacements.
- *No mention of decks, joints, bearings.*

Methodology Overview:
- Use 500 representative bridges from the National Bridge Inventory to determine structural demands.—*Bending only?*
- Use AASHTOWare Bridge Rating program (ABrR).
- Use LRFR Modeled Bridges.—*Very limiting!*
Bridge Structure Analysis – Method

- No comparative evaluation of alternative methods of assessing costs due to TS&W
- (1) Use the National Bridge Inventory (NBI) database to select the 500 representative bridges, consisting of the 12 most common bridge types, for structural analysis (enough?)
- (2) Compile and evaluate the resulting Load Rating Factors for the current fleet (base case trucks) and for the proposed alternative truck configurations.—low rating factors don’t necessarily mean degradation...
Conduct an axle-load based cost allocation approach to estimate costs related to the alternative truck configurations.

The Nov. Plan stated “59% to 70% of all bridge capital costs are non-load-related”. Still being studied.
Bridge Task – Assessment of Fatigue Effects

- Conduct a qualitative bridge fatigue study in two categories: load induced fatigue in steel, and concrete fatigue in reinforced concrete bridge decks. *Note: deck dgn State practices*
- Conduct a study of the effects of heavier trucks and more numerous heavy axle loads on bridges.
- Analyze typical bridge types with respect to primary stress fatigue in steel bridges.
- *Not enough info to comment on. Concern that the study is only QUALITATIVE.*
Bridge Analysis – Data

- National Bridge Inventory (NBI)
- Weigh-in-Motion (WIM) Data (only being used for posting study)
- Financial Management Information System (FMIS) for bridge capital cost information (not clear how bridge will be extracted from project costs)
- Unit cost data & Indices
Bridge Analysis – Models/Methods

- AASHTOWare Bridge Rating Software – ABrR (VIRTIS)
- Regional Bridge Deterioration Model *(more info on ‘models’ insisted on)*
- Fatigue Assessment using ‘CSI Bridge’ software to determine relative stress ranges at the fatigue critical locations on typical bridges. *(‘typical bridges’?)*
Bridge Analysis – Limitations:

- Little segregated cost data available for deck preservation and preventive maintenance. (495?)
- Of necessity, limited fatigue analysis performed supports a qualitative assessment.
- LRFR capability not available for structural analysis of trusses and girder–floorbeam bridges.
“Changing (weight) limits creates a need for a stream of future capital spending to compensate for the change in useful life of existing bridges....The financial impact would be reported as an increase in resources needed by bridges owners in the next year and in 2 years, 5 years, and so forth. The principal risk of changes in limits is that bridge inventories will decay more rapidly than expected without a corresponding increase in funding.” (Also time! Construction detours will negate some of the benefit.)
Next Steps for HSCOBS

- Goal: have best possible info, data ($, time) available AS OWNERS and be ready to talk
- T5/SH et al.—Contribute to Final Peer Review. Congress also needs to understand time to program replacements (usually a low priority), reroute traffic, etc.
- Anyone—Participate in future Public Outreach Mtg, if/when date TBD
- Continue active monitoring of other Studies
- Work within our organizations to
  - Understand ‘truck history’ on degraded bridges; effectiveness of law enforcement
  - Re-coup infrastructure degradation costs
For more information:

  - Milestones, Schedule
  - Nov. 2013 Desk scans; Project Plans
  - Public Input Session Presentations
  - (soon) registration for next session
