TIMBER RAILROAD BRIDGES

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OVERVIEW

- Timber used in RR bridges more than 100 years (many still in service)
- Solid sawn lumber superstructures
- Railroads need to be made aware of value of glued laminated options for rehabilitation and new construction
- Research and education needed to identify most cost effective options
PERTINENT PAST/CURRENT ACTIVITIES

- Testing and evaluation of RR bridges in Texas
- Testing and evaluation of RR bridge in Washington state
- Research needs study
BACKGROUND - Testing and Evaluation of RR Bridges

- Existing timber bridges on SP railway line
- Long term performance
  - >60 years
- Recent heavy axle loads
- Condition assessment
- Rehabilitation program to strength existing bridge (evaluation of effectiveness)
Ballast Deck
Typical Damage and Deterioration
Existing Stringer Condition

Can’t see interior stringers when in place
“Experimental” Usage of Glued Laminated Stringers
RESEARCH PROGRAM

- D’Hanis bridge test
- Test train
- Revenue traffic
- Static and dynamic loads
- Deflections, accelerations and wheel loads
D’HANIS BRIDGE

approx. 165'-8"

helper bent

Span 8

Span 2

Bent 2

test spans
D’HANIS BRIDGE

Cross Section - Span 8

4 stringer chord (sawn)

4 stringer chord (glued laminated)
D’HANIS BRIDGE

Cross Section - Span 2

helper stringer

5 stringer chord (sawn)

4 stringer chord (glued laminated)
Glued laminated packed chord

Solid sawn chord with helper
INSTRUMENTATION

- displacement transducer
- accelerometer
Measuring Shear Deformations
Instrumented Rails for Load Estimation
Controlled Test Train
LOAD TEST RESULTS

Test Train Wheel Loads

Wheel load (kip)

Time (sec.)

EMD 6870
SPMW 4345
SPMW 4337
DRGW 25101
## LOAD TEST RESULTS

### Dynamic Load Factor

<table>
<thead>
<tr>
<th>Velocity (mph)</th>
<th>Maximum Wheel Load in Span 8 (kips)</th>
<th>Maximum Wheel Load in Span 2 (kips)</th>
<th>Maximum Wheel Load on Approach (kips)</th>
<th>Span 8 DLF</th>
<th>Span 2 DLF</th>
<th>Approach DLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>crawl</td>
<td>41.0</td>
<td>40.0</td>
<td>40.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>15</td>
<td>41.6</td>
<td>40.7</td>
<td>39.8</td>
<td>1.02</td>
<td>1.02</td>
<td>1.00</td>
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<tr>
<td>30</td>
<td>41.6</td>
<td>46.8</td>
<td>42.8</td>
<td>1.01</td>
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<td>53.1</td>
<td>1.00</td>
<td>1.02</td>
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</tbody>
</table>
LOAD TEST RESULTS

Deflection (in) vs. Time (sec) for Slow and Fast conditions.

- Slow
- Fast

Graphs showing the deflection over time for different conditions.
## LOAD TEST RESULTS

### Dynamic Amplification Factor

<table>
<thead>
<tr>
<th>Test Train Velocity (mph)</th>
<th>Span 2</th>
<th>Span 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North Chord</td>
<td>South Chord</td>
</tr>
<tr>
<td>15</td>
<td>1.00</td>
<td>1.05</td>
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<tr>
<td>30</td>
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<td>1.05</td>
</tr>
<tr>
<td>40</td>
<td>1.22</td>
<td>1.06</td>
</tr>
</tbody>
</table>
LOAD TEST RESULTS

Span 8

Sawn Chord

Glulam Chord
LOAD TEST RESULTS

Span 2 vs. Span 8

Sawn Chord
Span 8

Sawn Chord
Span 2
LOAD TEST RESULTS

Span 2

![Graphs showing deflection over time for Sawn Chord and Glulam Chord.](image-url)
LOAD TEST RESULTS

Span 8 - Glulam

![Graph showing deflection versus time for experimental and analytical results. The graph displays three curves: black for Experimental, red for Analytical - Continuous, and green for Analytical - Simple. The x-axis represents Time (sec) ranging from 0 to 80, and the y-axis represents Deflection (in) ranging from -0.6 to 0.1.]
Research Needs Study

- Currently in progress
- Seeking to define what research is needed to advance the use of timber by railroads