Simplified Analytical Model of a Covered Queen-Post-Truss Timber Bridge

Fouad Fanous, Douglas Rammer & Terry Wipf

Iowa State University, Bridge Engineering Center

Forest Product Laboratory

Study Scope

Objective

- Develop a simple analytical model
  - Approximately predicts behavior
  - Assist in load rating calculations
- Include as built characteristics – eccentric connections, splice joints, material properties, etc.

Finite Element Analysis

- Development of 2-D and 3-D finite element models for each bridge

Selected Bridges

- Indiana & **Vermont**
- Burr-Arch and **Queen-Post** Truss Bridges

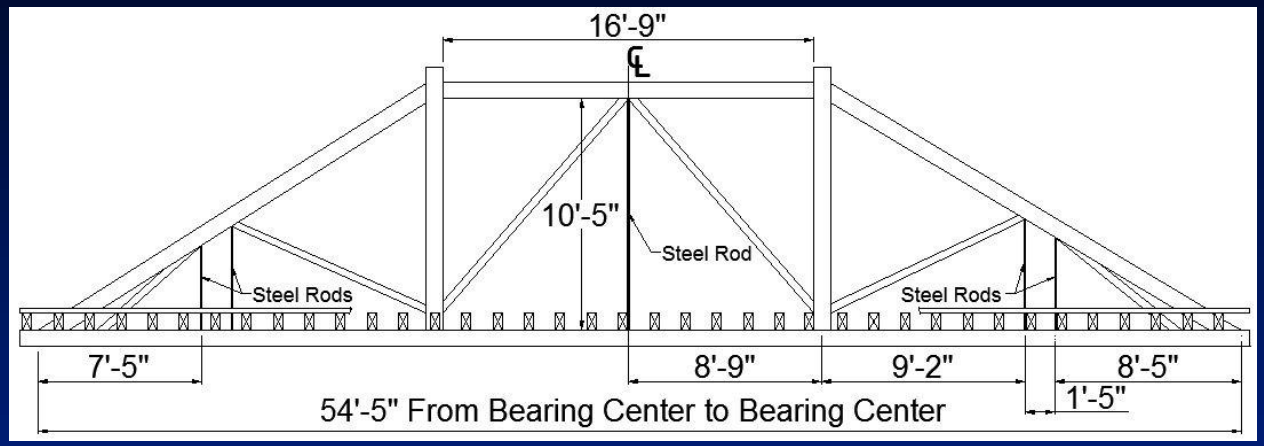
Recommendation

- From comparison of displacement and strain values of field and analytical – recommend appropriate modeling approach

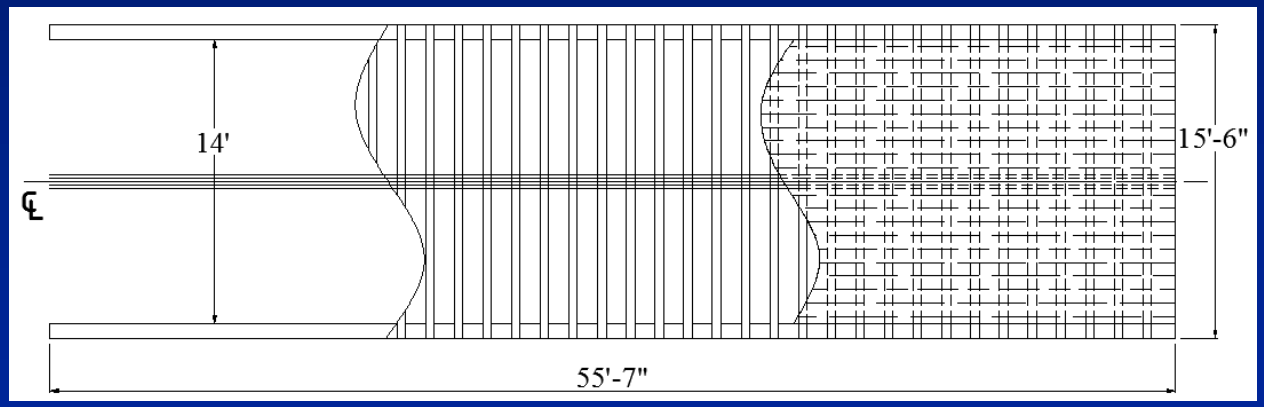
Bridge Descriptions

Moxely Bridge

Views of the Moxley Bridge



Elevation View

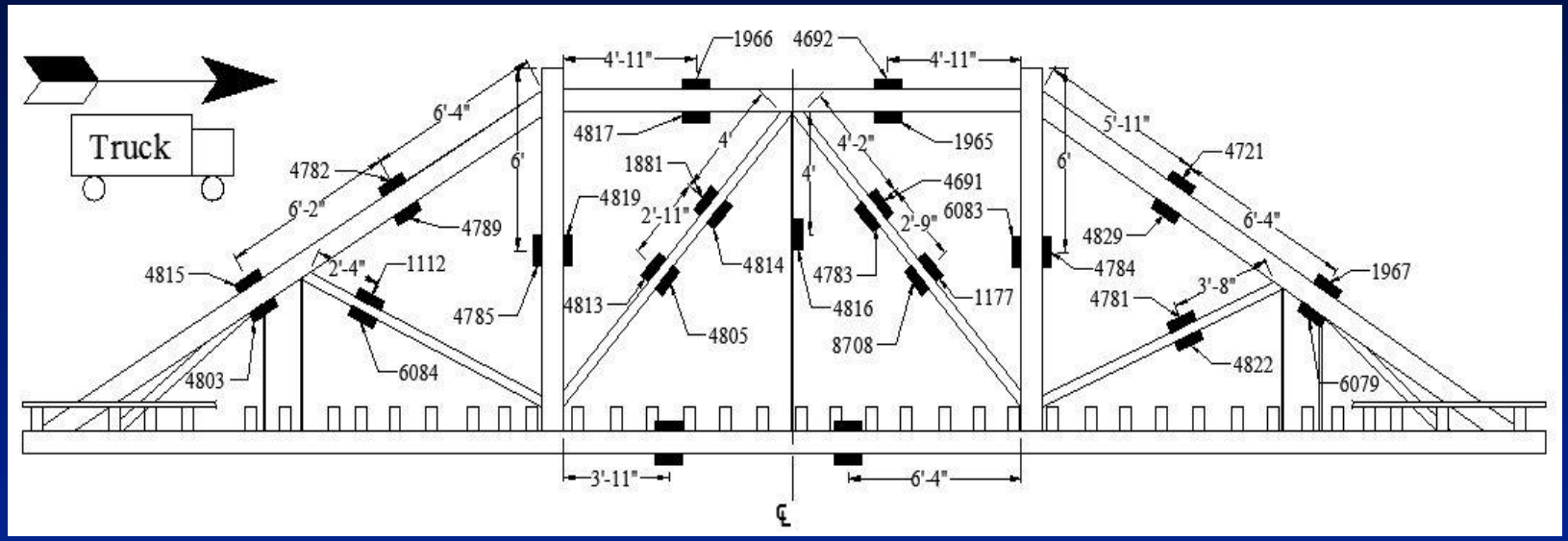


Plan View

Field Measured Timber Dimensions

Structural Member	Width (in.)	Height (in.)
Bottom & Top Chords	9	9
Floor Beam	5	9 ½
Verticals	9	9
Diagonals	4	9
Tension Rods	1 in. diameter	

Bridge Schematics – Strain Gage Locations



Front Axel 4,700 lbs.

Back Axel 11,440 lbs.

Distance between axels
176 inches

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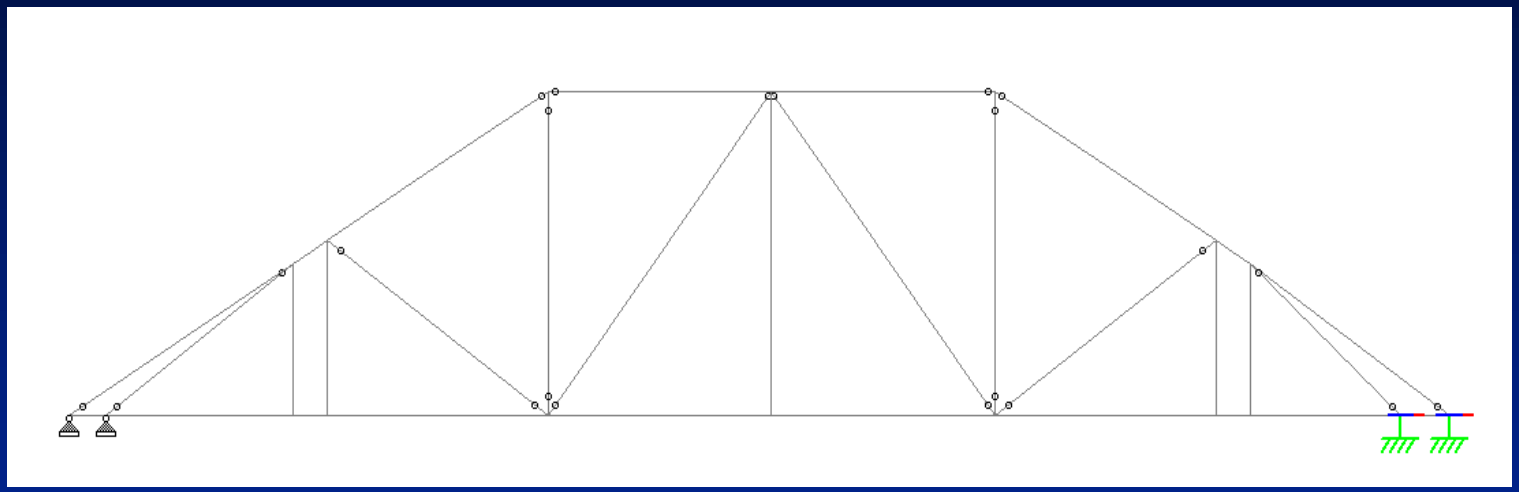
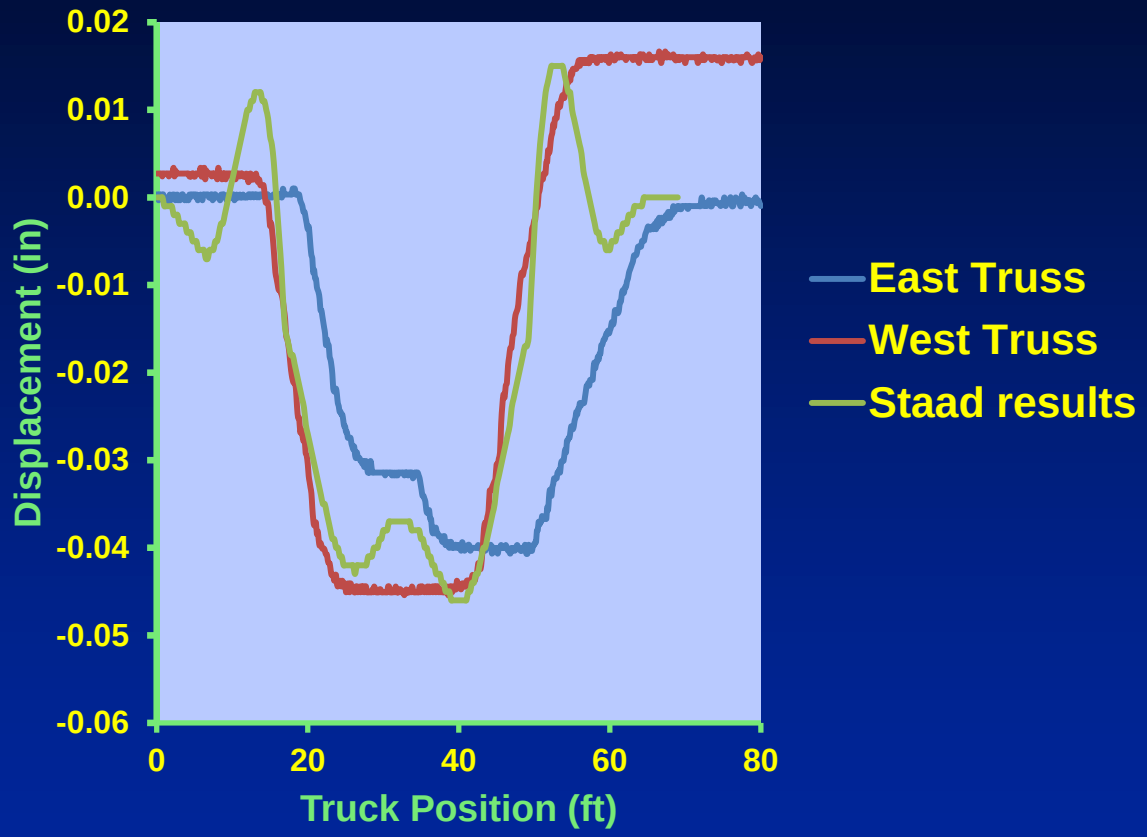
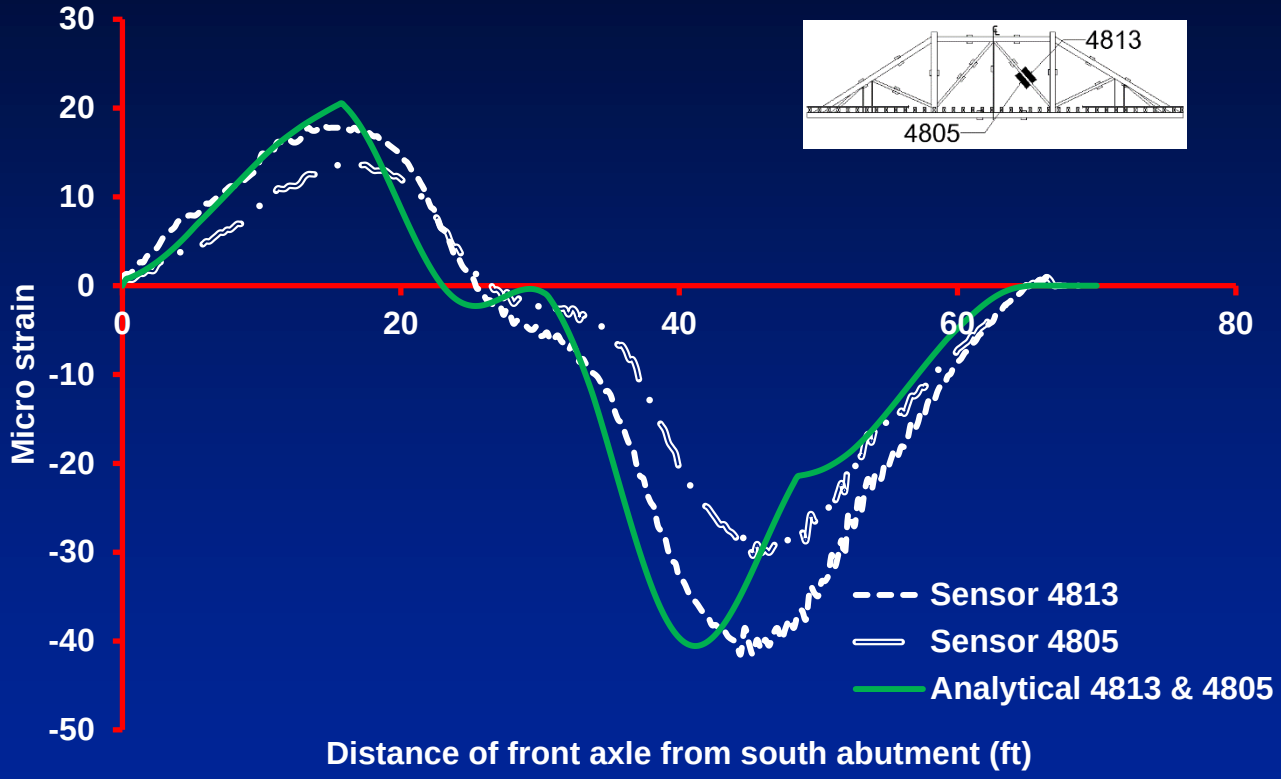
Analysis using STAAD Software



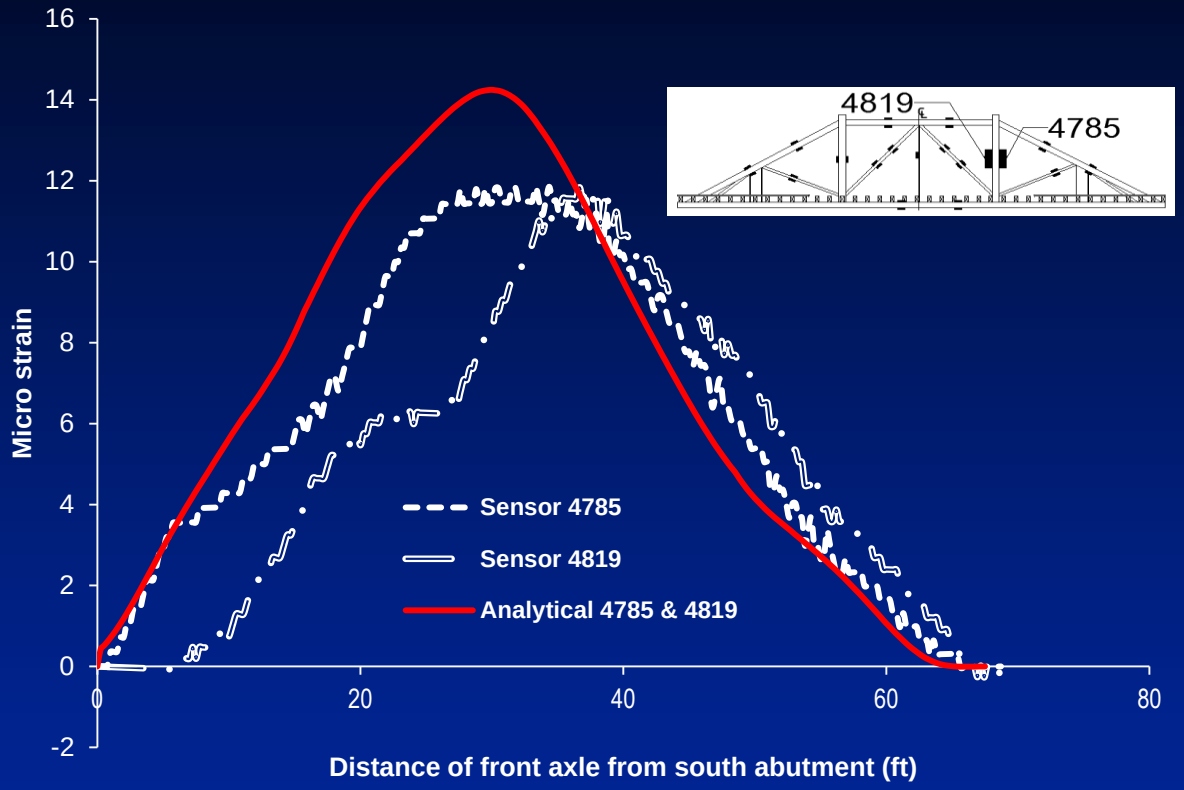
Measured and Calculated Deflection



Strain Compaison



Strain Comparison –Cont.



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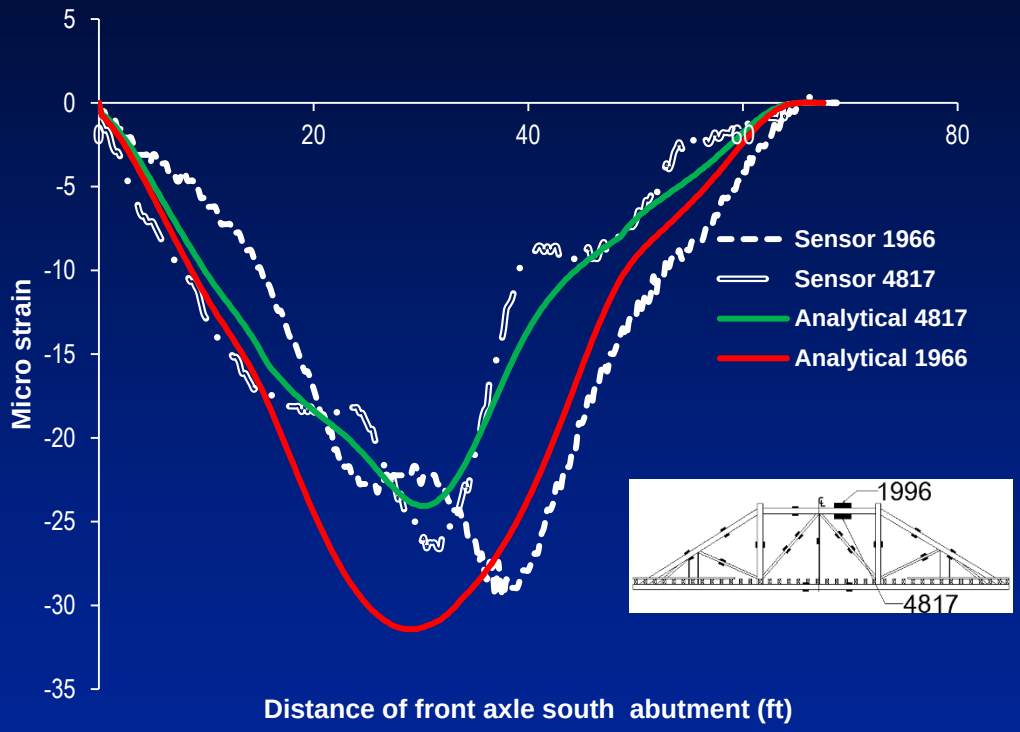
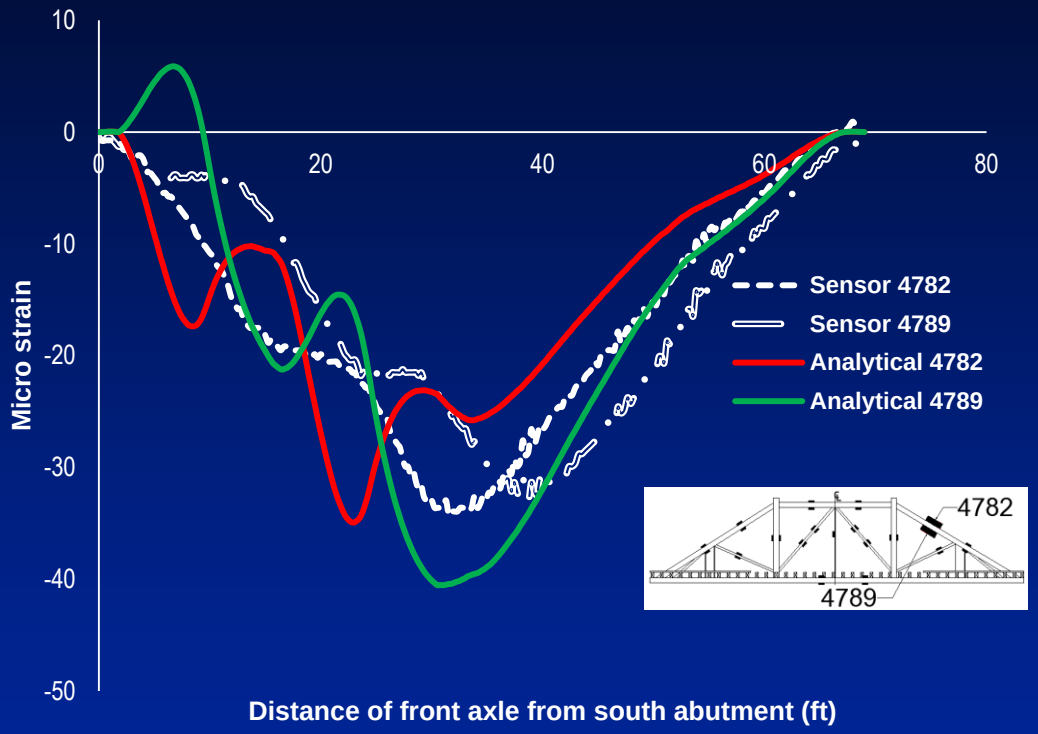
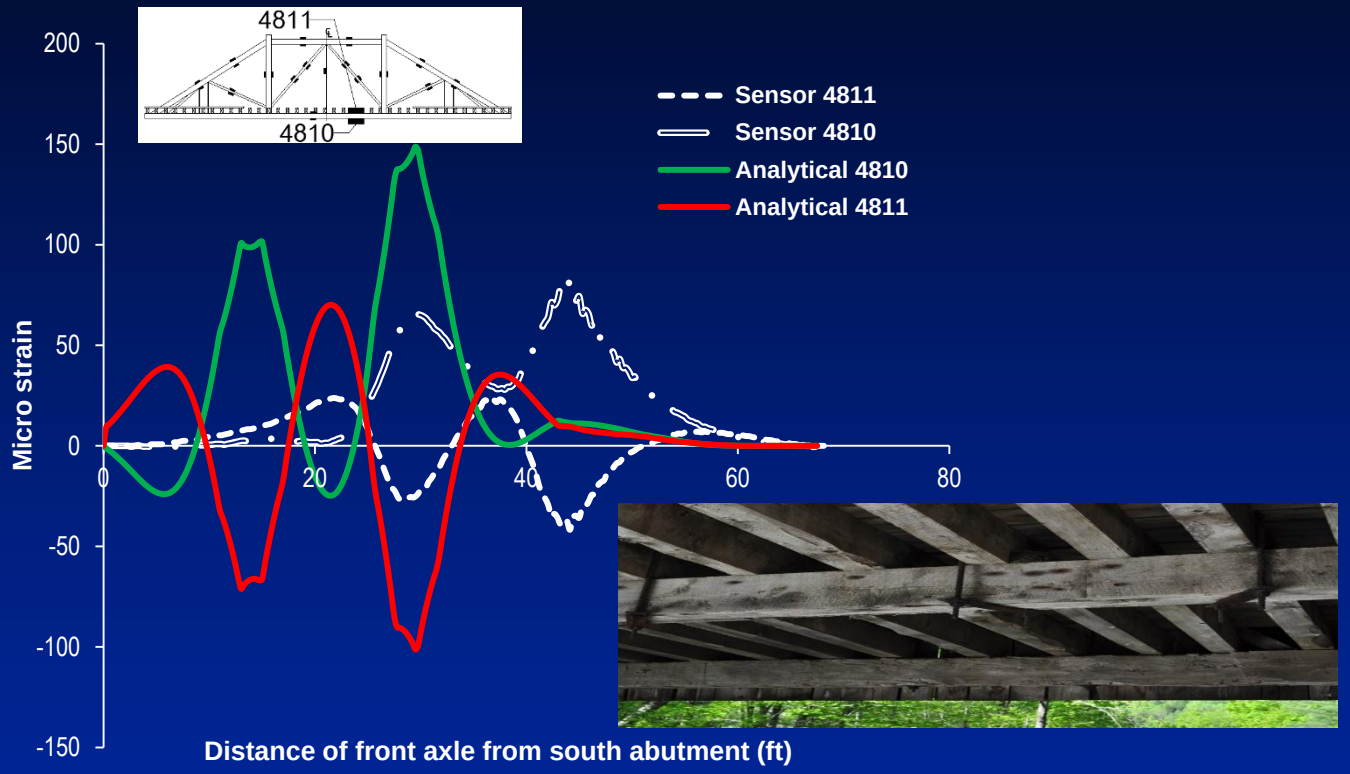


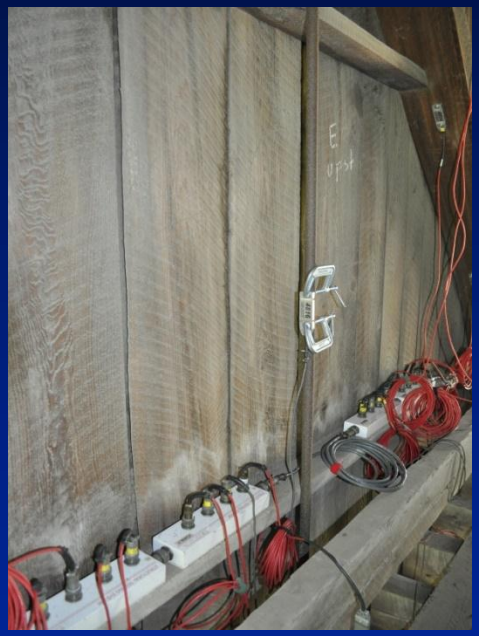
Strain Comparison –Cont.

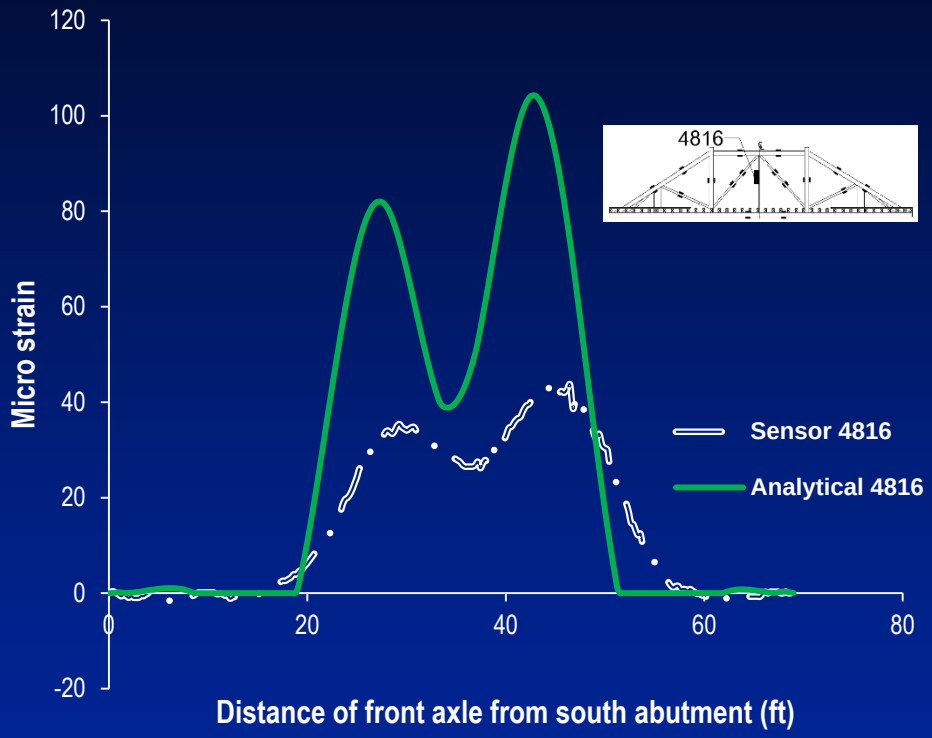


Strain Comparison –Cont.



Strain Comparison –Cont.





Source of Discrepancies

- Data Collection Method

Source of Discrepancies – Cont.

- Members Conditions and Dimensions
- Load Distribution
- Irregularities Present in the Bridges
- Geometric Irregularities
- Material Properties

Summary & Conclusions

- Finite element
- Joint Eccentricities
- Material Properties
- Analyze the as built structure

Acknowledgement

This study is part of the Research, Technology and Education portion of the **National Historic Covered Bridge Preservation** (NHCBP) Program administered by the Federal Highway Administration. The NHCBP program includes preservation, rehabilitation and restoration of covered bridges that are listed or are eligible for listing on the National Register of Historic Places; research for better means of restoring, and protecting these bridges, development of educational aids; and technology transfer to disseminate information on covered bridges in order to preserve the Nation's cultural heritage.

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Federal Highway Administration Program Manager - Sheila Rimal Duwadi, P.E.

Forest Products Laboratory Program Manager - Michael A. Ritter, P. E.

- **Douglas Wood**
- **Allison Lunde**
- **Graduate Students**