Civil Engineering Theses, Dissertations, and
Student Research

Civil Engineering

4-2017

Optimizing Steel Railway Truss Bridge Health Monitoring

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Optimizing Steel Railway Truss Bridge Health Monitoring

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Problems - Steel Railway Trusses

- **Aging**
- **Large system – bridge AND railway**
- **Labor intensive condition eval**
- **Reported conditions:**
  - ü Stringer-to-floor beam connections [Haghani 2012]
  - ü Stringer flange clip angle cracks [Haghani 2012]
  - ü Unequal eyebars stress distribution [DelGrego 2008]
  - ü Displaced eyebar pins [DelGrego 2008]
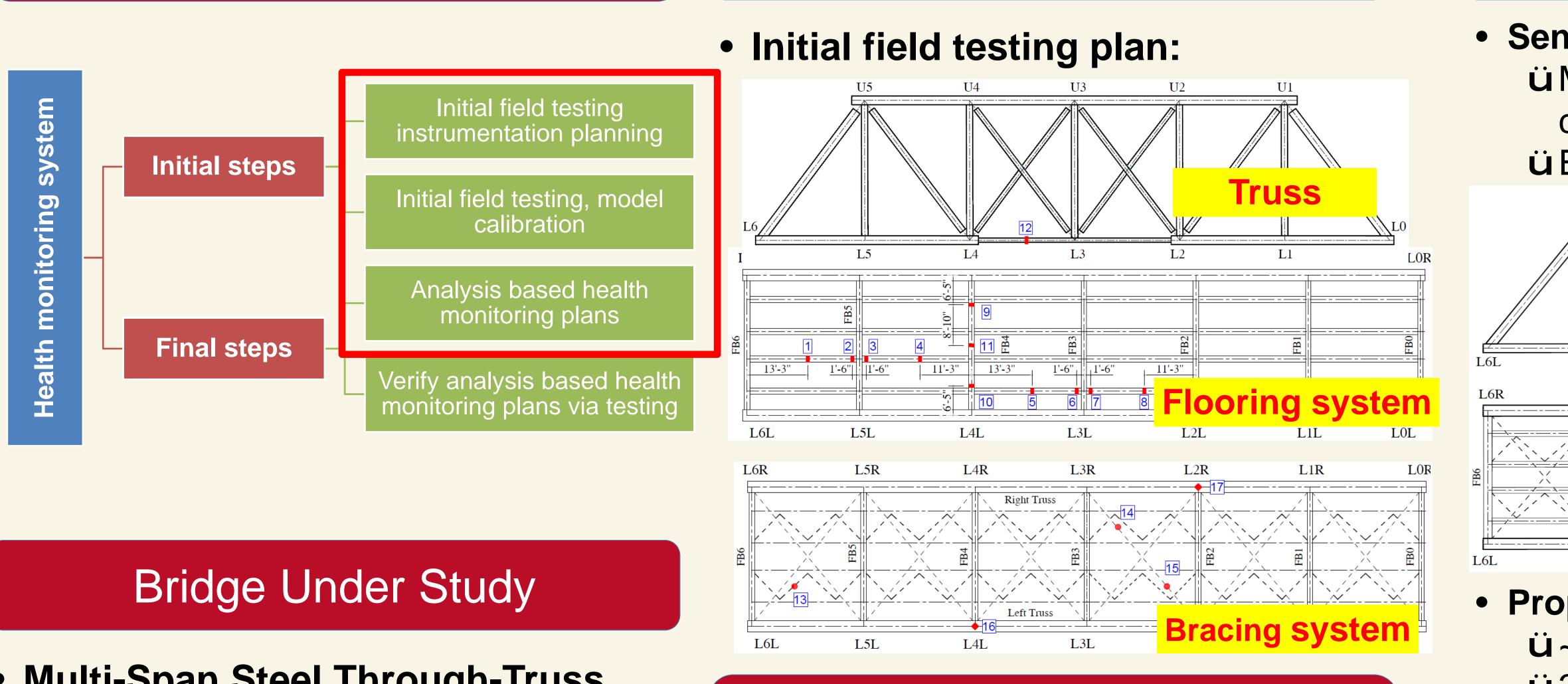

Stringer-to-floor beam connection

Stringer flange clip Angle

Problems – Condition Evaluation

- **Visual inspection:**
  - ü Prescribed frequency
  - ü Costly
  - ü Subjected to human interpretation

- **Sensors:**
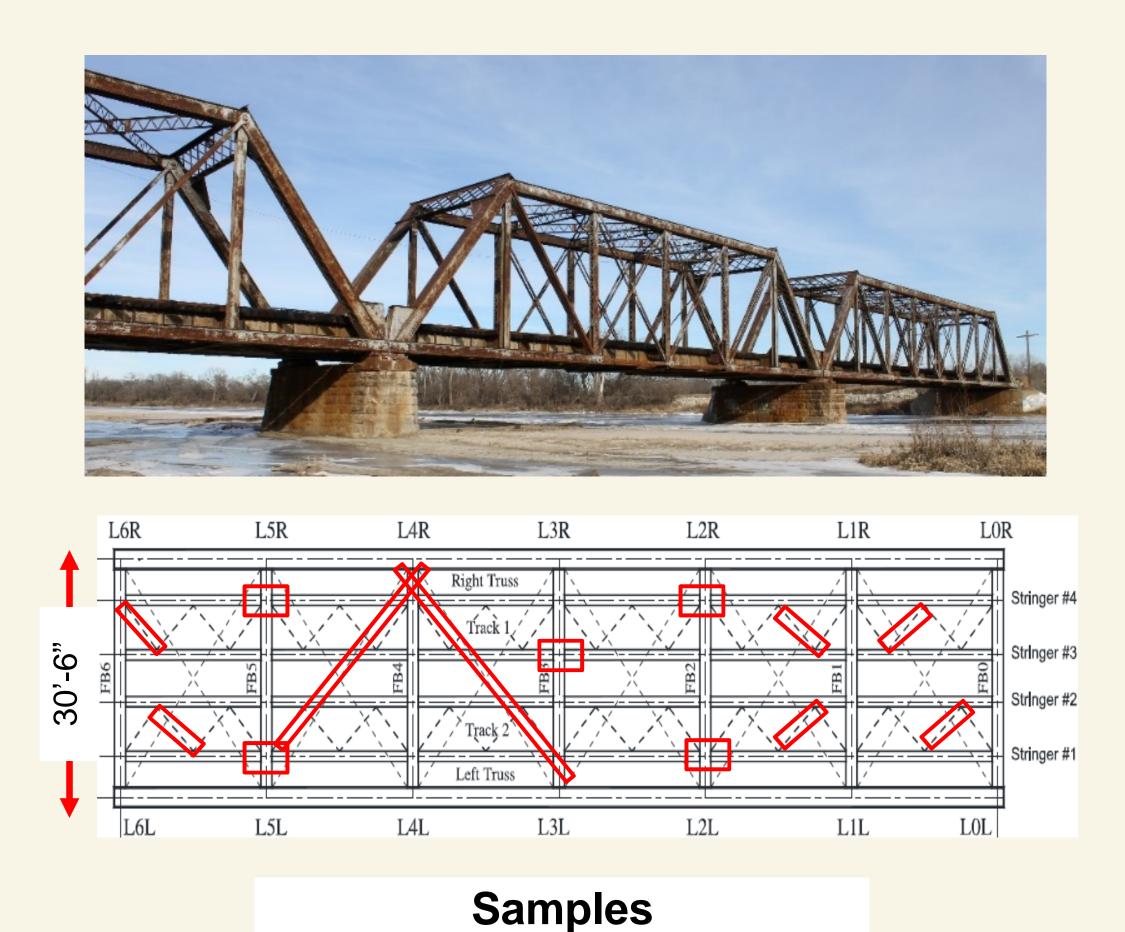 - ü Focused on a single bridge
  - ü Extensive array
  - ü Costly

Objectives

Bridge Under Study

- **Multi-Span Steel Through-Truss**
  - ü Double-Track
  - ü Riveted Construction
  - ü Eyebars

- **Condition Foci:**
  - ü Stringer-to-floor beam connections
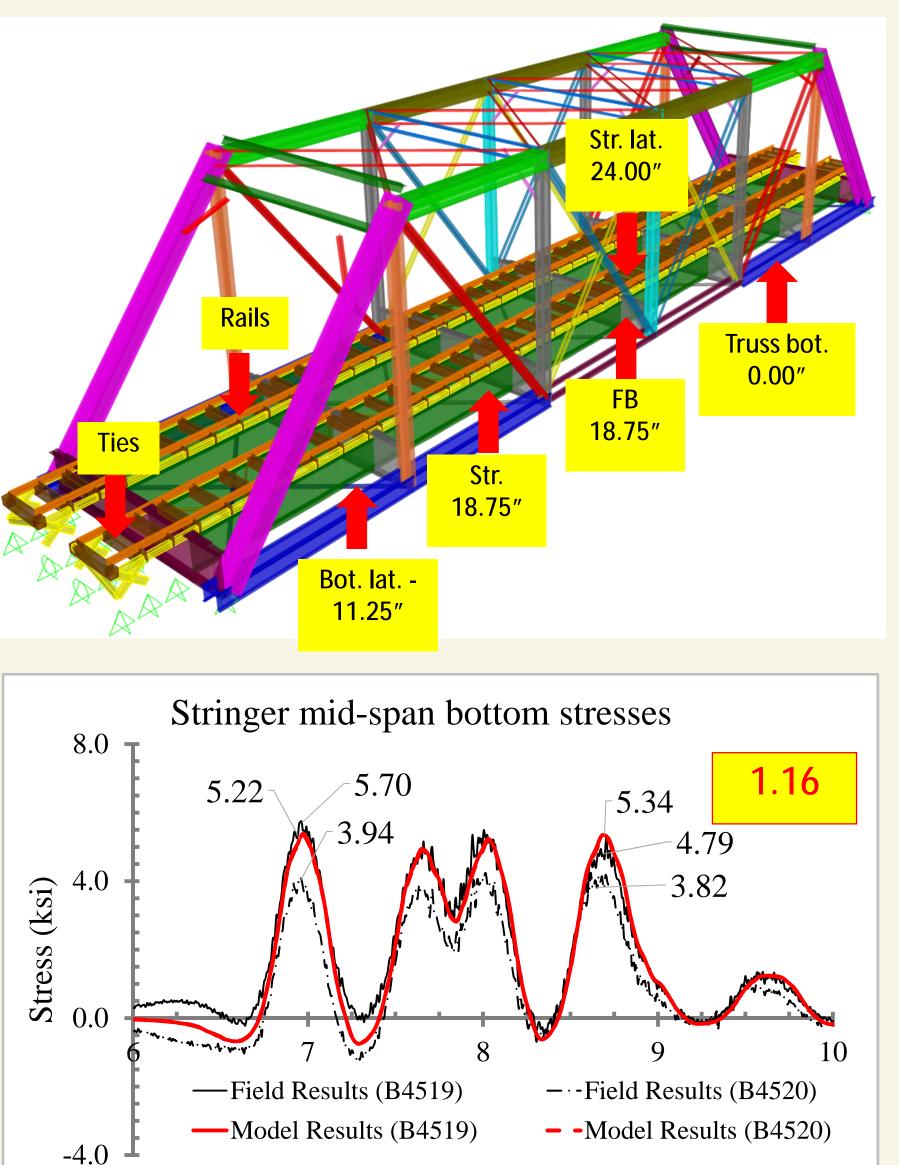 - ü Stringer and truss bottom laterals
  - ü Eyebars
  - ü Bearings

Samples

Initial Field Testing

- **Initial field testing plan:**

Truss

Flooring system

Bracing system

Model Calibration

- **Model:**
  - ü 3D frame model PLUS
  - ü Rails/ties
  - ü Geometric offsets, connections

Stringer mid-span bottom stresses

Analysis Based Health Monitoring Plan

- **Sensitivity Analyses:**
  - ü Modified models - mimic reported condition - 20 models
  - ü E.G. – cracked connection

Assumed conditions

- **Proposed health monitoring plan:**
  - ü ~2200 permutations
  - ü 3 proposed plans

Stringer #1 end-span bottom stresses

Conclusions, Future Work

- **Validated model - published test results**
- **Field tests/model calibration – SHM planning**
- **Proposed SHM plans**
- **Validated SHM plans - field monitoring**