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# Optimizing Steel Railway Truss Bridge Health Monitoring


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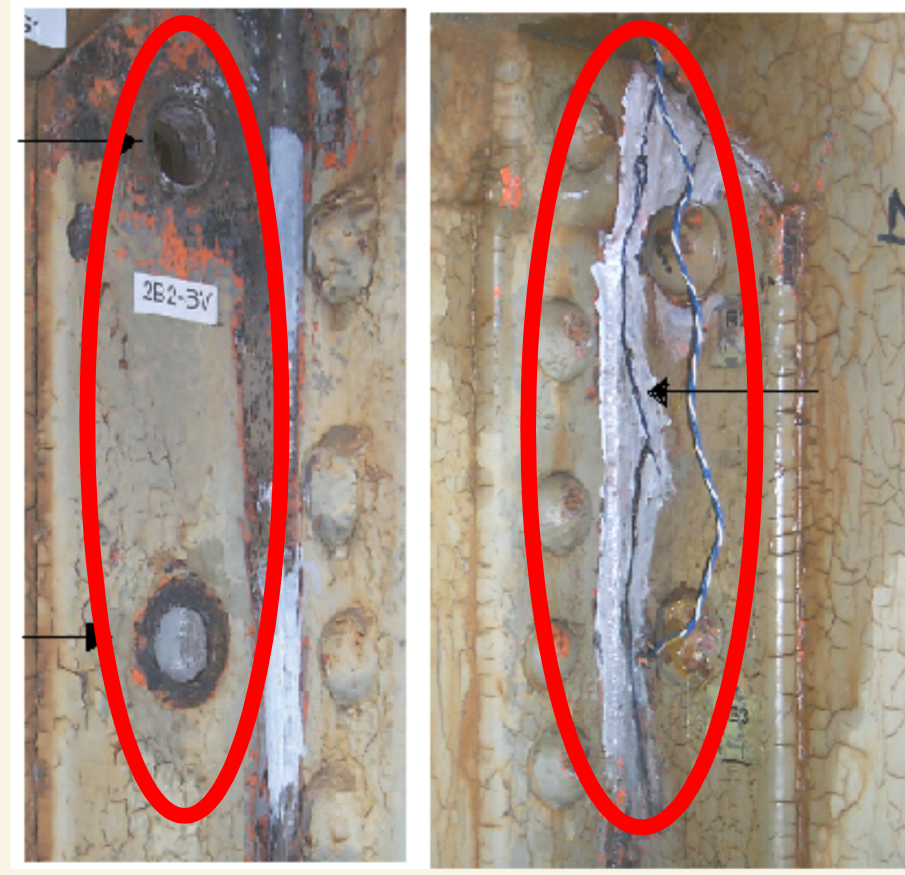


# Optimizing Steel Railway Truss Bridge Health Monitoring

Ahmed Rageh (MS), Daniel Linzell (Ph.D., P.E., F. ASCE) – University of Nebraska-Lincoln

## 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

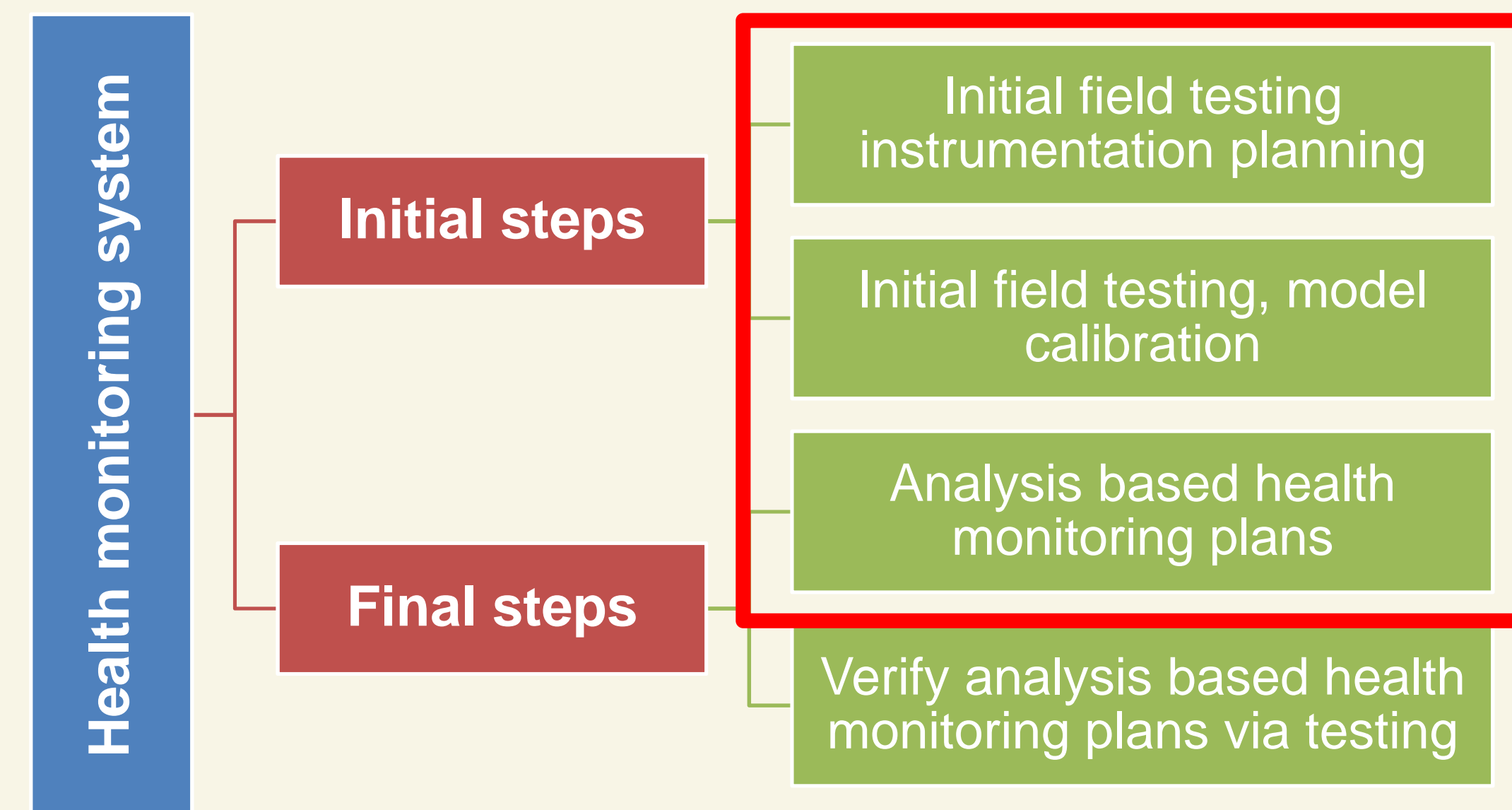


Stringer flange clip Angle

## Problems – Condition Evaluation

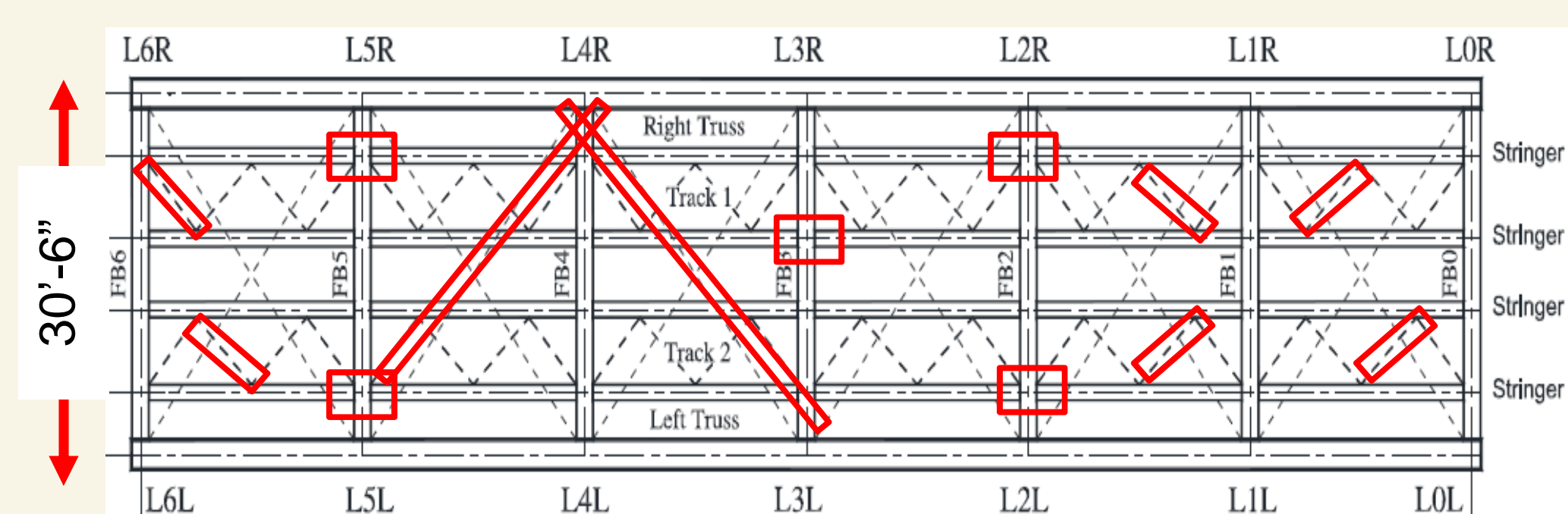
- Visual inspection:
  - ü Prescribed frequency
  - ü Costly
  - ü Subjected to human interpretation
- Sensors:
  - ü Focused on a single bridge
  - ü Extensive array
  - ü Costly

## Objectives



## Bridge Under Study

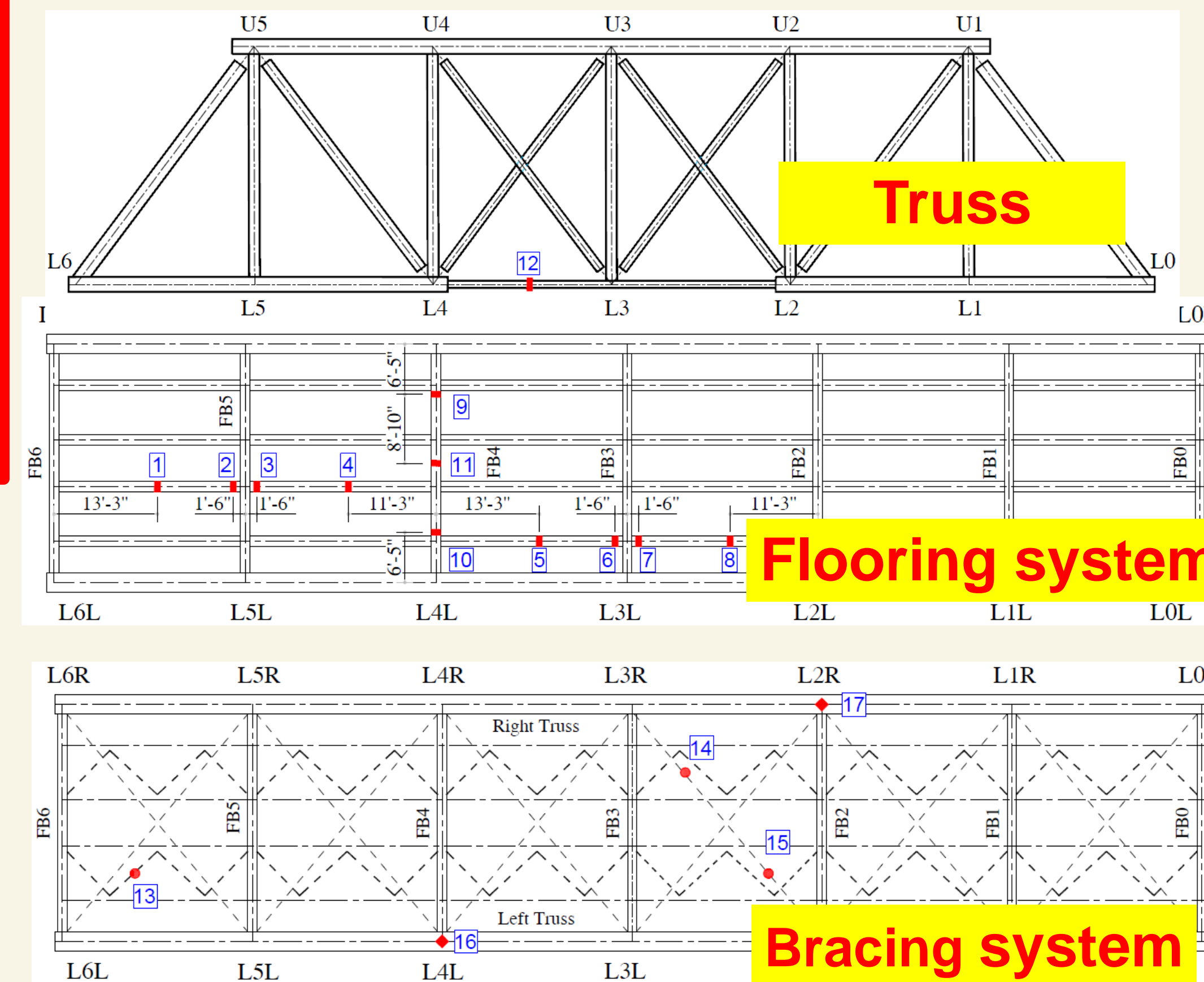
- Multi-Span Steel Through-Truss
  - ü Double-Track
  - ü Riveted Construction
  - ü Eyebars
- Condition Foci:
  - ü Stringer-to-floor beam connections
  - ü Stringer and truss bottom laterals
  - ü Eyebars
  - ü Bearings



Samples

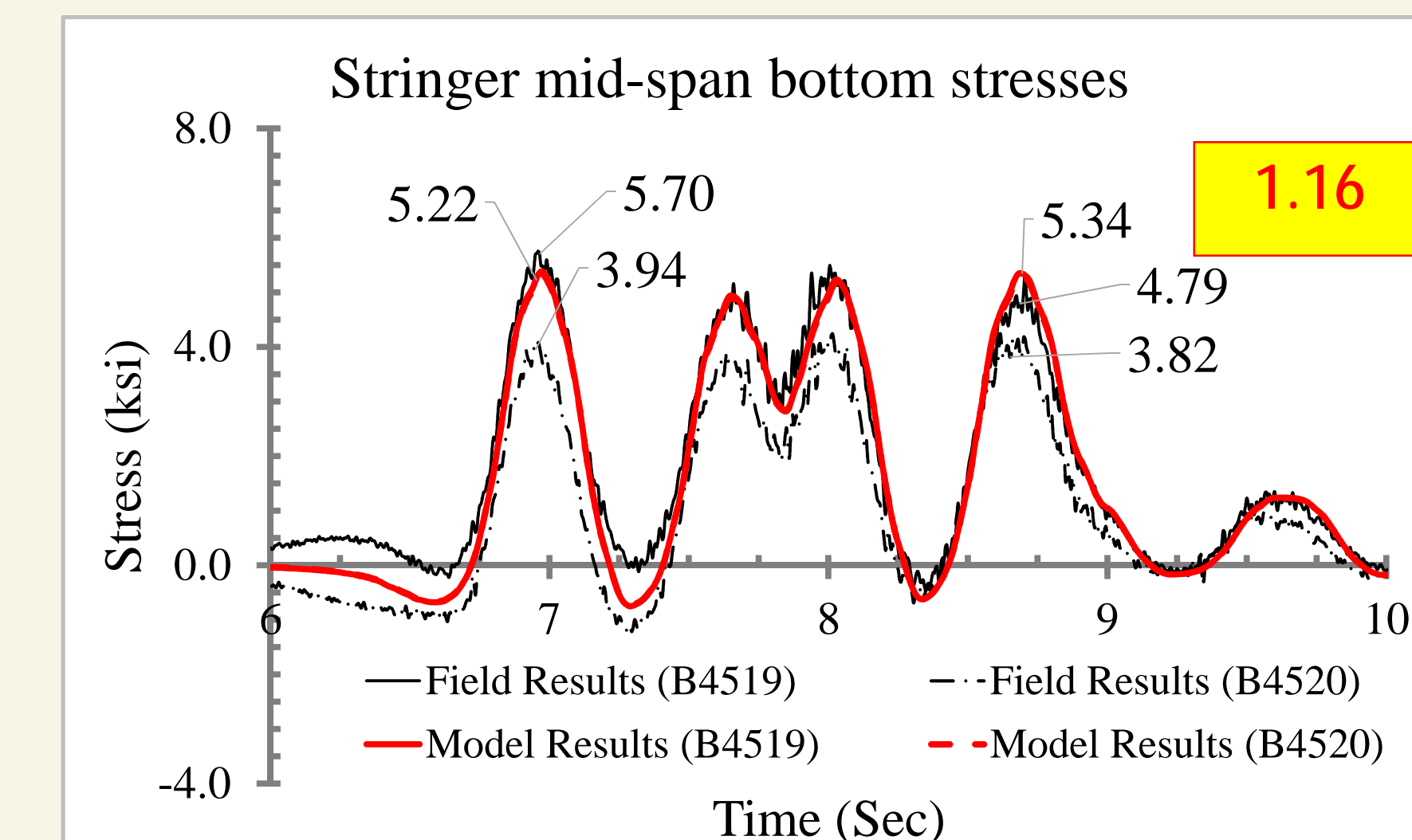
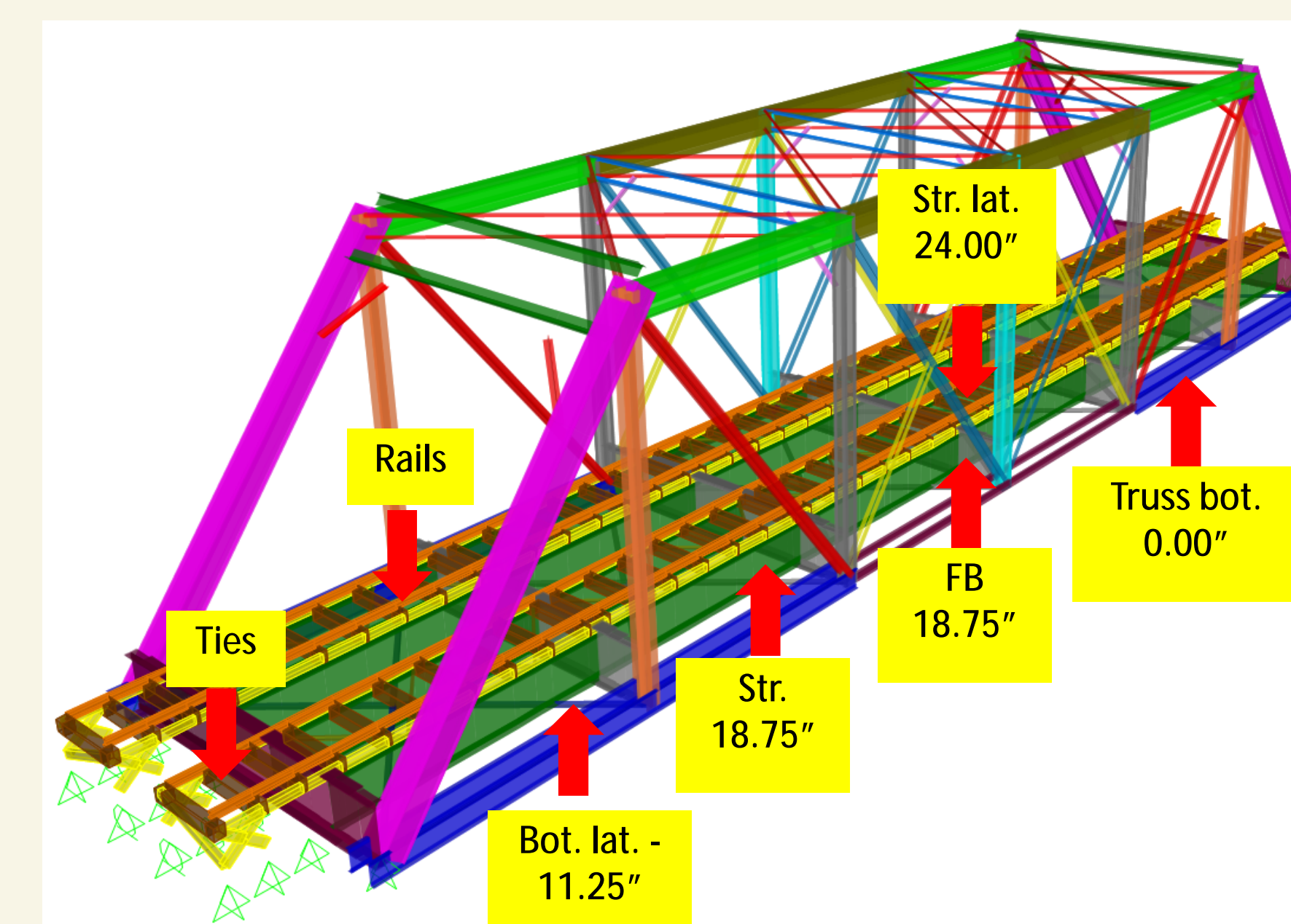
## Initial Field Testing

- Initial field testing plan:



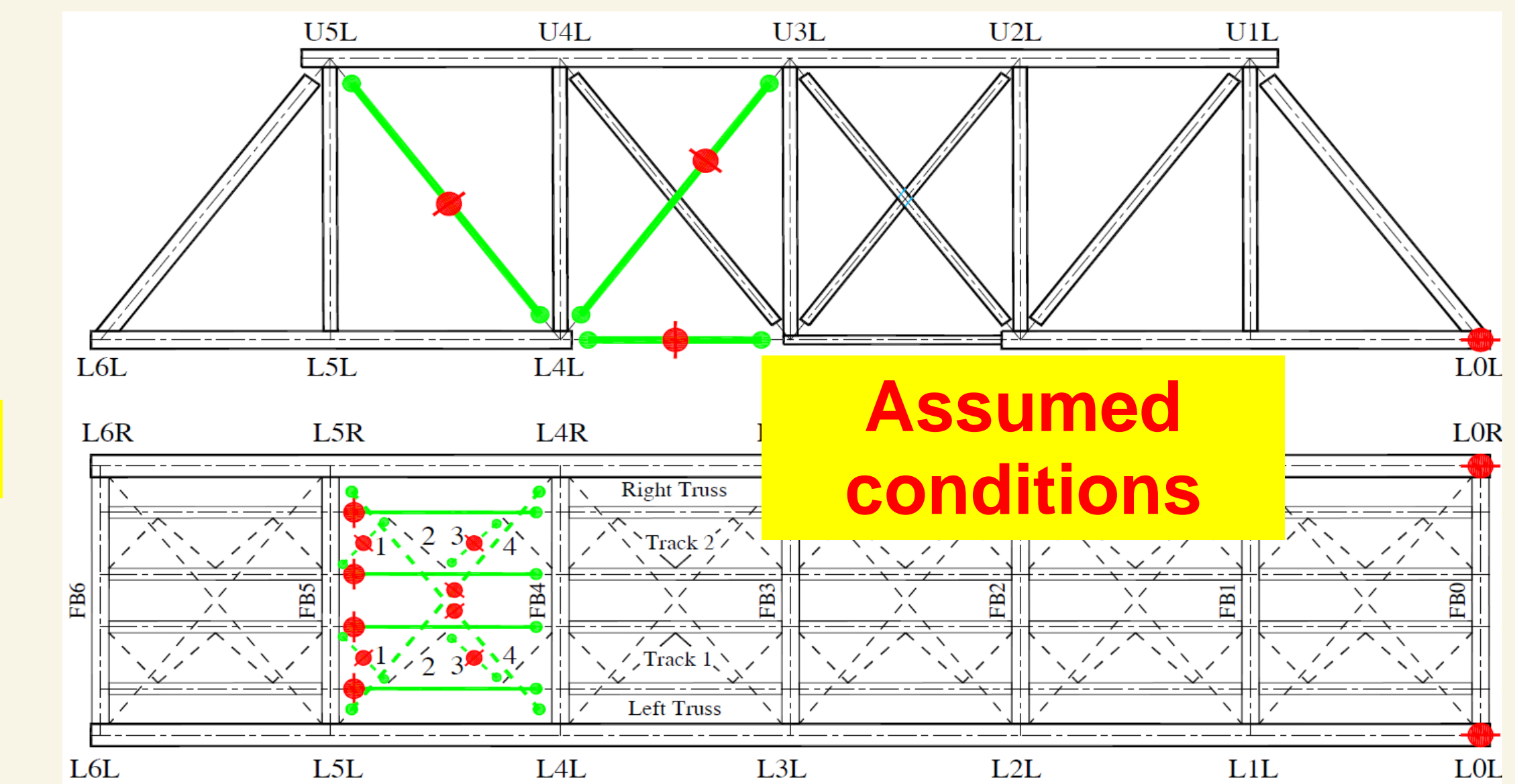
## Model Calibration

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

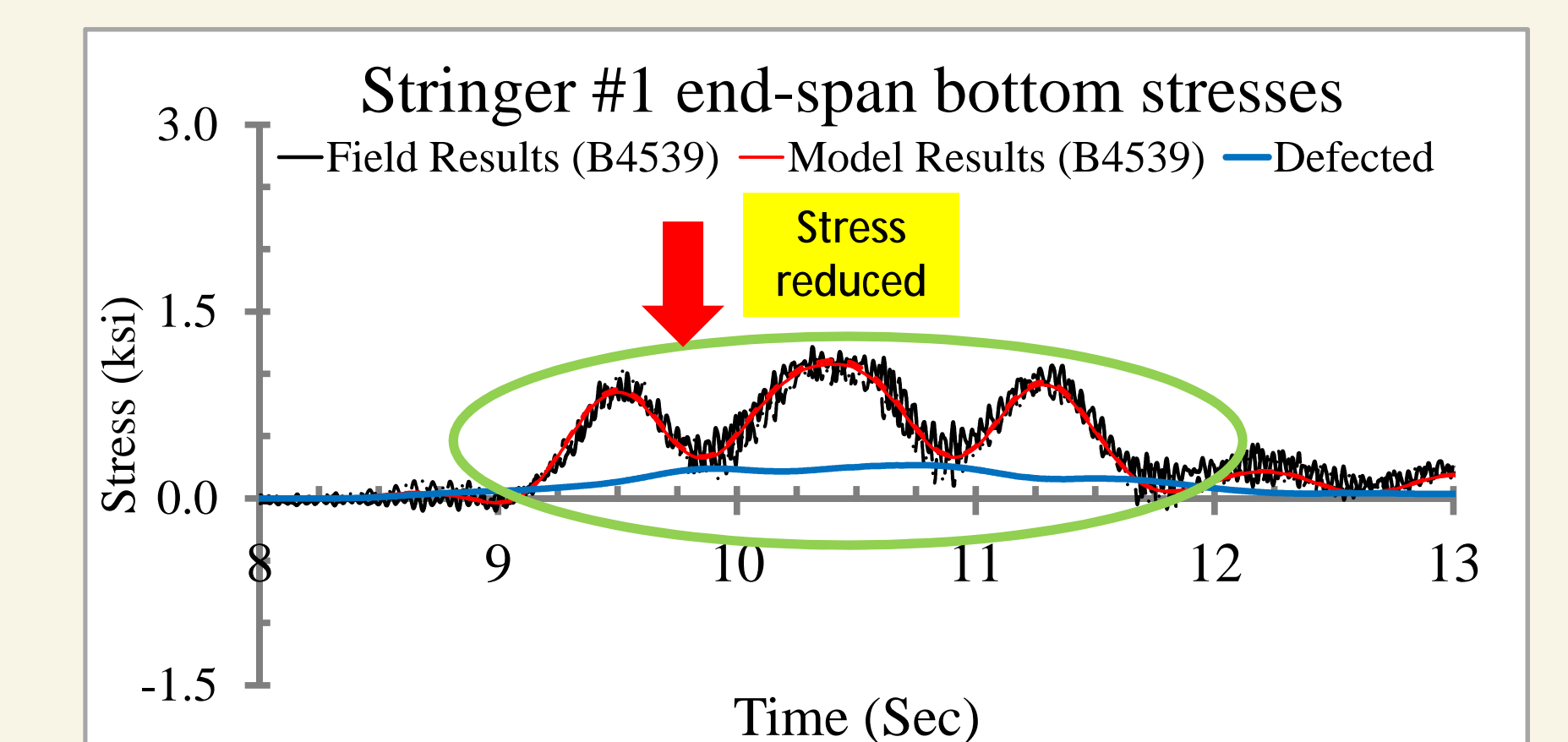
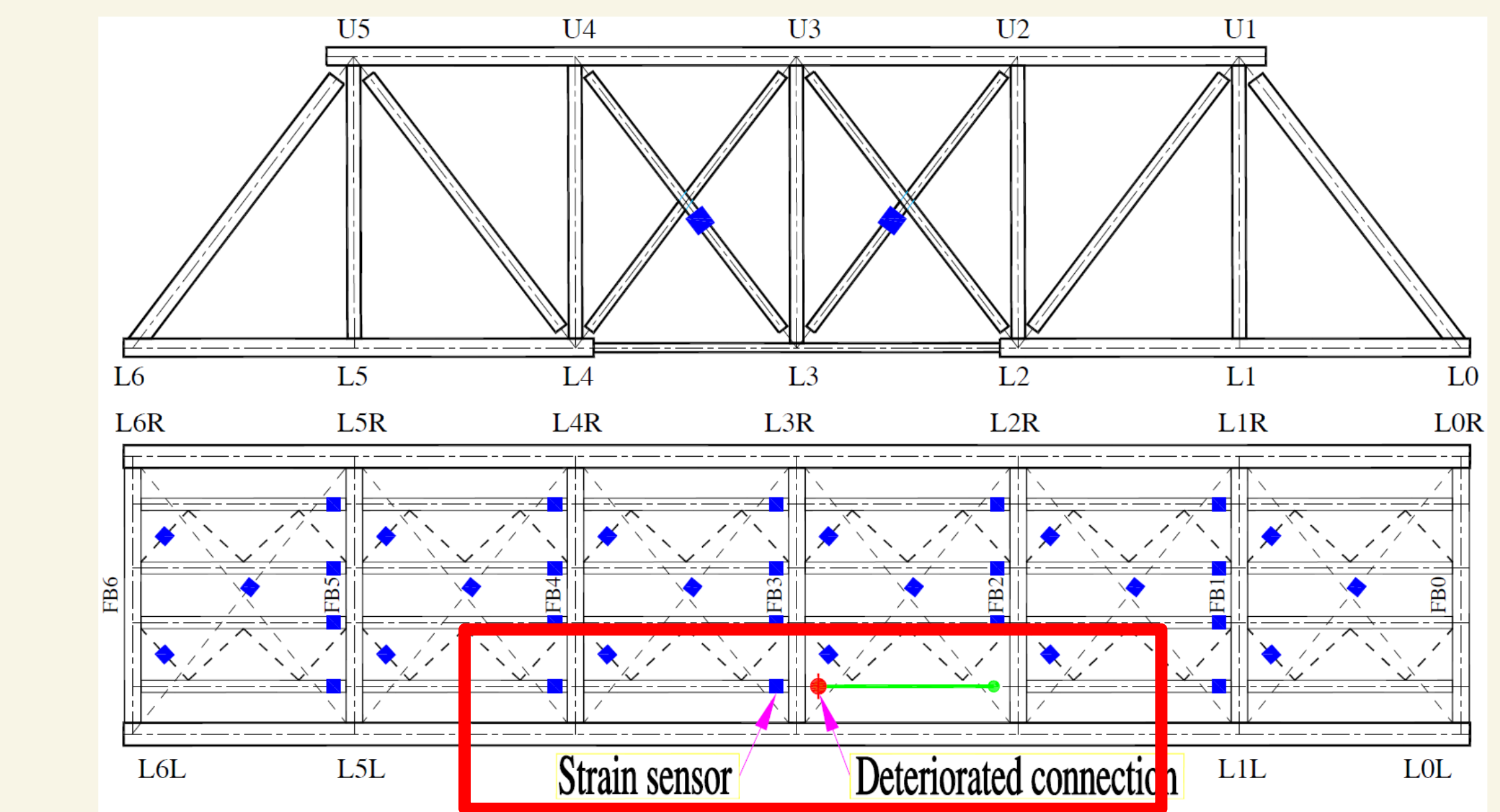


## Analysis Based Health Monitoring Plan

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



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



## Conclusions, Future Work

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