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**INNOVATION**  
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# Research Topics related to Bridge Preservation

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# Bridge Preservation

- Keeping good bridges good
- Understanding the causes and addressing the source of problems
- Fixing problems before damage spreads
- Applying effective repairs to extend life
- Using what works and eliminating what does not work from future designs



# Bridge Information Systems Laboratory

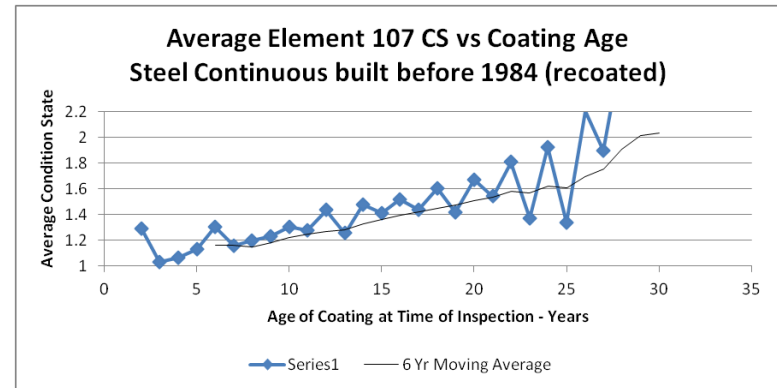
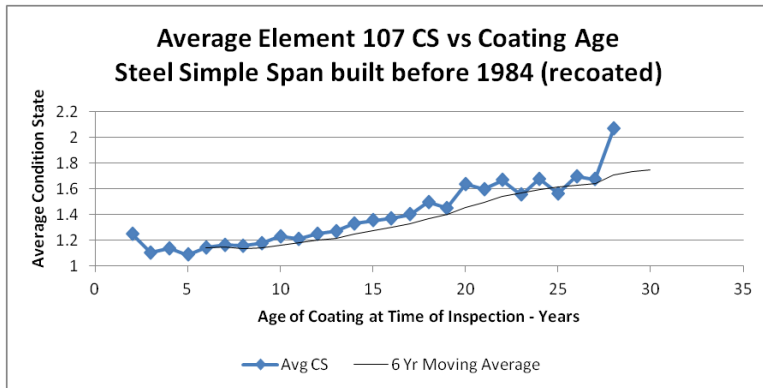
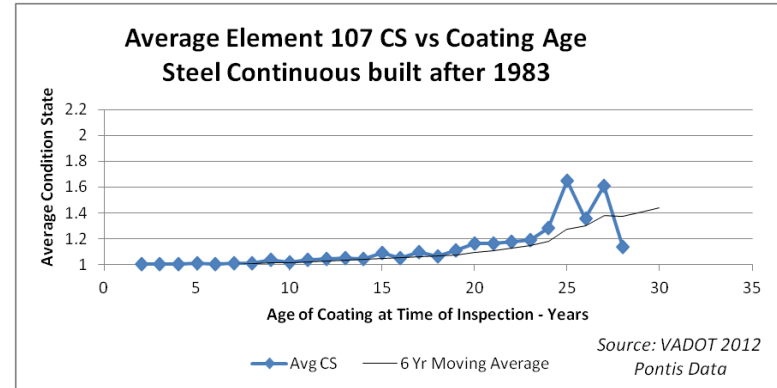
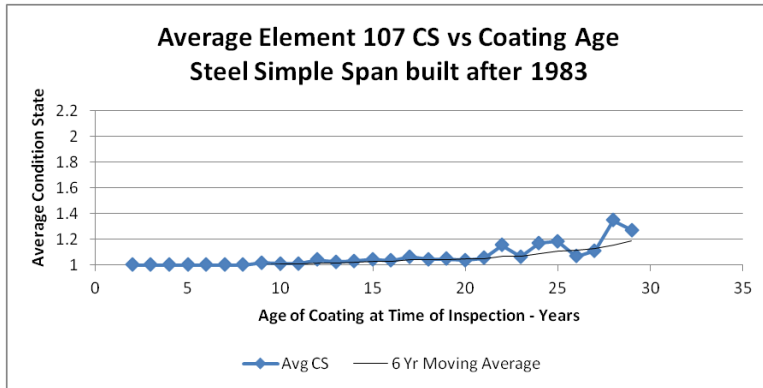
An ongoing, interactive effort to mine existing data for trends in behavior or effectiveness of systems or treatments:

- Coatings
- Joints
- Overlays
- Joint elimination
- Other systems

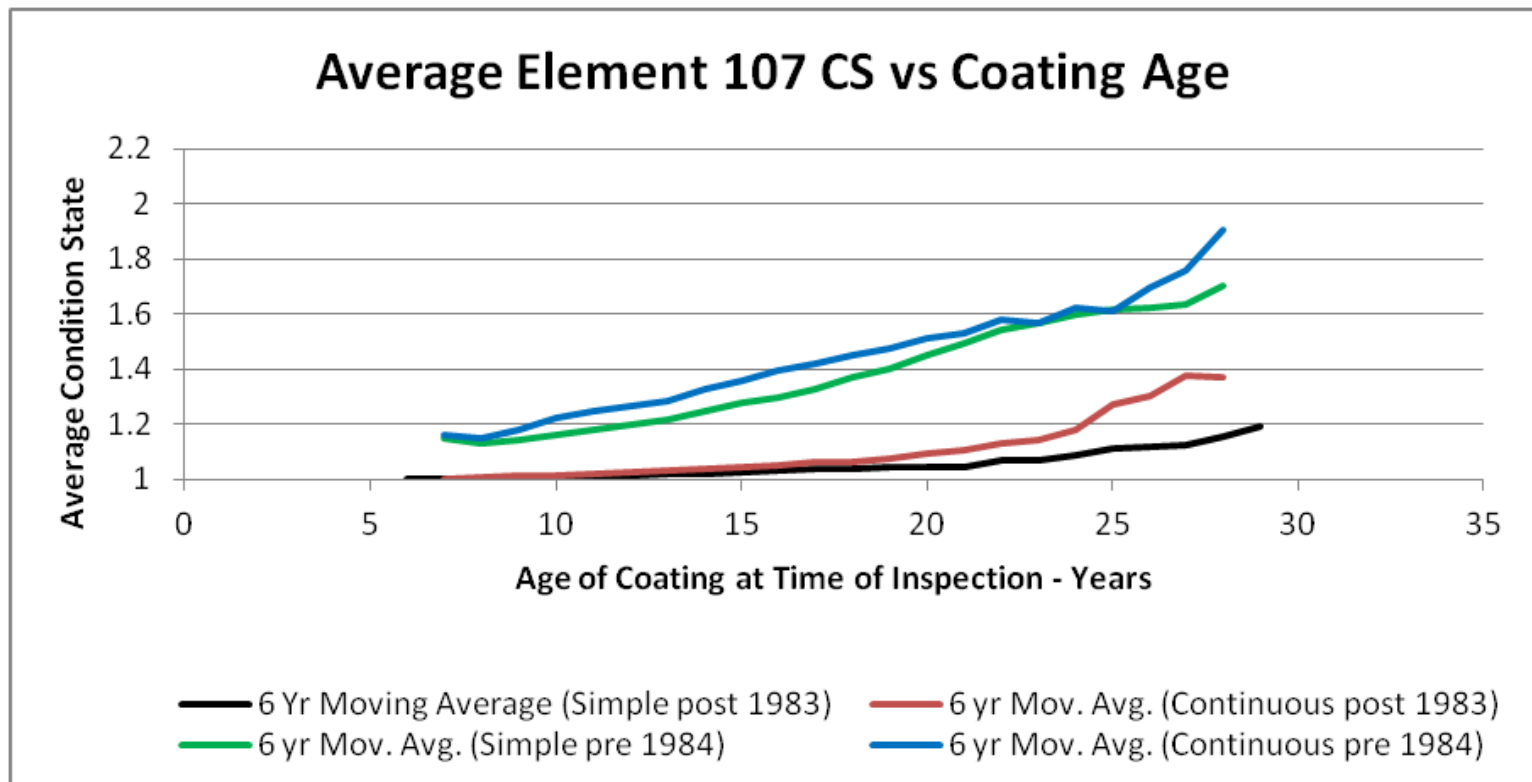
Using NBI, Pontis, maintenance records, etc.



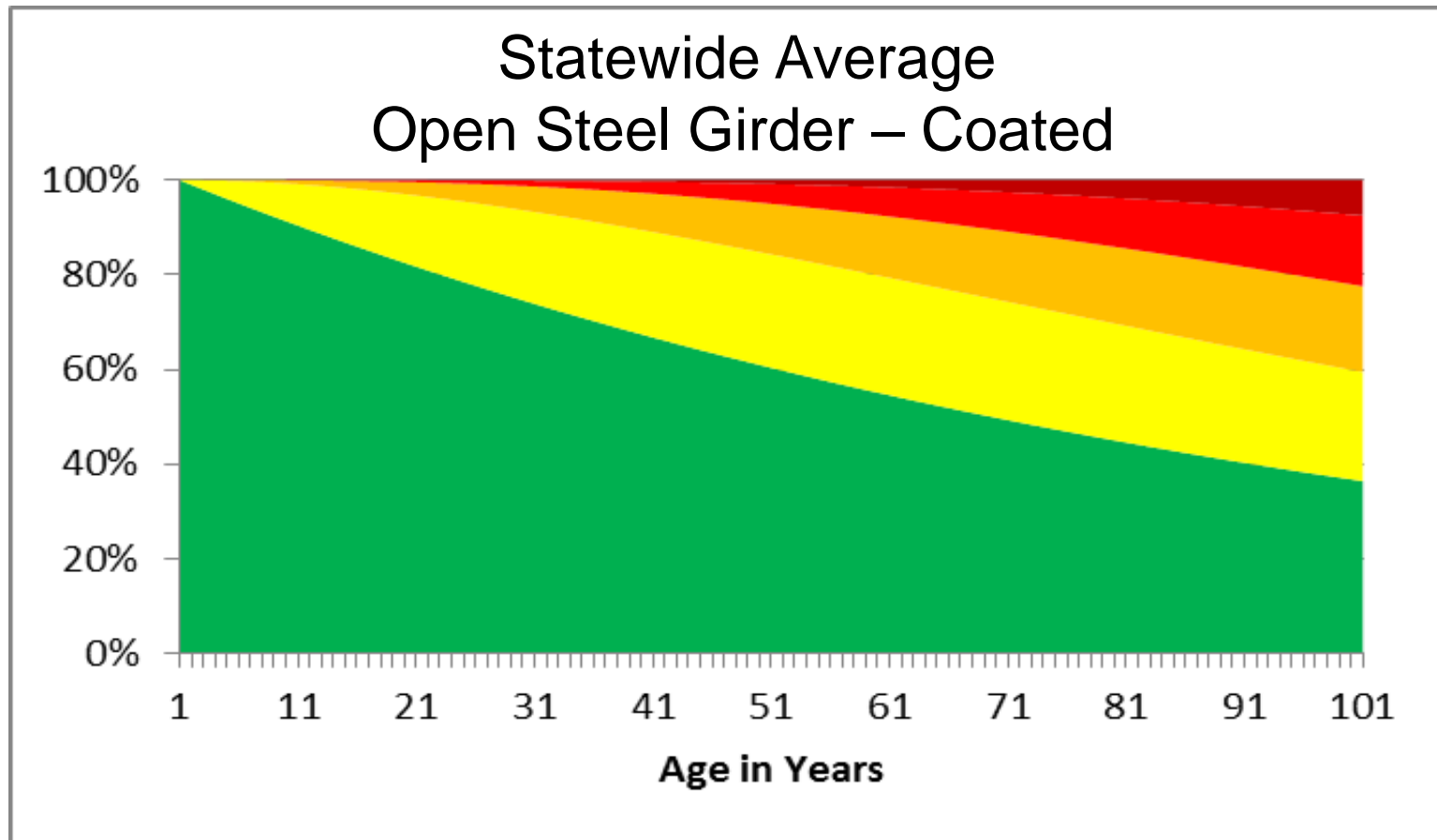
# Bridge Information Systems Laboratory: Condition State versus Age of Coating



# Bridge Information Systems Laboratory: Condition State versus Age of Coating



# Bridge Information Systems Laboratory: Markov Deterioration Model

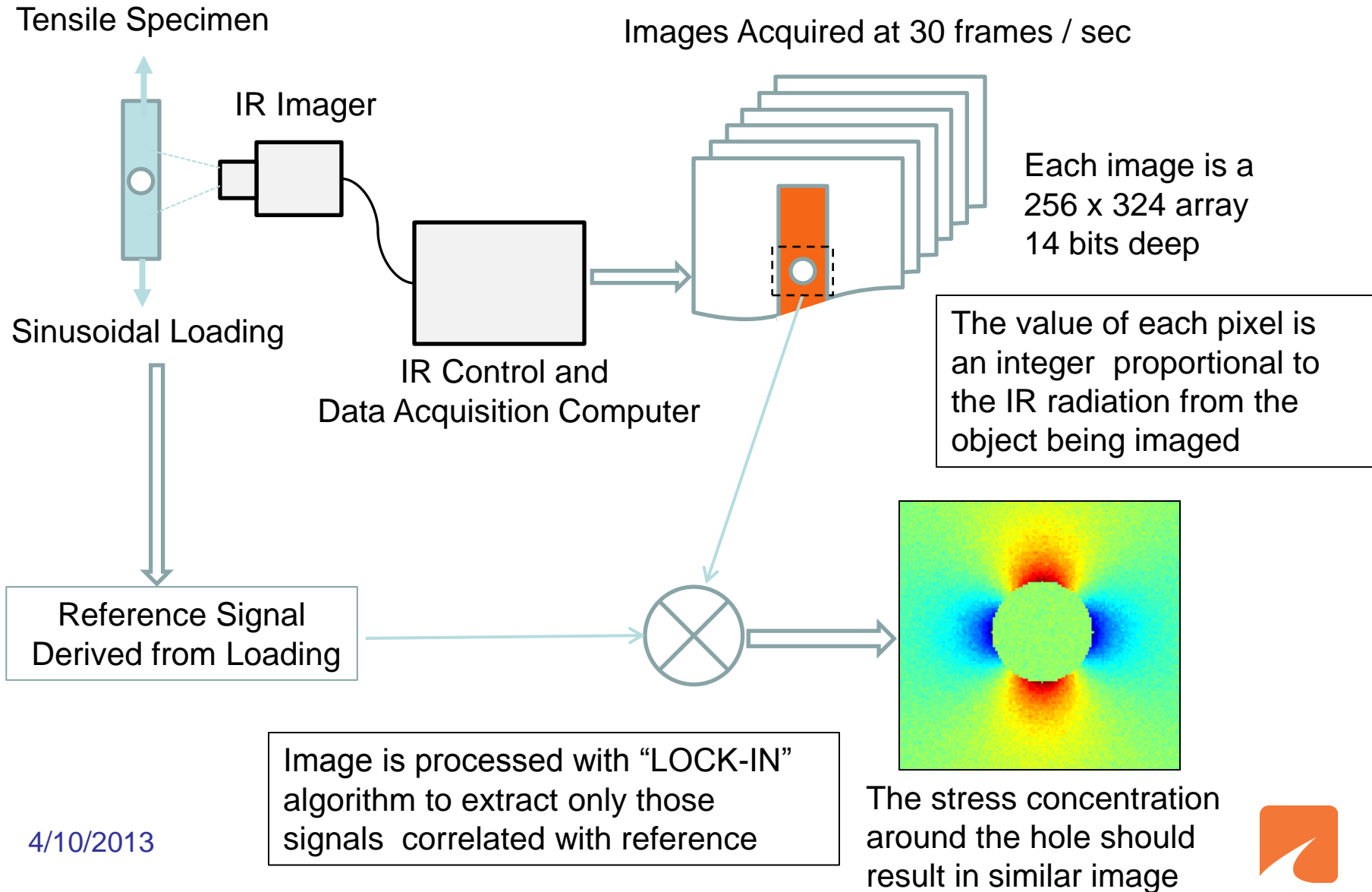


# Thermoelastic Stress Analysis

- Many structures in the inventory with fatigue-prone details
- Need a tool to determine location and probability of cracking under service loading
- Need a tool to verify effectiveness of crack-arresting activities for active cracks

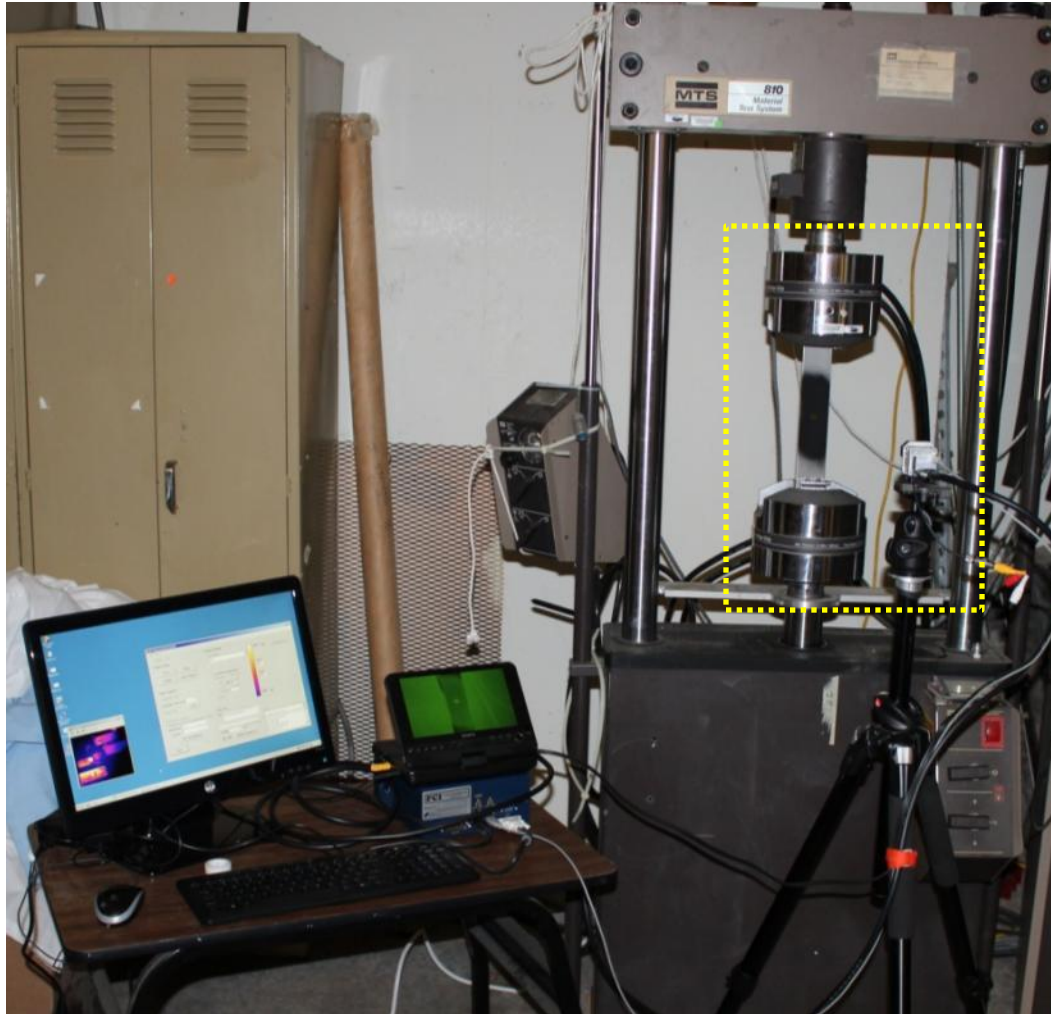


# Thermoelastic Stress Analysis: Concept





# Thermoelastic Stress Analysis: Setup



# Thermoelastic Stress Analysis: Results

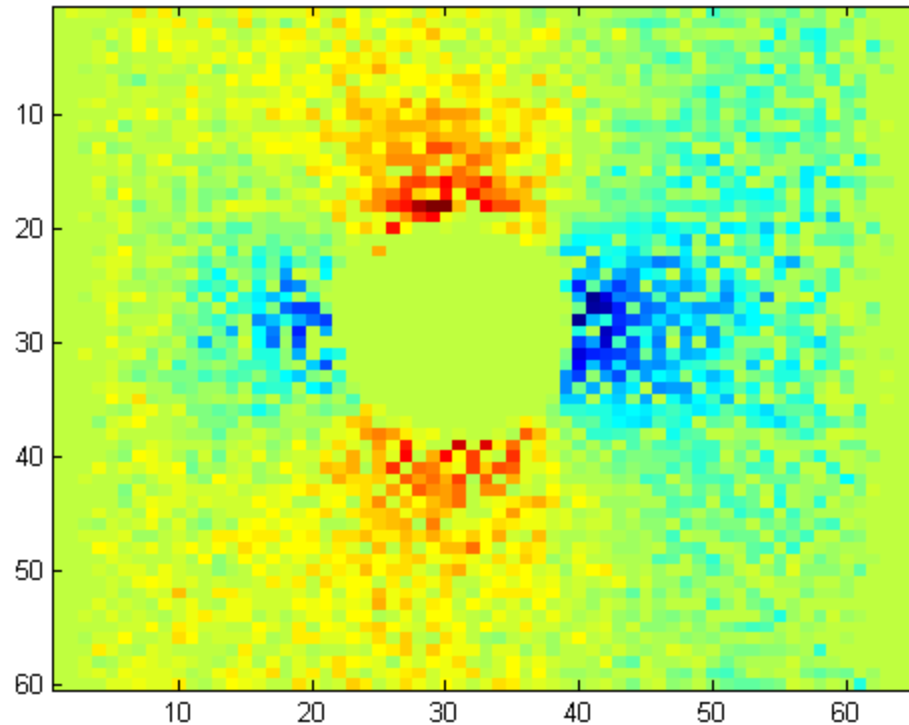


Image created by Steven Chase, UVA, March 29, 2012

Thermoelastic Stress Analysis Image produced from 60 second test.  
(The asymmetric pattern is probably due to eccentricity in loading.)



# High performance fiber-reinforced concrete

- Develop high performance fiber-reinforced concrete or cementitious composite for closure pours that will:
  - achieves standard concrete properties compatible with conventional class A4 deck concrete (compressive strength and modulus of elasticity)
  - produce tight cracks under service loads (exhibit deflection hardening)
  - prevent separation from bridge deck sections (possess high bond strength and minimal shrinkage)



# HPFRC/ECC Laboratory Testing

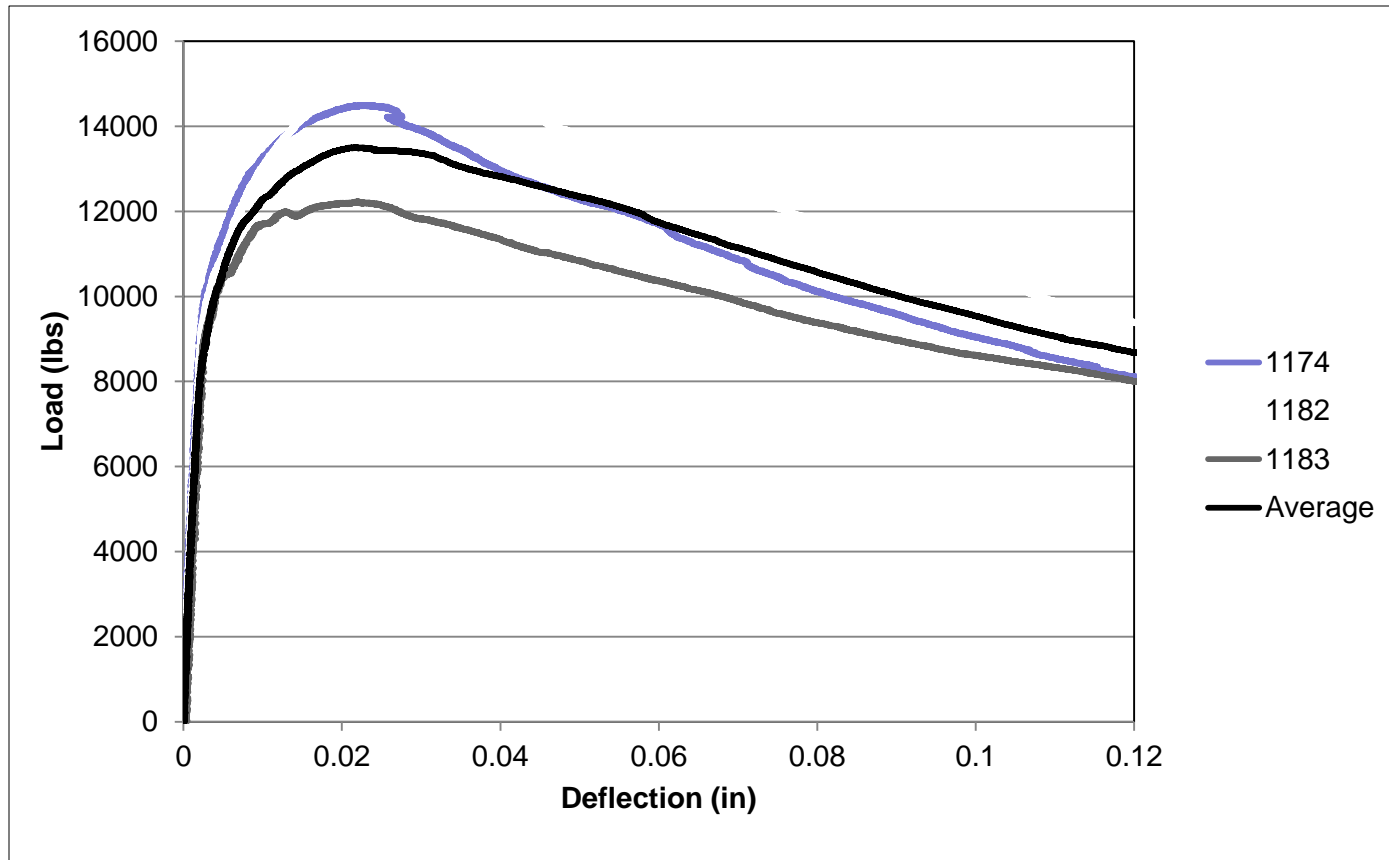


Comparing  
Hybrid FRC using  
PVA and steel fibers  
and  
ECC using PVA fibers



# HPFRC - Toughness

## 28-Day Flexural Toughness of Hybrid A Mix



# HPFRC – Applications

Plan to develop mixture(s) for the following applications:

- Joint elimination/”poor-man” continuity
- Longitudinal closure pours in phased deck construction
- Joint filler for adjacent precast construction



# SCC for Pier Bent Repair



SCC placement using pump



# SCC Repairs for Concrete

## Shotcrete





# Research into Durable Design

- Flexural Behavior of Bridge Deck Slabs Reinforced with Corrosion-Resistant Reinforcing Bars
- Corrosion-Resistant Structural Steel (ASTM A1010)
- Ultra-High Performance Concrete (UHPC)
- Full-depth Precast Deck Panels
- Inverted T-Beam



# Corrosion Resistant Reinforcing Steel



- Support VDOT implementation of CRR specification
- Continue to evaluate alternative materials
- Consider design parameters to optimize use of material properties



# Carbon Fiber Composite Cable



4/10/2013  
Corrosion on Steel Strand

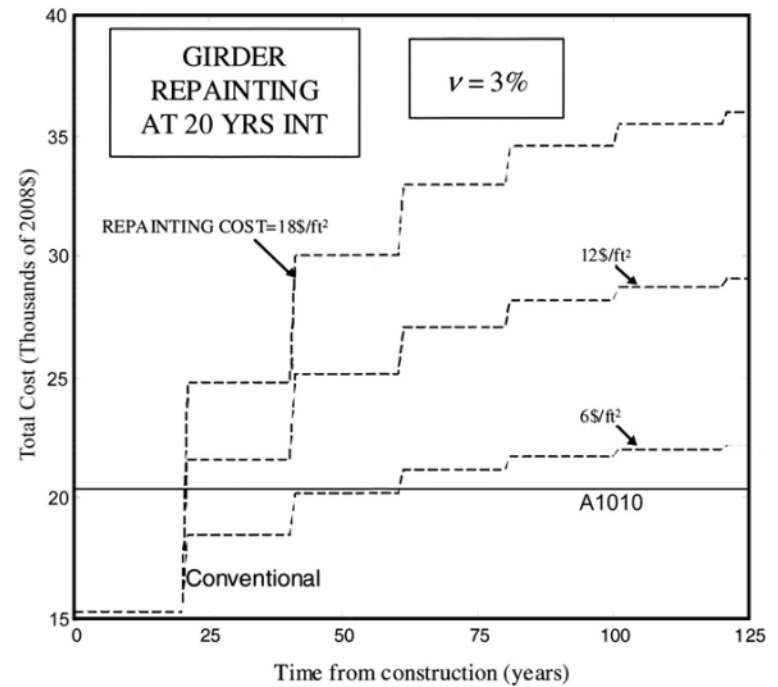


CFCC

Corrosion Resistant  
Strand



# Use of ASTM A1010



# Inverted T Beams

