
DETERMINE JOINTED PLAIN CONCRETE PAVEMENT (JPCP) SLAB REPLACEMENT TREATMENT USING SENSING TECHNOLOGY

Presented by

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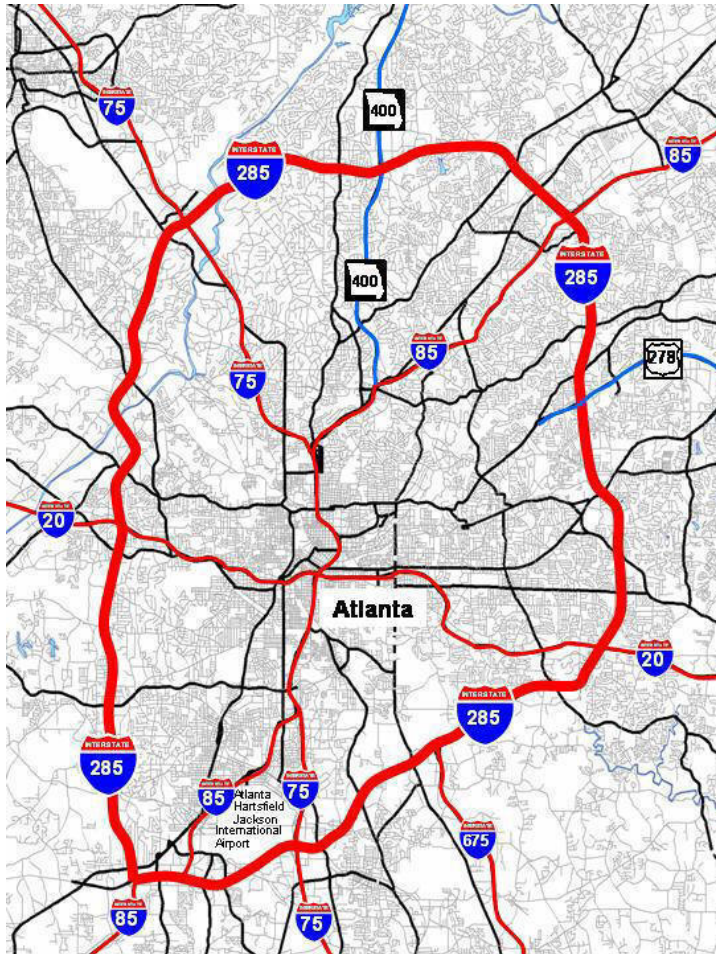
Pavement Evaluation 2014

September 15-18, 2014 ▼ Blacksburg, Virginia

Acknowledgement

- Georgia Department of Transportation
“Enhancing GDOT's Jointed Plain Concrete Pavement (JPCP) Rehabilitation Program Using Emerging 3D Sensing Technology and Historical Concrete Condition Survey Data”
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Introduction



- Constructed in 1968
- 10-in thickness
 - No dowel
 - 30-ft joint spacing
 - cement stabilized graded aggregate base

Introduction (cont'd)

After 46 years of heavy truck traffic (10,000+ AADT)



Ultimate Goals

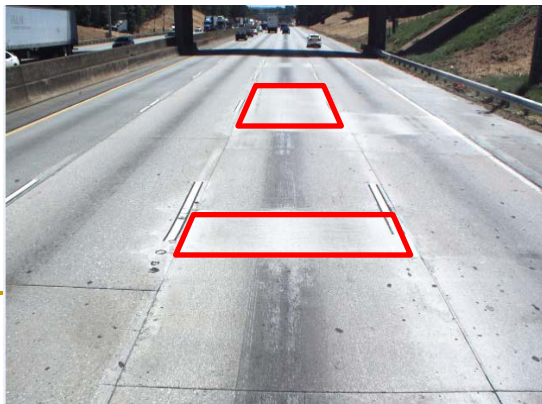
- To develop a method for establishing annual JPCP M&R programming at slab level safely and reliably, including slab replacement, crack sealing, etc., using sensing technology and CFE.
 - Conduct slab level condition evaluation using sensing technology
 - Extract detailed level crack/distress characteristics, using Crack Fundamental Element (CFE) to analyze crack/distress characteristics and their propagation
 - Determine annual slab level M&R, including slab replacement, crack sealing, etc.
 - Forecast slab level JPCP condition
 - Forecast slab level M&R need and their urgency
 - *Cluster slabs for M&R treatment for minimizing life cycle cost*
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Objective of this presentation

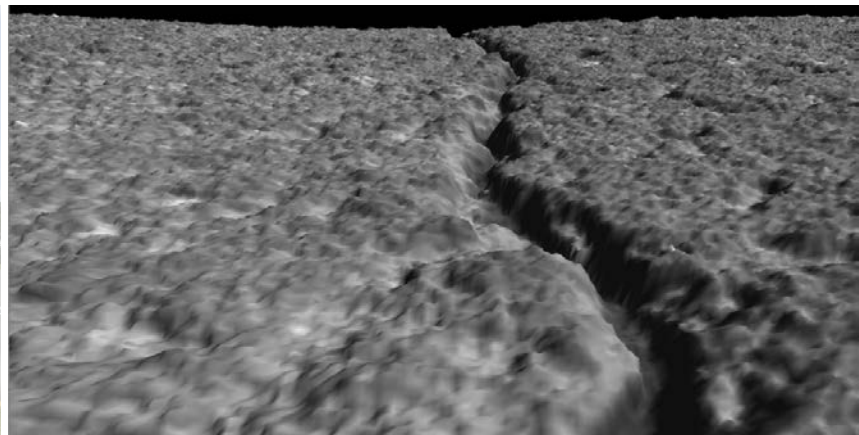
- Conduct slab level condition evaluation using sensing technology
 - Extract detailed level crack/distress characteristics, using Crack Fundamental Element (CFE) to enable us to observe and analyze crack/distress characteristics and their propagation at the detailed level.
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Need for Detailed Condition Assessment

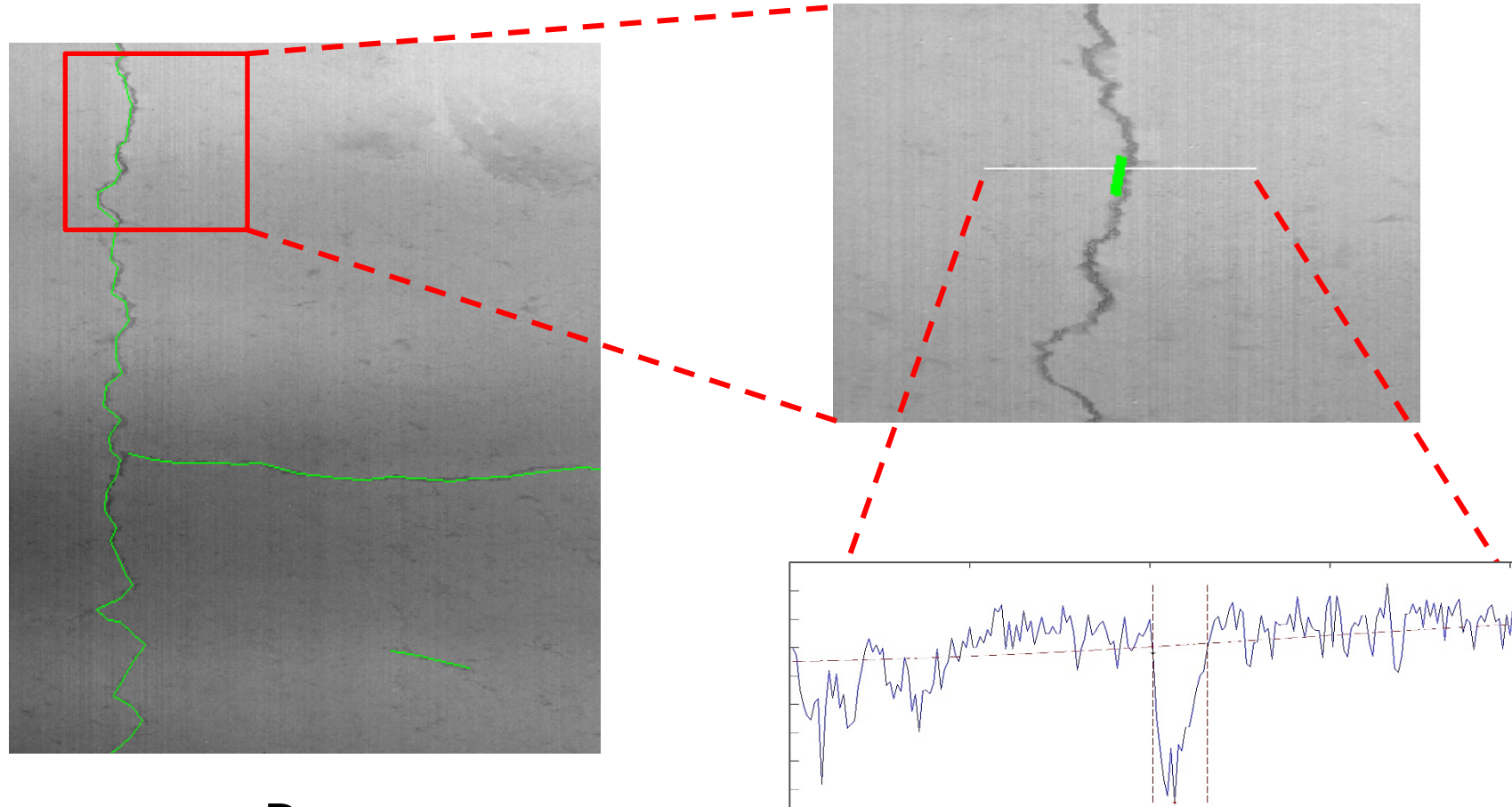
- To assess condition on each slab on each lane for determining adequate M&R method.
- To forecast a) the pavement condition, and b) M&R need and their urgency at slab level.



Georgia Tech Sensing Vehicle (GTSV)



Automatic Crack Width Measurement



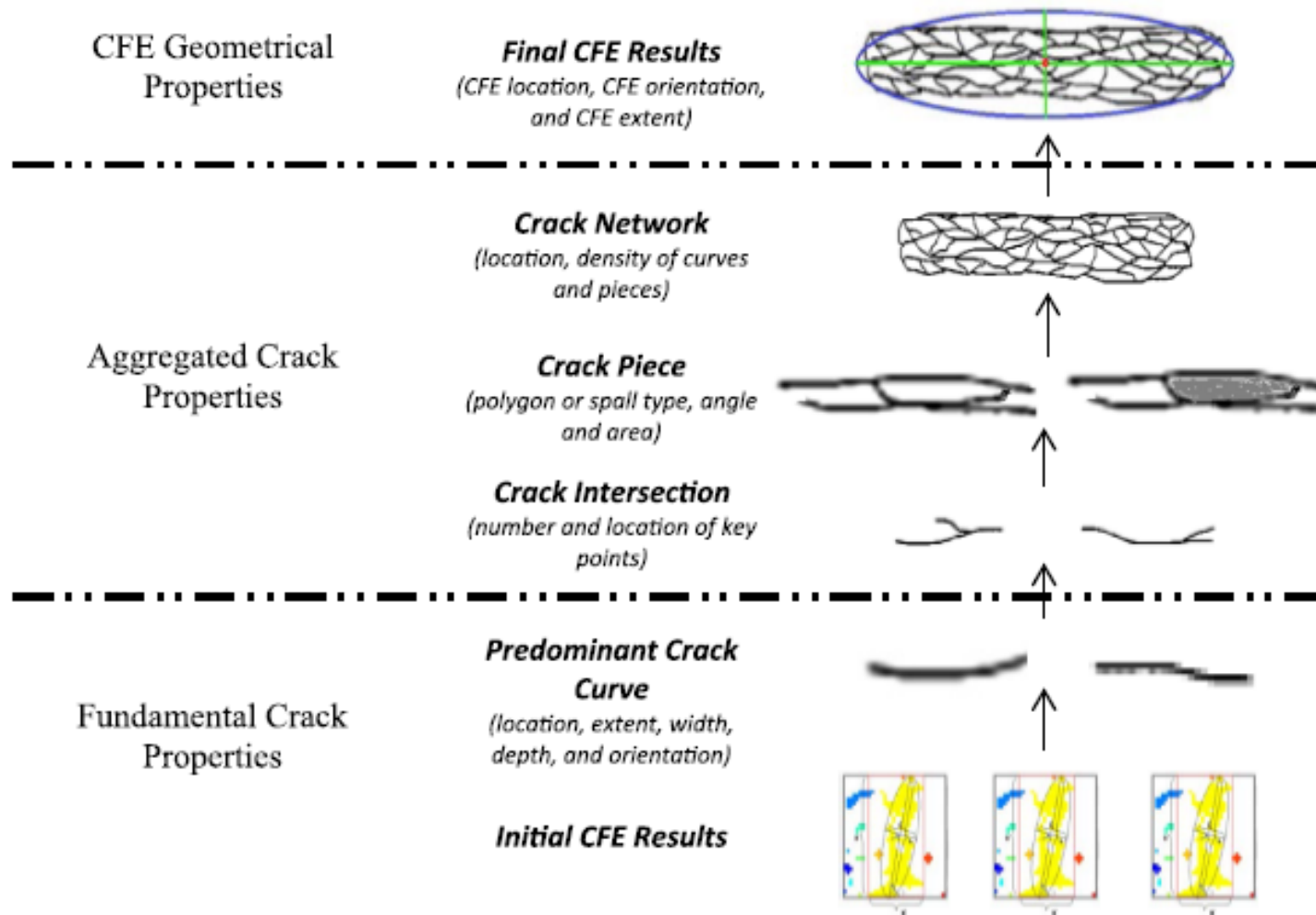
Demo

Profile Measure: 15 pixels

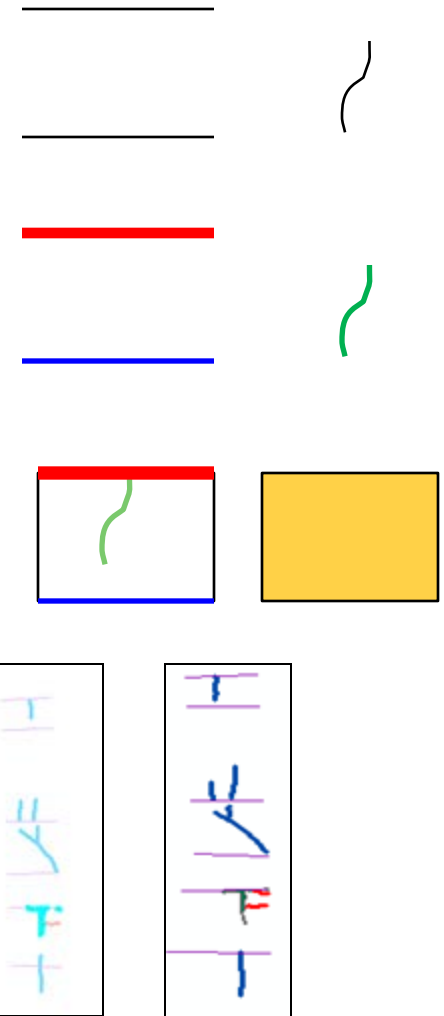
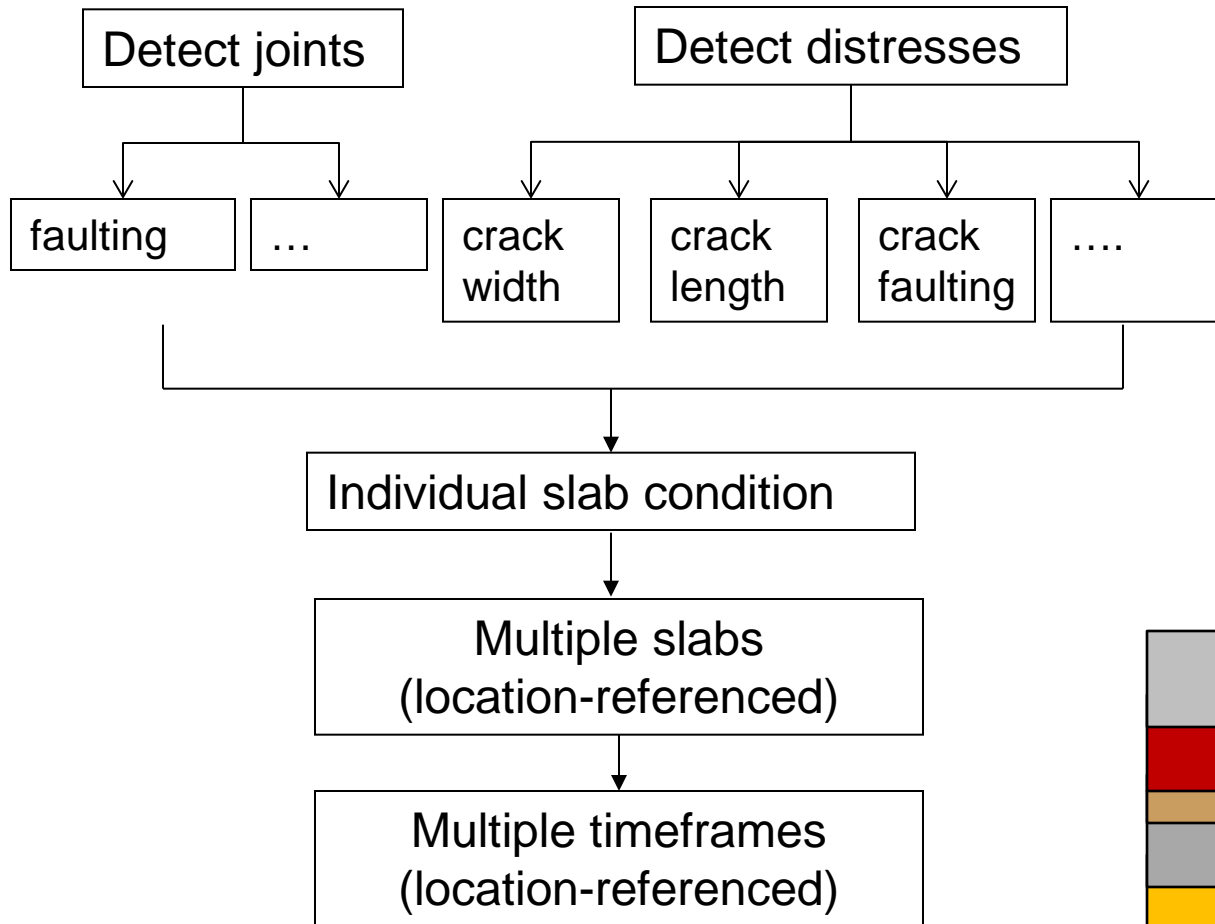
Crack Width: 14.2 mm

Angle Adjustment

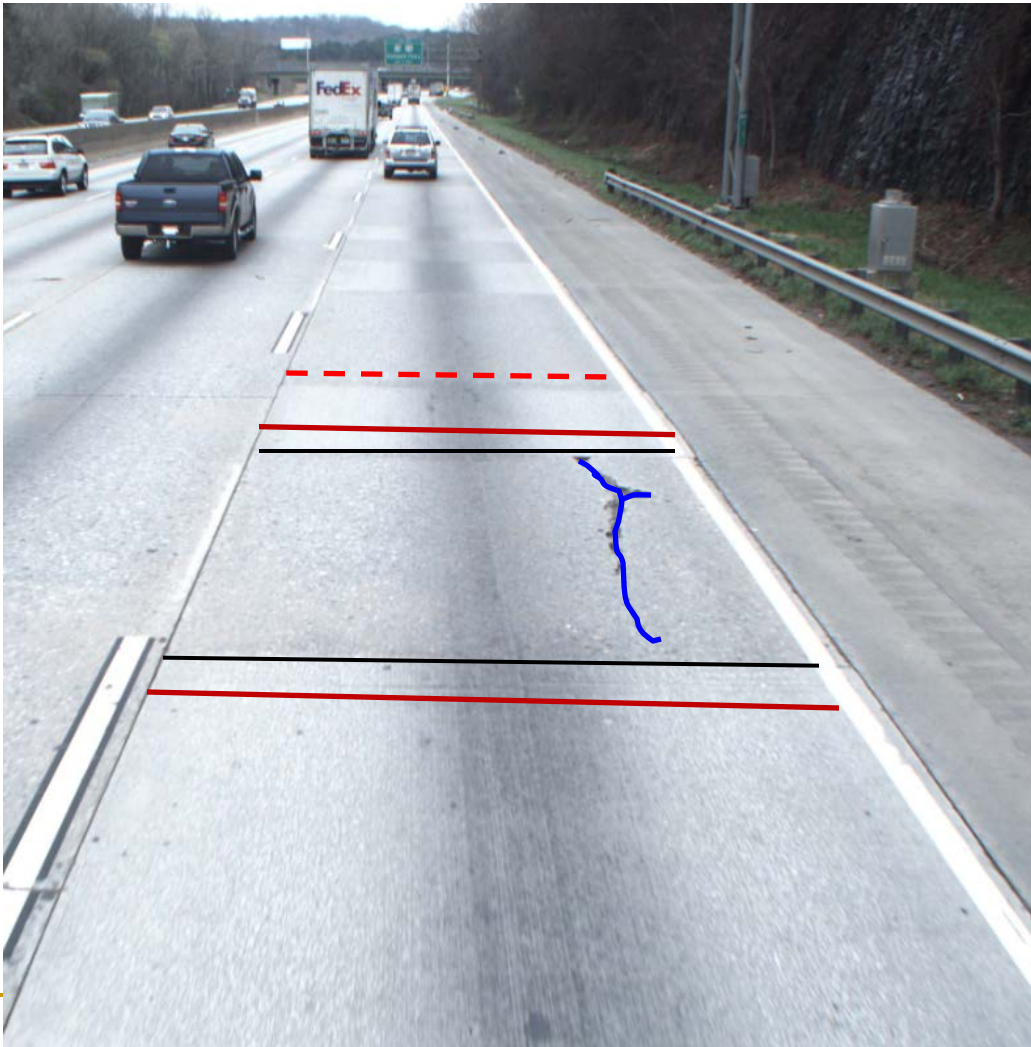
Multi-scale Crack Fundamental Element Model



Multi-scale Topological Distress Representation



Determine when, where, and what to treat at a JCPD slab level

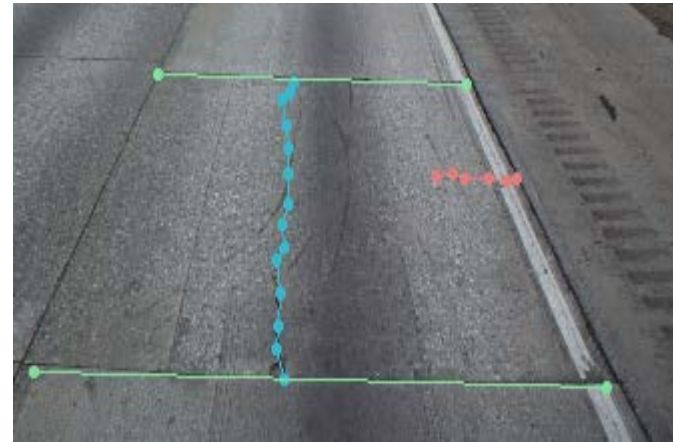


1. Detect joint
2. Detect crack
3. Determine slab treatment
4. Quantity estimate (12 ft)
(dowel bars at both sides;
add 1 ft at each side)
5. Check the length of
remaining slab to
determine if need to
extend the treatment to
adjacent slab.
6. Forecast the condition
and M&R need

Crack Growth at Detailed Level



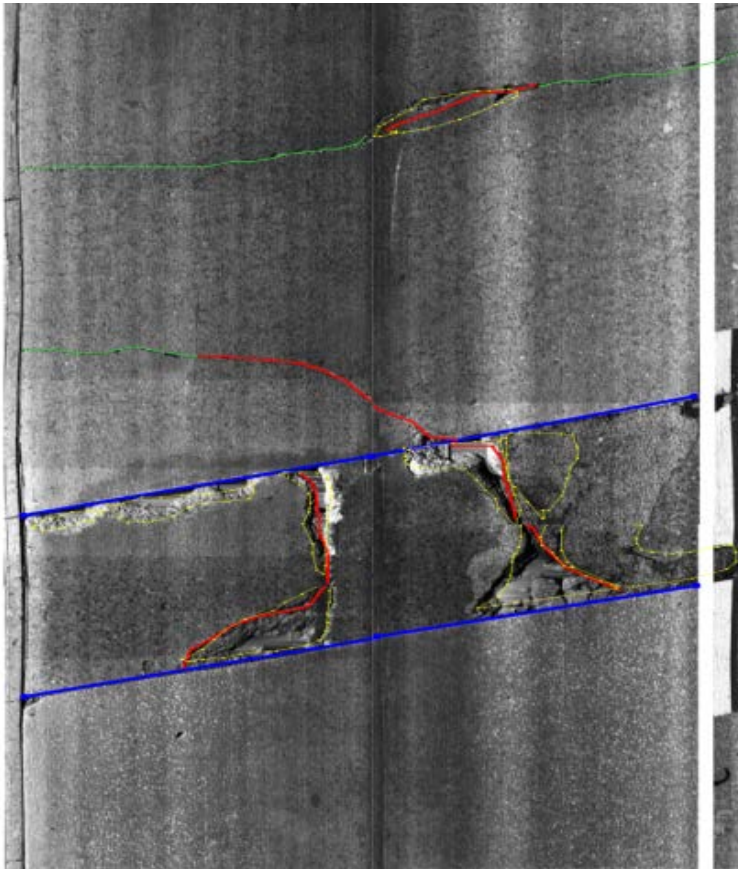
Crack Length: 3.201 m



Crack Length: 4.655 m

Pavement Condition Assessment for MP 12-13

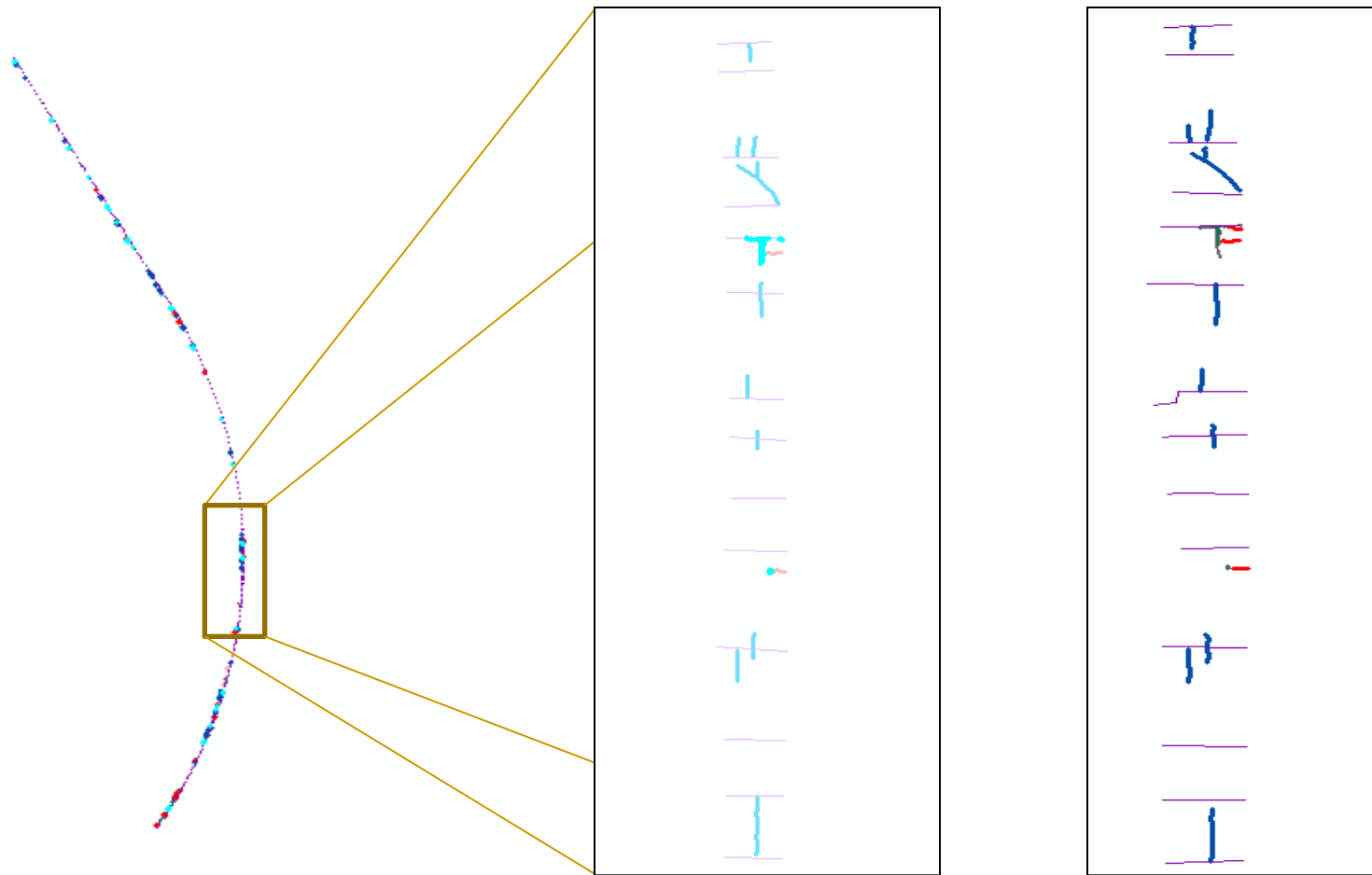
- Pavement condition at 1-mile (or project level) to support project prioritization/selection (this slide is needed or not?)



# Slabs	193
# Broken Slab Severity Level 1	19
# Broken Slab Severity Level 2	4
Distresses	
Total Number of Longitudinal Cracks	34
Total Longitudinal Crack Length (ft)	202.43
Total Number of Transverse Cracks (>6ft)	14
Total Number of Corner Cracks	1
Total Number of Spalls	35
Faulting	...
Bump	...

Crack Growth at Detailed Level

Location-referenced distress data



MP 12-13

March 18, 2014

July 16, 2014

Summary

- The case study demonstrates that **the detailed level of JPCP distresses at slab level can be quantitatively evaluated** using sensing technology to support subsequent **M&R** determination.
 - The detailed distress data can be modeled based on CFE to represent the information at various levels to support the **JPCP M&R decisions**, especially at slab level.
 - A more accurate and reliable **JPCP M&R quantity and cost estimation at slab level can be obtained**.
 - The location-referenced distress data enable the development of accurate pavement performance forecasting models and will improve our understanding of the detailed level, in-field JPCP concrete slab pavement behavior.
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Summary (cont'd)

- The framework and detailed information can support the future study of:
 - Determining annual slab level M&R, including slab replacement, crack sealing, etc.
 - Forecasting slab level JPCP condition
 - Forecasting slab level M&R need and their urgency
 - *Clustering slabs for M&R treatment for minimizing life cycle cost*
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Q/A