Multi-Variable Analysis for Pavement Assessment

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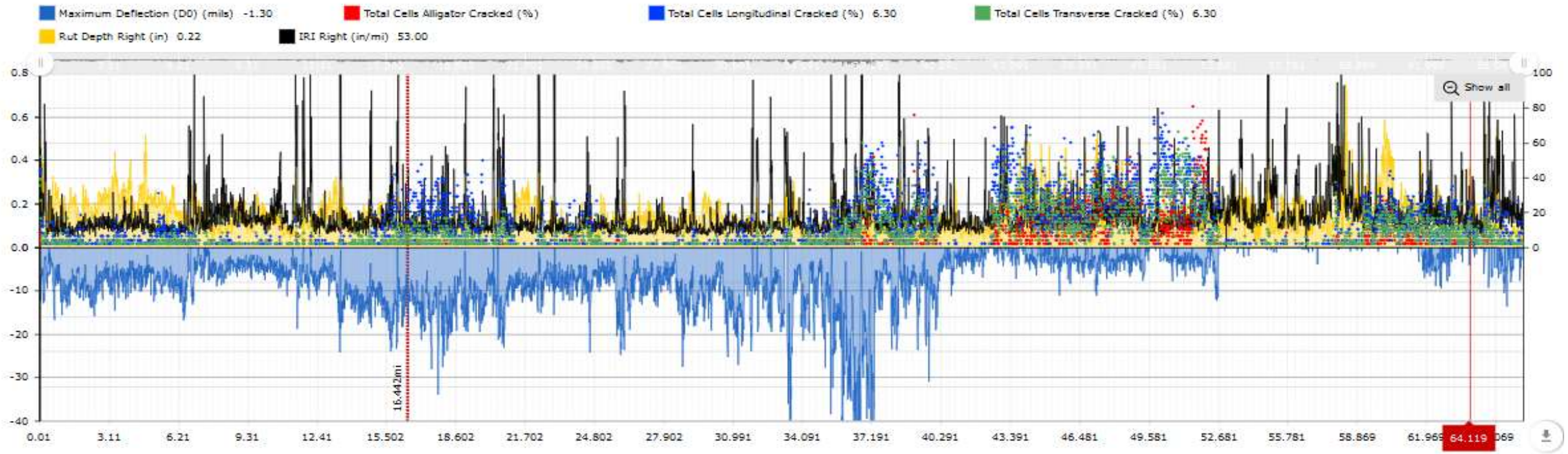
RPUG Road Profile Users' Group

Objectives

1. Review continuous pavement data
2. Examine pavement metrics and distress
3. Share case studies
4. Discuss advantages and limitations

Continuous Data

- Continuous properties being measured
- Provides detailed assessment of project



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Continuous Data Collection

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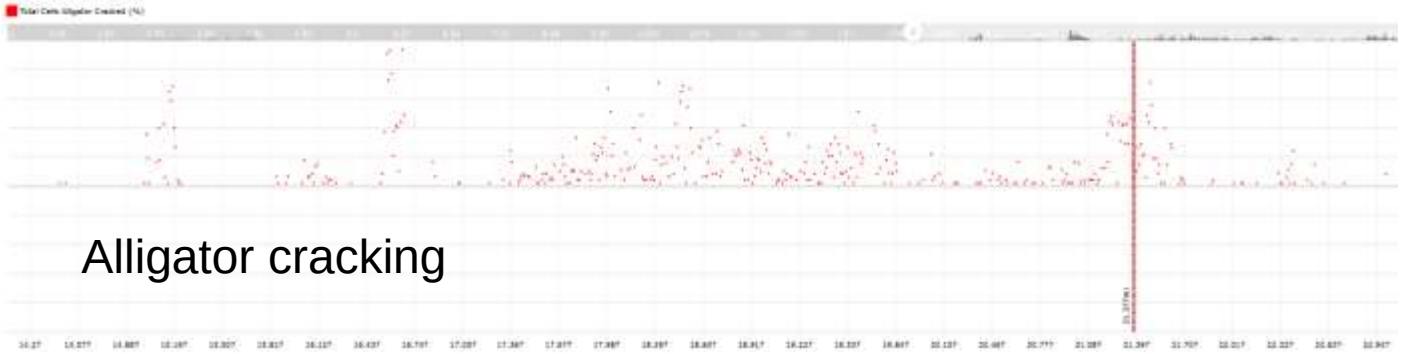
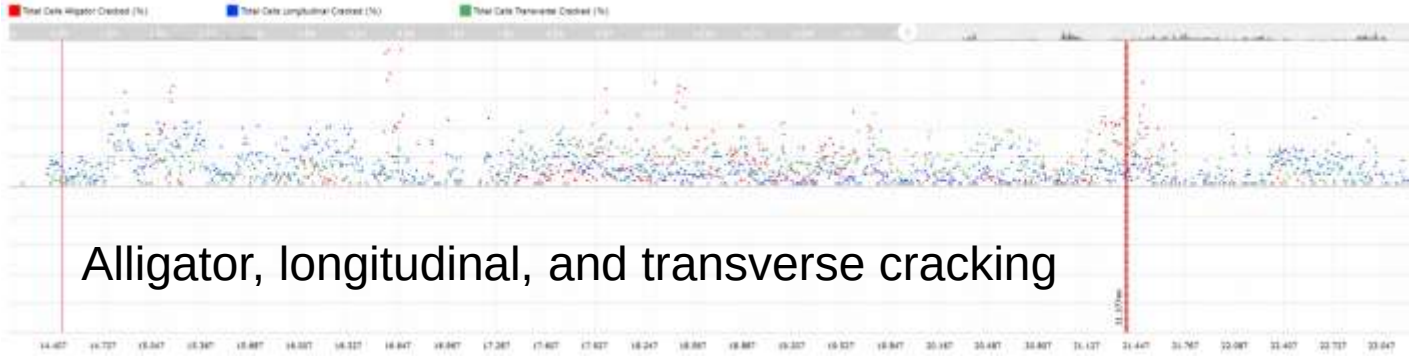
How to Use Continuous Data?

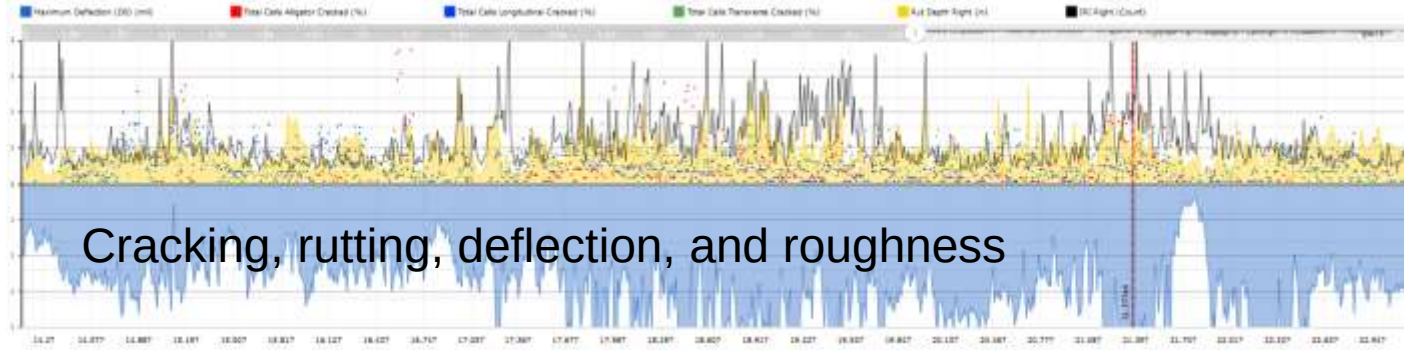
Individual data streams



Group data streams by type



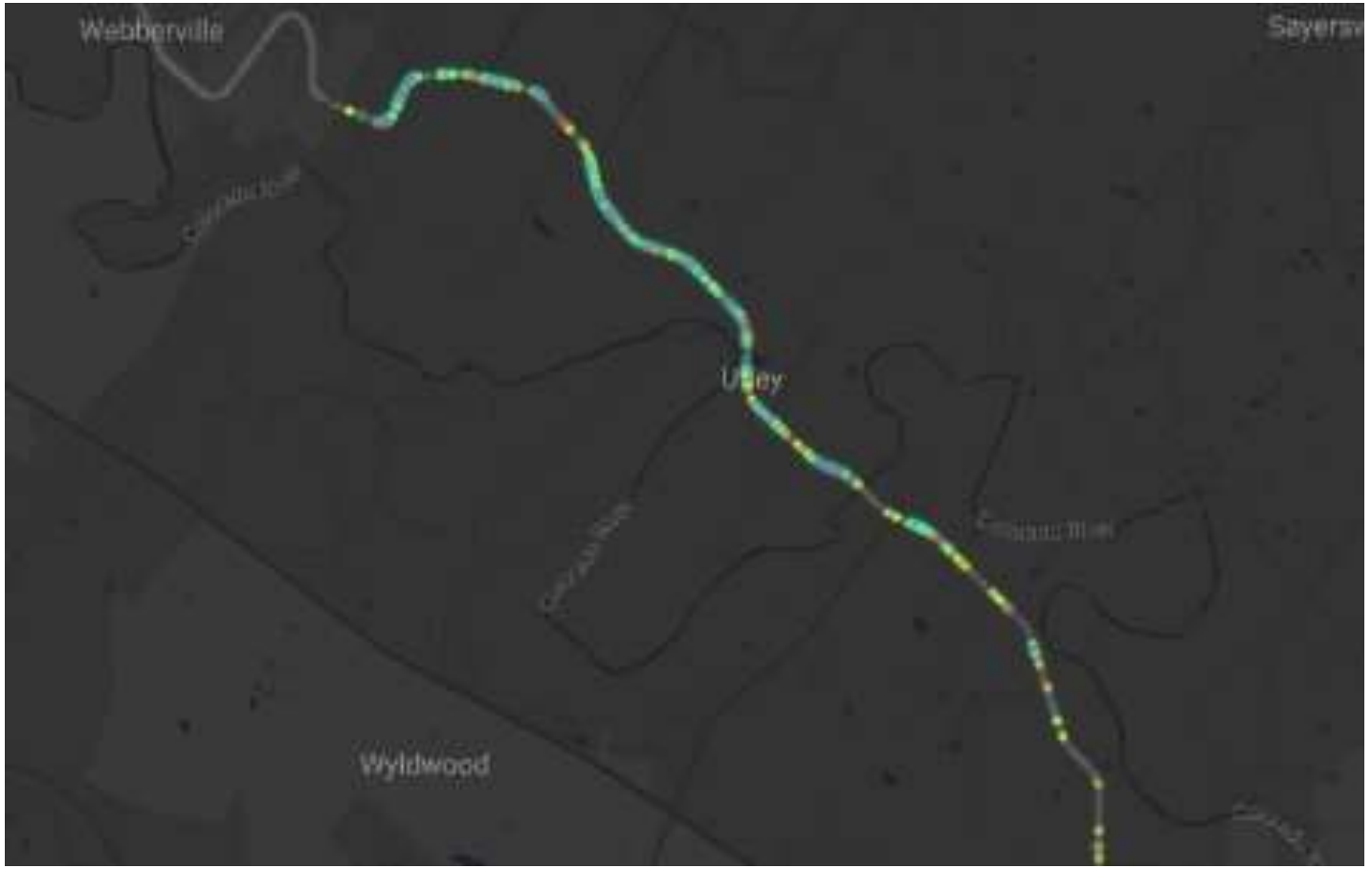
Analyze all data streams together



Single Data Stream

Cracking shows areas of surface distress, but not cause of distress

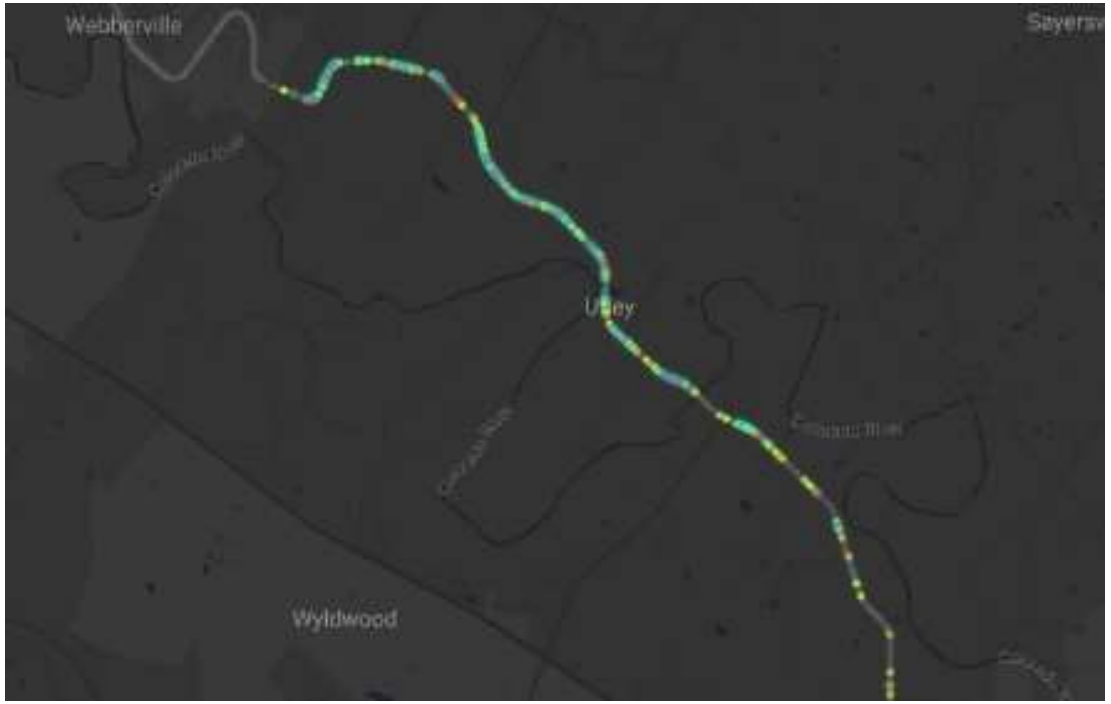
Wheelpath Cells
Cracked > 25%



Group Data by Type

- Cracking shows areas of surface distress, but not structural condition
- Deflection shows structural condition, but not extent of surface distress

Wheelpath Cells Cracked > 25%



D0 > 35 mils

Use All Data Streams

Combining cracking and deflection highlights areas of structural concern

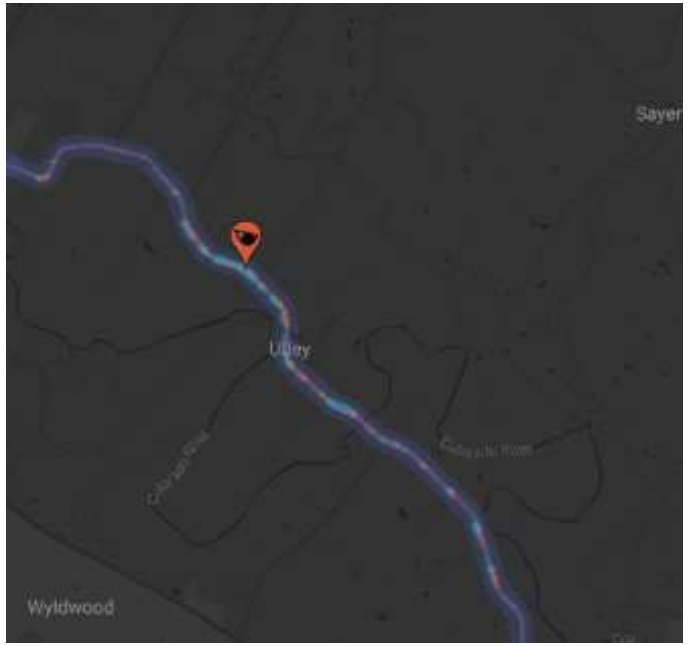
Wheelpath Cells
Cracked > 25%

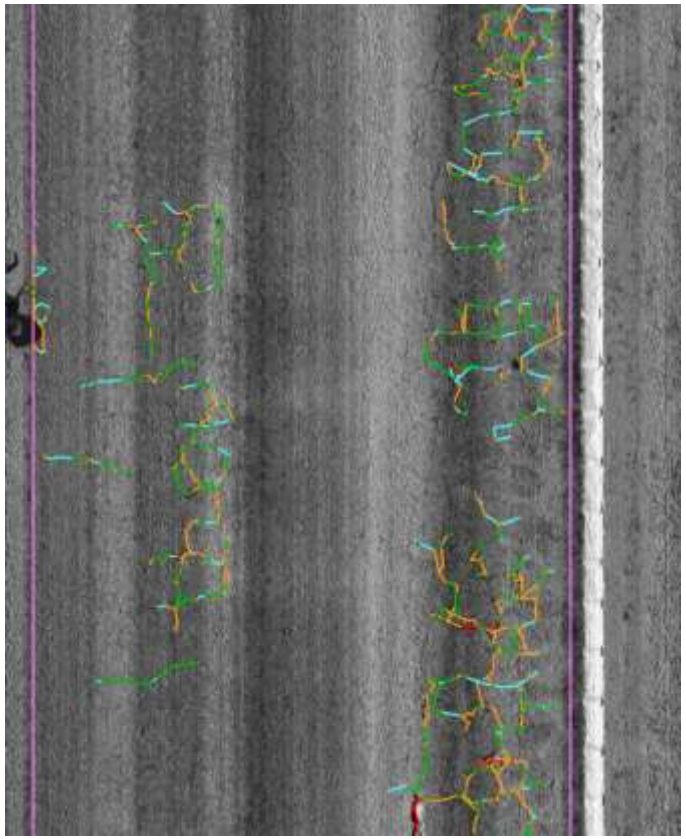
and

D0 > 35 mils

Use All Data Streams

Combining cracking and deflection highlights areas of structural concern





Multi-Variable Analysis

Strength Metrics: Deflection, deflection velocity, indices

Surface Metrics: Roughness, rutting, cracking, texture

Combination of metrics determines appropriate treatment:

Surface Metrics

Strength Metrics	Rough Surface	Smooth Surface
High Deflection	Full depth repair	Monitor / plan for repair
Low Deflection	Surface preservation	No treatment

Critical Combinations

Case 1: High Deflection / Rough Surface

Case 2: High Deflection / Smooth Surface

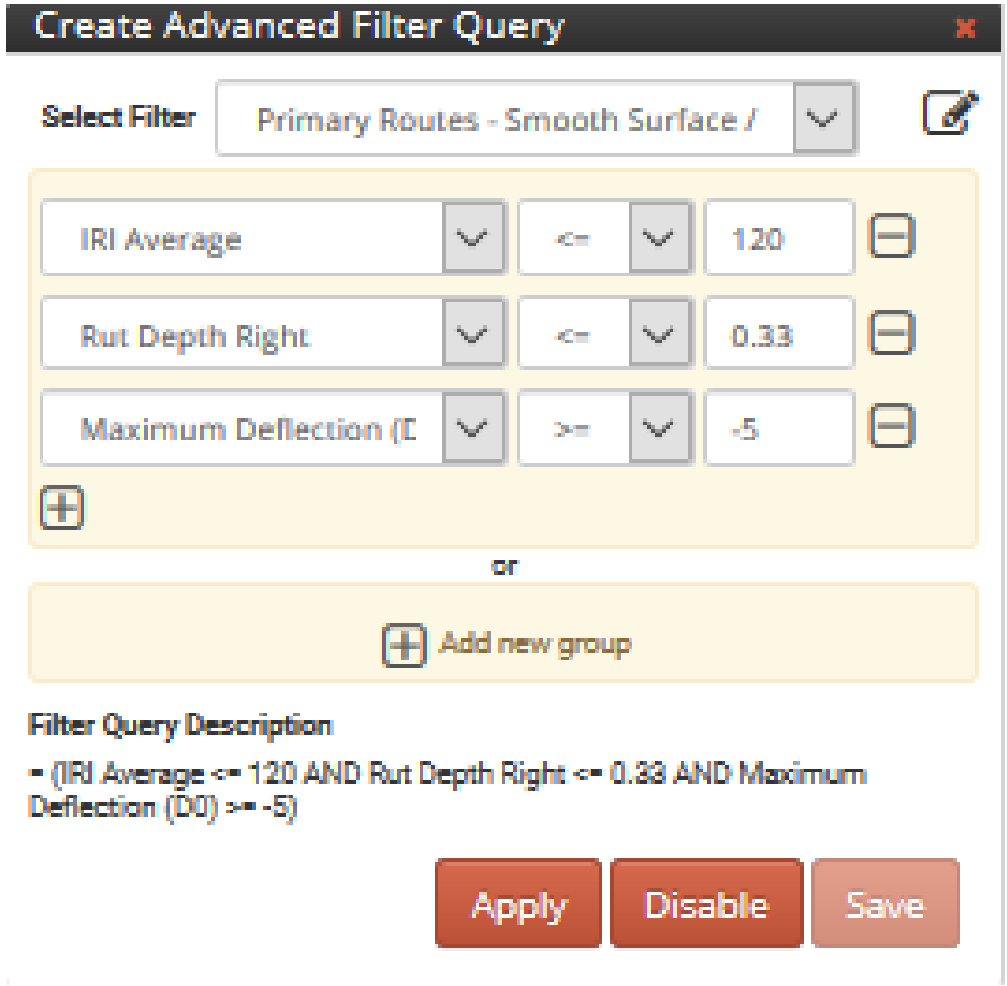
Case 3: Low Deflection / Rough Surface

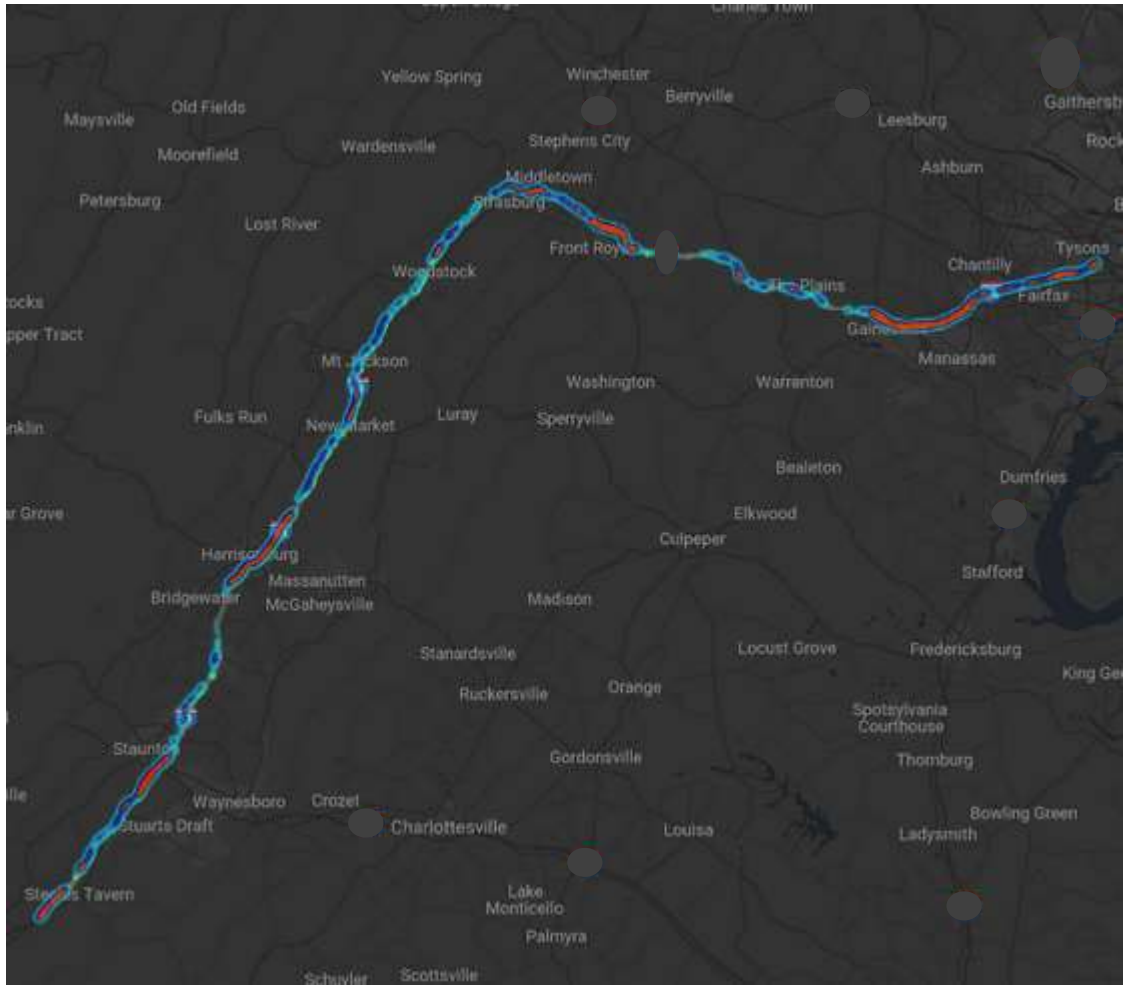
Case 4: Low Deflection / Smooth Surface

Surface Metrics

Strength Metrics	Rough Surface	Smooth Surface
High Deflection	Full depth repair	Monitor / plan for repair
Low Deflection	Surface preservation	No treatment

Filtering Continuous Data





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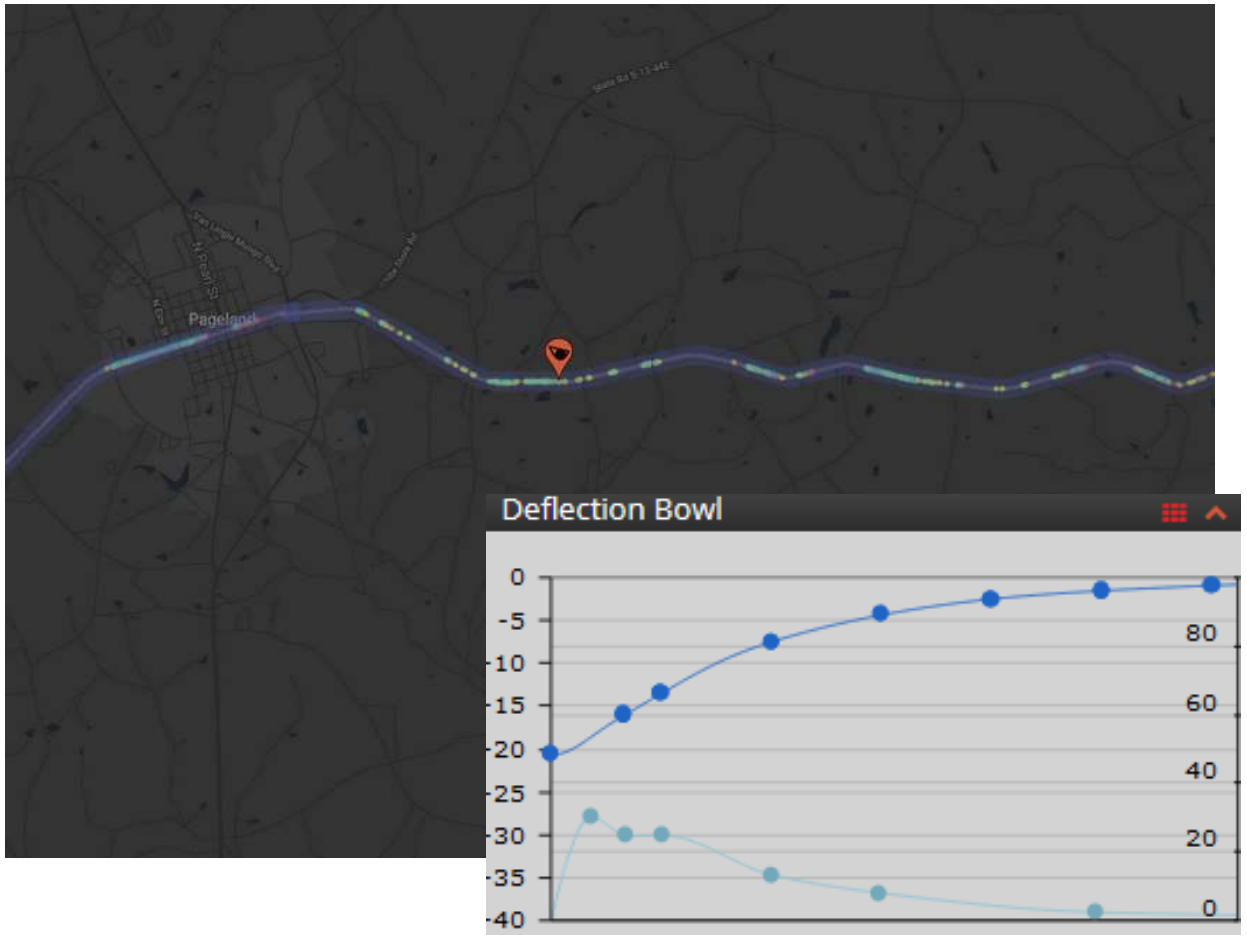
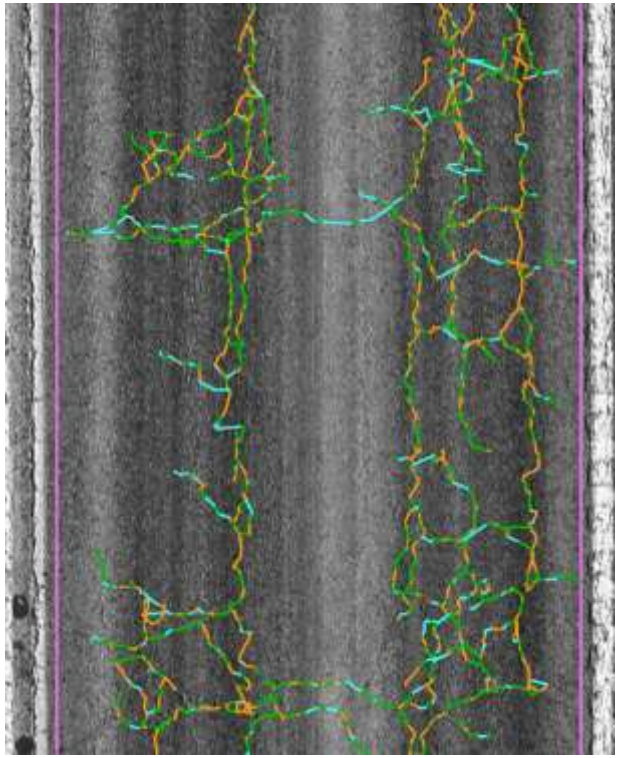
High Defl., Rough Surface (Case 1)

Deflection and alligator cracking identify fatigue damage



- D0 > 15 mil
- Cells Alligator Cracked > 25%



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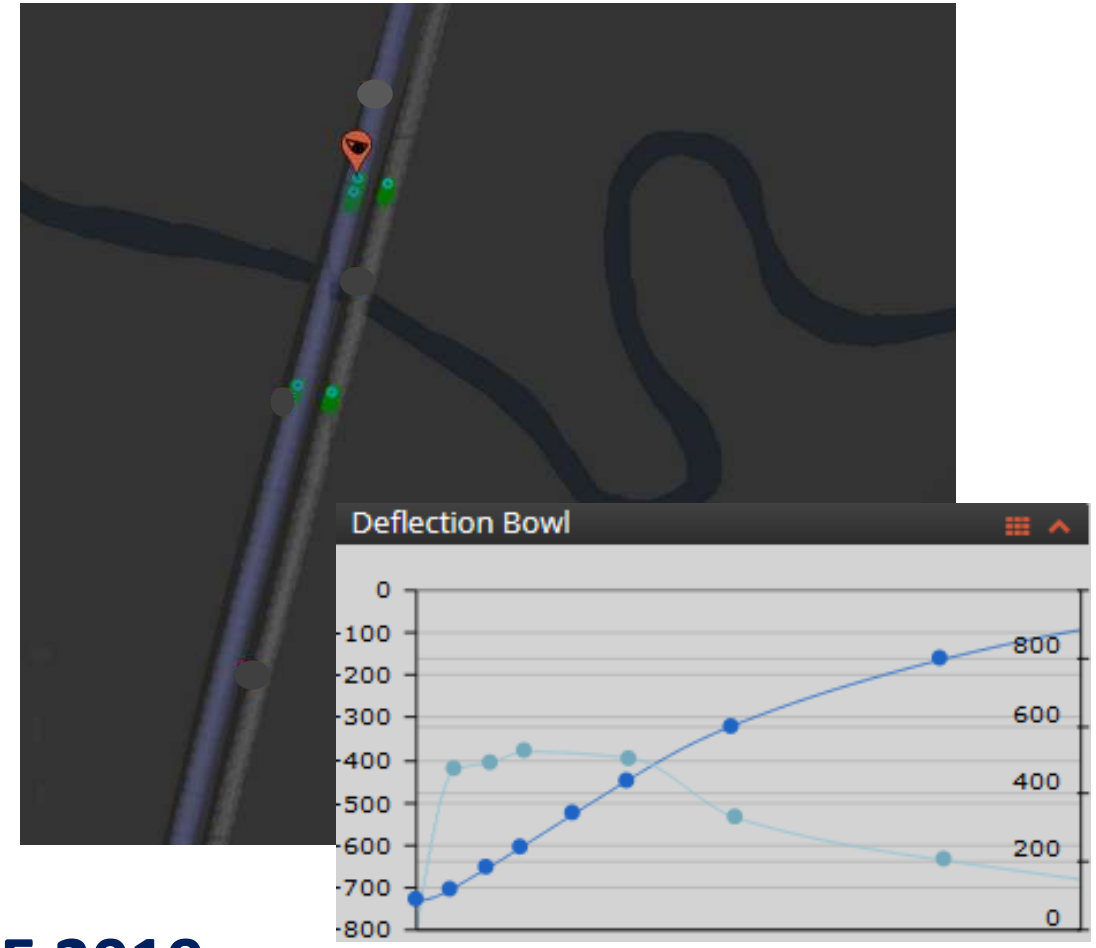
High Defl., Rough Surface (Case 1)

Deflection and roughness identify problematic approach slabs



- D0 > 12 mil (300 um)
- IRI Avg. > 250 in/mi

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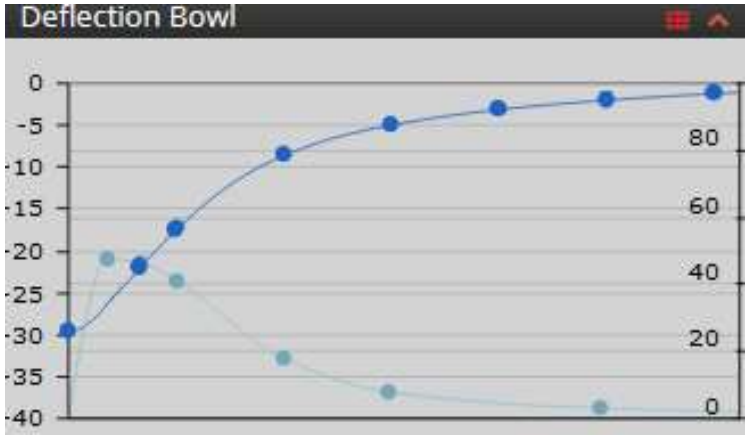
High Defl., Smooth surface (Case 2)

Deflection indicates weak structure despite smooth surface

- D0 > 15 mil
- Total Cells Cracked < 25%
- Rut Avg. < 0.3 in
- IRI Avg. < 150 in/mi



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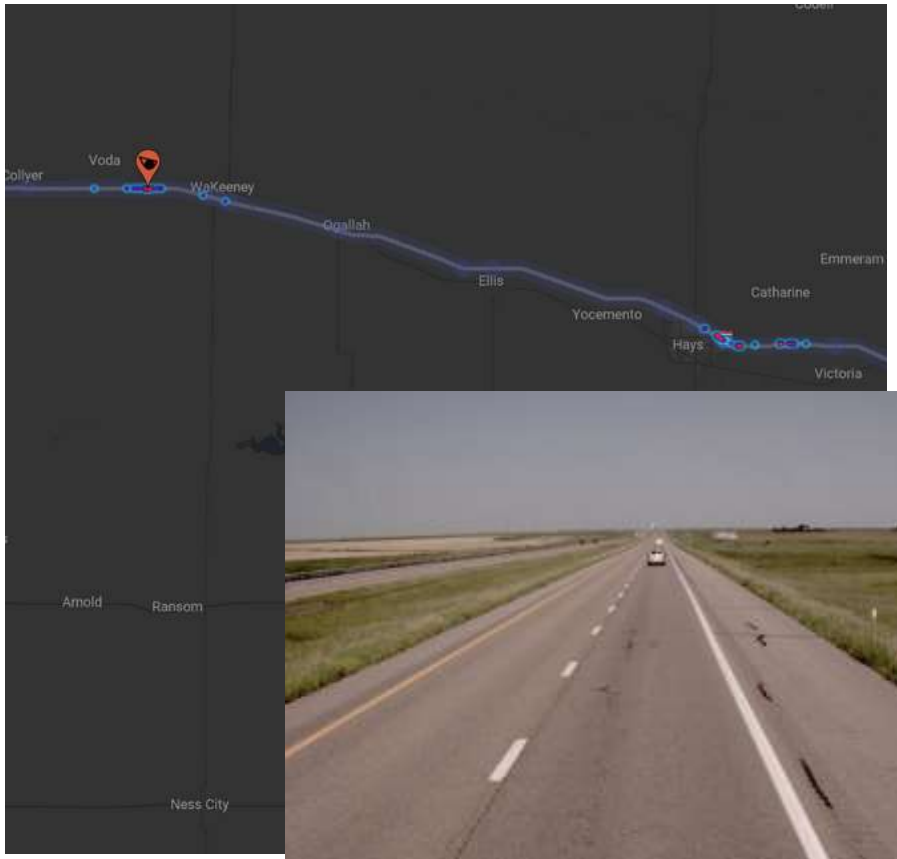
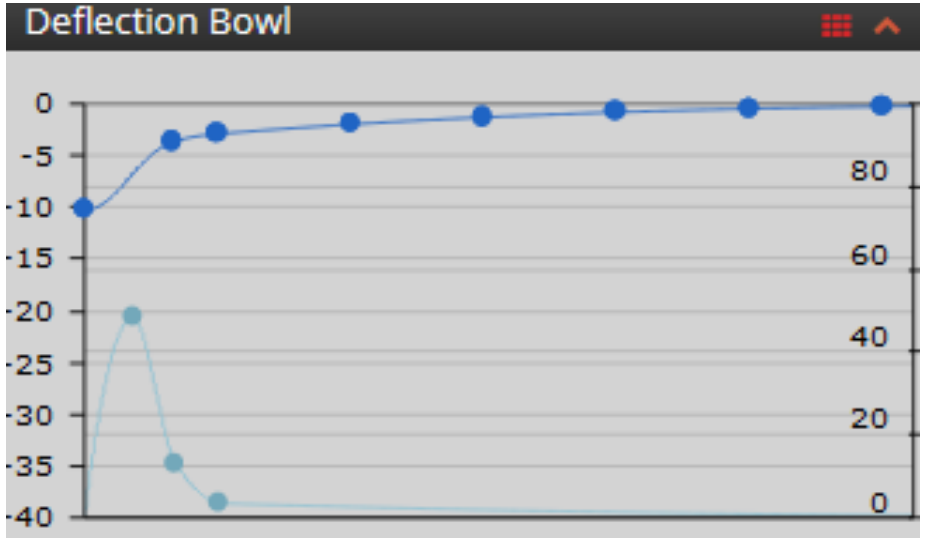
High Defl., Smooth Surface (Case 2)

SCI 8 indicates weak intermediate layers despite smooth surface



- SCI 8 (|D8-D0|) > 5 mil
- Total Cells Cracked < 25%
- IRI Avg. < 150 in/mi



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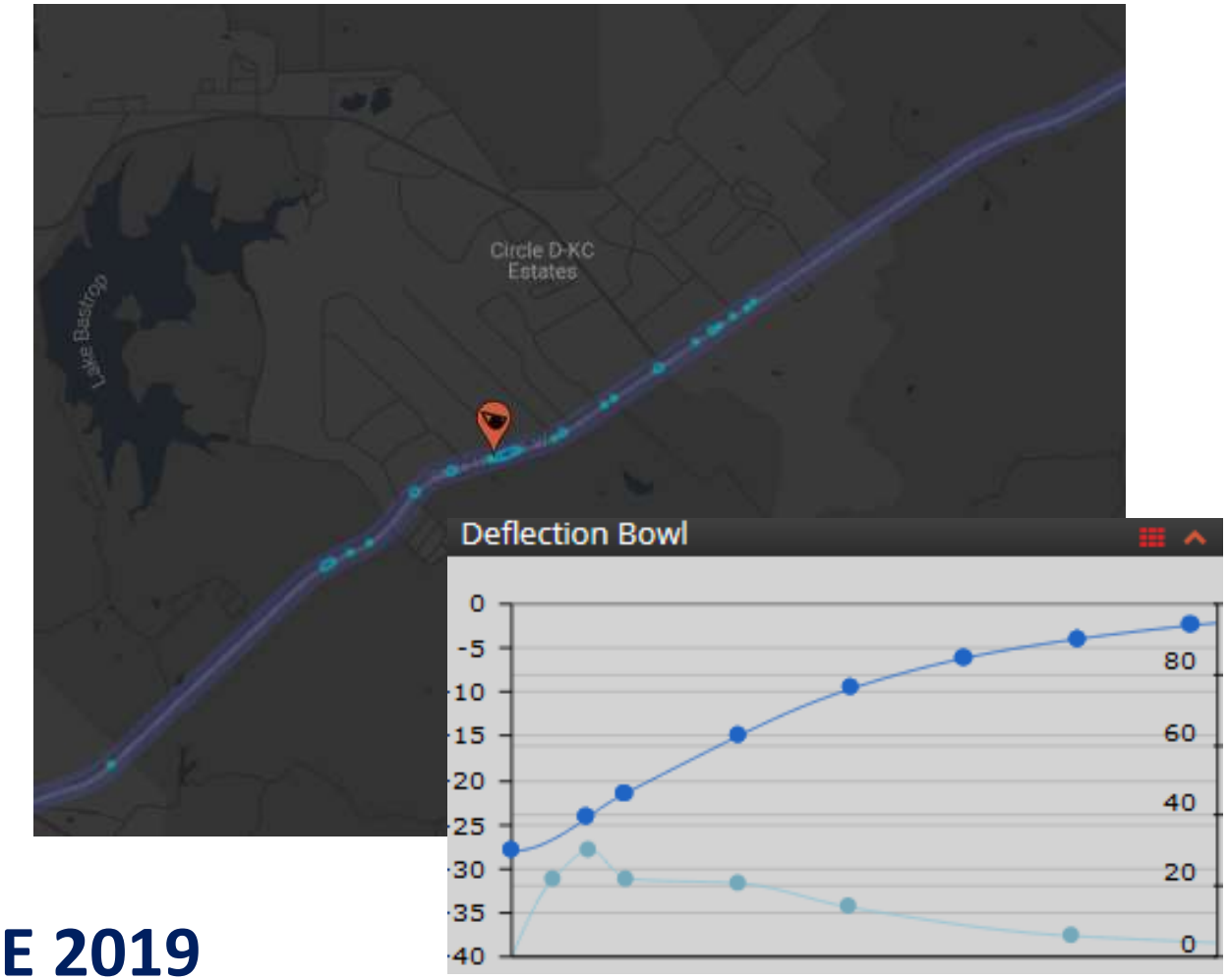
High Defl., Smooth Surface (Case 2)

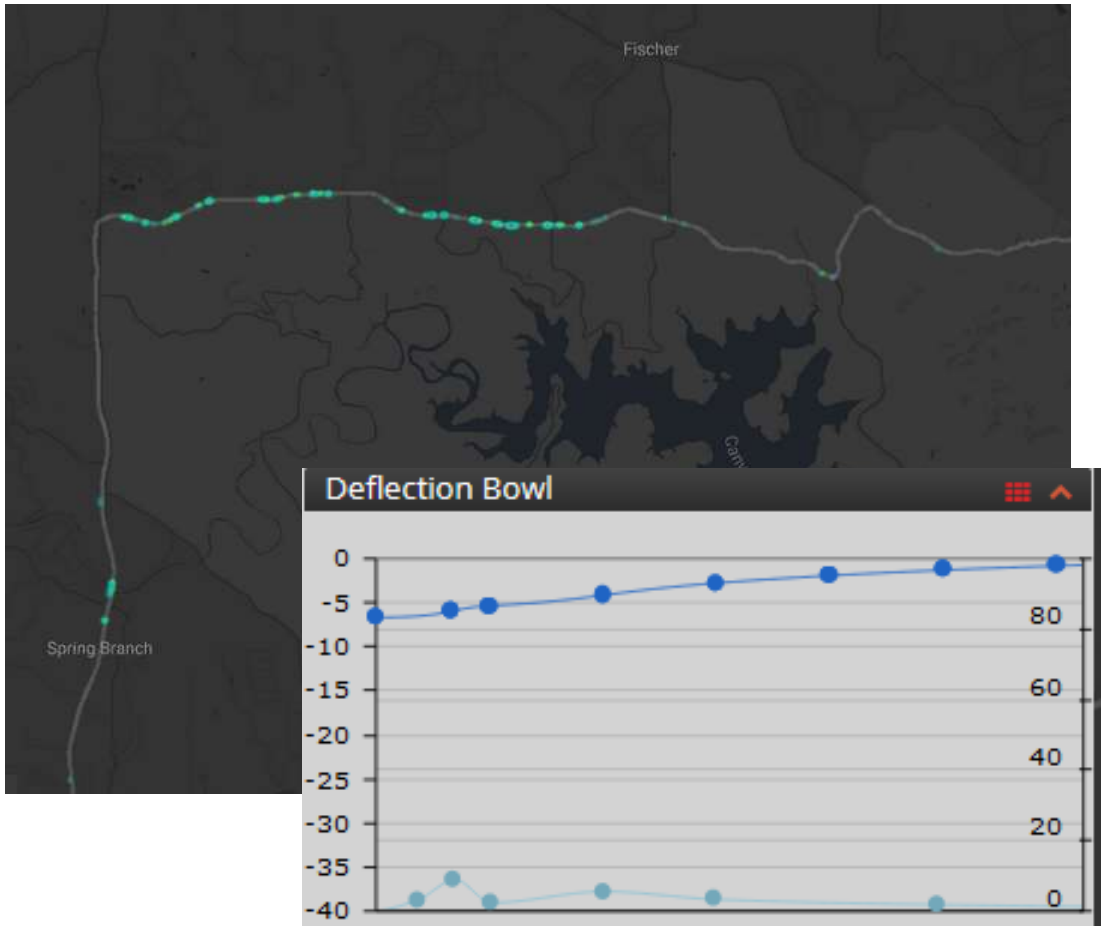
SCI Subgrade indicates weak subgrade under smooth surface



- SCI Subgrade (|D60-D36|) > 5 mil
- Total Cells Cracked < 10%

Low Defl., Rough Surface (Case 3)

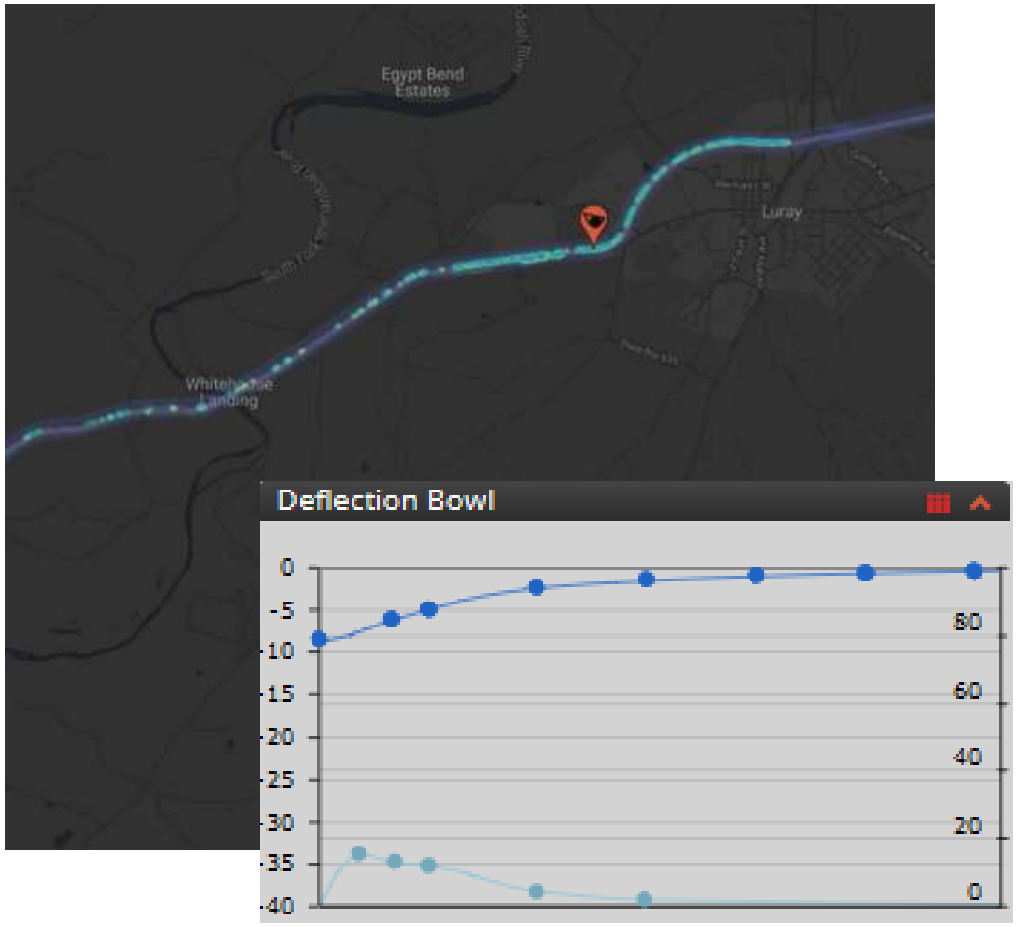
Low deflection suggests rough section is structurally adequate



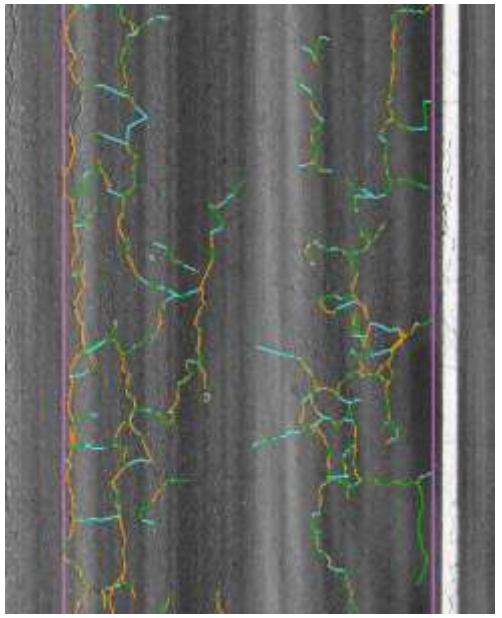
- IRI Avg. > 200 in/mi
- D0 < 10 mil

Low Defl., Rough Surface (Case 3)

Low deflection confirms cracked area is structurally adequate



- Wheelpath Cells Cracked > 50%
- D0 < 10 mil



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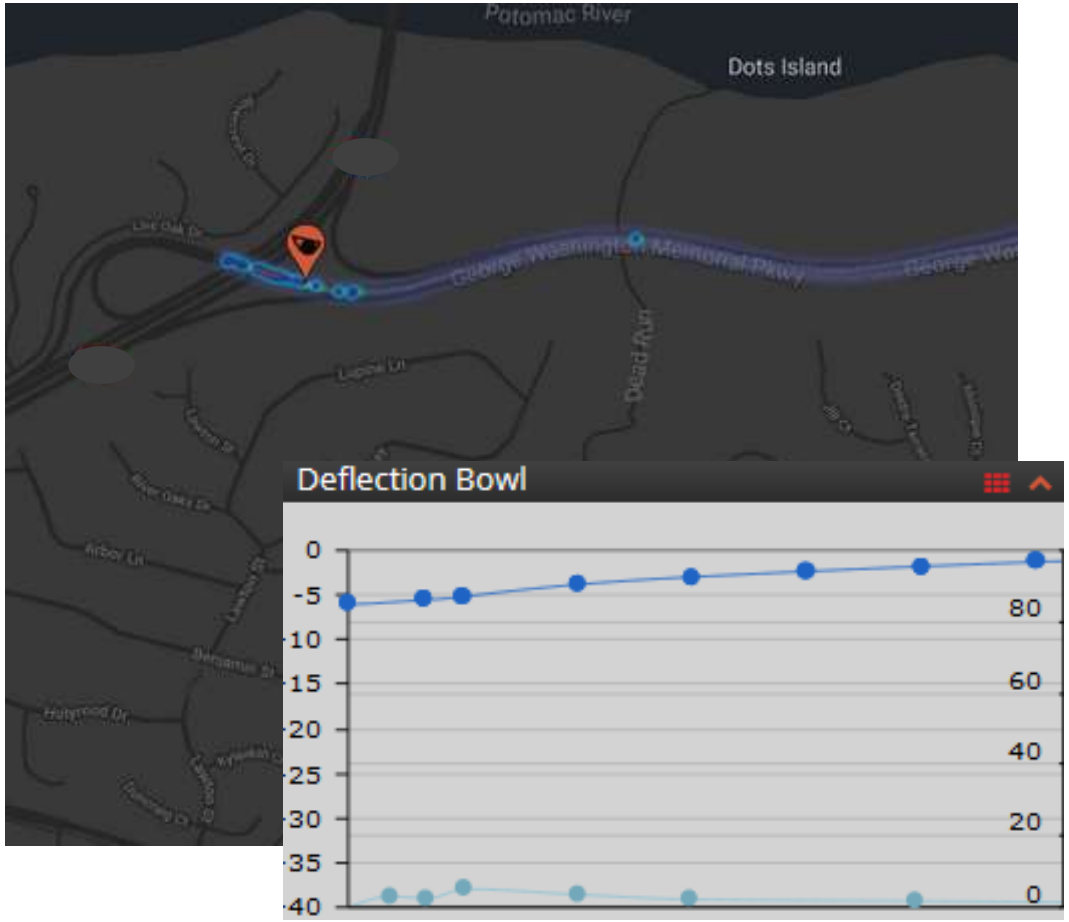
Low Defl., Rough Surface (Case 3)

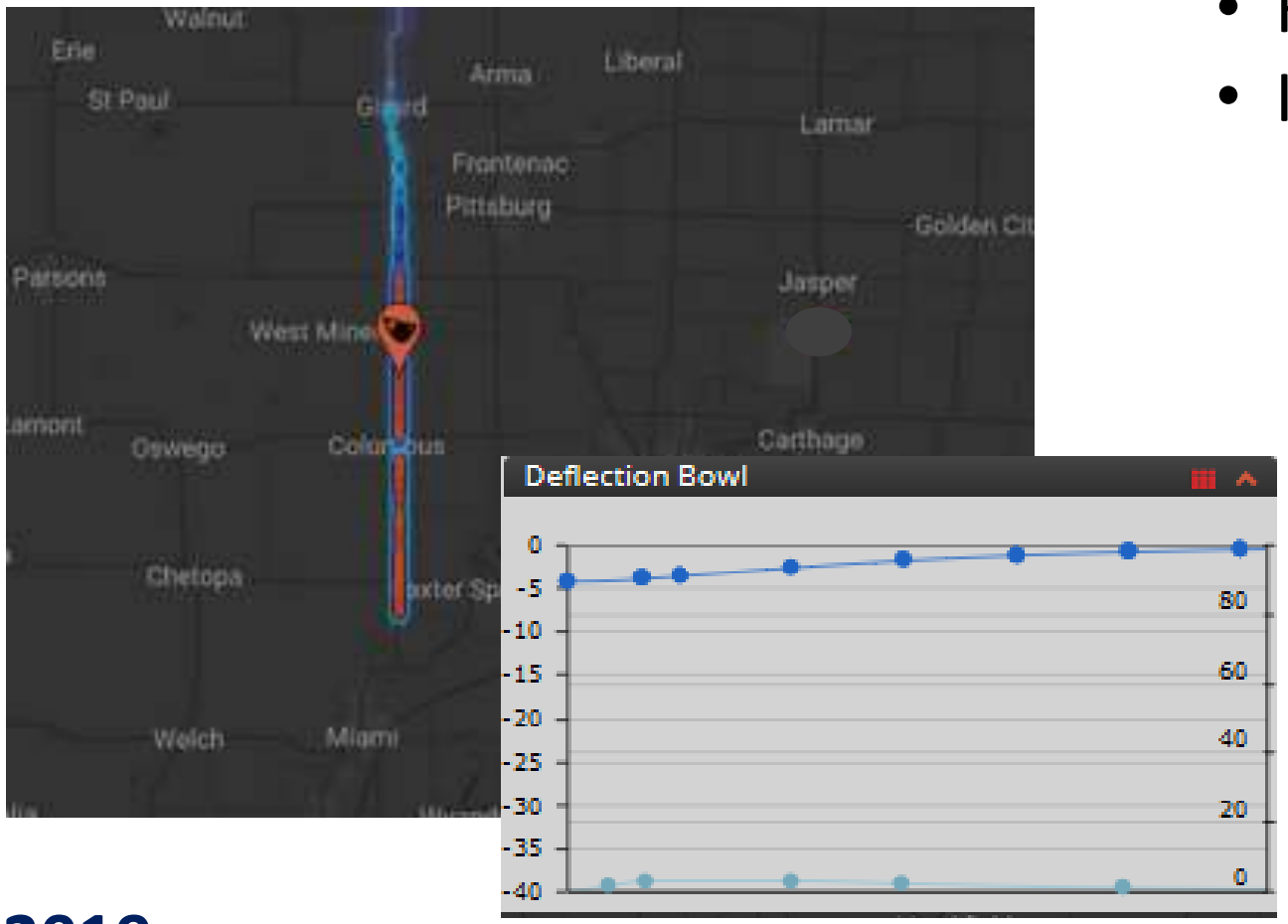
Low deflection confirms patched, rough area is structurally adequate



- IRI Avg. > 300 in/mi
- D0 < 10 mil

Low Defl., Smooth Surface (Case 4)

All is good!

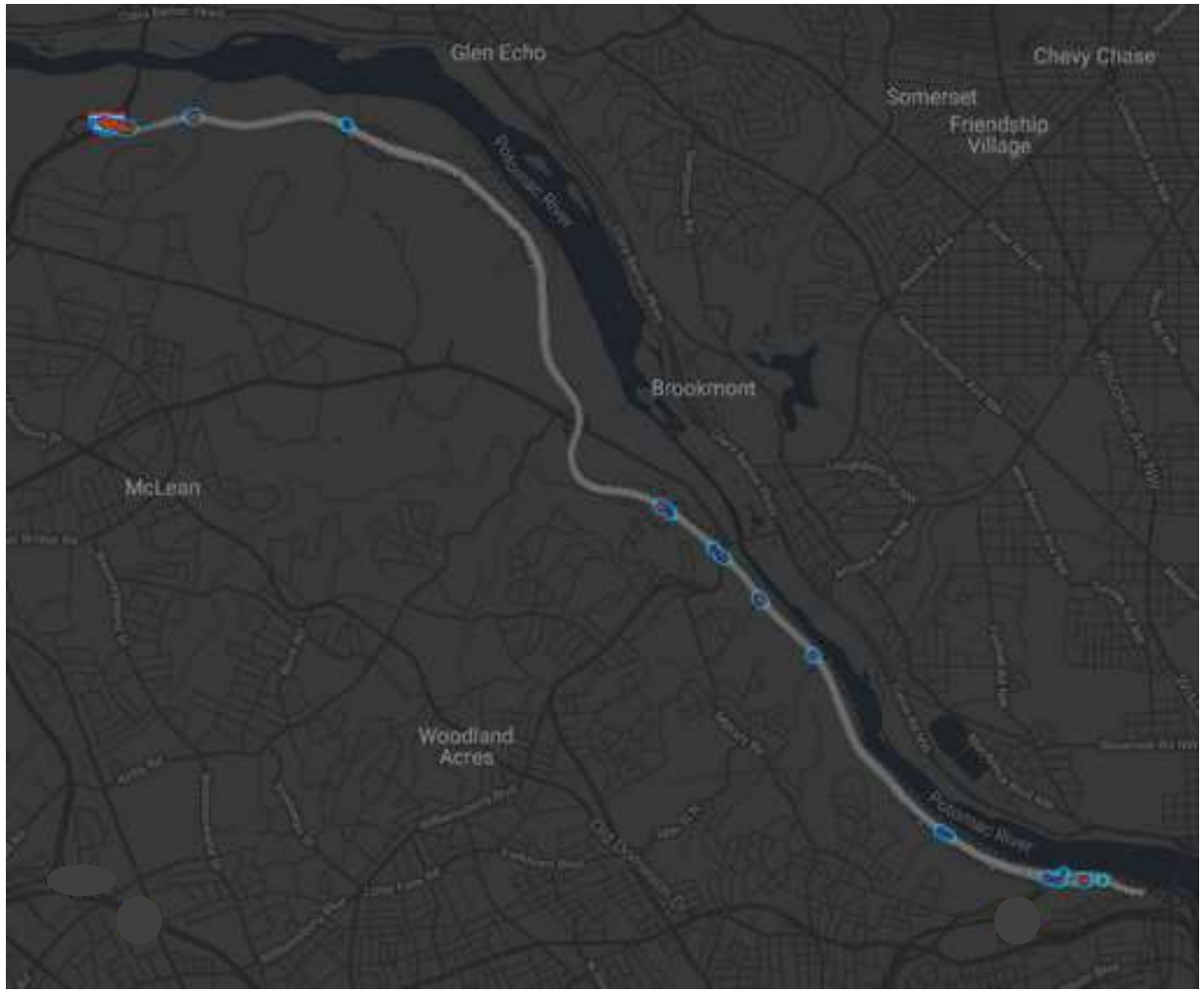


- D0 < 5 mil
- Rut Right < 0.33 in
- IRI Avg. < 120 in/mi

Advantages

- Identify distress mechanism
- Improved treatment selection
- Multi-scale application

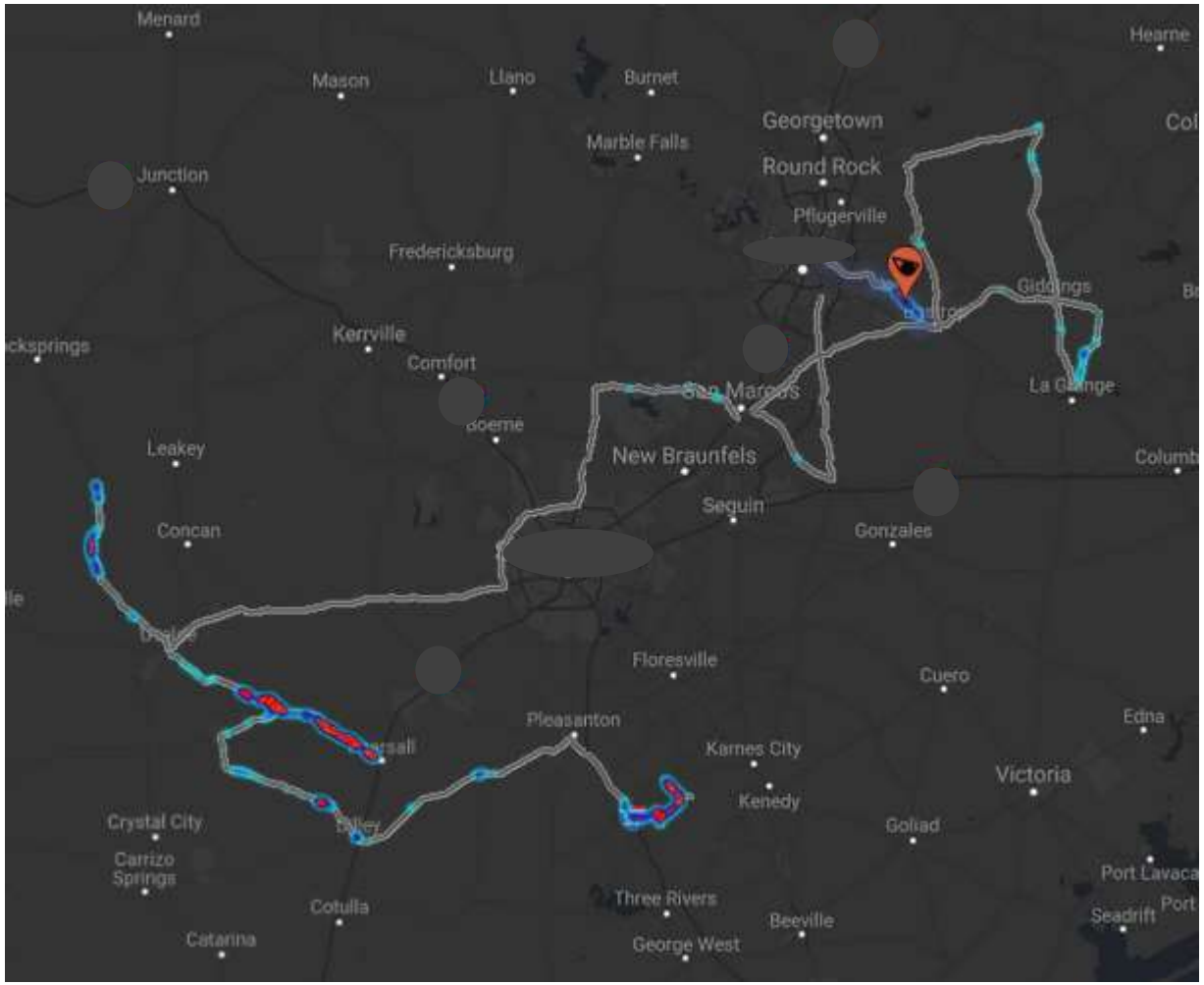
IRI Avg. > 200 in/mi, D0 < 10 mil



Limitations

- Critical distress combinations vary
- Unknown variables
- Use in pavement management
- Large amount of data (~1.5 GB/mile)

Wheelpath Cells Cracked > 25%, D0 > 35 mils



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Questions

- What other combinations of metrics should be used?
- How should critical combinations be defined for different pavement types/classes?
- How can continuous data be used in existing pavement management systems?

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