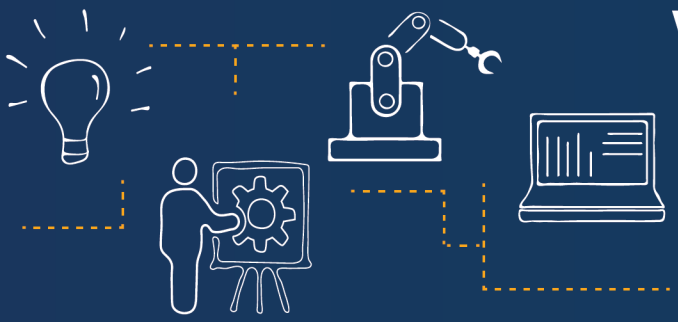
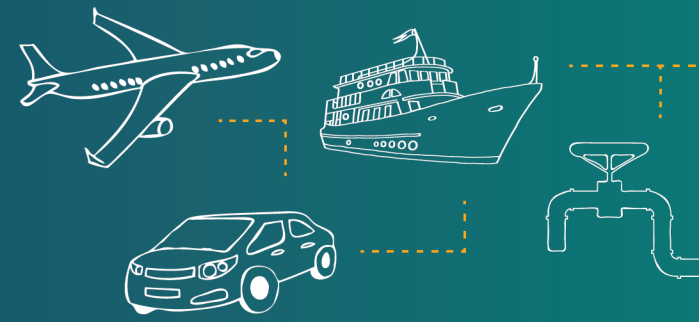


WE FORM THE FUTURE



COMBINED STRENGTH. UNSURPASSED INNOVATION

CAMX
THE COMPOSITES AND ADVANCED MATERIALS EXPO

SEPTEMBER 23-26
ANAHEIM, CA, USA
2019

NON-DESTRUCTIVE PRODUCTION LINE STRUCTURAL EVALUATION

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CAMX
THE COMPOSITES AND ADVANCED MATERIALS EXPO
Anaheim Convention Center | Anaheim, CA, USA

The Product

- Glass-reinforced thermoplastic rail ties
  - Recycled polymer
  - Glass fiber reinforcement
  - Closed mold production
- Intended as full replacement for wood crossties

Wood Crossties

- Most railway crossties
- Treated with preservatives
- Tree trunk >330mm (13”) dia.

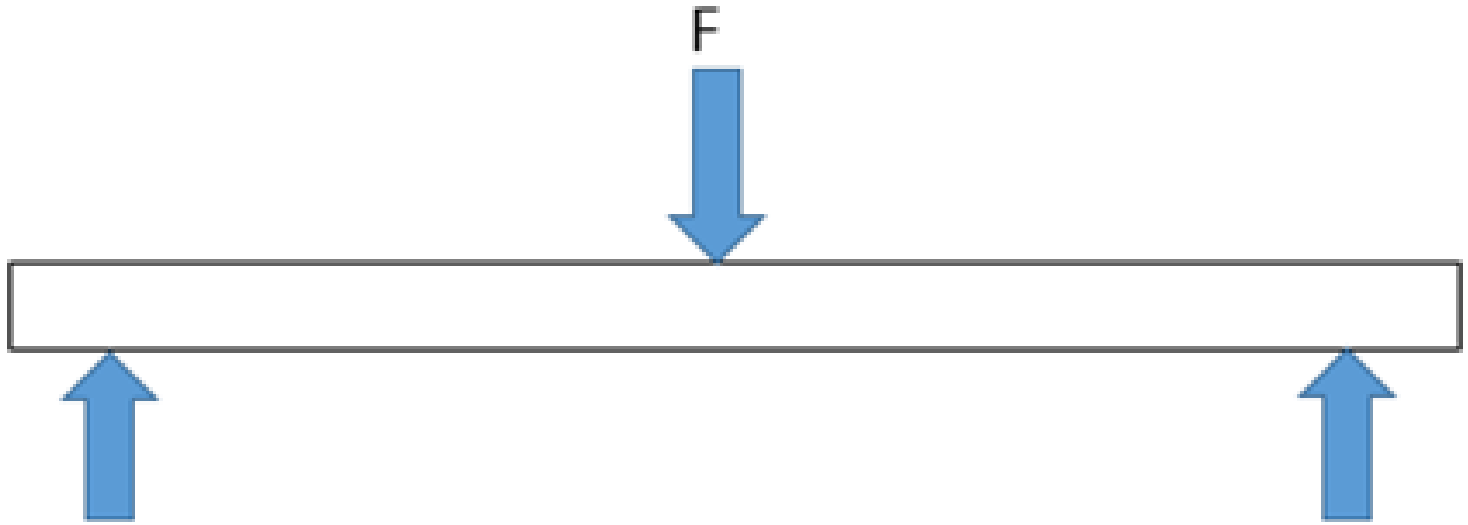
Performance Requirements

- Dimensions
- Dimensional stability
- Modulus of Elasticity
- Modulus of Rupture

Destructive

Modulus

- 3-point Bend Test

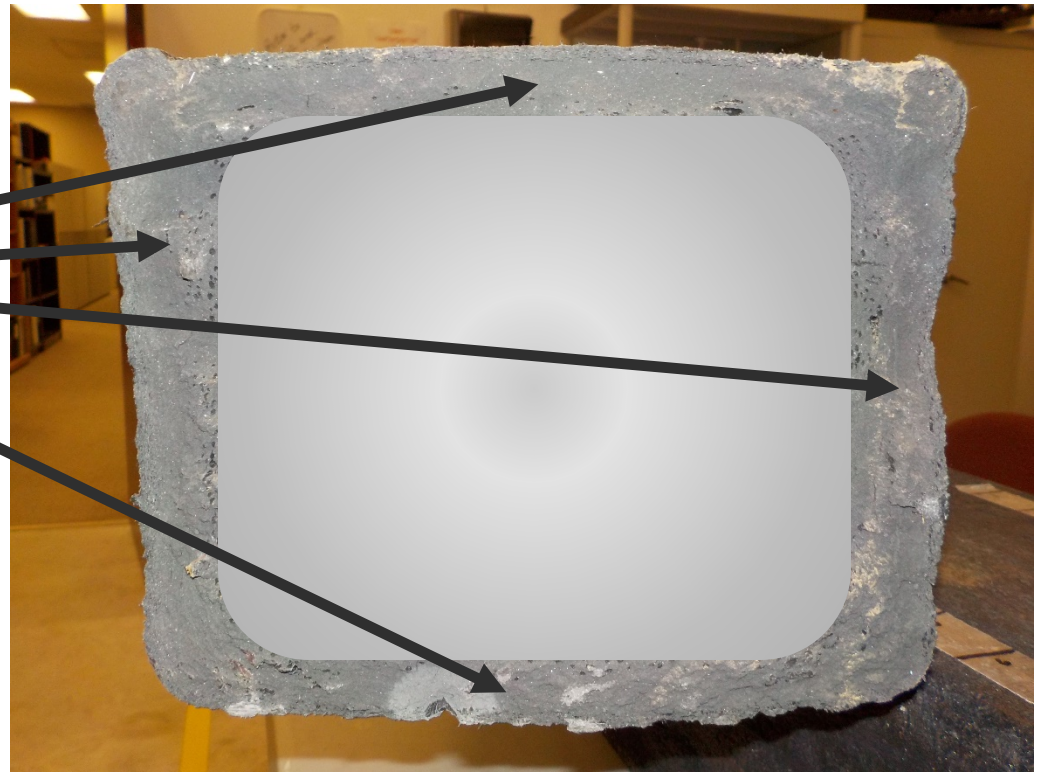


Proxies for Performance

- Wood ties:
  - Dry rot,
  - End splits,
  - Poor creosote retention.
- Polymer Composite ties:
  - Weight (density),
  - Feedstock records for glass and polymer,
  - Process control documentation.

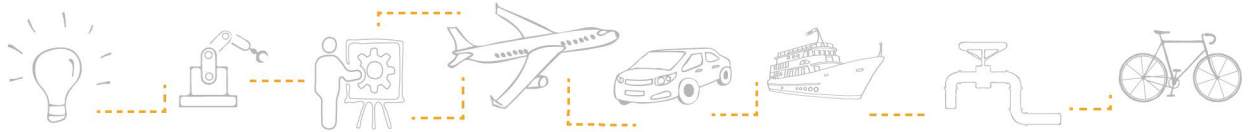
Tie Construction

- Think of it like a box-beam
- Higher strength material in outer ligaments



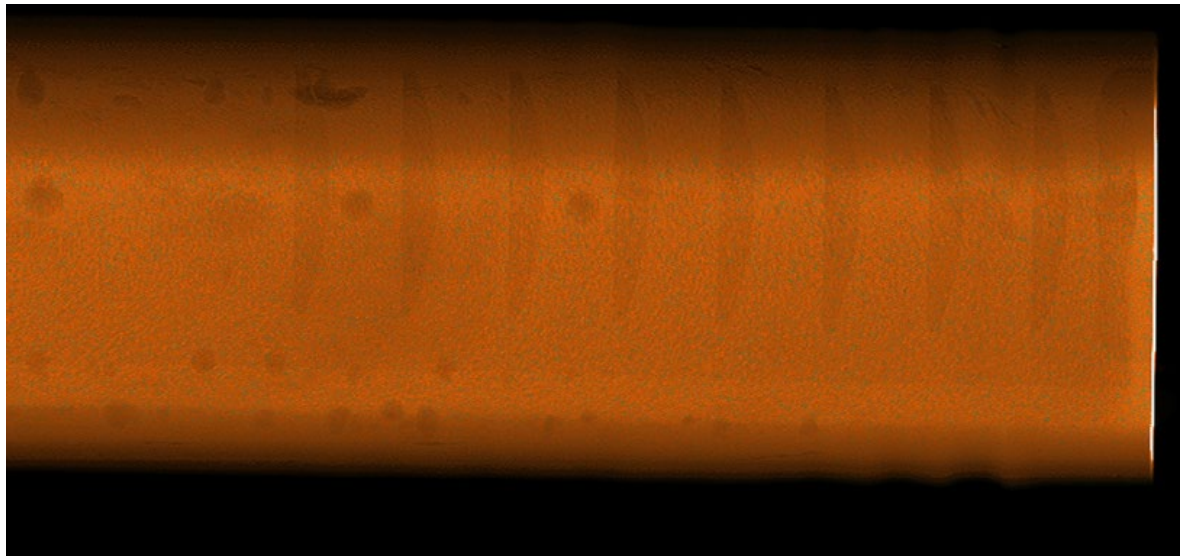
Additional requirement

- Find 12mm (1/2”) void or defect in the tie



Early shop test

- X-ray



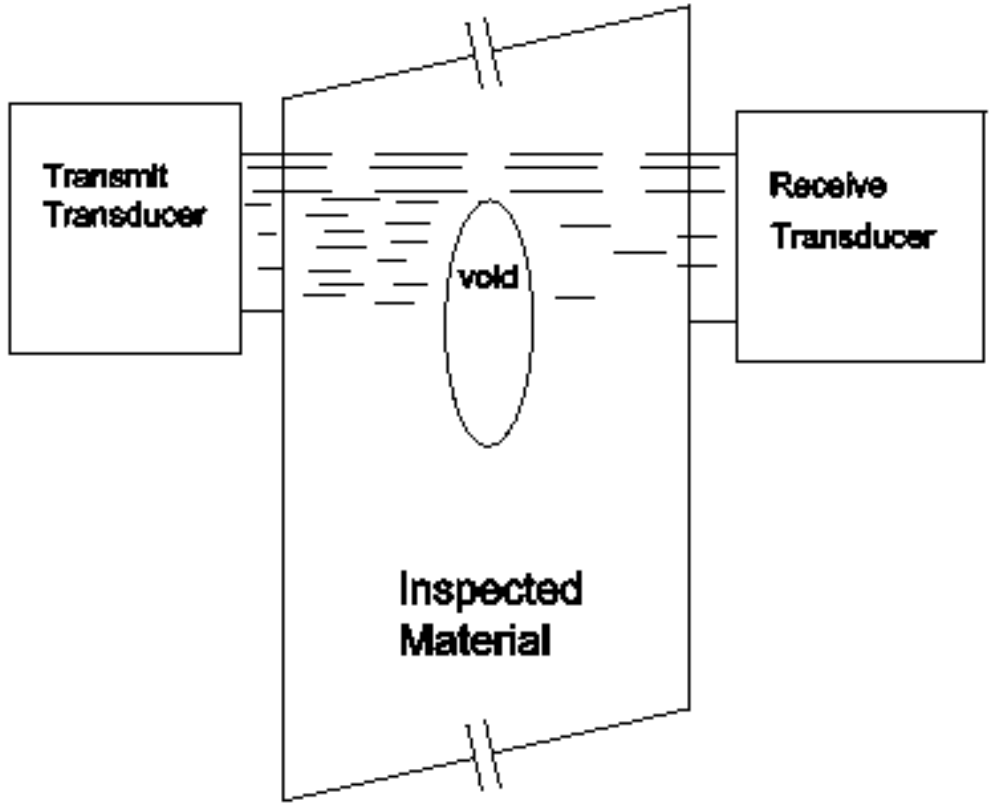
Location uncertain

Material variation

Porosity?

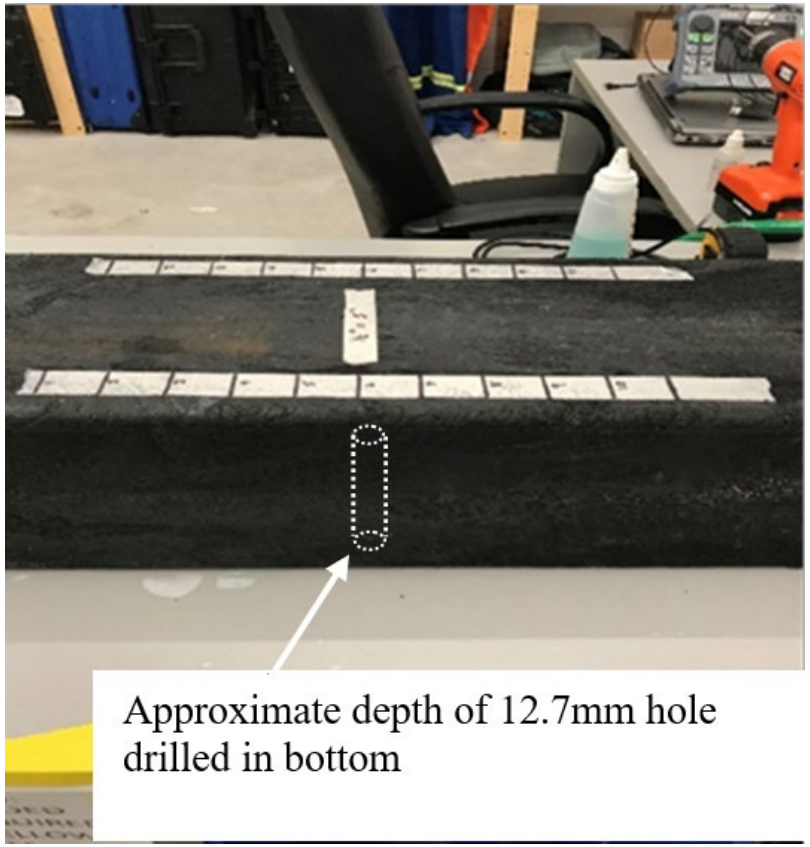
Early testing

- Ultrasound
- Voids and porosity can be detected



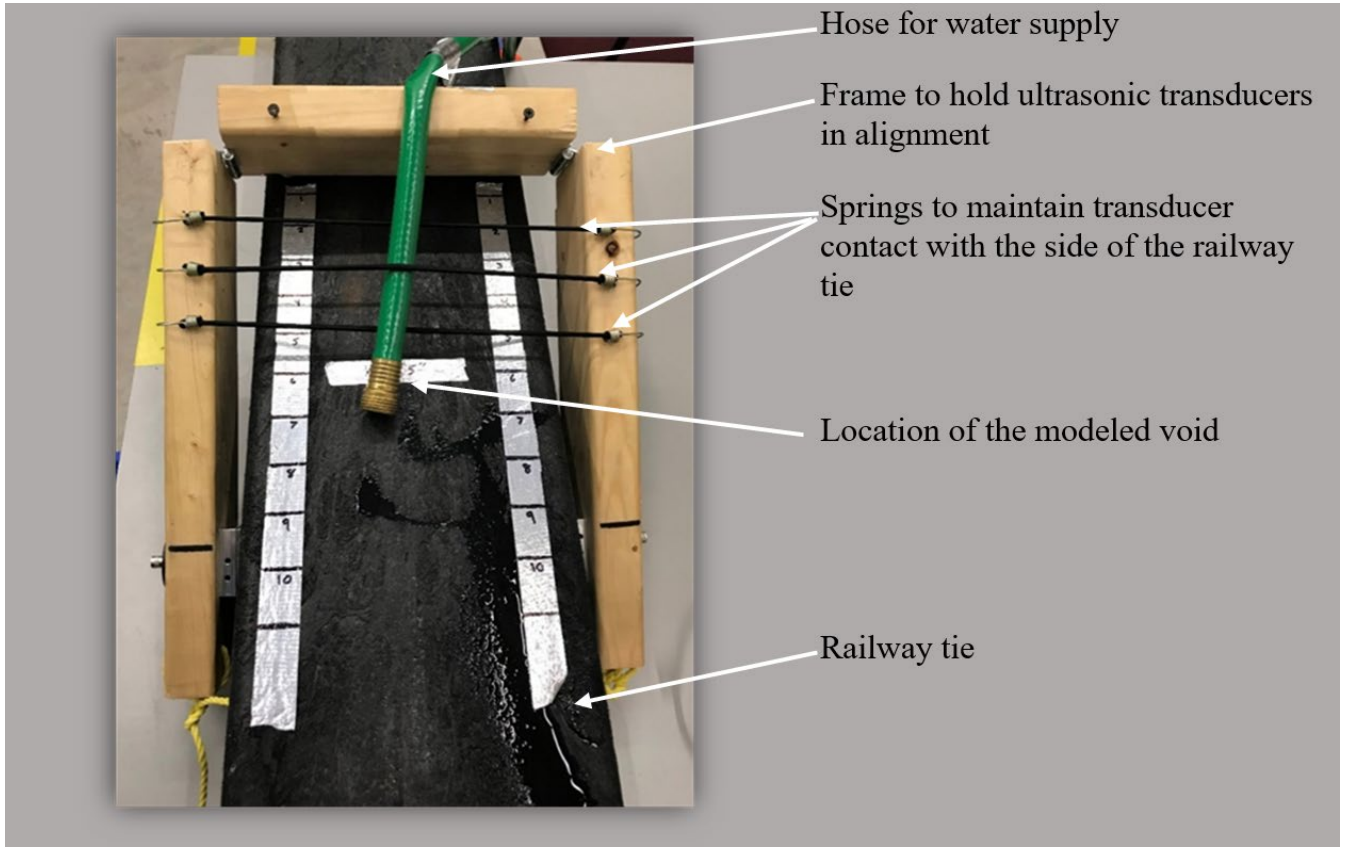
Lab testing

- Target created



Lab Test

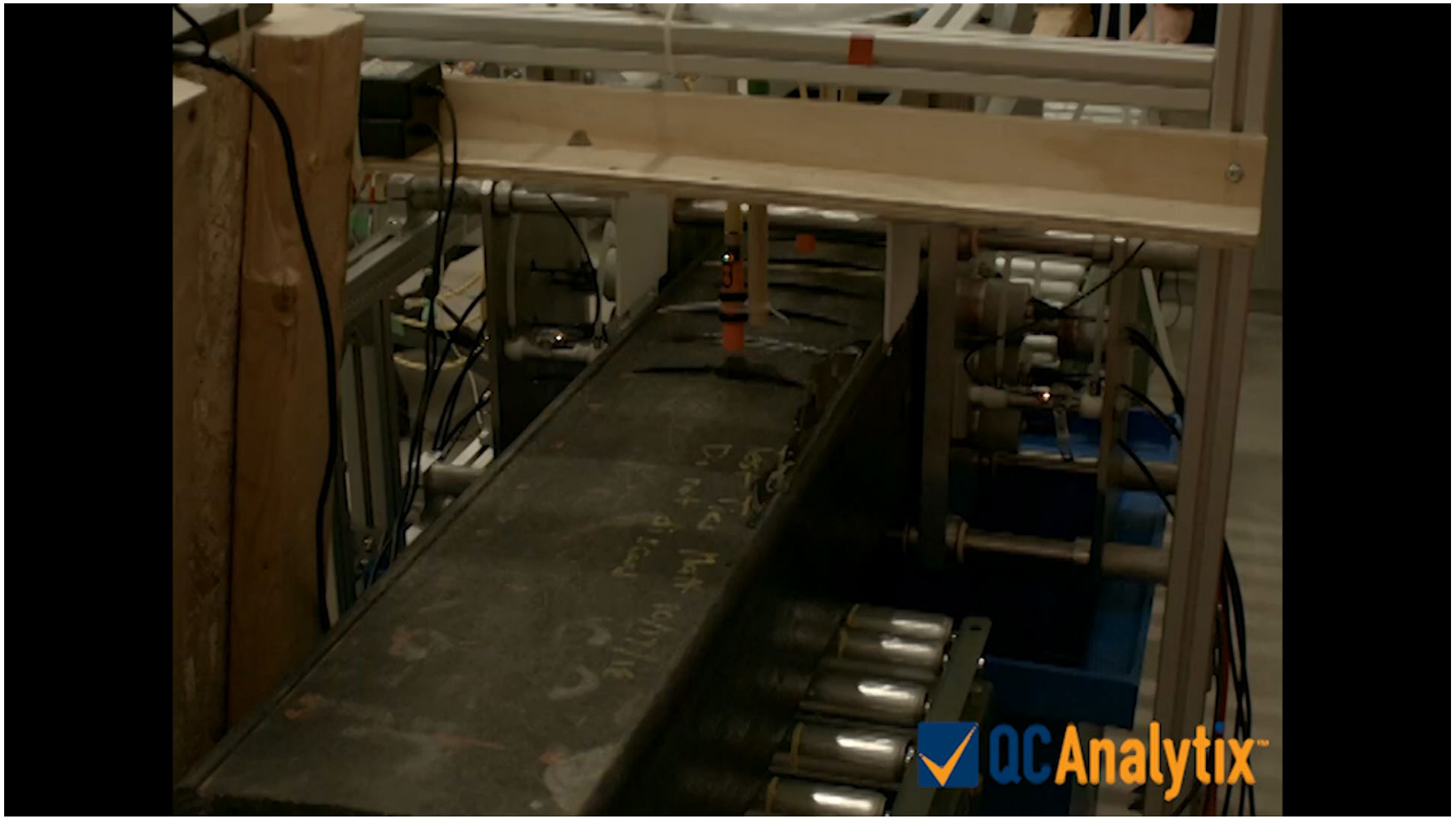
- Computer control
- Pull frame along tie
- Find Hole

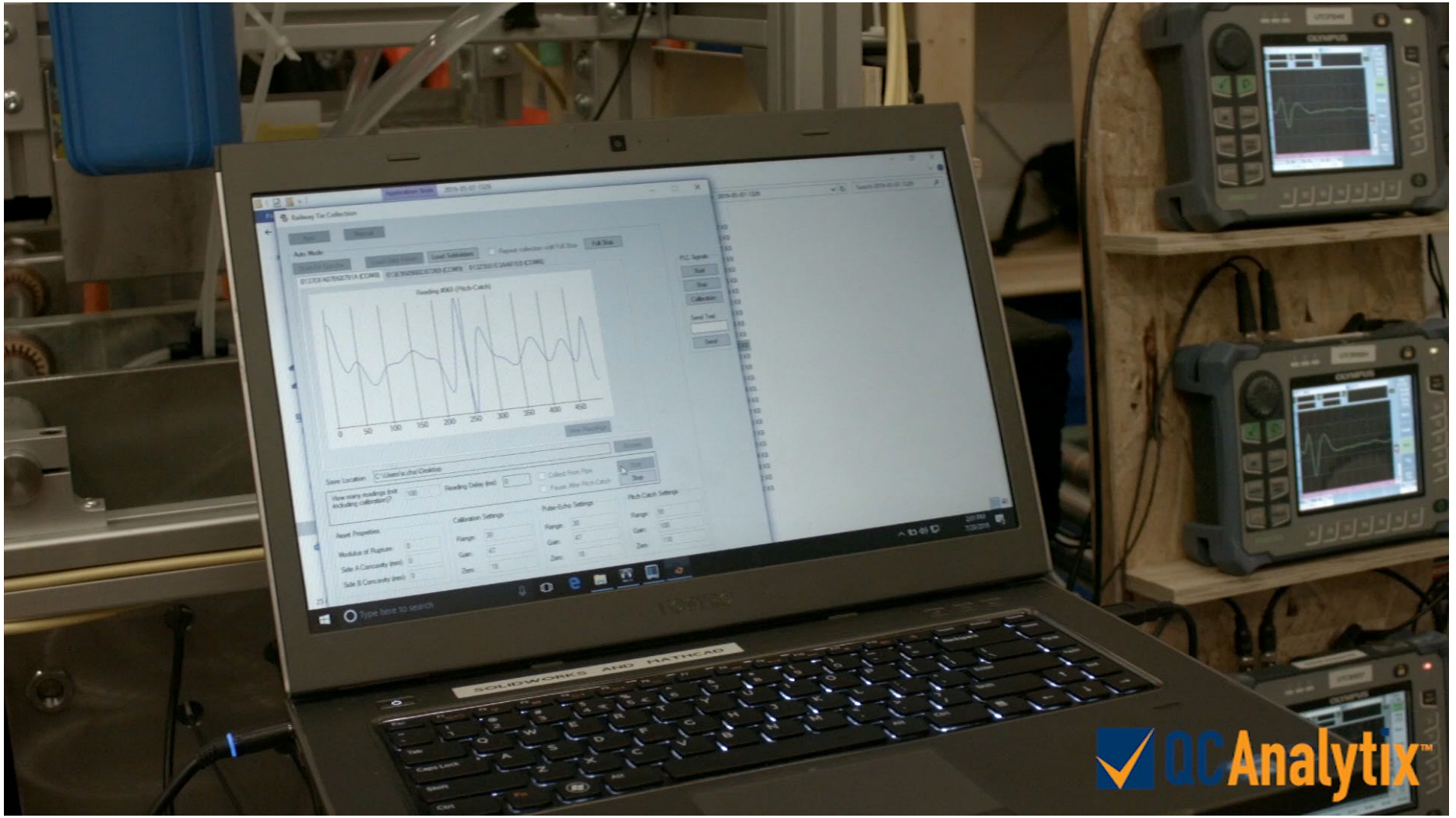


Along the path

Automation Prototype

- 100% coverage of tie
- 20mm per minute
- 100% automated
- Uses off-the-shelf ultrasonic hardware with in-house computer control


QC Analytix™


QCAnalytix™

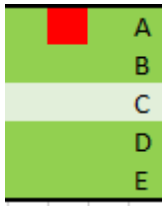
Typical Results

- Visual Display:

- Local Assessment: “Go” or “No Go”

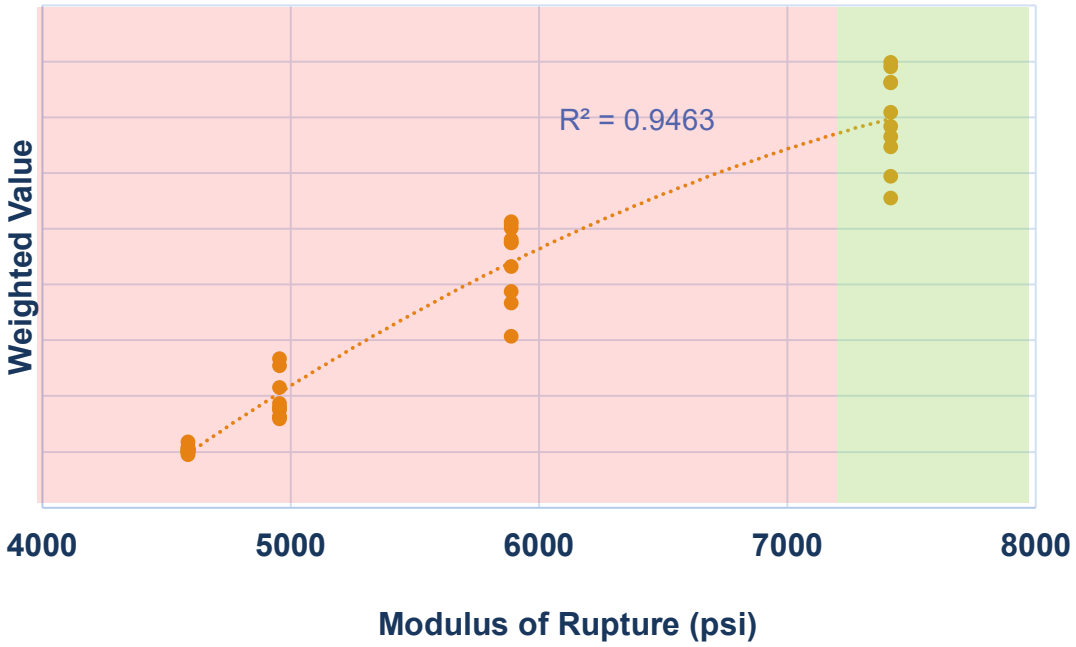
Other Results

- Consider Weighted Value (W):



$$W = \sum_{i=A}^{E} Value_i(Distance\ from\ C\ to\ Reading_i)^2$$

Performance Prediction



Conclusions

1. Detection of 12mm voids or large porosity.
2. 100% inspection of 3 m. rail tie in 150 seconds.
3. Performance prediction is possible.