



# A comparative study of bridge deck condition assessment by high frequency GPR antennas

**NESMEA 2008**

Center for Advanced Infrastructure and  
Transportation (CAIT)

# Authors:

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- Mr. Carl Rascoe – Research Engineer

## GSSI

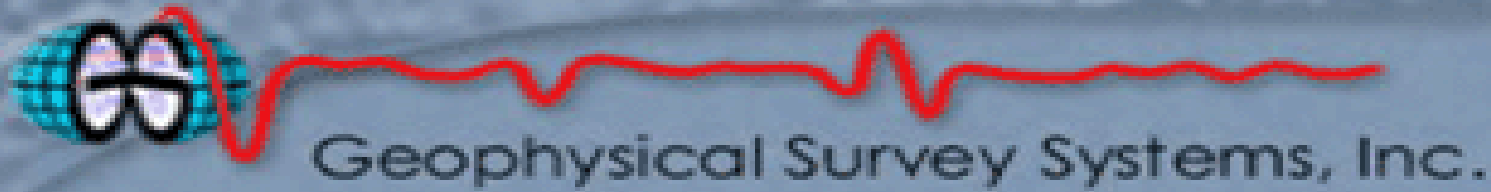
- Mr. Robert Parrillo – Sales Engineer
- Dr. Roger Roberts – Research Engineer

## Rutgers University

Dr. Nenad Gucunski – Chair Civil &  
Environmental Engineering Dept.

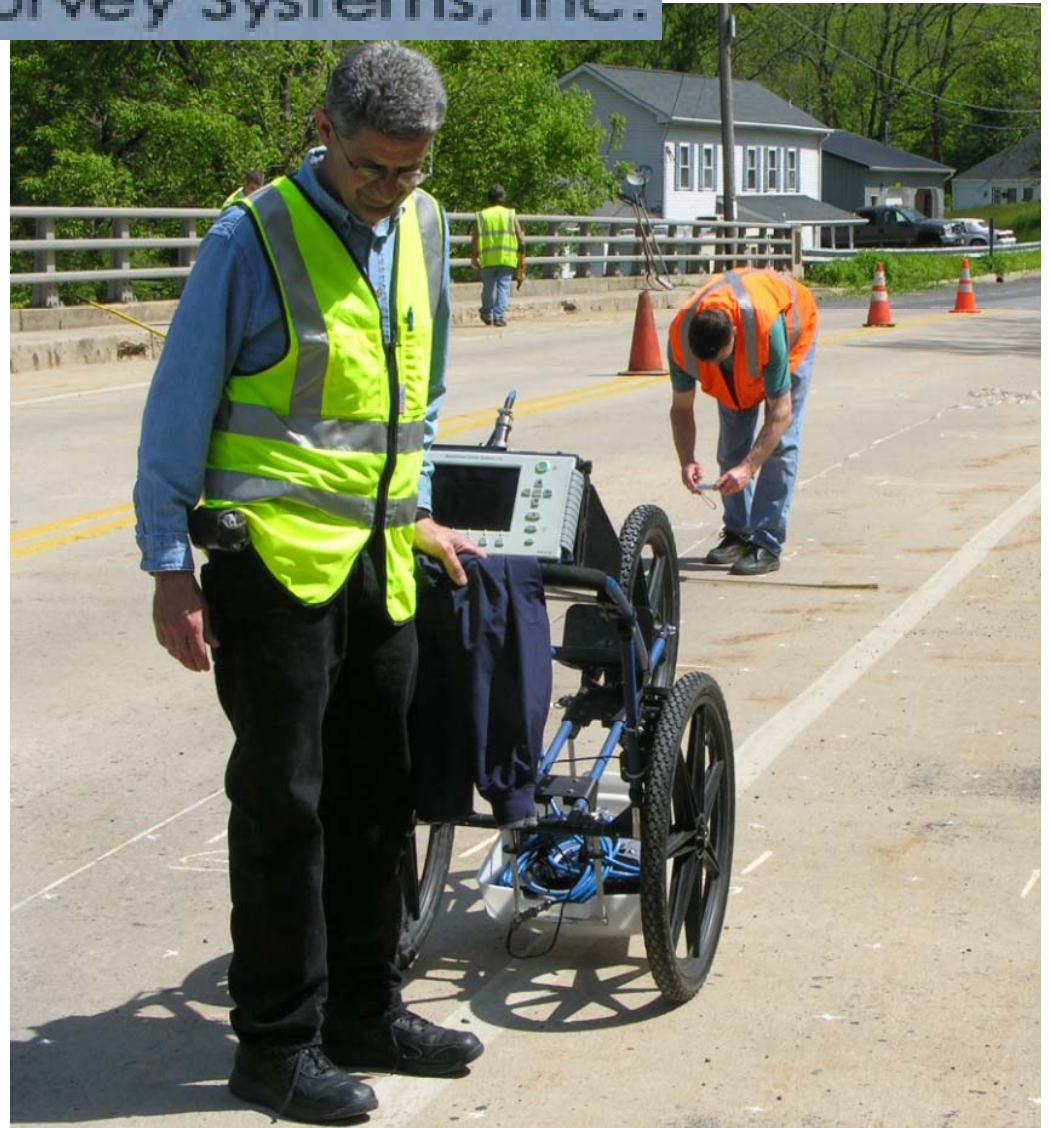
Mr. Carl Rascoe – Research Engineer

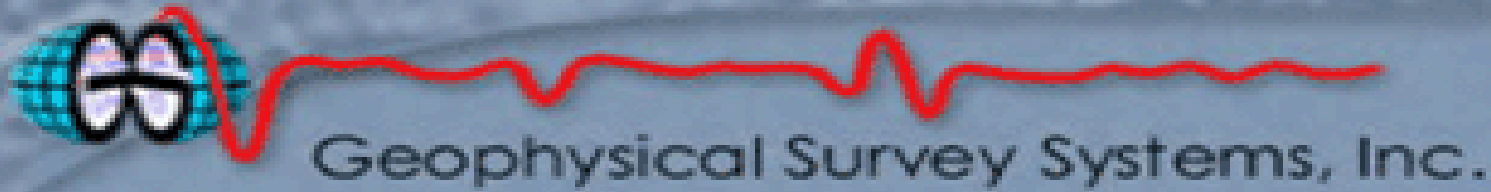




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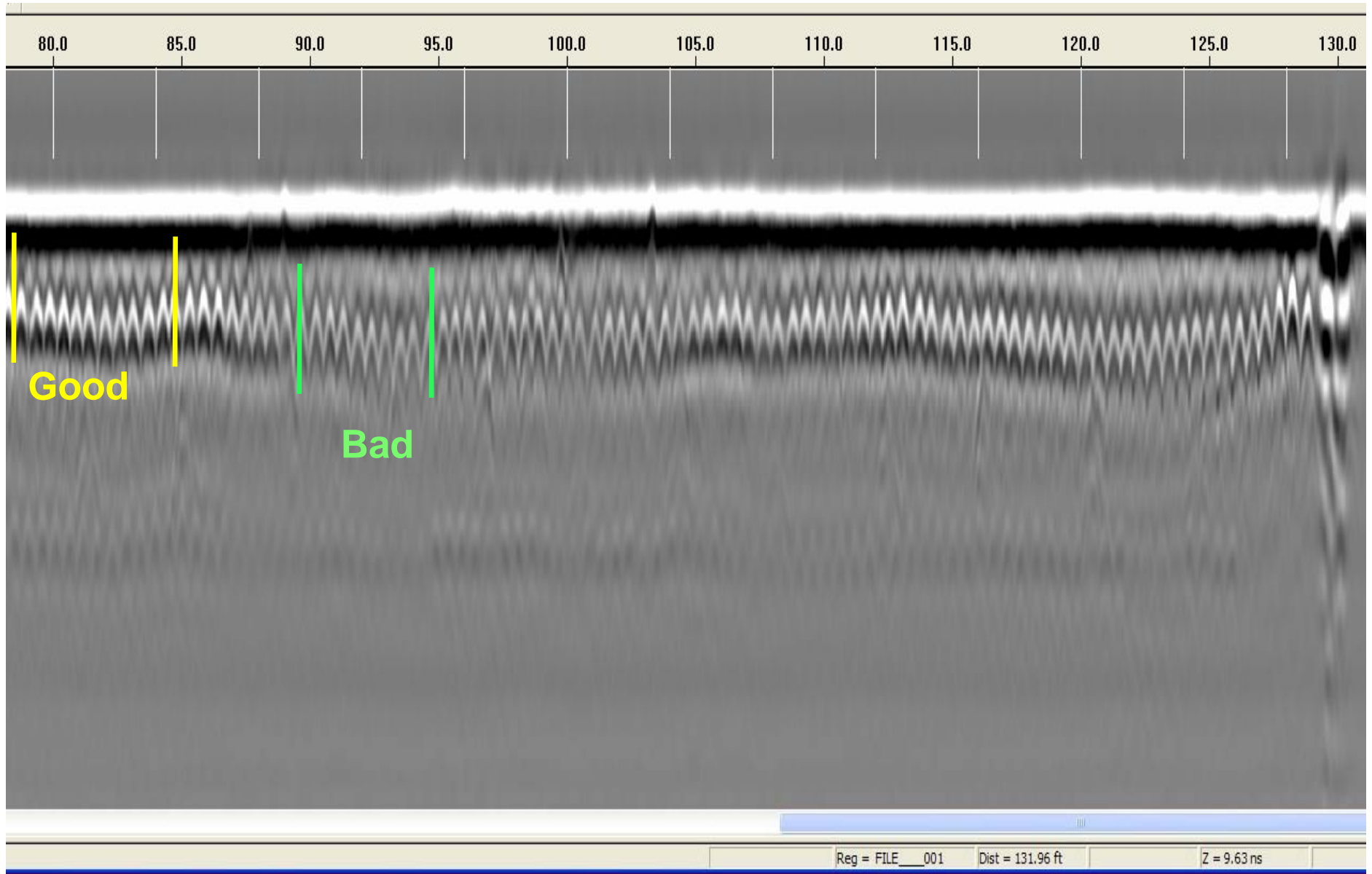


# DELAMINATED DECK AND CHAIN DRAG



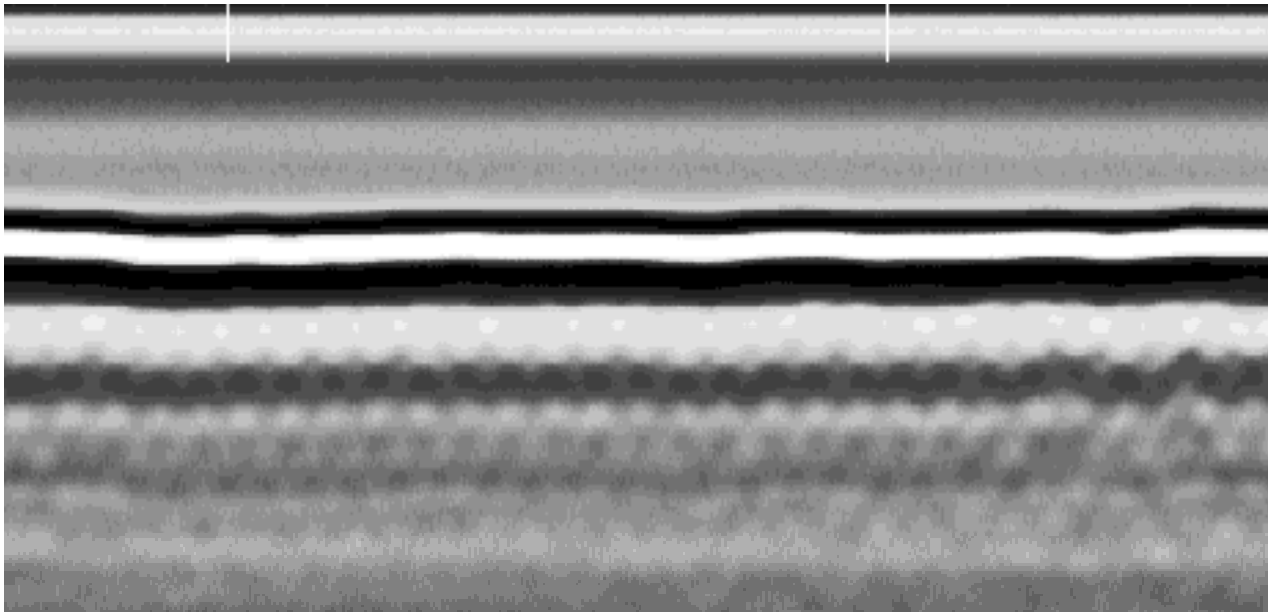
# DECK DELAMINATION







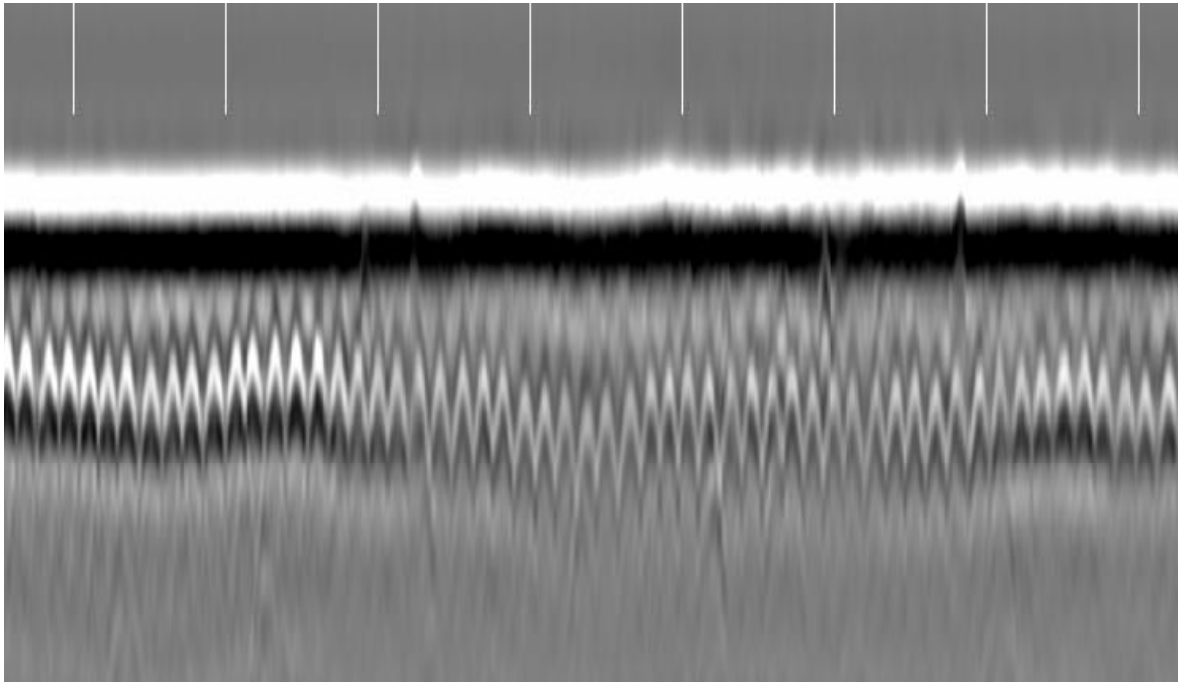
Air Launched: **Fast Overview**



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'01 05 08

# Ground Coupled: **Detailed Imaging**



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# Municipal Drive Bridge

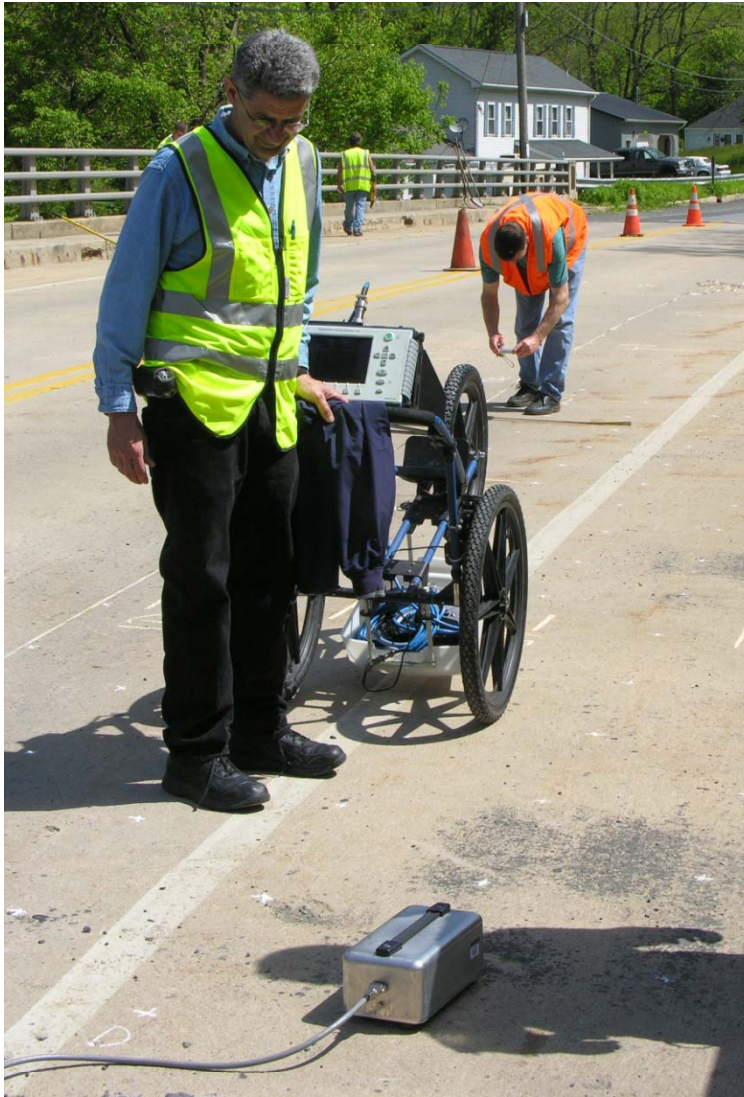


# Church Street Bridge



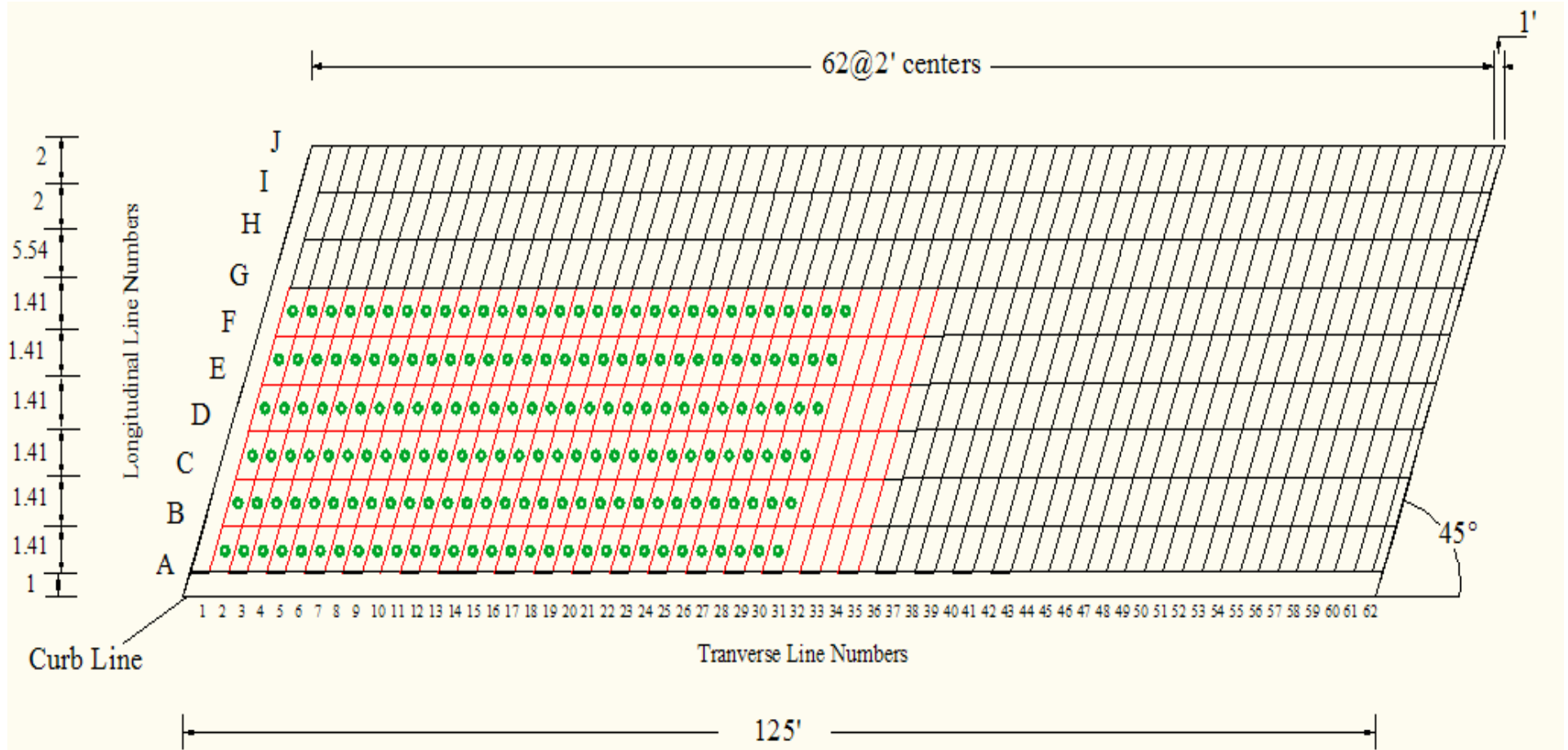
# Church Street Bridge





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# Municipal Drive Bridge



\* West Bound Not Tested

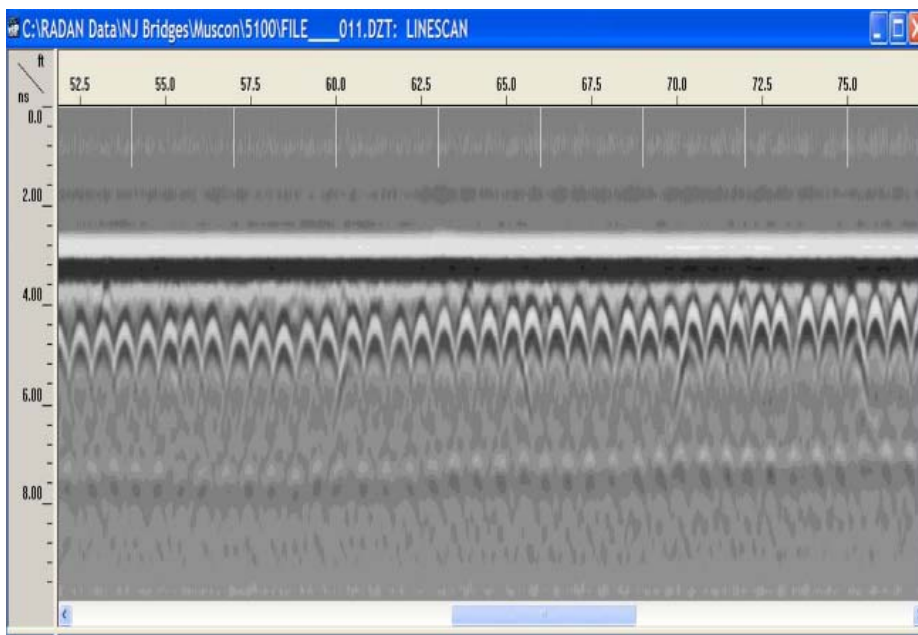
Red Lines Indicate Completed Impact Echo Tests



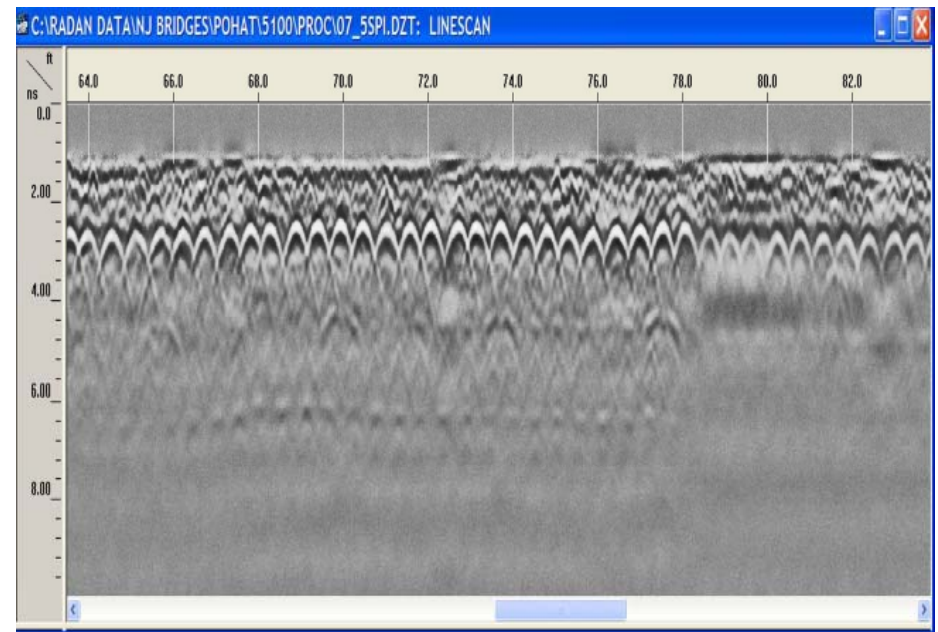
# DATA PROCESSING

- **RADAN and Bridge Assessment Module**
- **Combine 2-D GPR files into a single 3-D file**
- **Create a deterioration map**
  1. **time-zero correction, migration, and rebar reflection mapping**
  2. **interactive interpretation**
  3. **contour map of the deterioration data**

# Raw data for 1.5 GHz antenna (a) and 2.6 GHz antenna (b) at 24 scans/foot



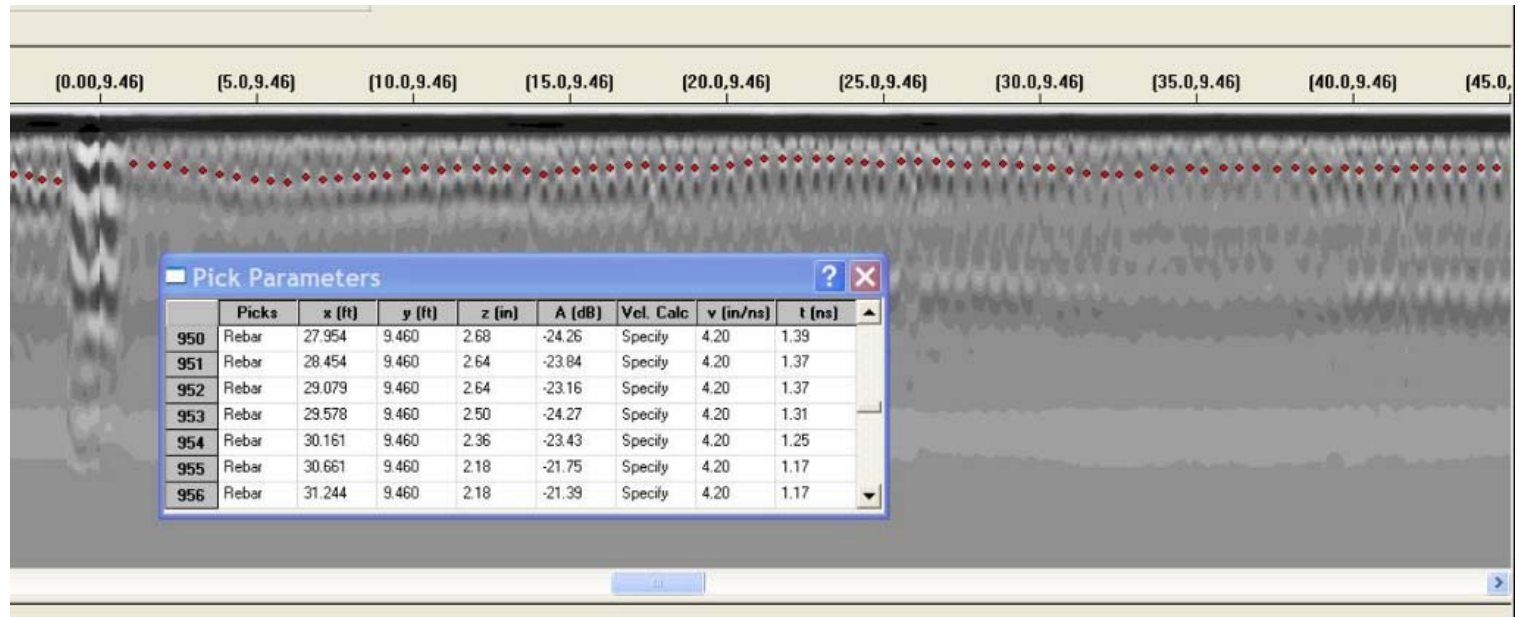
(a)



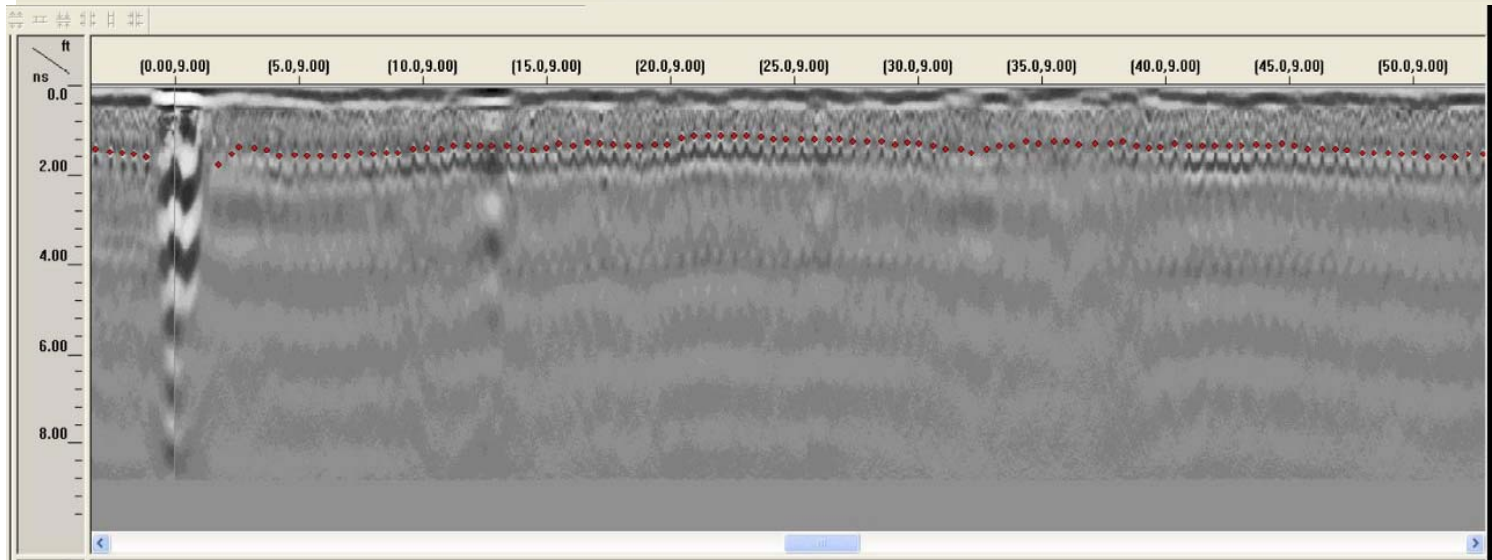
(b)

# Processed data and rebar picking

1.5

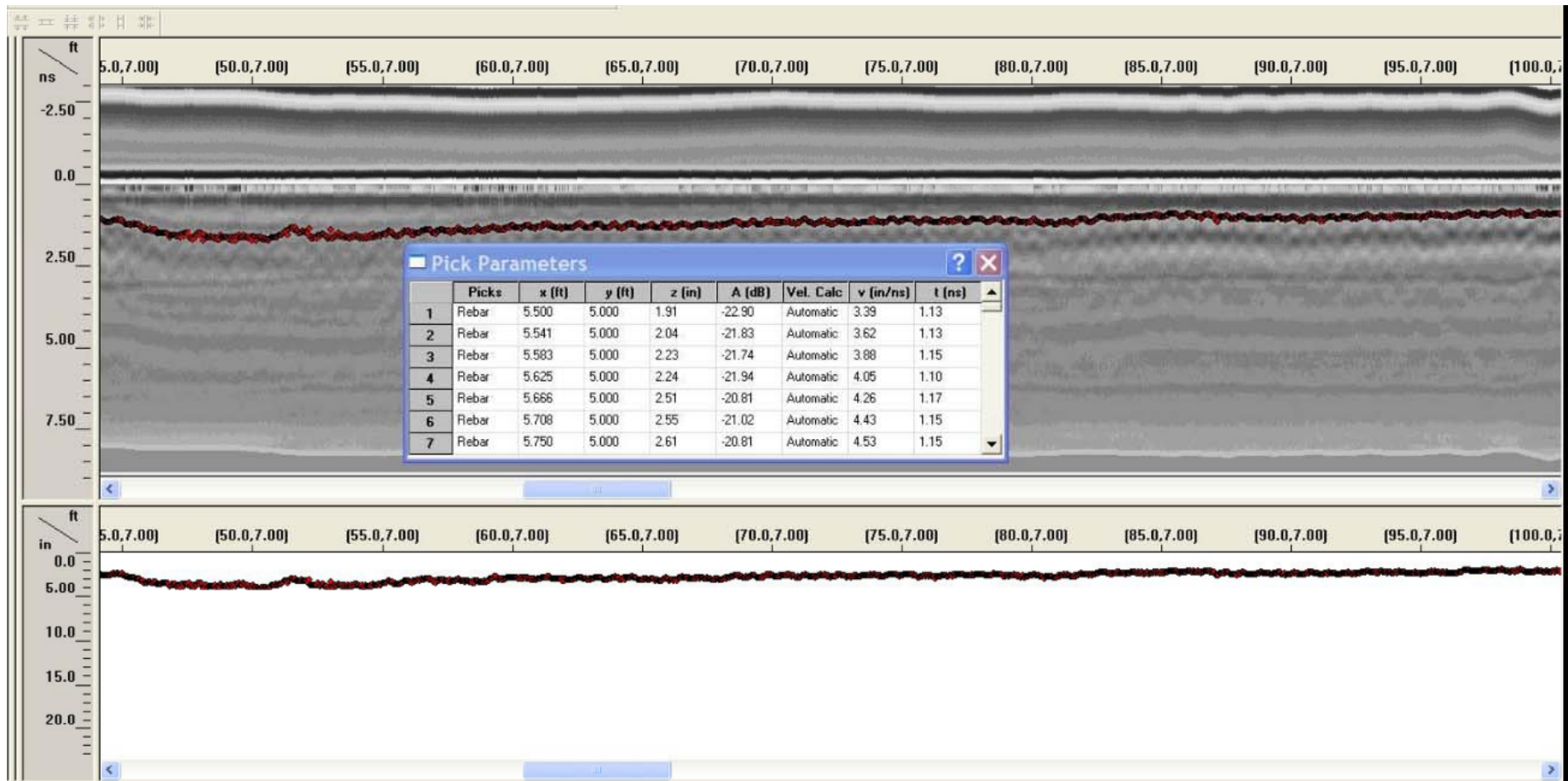


2.6

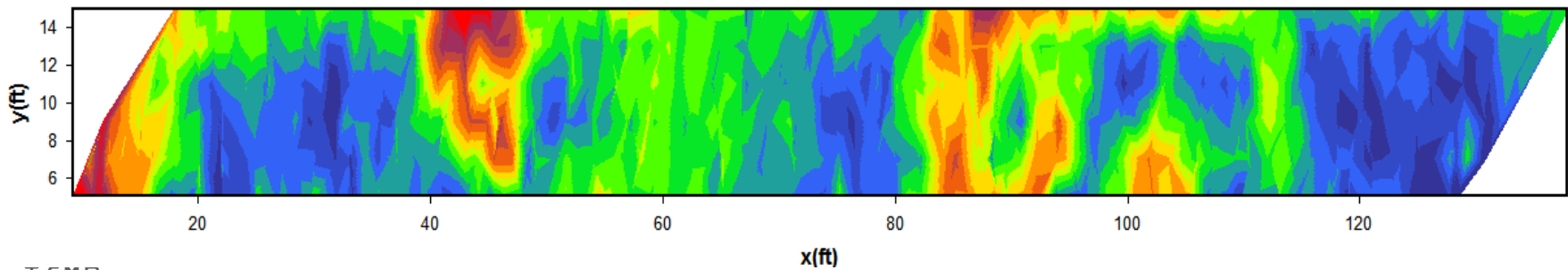
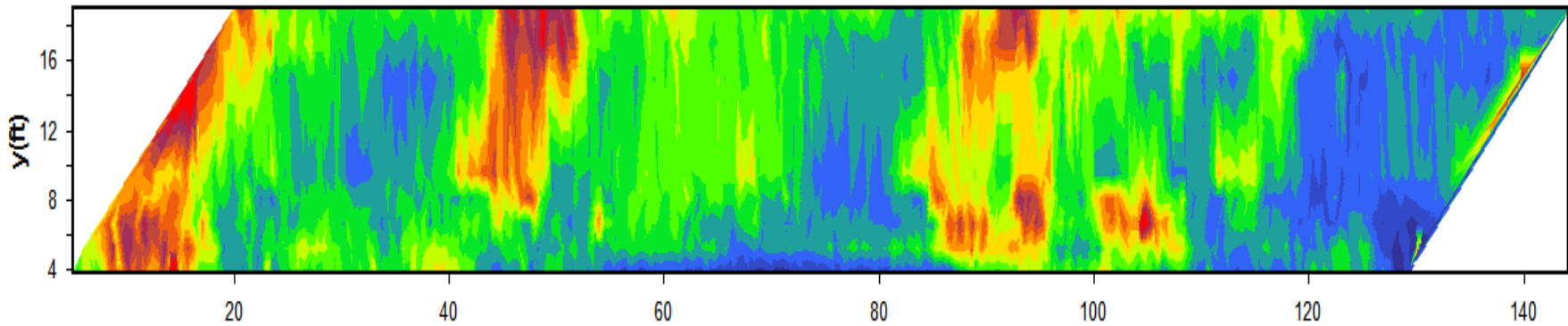
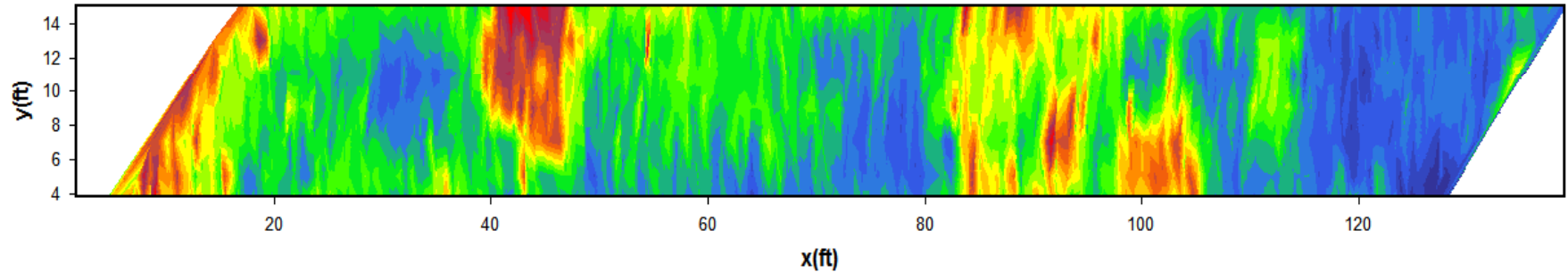


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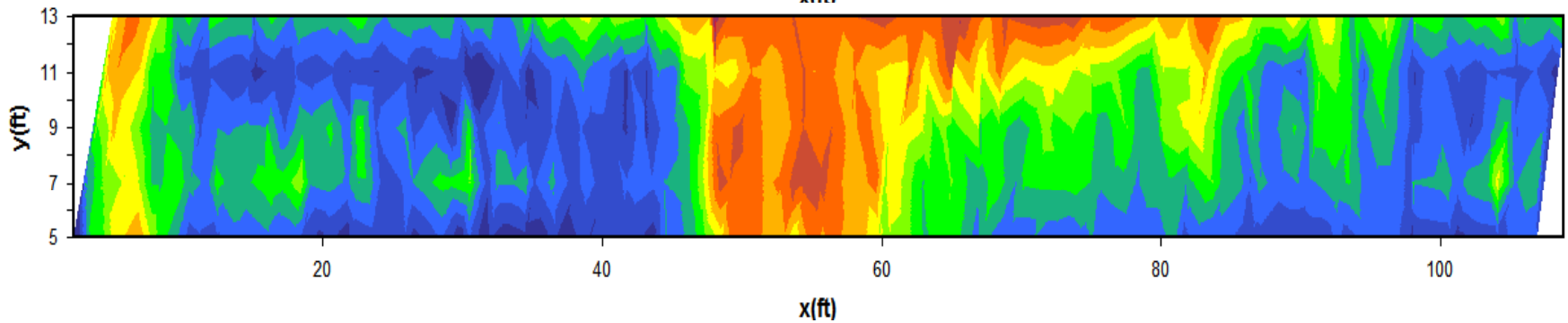
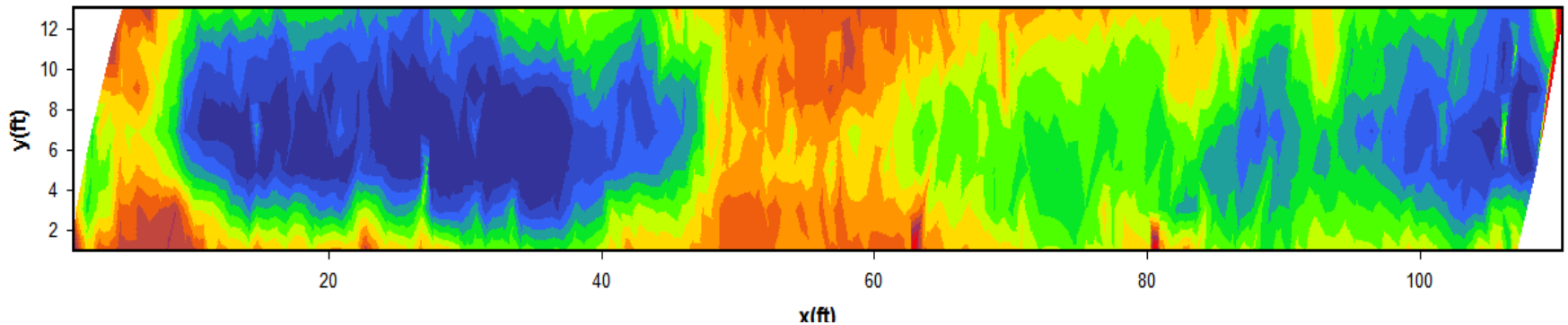
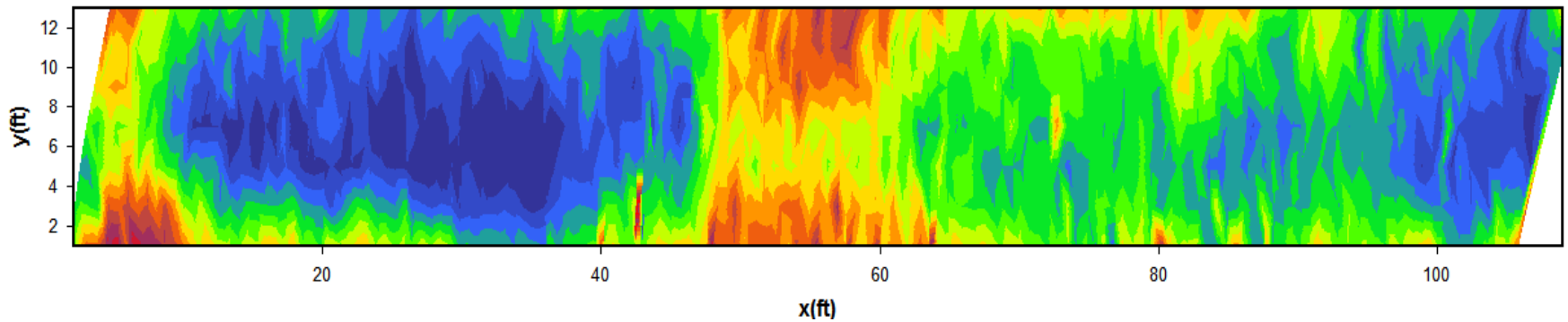
# Processed data and rebar picking for 2.0 GHz air launched antenna at 24scans/foot



# Municipal Drive Bridge



# Church Street Bridge

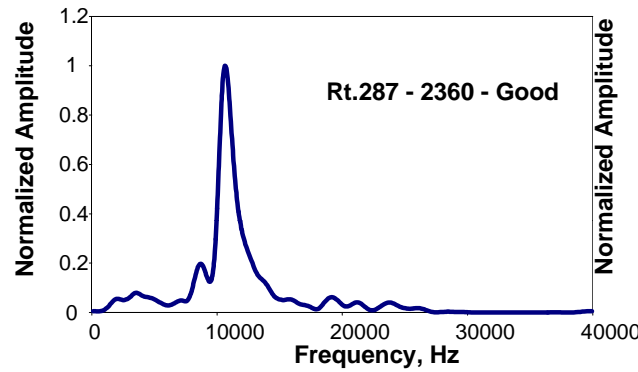
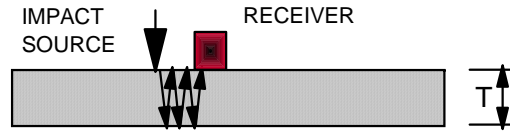


# Impact Echo

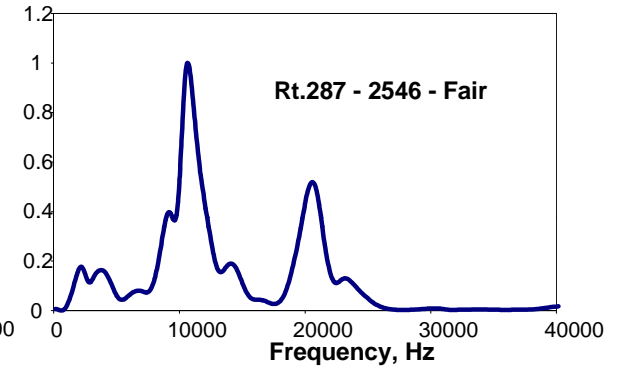
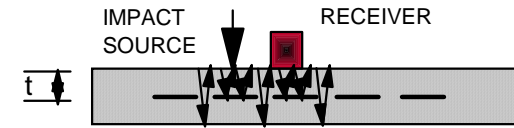


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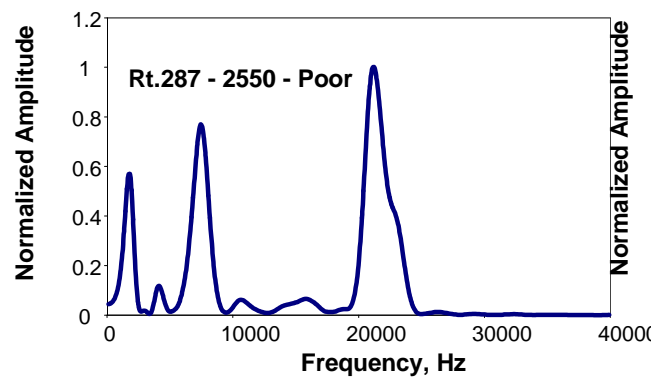
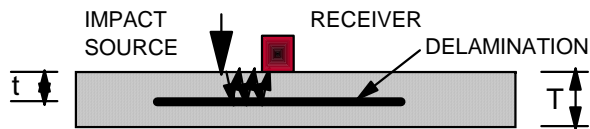
## GOOD (INTACT) CONDITION



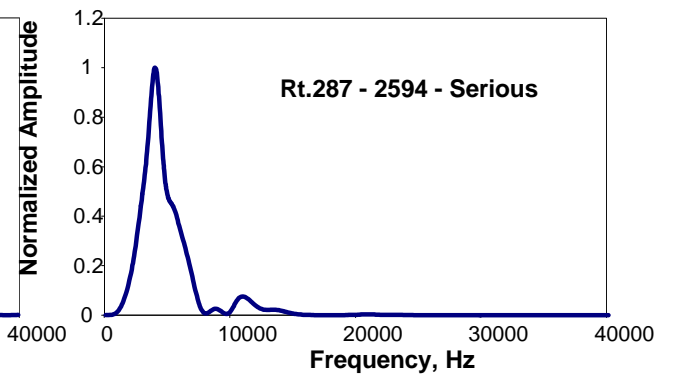
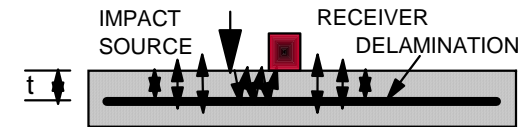
## FAIR CONDITION

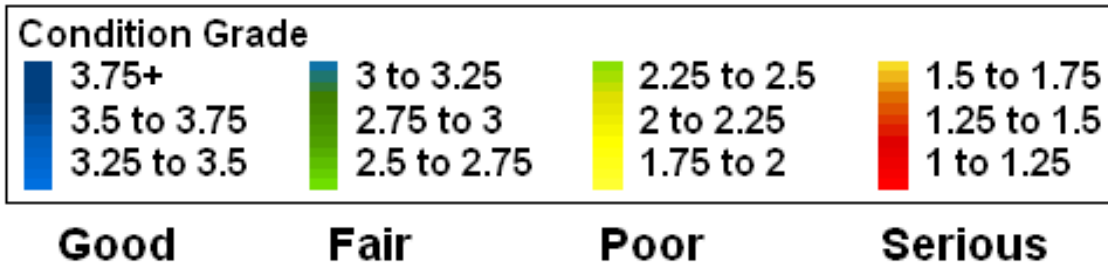
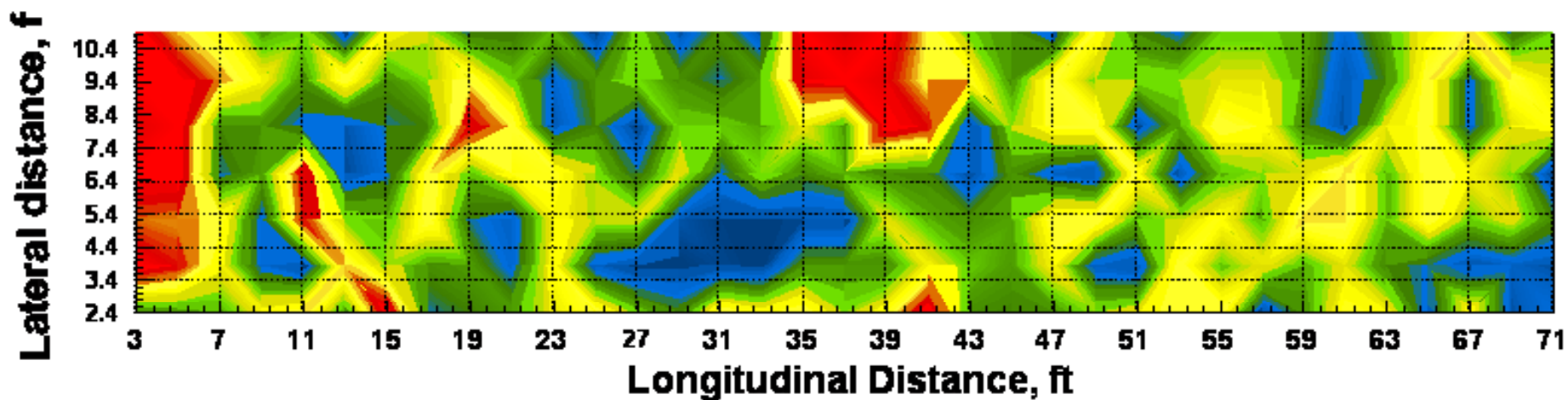
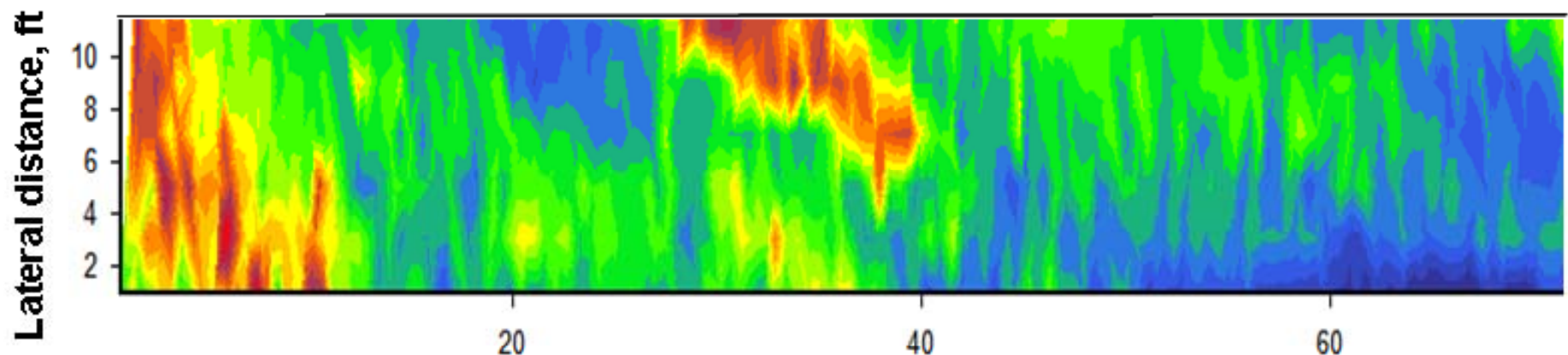


## POOR CONDITION

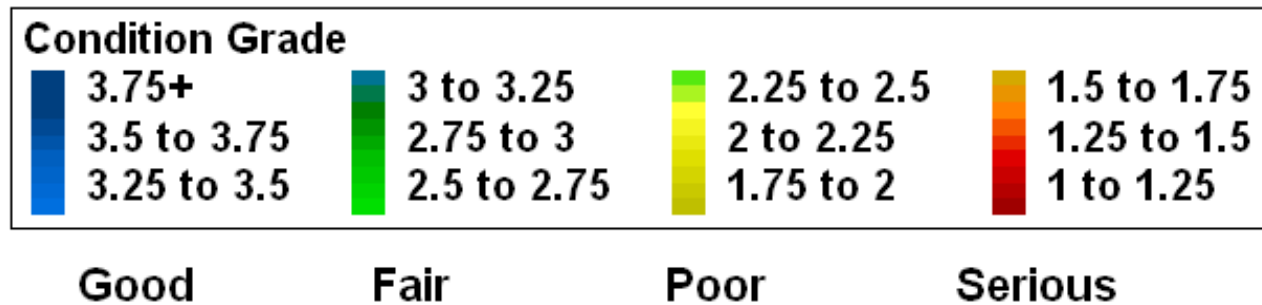
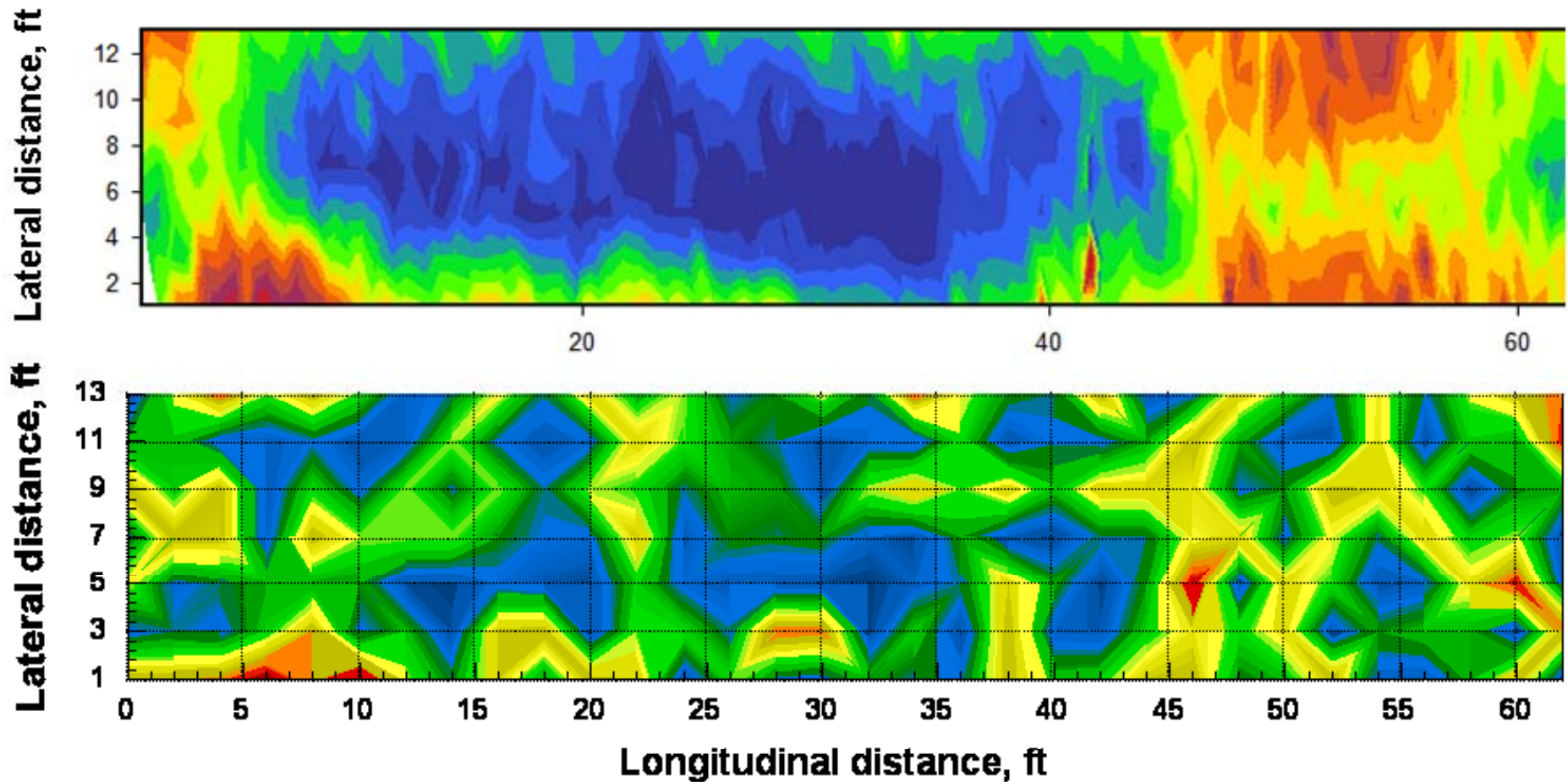


## SERIOUS CONDITION









## Summary and Conclusions:

- Evaluate 2.6 GHz ground coupled antenna on bare concrete decks
- comparison with existing high frequency 1.5 GHz ground coupled and 2.0 GHz air coupled antennas
- 2.6 GHz provides significantly more detail compared to the 1.5 GHz
- strong scatter from the aggregate in the concrete above the rebar level becomes clearly visible.

## Summary and Conclusions (cont'd):

- The immediate benefit is higher confidence in the results
- IE points to similarities
- IE points to differences
- Disadvantages of lower resolution of images from the air coupled antenna are compensated by the capability to conduct surveys of bridge decks at highway speeds

## Acknowledgements:

- Warren County Engineering Department
  - Mr. Nicholas Paolella, P.E.
  - Mr. John P. Tate
  - Mr. Rich



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