



# Bridge Deck Evaluation

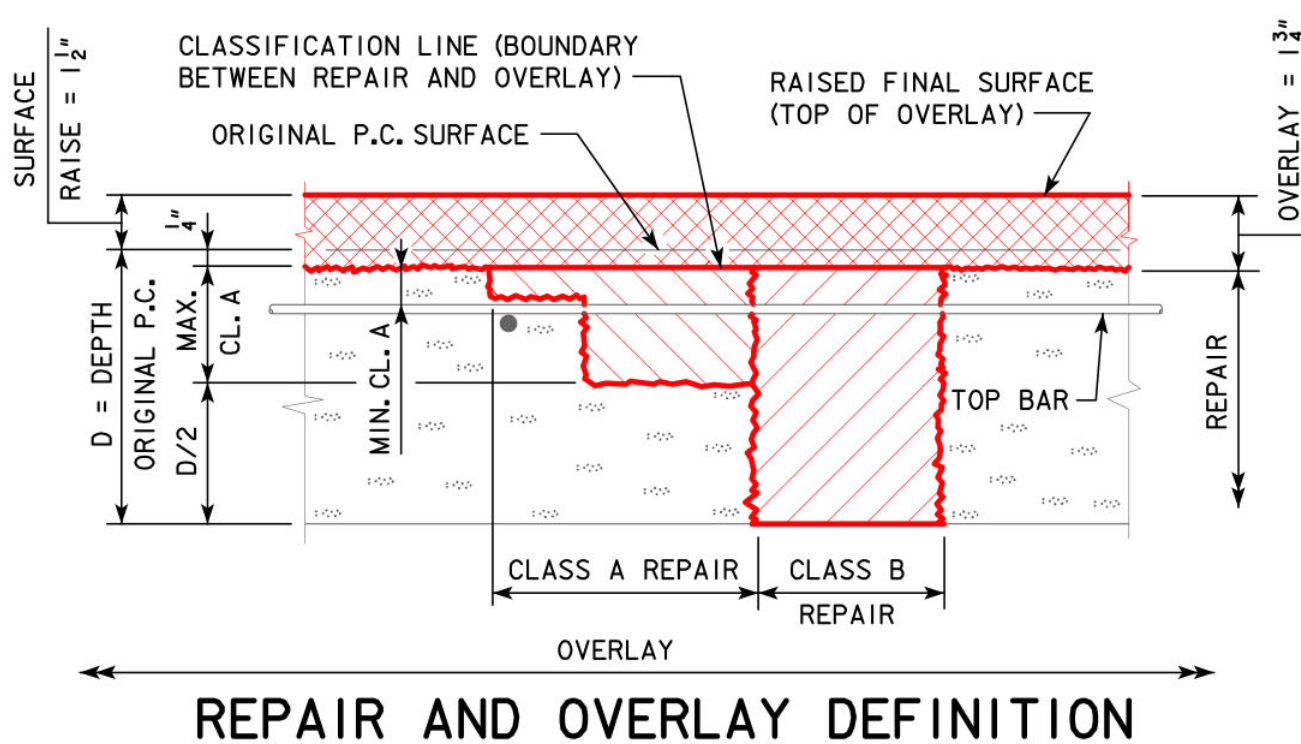
non-destructive testing methods

# Goal

- Project level assessment
- Typical multi-beam/girder bridges
- Bridges scheduled for second overlay
- Assess deck condition beneath existing PC overlay to identify repair areas in original deck
- Ideally scan lane width at 45 mph



# Deck overlays



# Remove deteriorated concrete

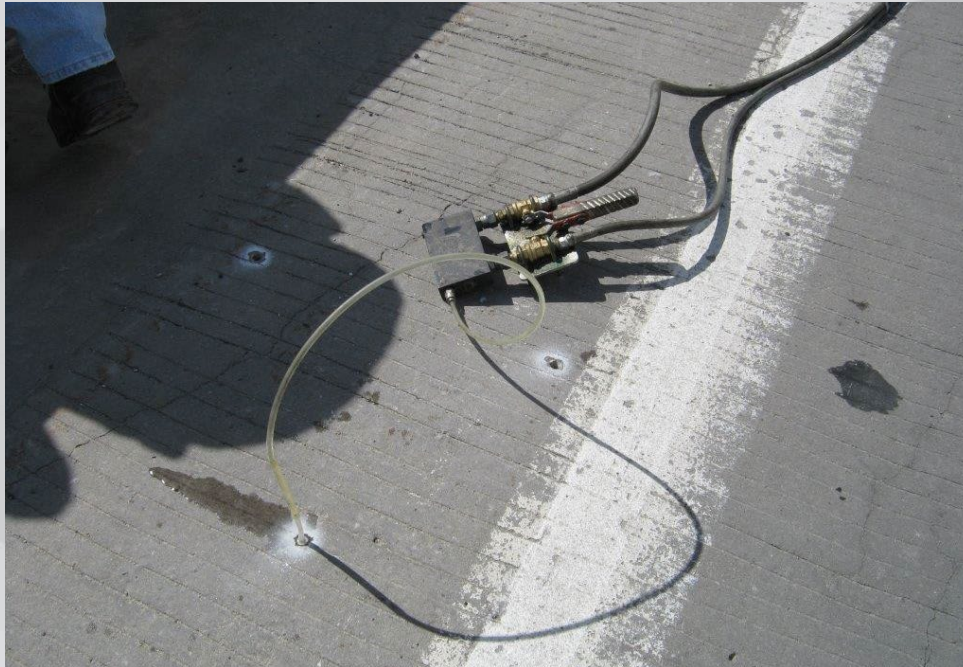


# Place the overlay



# Epoxy injection

- Restores overlay bond
- Extends service life of overlay
- Adds additional material to scan thru



# Current (traditional) methods

- Visual
- Hand sounding by hammer or chain
- Time consuming
- Operator dependent



# Delamtec

- Purchased in 1970's
- Automated deck sounding
- Removed operator variation
- Automatic data collection
- No longer functional





# Problems with traditional methods

- Cannot differentiate between delamination and deck deterioration
- Need to evaluate original deck
- Depth of deterioration increases difficulty in identifying deterioration
- Require lane closures



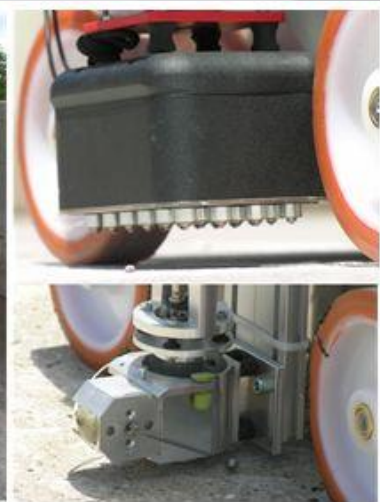
# Search for a better method

- The help
  - Rutger University
  - Wiss, Janney, Elstner Associates
  - University of Missouri
  - SHRP2 program
- The goal
  - Practical solution
  - Correlation with field conditions



# Rutgers University

- Acoustic / seismic technology
  - Impact echo
  - Ultrasonic surface waves



# Rutgers University

- Electro-magnetic technology
  - Ground penetrating radar
  - Eddy current method



# Rutgers University

- Chemical / potential technologies
  - Half-cell potential
  - Electrical resistivity method



# Wiss, Janney, Elstner

- Infrared thermography
- Ground penetrating radar
- Impact echo
- Half-cell potential



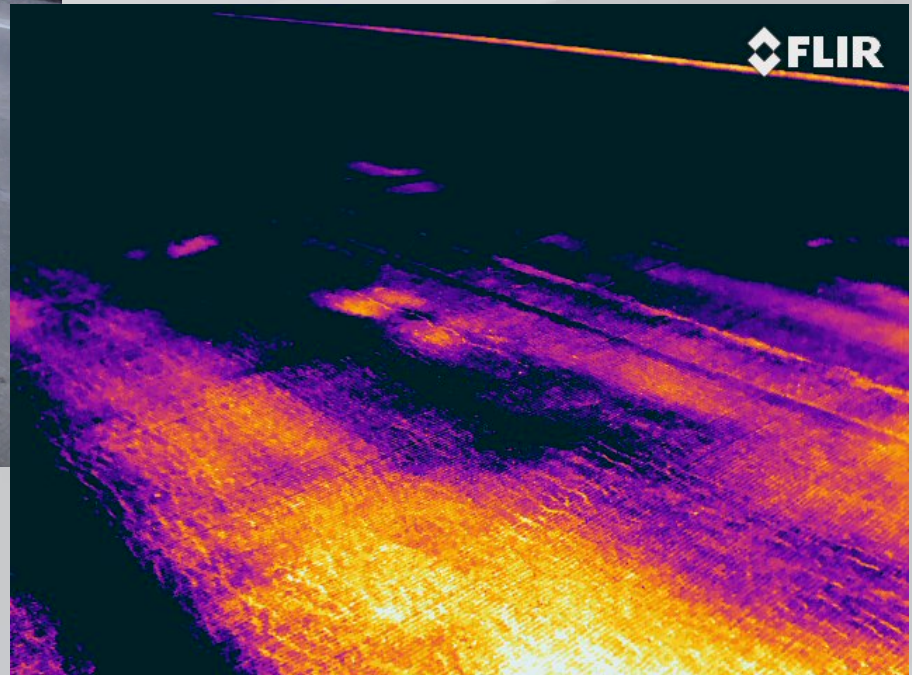
# University of Missouri

- Infrared thermography
- Handheld camera
- Ultra time domain infrared



# University of Missouri

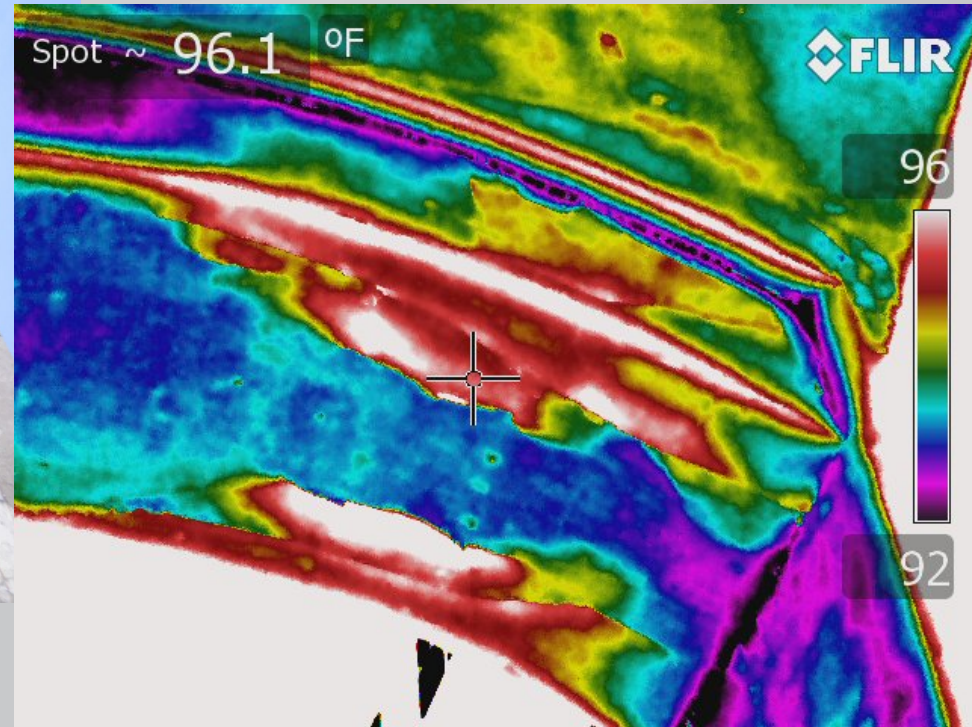
- Handheld camera deck evaluation





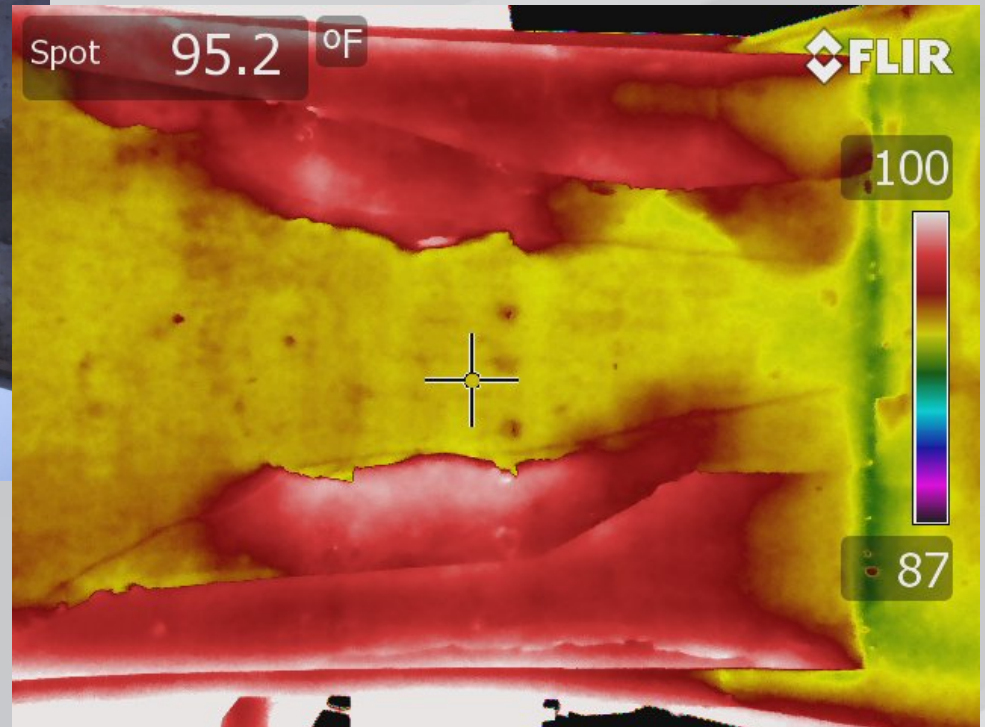
# University of Missouri

- Handheld camera substructure evaluation



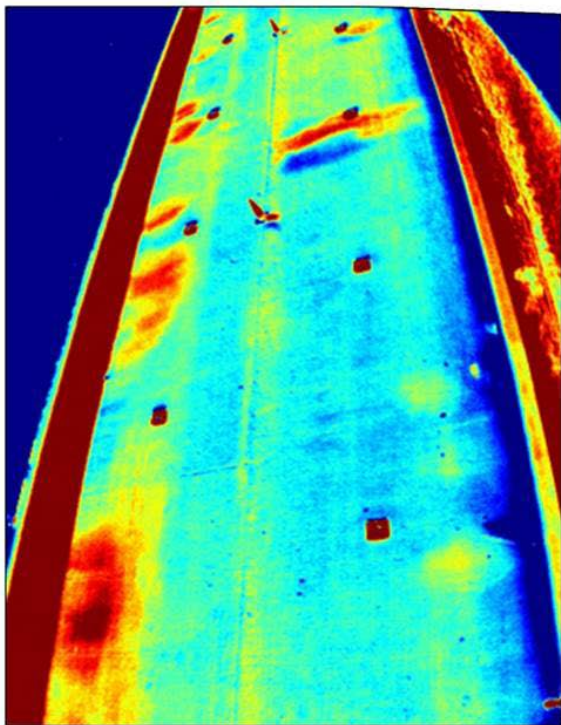
# University of Missouri

- Handheld camera substructure evaluation



# University of Missouri

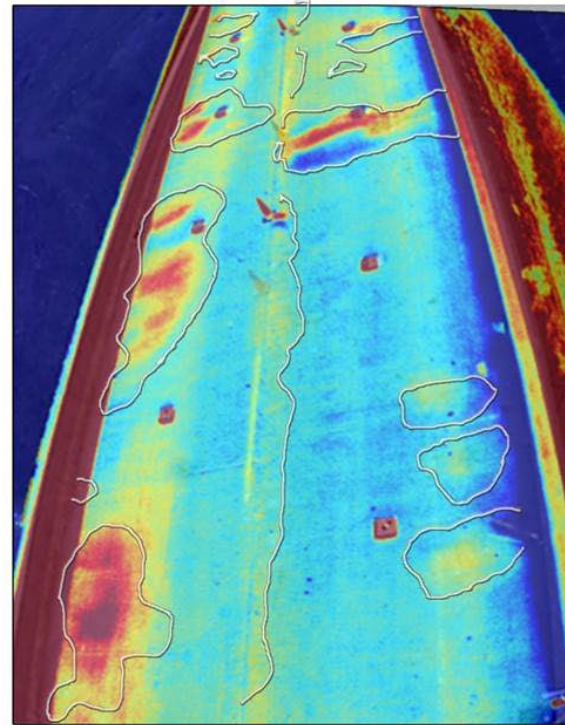
- Ultra time domain infrared



Processed IR



Visual with Sounding Areas Marked



Overlay IR / Visual



# SHRP2

- Scanning impact echo
- 3D Radar



# Scanning Impact Echo

- Bridge Deck Scanner (BDS)  
Olson Instruments, Inc.
- Rolling transducer array
- Integrated PC based data collection
- Variable scan widths
- Records sound waveform



# Scanning Impact Echo

- Correlation on decks without overlays
- Data collection straightforward
- Data processing requires more knowledge
- Does require lane closure
- Some layout work required
- Deck needs to be clean of debris
- Is time consuming



# Scanning Impact Echo

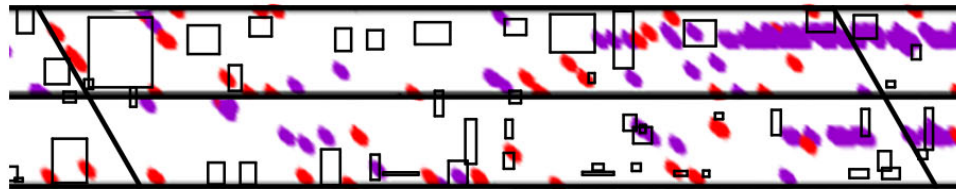
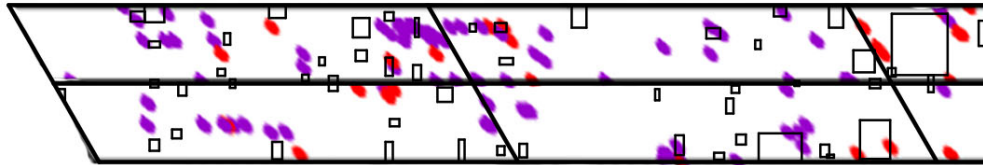


# Scanning Impact Echo





# Scanning Impact Echo



# 3D Radar

- Step frequency GPR, ultra-wideband antenna array
- Scan 6 to 8 foot width with each pass
- 6 foot, 21 channel air coupled antenna used
- 200-3000 MHz frequency range
- 5 mph scan speed – traffic friendly
- Vehicle mounted – no on-site setup
- Incorporates GPS receiver for location



# 3D Radar

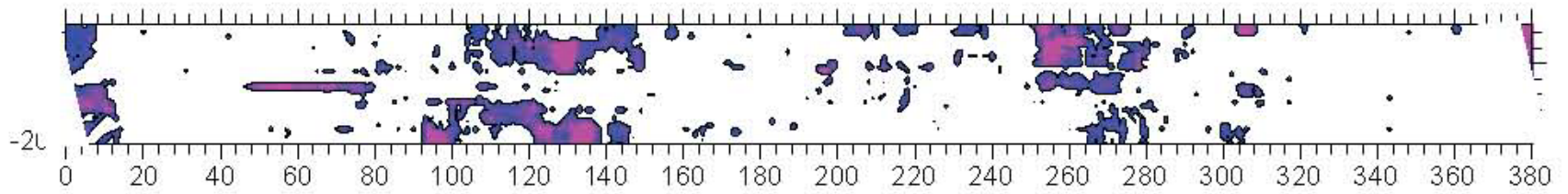


DX1821 antenna

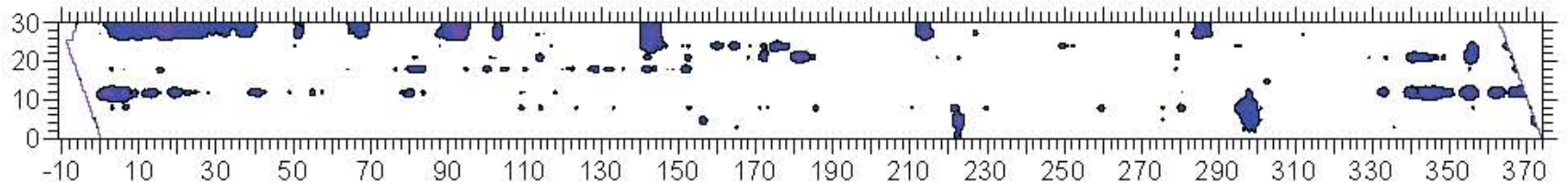


# 3D Radar

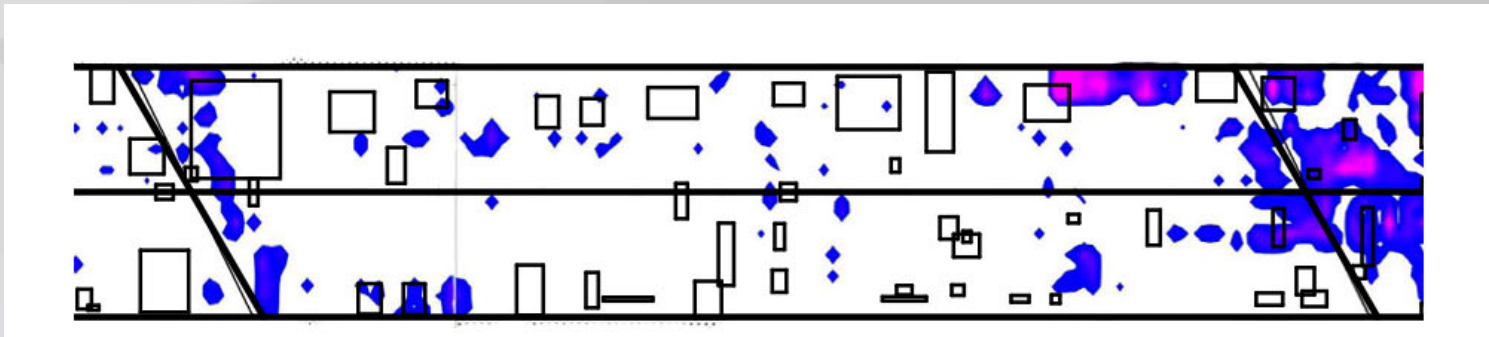
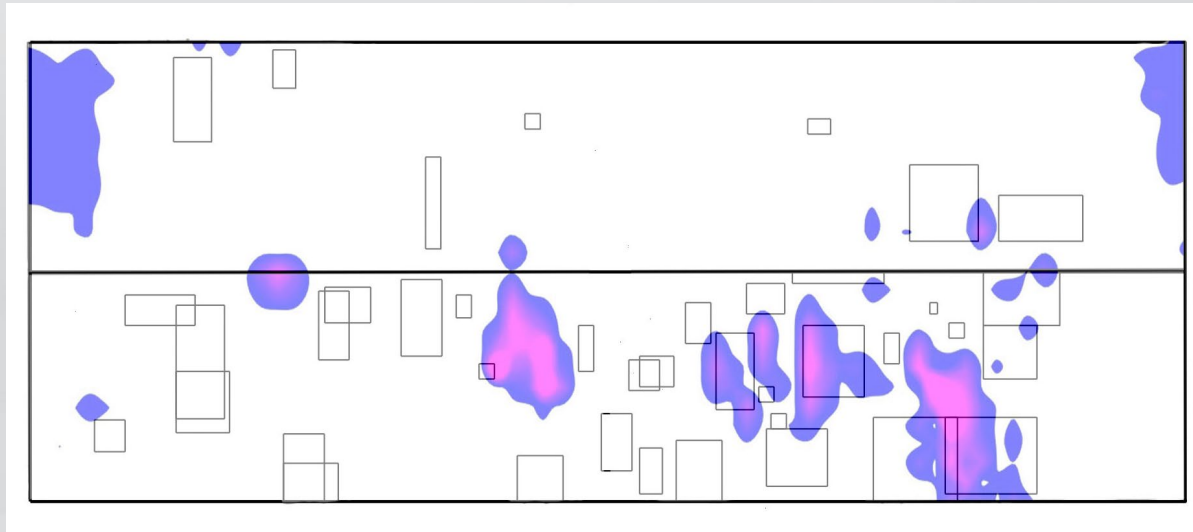
4959 - 3D



4959 - 2G Horn



# 3D Radar



# What's next

- Work with vendors to improve correlation of results and field conditions
- Consider new/different technologies as they are available



Questions ?

