



UNIVERSITY OF  
**TEXAS**  
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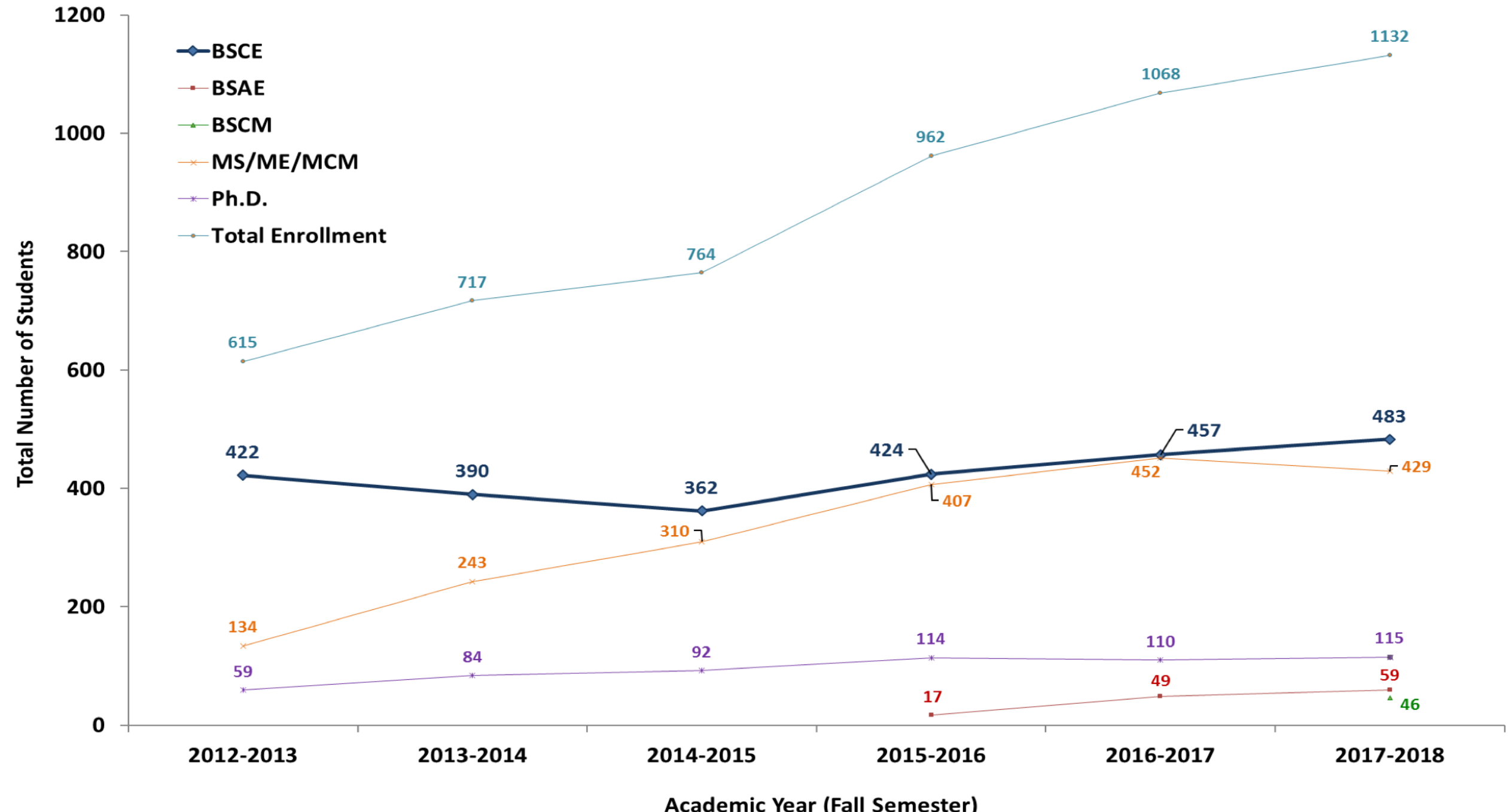
# **Condition Assessment, Subsurface Exploration and Evaluation using NDE methods**

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**Professor and Former Chairman**  
**Department of Civil Engineering**  
**University of Texas at Arlington**

# Outline

- **NDE Equipment Overview**
- **Structural Condition Assessment**
  - Concrete delamination, corrosion, air voids, rebar location
- **In-service Capacity Assessment**
- **Material Property Evaluation**
- **Rehabilitation and retrofit**
- **In-service Monitoring**
- **Sub-surface Exploration**
  - Utility detection and mapping
  - Soil profile
  - Water pockets, air voids

# Civil Engineering Department Enrollment

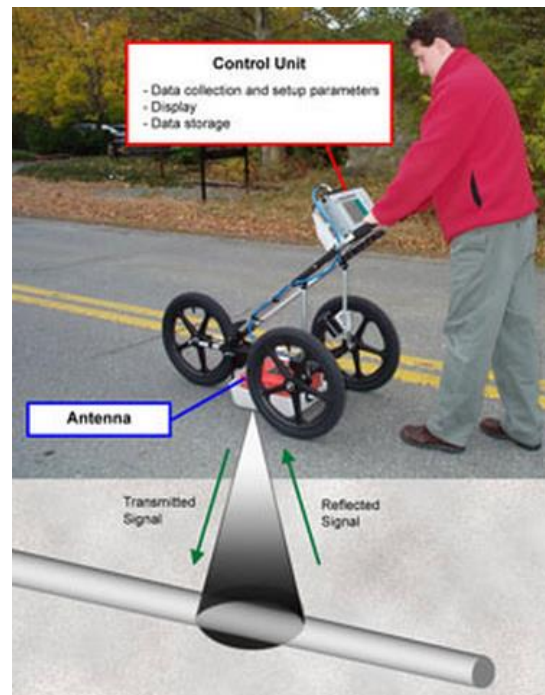




GRADING

INCOMPLETE

## Ground Penetration Radar (GPR)



# Data Collection and Processing

## ➤ Antenna mounts:

- Mini cart
- Hand held
- Cart
- Truck mount



# Data Collection and Processing

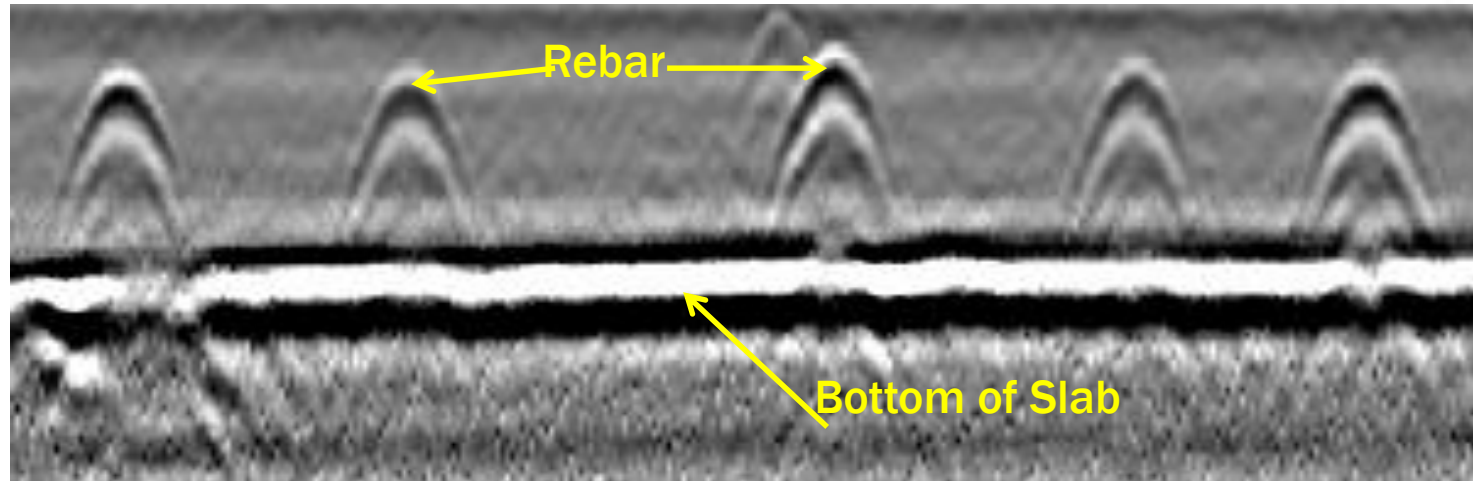
- Choosing the antenna of **right frequency** is the most important parameter of GPR Survey

Center Frequency	Depth of Penetration	Typical Applications
2600 MHz*	0-12 in (0.4 m)	Concrete Evaluation
2000 MHz Palm	0-12 in (0.4 m)	Concrete Evaluation
1600 MHz*	0-18 in (0.5 m)	Concrete Evaluation
900 MHz	0-3 ft (0-1 m)	Concrete Evaluation, Void Detection
400 MHz*	0-12 ft (0-4 m)	Utility, Engineering, Environmental, Void Detection
270 MHz*	0-18 ft (0-6 m)	Utility, Engineering, Geotechnical
200 MHz	0-30 ft (0-9 m)	Geotechnical, Engineering, Environmental



# Data Collection and Processing

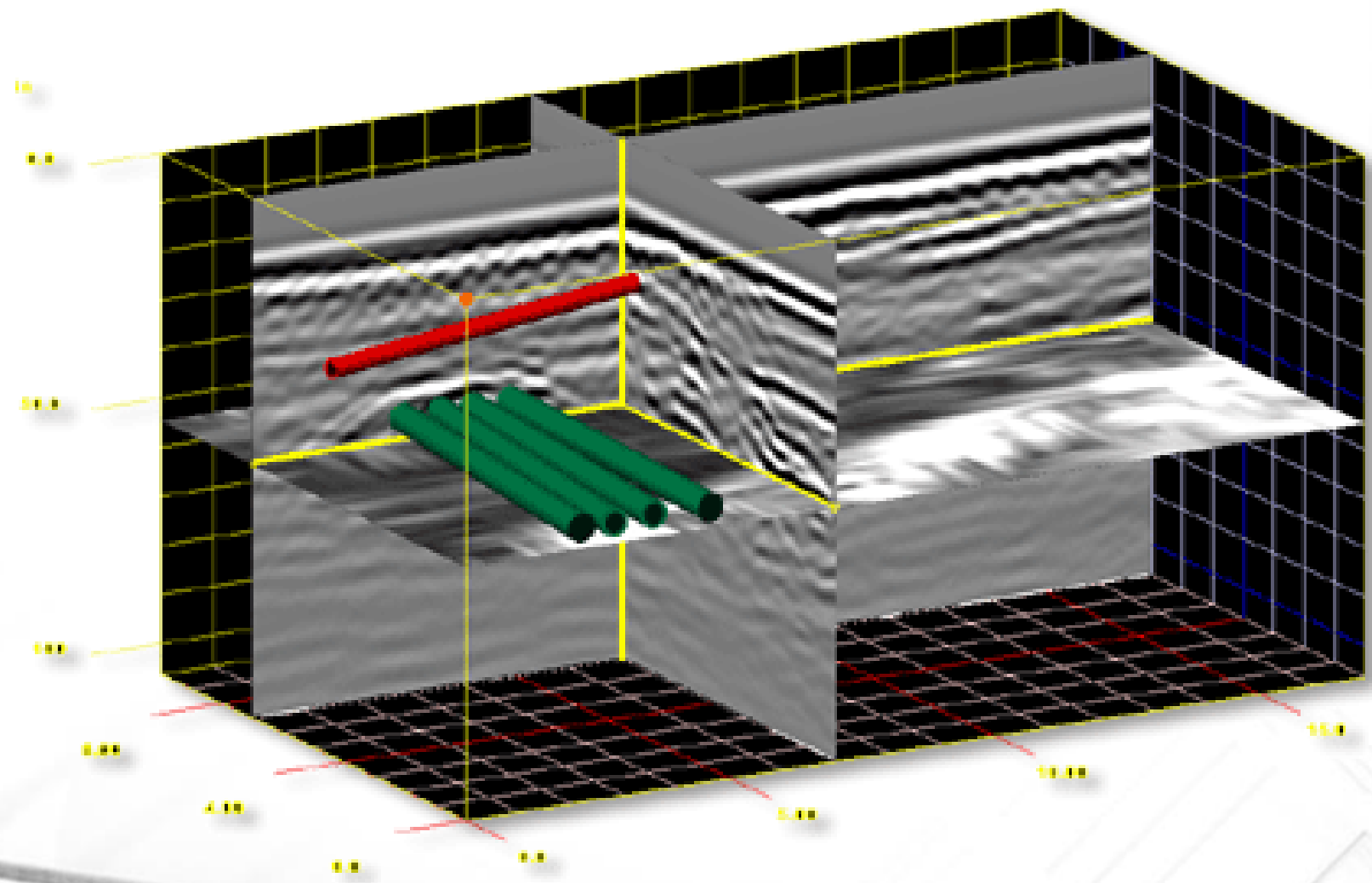
- Survey is generally conducted along a straight line to produce **2-D cross section of subsurface**.



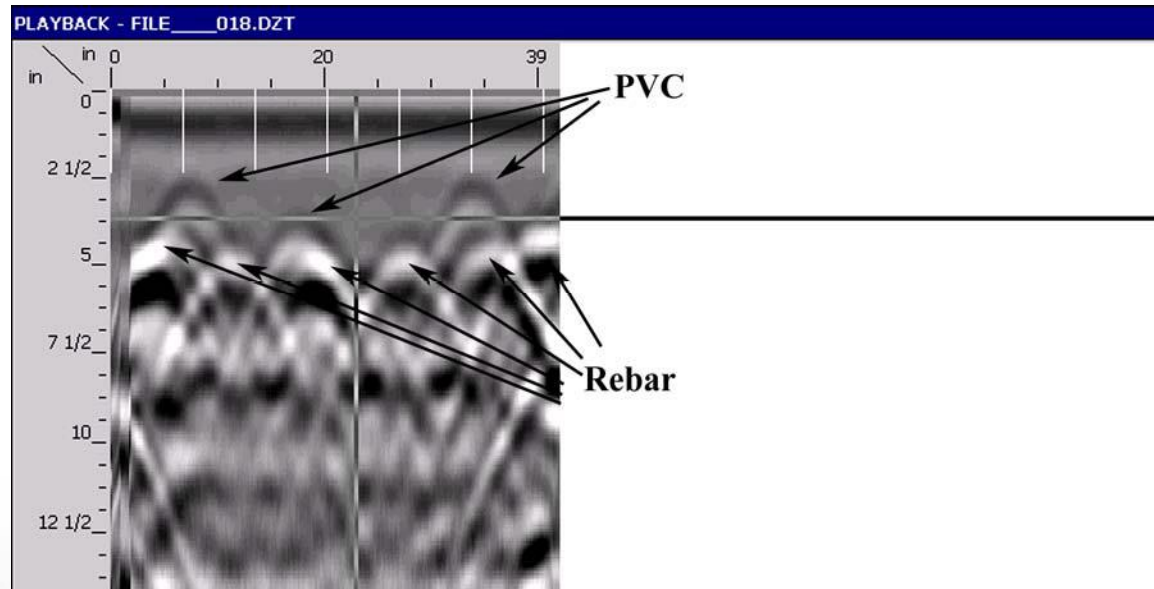
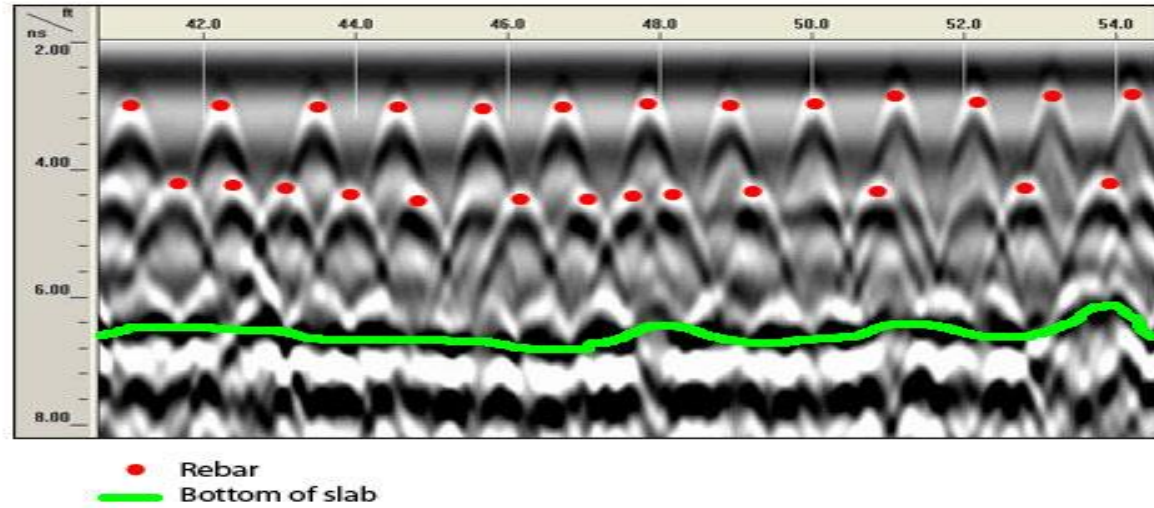


# Exporting Data

➤ The results can be exported to **BIM** models.

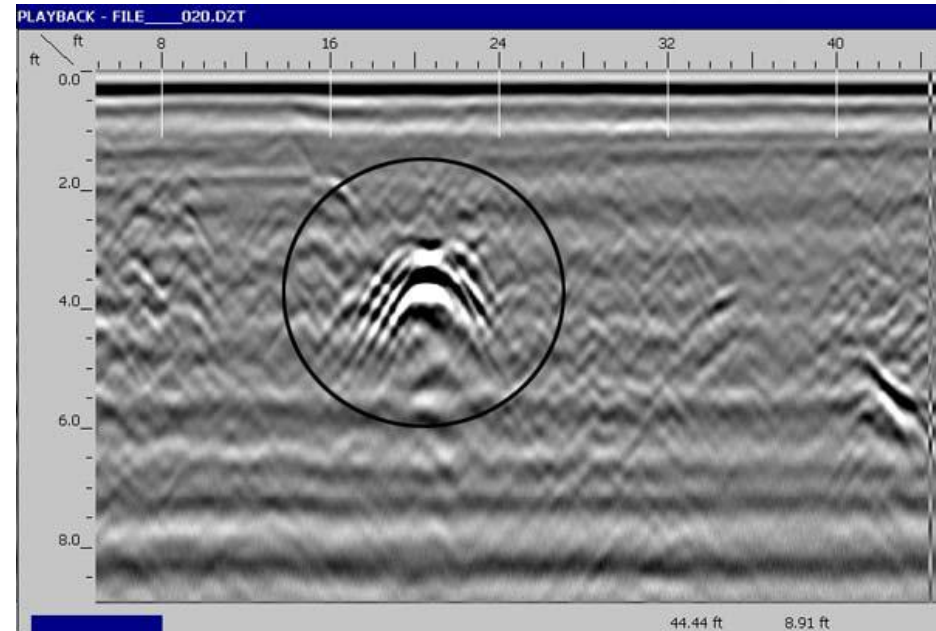
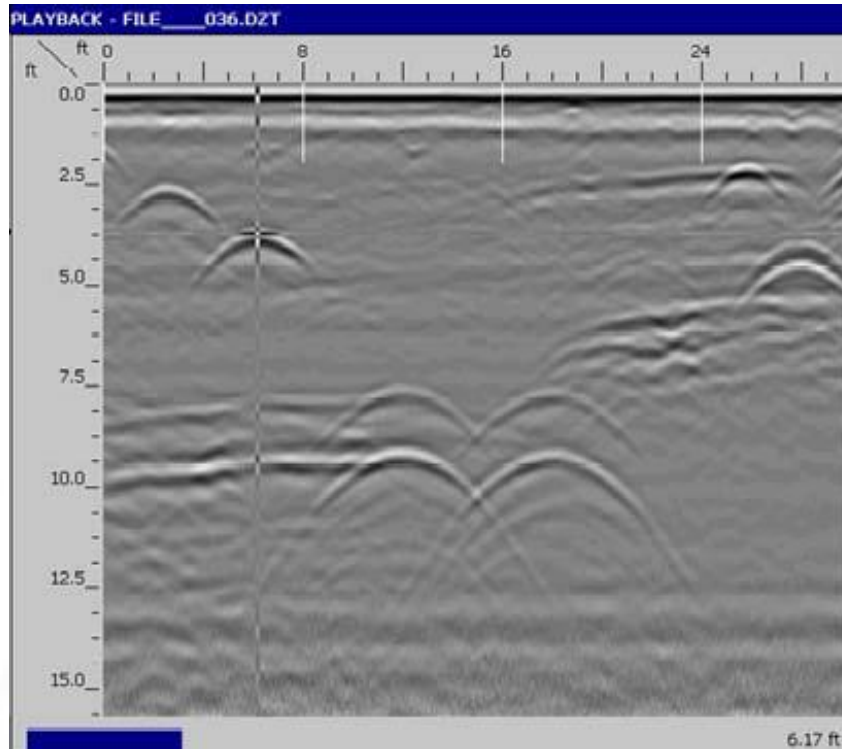


# Concrete Inspection



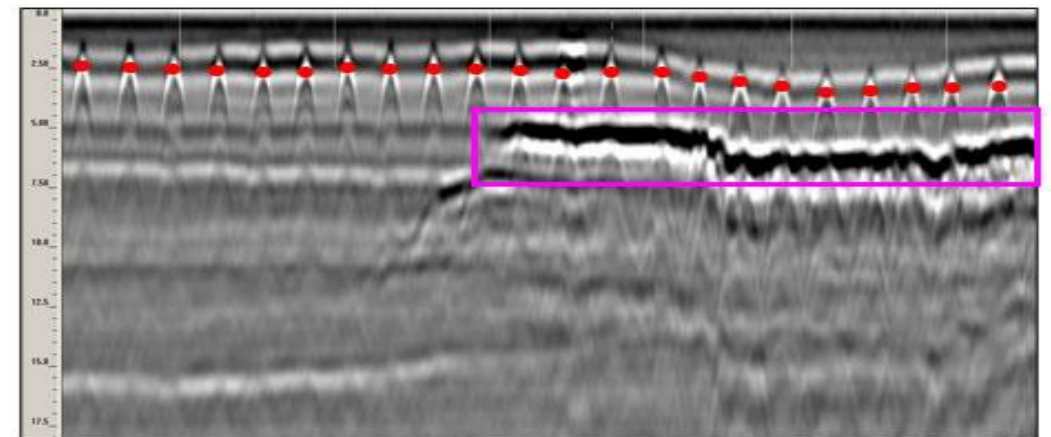
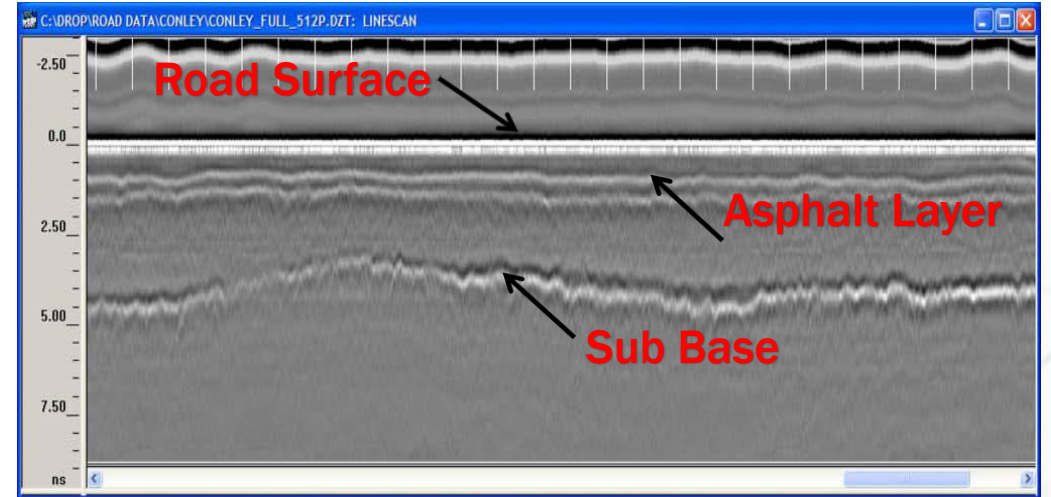
# Utility Locating

- Can detect metallic/non metallic pipes
- Identify voids
- Locate the utility duct banks



# Road/Pavement Inspection

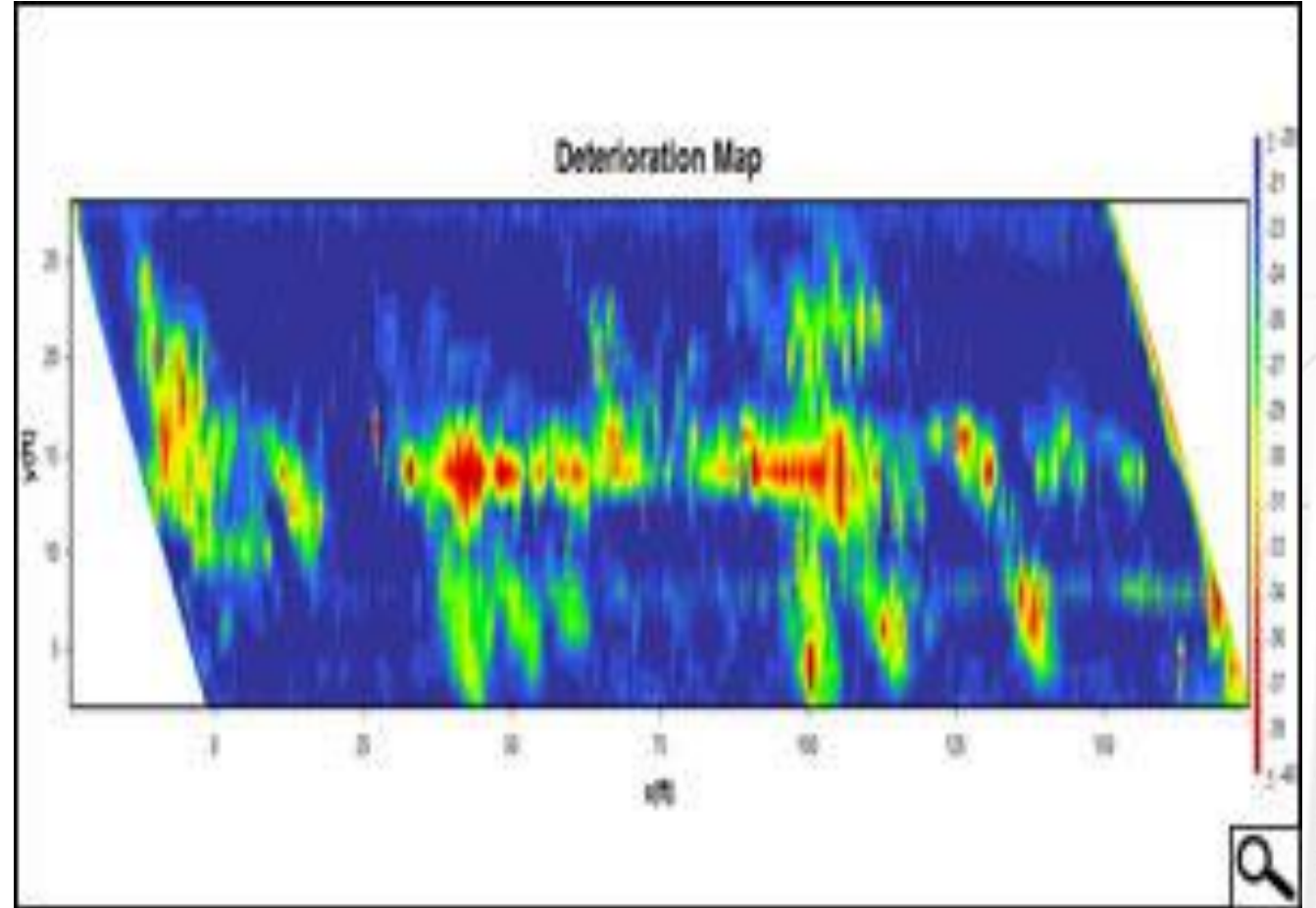
- Asphalt Layer Thickness
- Thickness and Condition of the base and sub-base layers
- Change in moisture level in pavement layers.
- Void detection between pavement layers



- Rebar
- ▭ Large void

# Bridge Inspection

- Condition Assessment
- Concrete Cover
- Bridge deck thickness
- Bridge Deck Deterioration Mapping



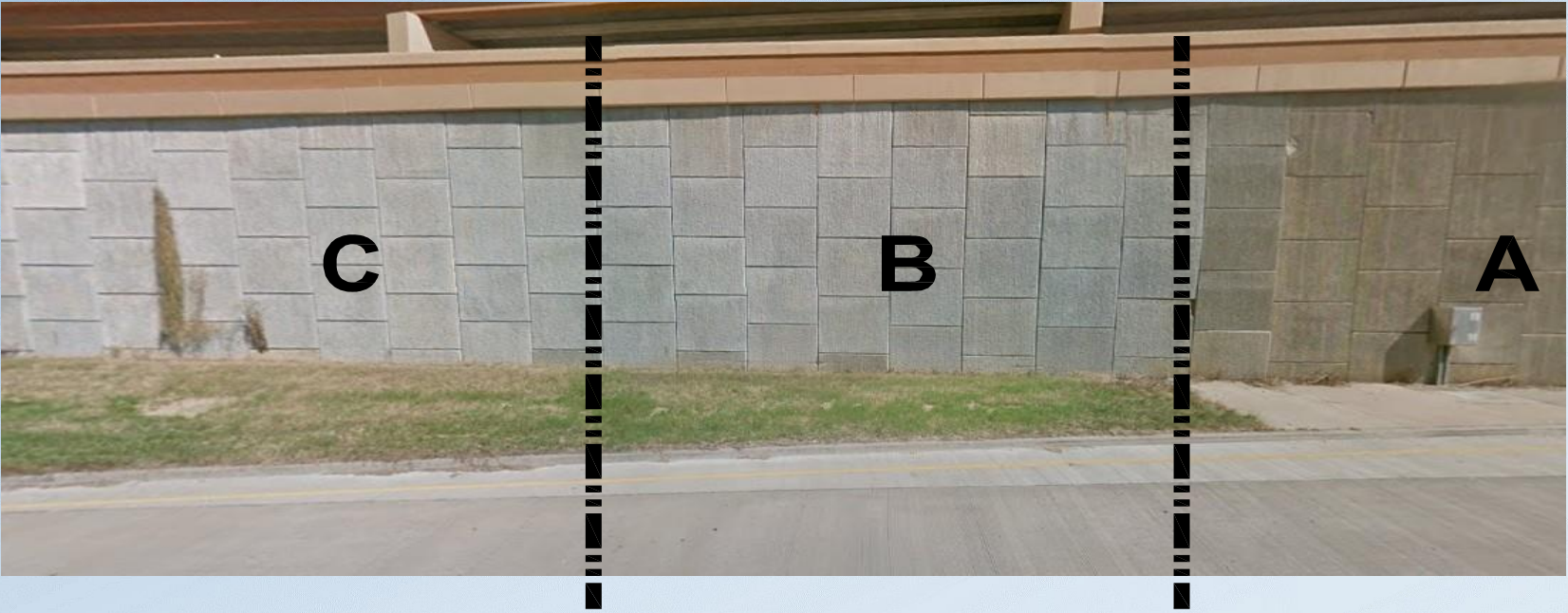
# Retaining Wall and Pavement Inspection

- Condition Assessment
- Wall/slab thickness
- Voids and defect within the wall/slab
- Voids and defect behind/below the wall/slab



# TxDOT MSE Wall Monitoring:

- Panel rotations
- Void below approach slab
- Water infiltration
- Soil erosion



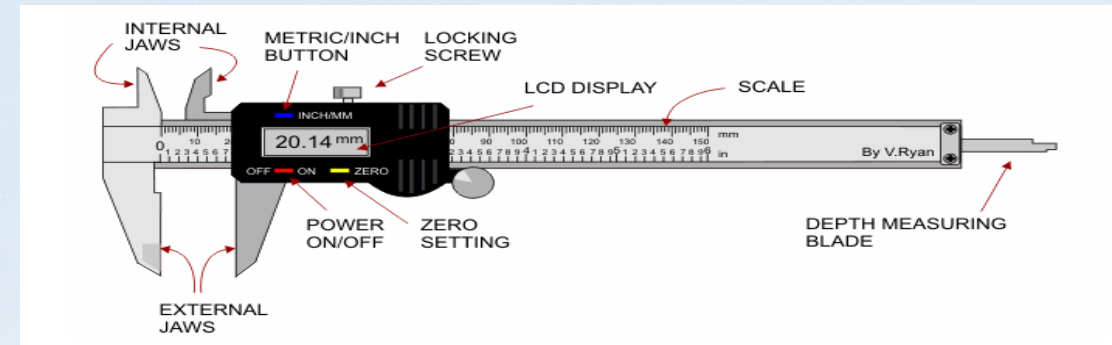
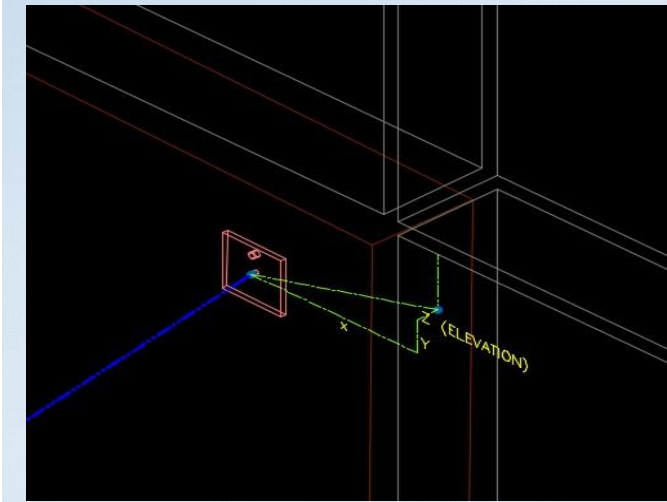
# Monitoring with Sx-10 Robotic Total Station

Wall A – Loop 820 and Pipeline

Wall B – Loop 820

Wall C- 183 and I-20

- Set 1 main point on each wall as critical (highest movement) – Robot Station
- Set 2 or 3 points on the adjacent panels to determine relative movements.
- Determine gap or separation between panels - Digital Caliper

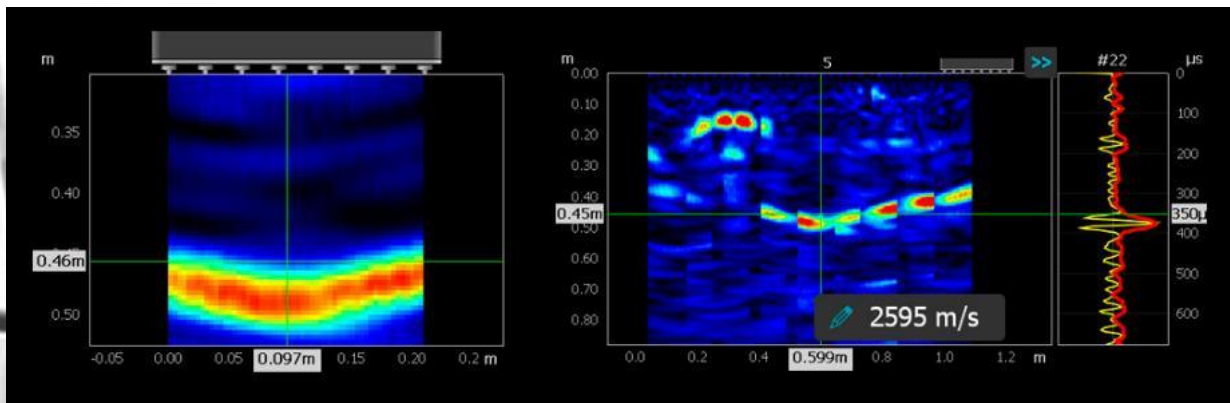


**DIGITAL CALIPER**



# Ultrasound Tomography

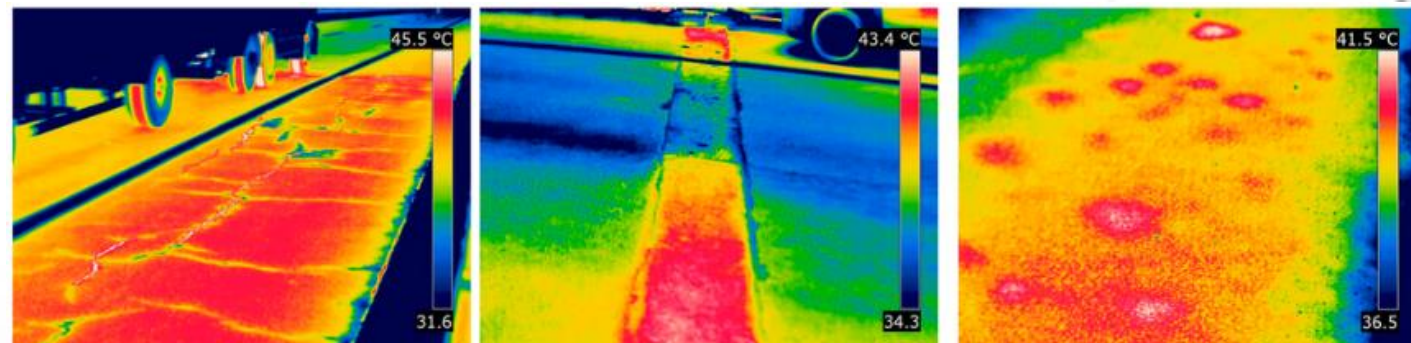
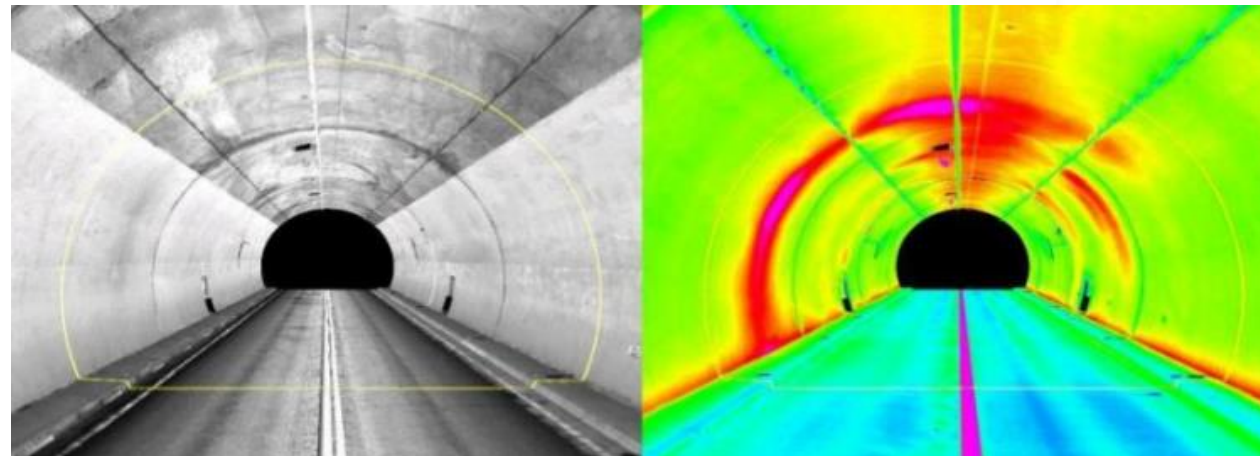
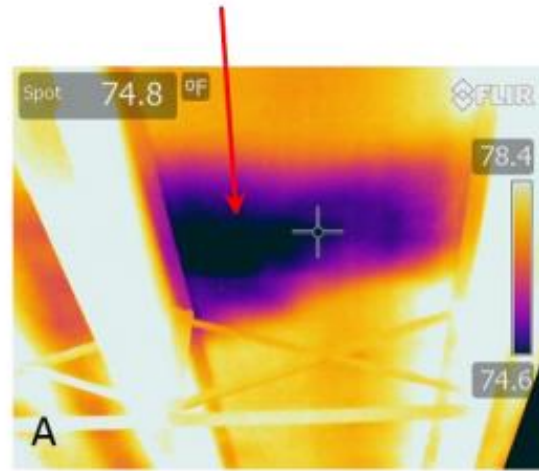
- Uses an antenna formed by several bundled transducers
- Builds 2D/3D images
- Show internal disturbances non visible at the outside surface:
  - Voids
  - Cracks
  - Honeycombing



# Applications

- ✓ Delamination in concrete
- ✓ Detects near-surface defects (cracks and voids)
- ✓ Moisture and water damage
- ✓ Missing insulation

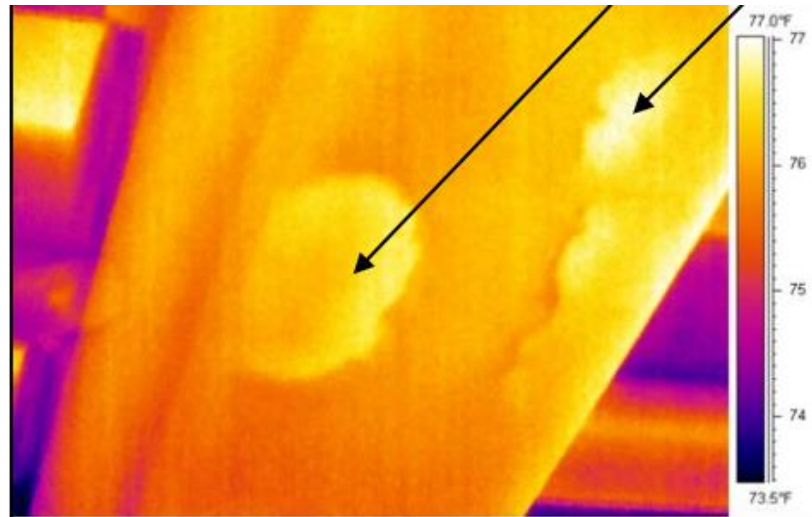
Delamination



# Infrared camera

➤ With thermal imaging, we can see detect temperature differences that show:

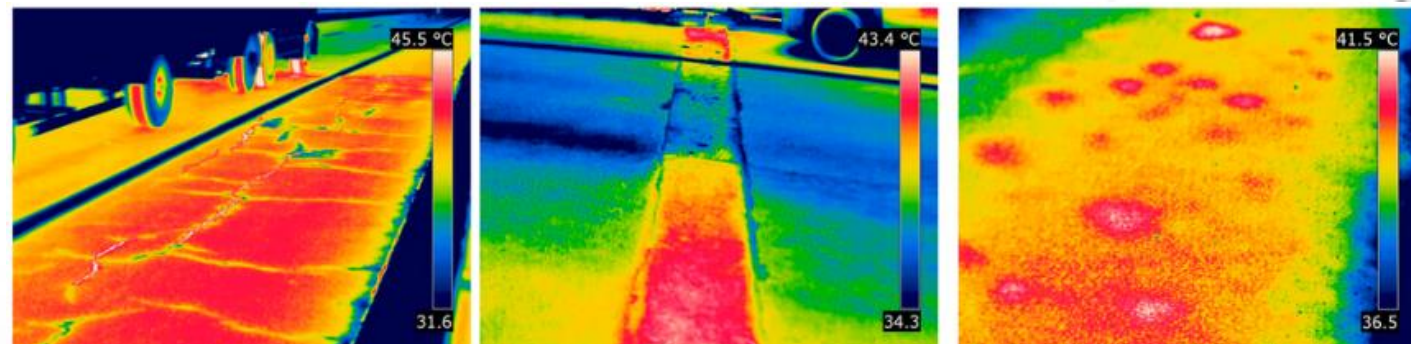
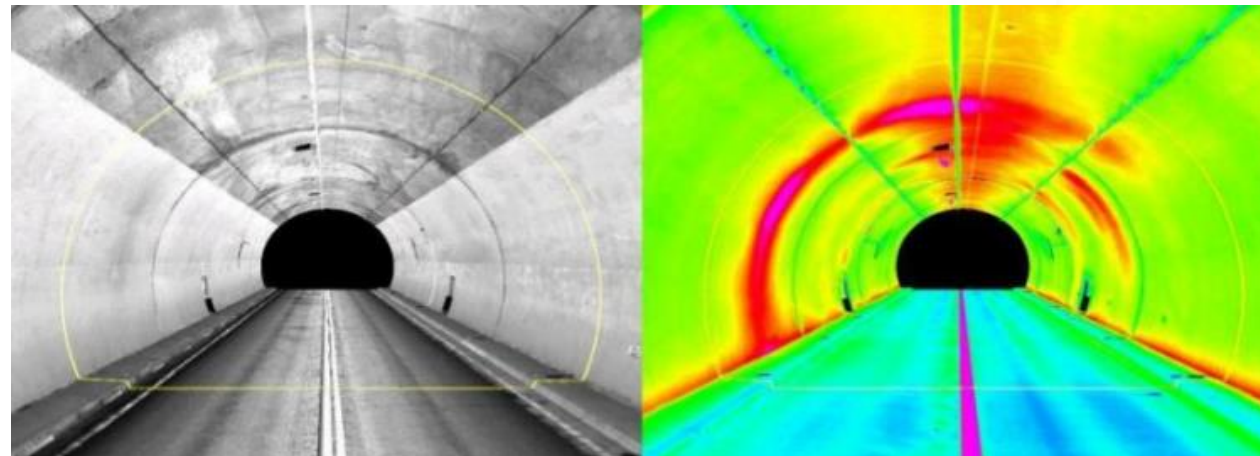
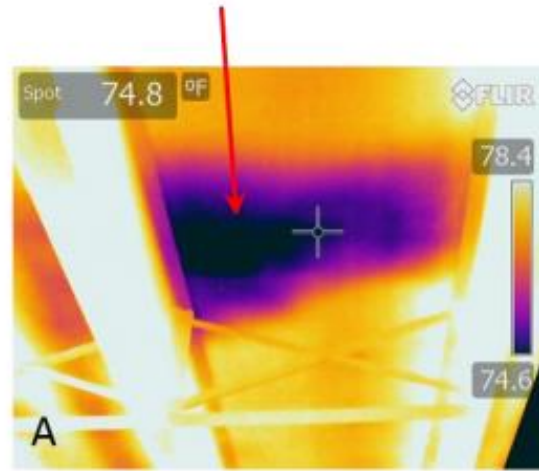
- Moisture damage
- Concrete delamination



# Applications

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Delamination



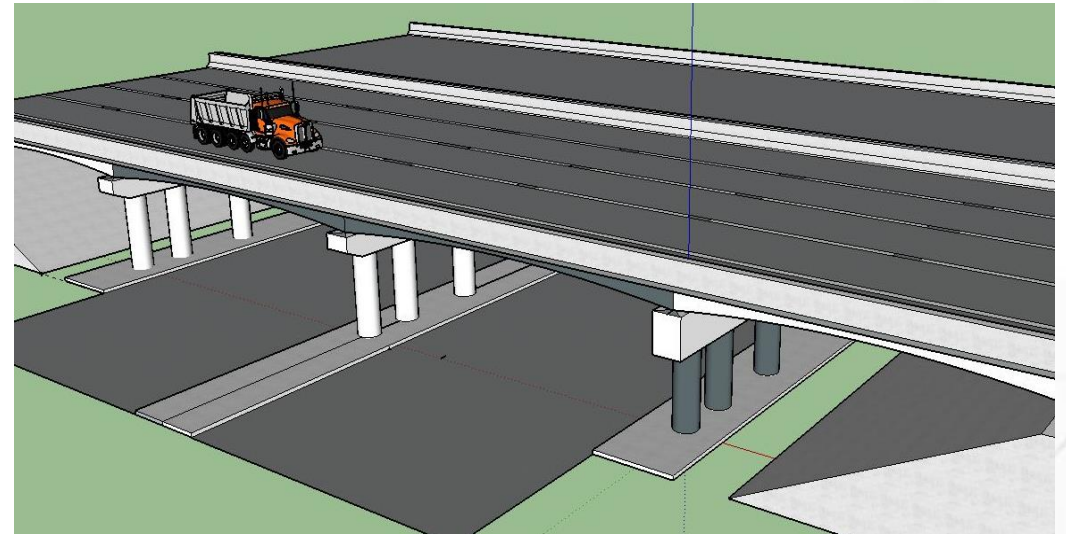
# NDE of Structural Capacity

- Condition Assessment and Load Rating of Bridges is still carried out visually.
- Considers individual structural components instead of overall system behavior.
- NDE load testing of bridge structures quantifies the bridge condition.



# STATIC LOAD TESTING

- A pre weighed truck is moved along the bridge to record the flexural, shear and deflection response.
- The speed of the truck is kept below 5 mph not to produce any vibrations or dynamic response in the bridge.



# TxDOT Bridge Condition Assessment by UTA



**SH183 Over MacArthur Boulevard, Irving**



**SH183 Over Loop 12, Dallas**

# CFRP External Strengthening





# Benefits of UTA-NCTCOG Members Collaboration

- State of the Art facilities, equipment and know-how
- Successful ongoing and past collaborations of mutual benefits
  - Cities, Counties, State, Federal
- UTA is non-profit
- Student training and professional development
- UTA perfectly located within NCTCOG territory