Condition Assessment, Subsurface Exploration and Evaluation using NDE methods

Nur Yazdani, Ph.D., P.E., F. ASCE, F. ACI, F. SEI
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
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

<table>
<thead>
<tr>
<th>Center Frequency</th>
<th>Depth of Penetration</th>
<th>Typical Applications</th>
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</thead>
<tbody>
<tr>
<td>2600 MHz*</td>
<td>0-12 in (0.4 m)</td>
<td>Concrete Evaluation</td>
</tr>
<tr>
<td>2000 MHz Palm</td>
<td>0-12 in (0.4 m)</td>
<td>Concrete Evaluation</td>
</tr>
<tr>
<td>1600 MHz*</td>
<td>0-18 in (0.5 m)</td>
<td>Concrete Evaluation</td>
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<tr>
<td>900 MHz</td>
<td>0-3 ft (0-1 m)</td>
<td>Concrete Evaluation, Void Detection</td>
</tr>
<tr>
<td>400 MHz*</td>
<td>0-12 ft (0-4 m)</td>
<td>Utility, Engineering, Environmental, Void Detection</td>
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<tr>
<td>270 MHz*</td>
<td>0-18 ft (0-6 m)</td>
<td>Utility, Engineering, Geotechnical</td>
</tr>
<tr>
<td>200 MHz</td>
<td>0-30 ft (0-9 m)</td>
<td>Geotechnical, Engineering, Environmental</td>
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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
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
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
Infrared camera

- With thermal imaging, we can see detect temperature differences that show:
  - Moisture damage
  - Concrete delamination
Applications

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