SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

Extracting Value from NDT Applications – NDT Results to Asset Management to NTIS

R06G Implementation

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We Have Lots of Tools for Tunnel Evaluation -

Where do we go next?

•Next Steps -

•Use proven NDT scanning technologies plus traditional evaluation tools together to evaluate tunnel linings quickly and comprehensively.

• The final and most important step –

•Use these results in an integrated **Asset Management** program

Tunnels Managed as Assets

- **As noted - 473+** highway tunnels in the national inventory
- **37 states** have at least 1 tunnel on a highway
  - Tunnel Inspection Requirements based on the **NTIS** are in-place and require tunnel inspection
  - Use the Inspection and NDT Results to rate tunnels, assign conditions, and (ultimately) determine how and where to spend LIMITED FUNDS

R06G Wrap-up

This project had **TWO major parts**

- Use of NDT Techniques for both Rapid and Detailed tunnel evaluation in conjunction with traditional evaluation methods
- **And then –**
- To determine the best ways to USE that information as part of an overall Asset Management plan.

Not implementing the second part effectively essentially makes the first part POINTLESS

R06G Wrap-up (continued)

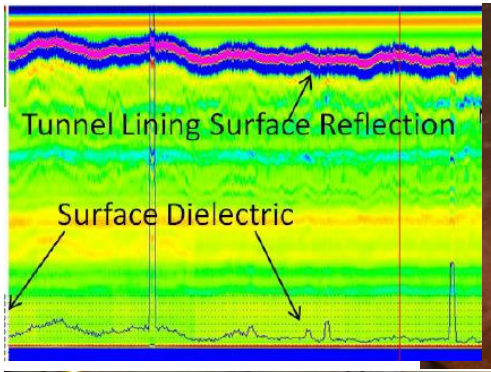
So – USE the "traditional" evaluation methods:

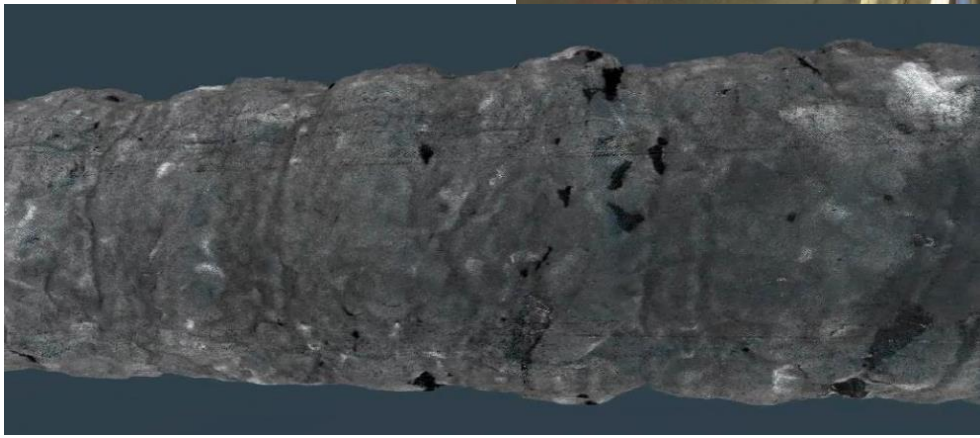
- Visual Inspection
- Hammer Sounding

R06G Wrap-up (continued)

And USE the Mobile Scanning Methods:

- Air-coupled ground-penetrating radar (GPR)
- Thermography
  LIDAR Scanning
- Photogrammetry/
  Photographic

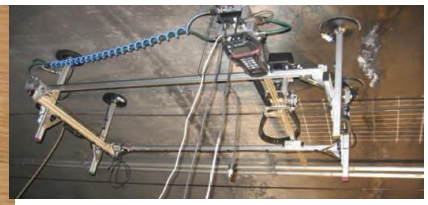




R06G Wrap-up (continued)

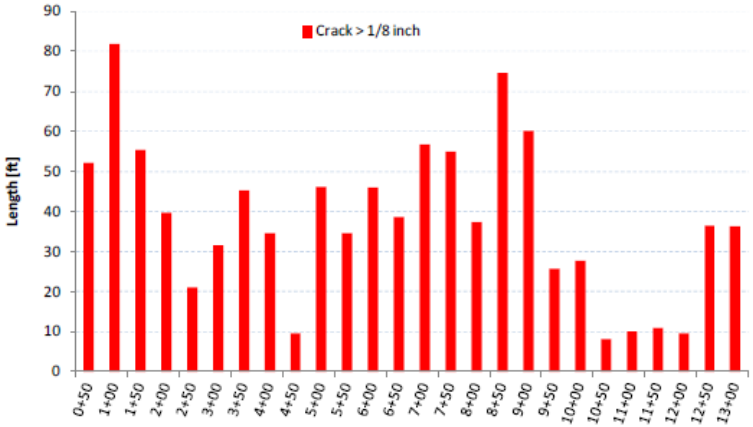
…And USE the Hand-Held Technologies:

- Ground-coupled GPR
- Thermography
- Ultrasonic tomography (UST)
- Ultrasonic echo
- Portable seismic property analyzer (PSPA)
- Ultrasonic surface waves (USW)
- Impact Echo (IE)



R06G Wrap-up (continued)

…And the use the results together to accurately evaluate tunnel condition and keep your tunnels operating "worry-free"



Distribution of Cracks Greater Than 1/8", Armstrong Tunnel

CDOT Tunnels Maintenance/Benefit Worksheet

Element		Type	Unit Cost	Unit	Trigger(s) of Available Funding Options
10001, 10003, 10006	Liner	Minor	$ 250.00	SF	Liner WCI ≥ 2.2 and < 2.5
10001, 10003, 10006	Liner	Major	$ 500.00	SF	Liner WCI ≥ 2.5 or %CS4≥0%
10001, 10003, 10006	Liner	Replace	$ 670.00	SF	Life < 0% and WCI ≥ 2.5 **or %CS4>30%**
10090, 10091	Ceiling Panels	Minor	$ 370.00	SF	Ceiling Panels WCI ≥ 2.2 and < 2.5
10090, 10091	Ceiling Panels	Major	$ 300.00	SF	Ceiling Panels WCI ≥ 2.5 or %CS4>0%
10090, 10091	Ceiling Panels	Replace	$ 200.00	SF	Life < 0% and WCI ≥ 2.5 **or %CS4>30%**
10080	Steel Hangers and Anchorages	Minor	$ 150.00	EA	H&A WCI ≥ 2.2 and < 2.5
10080	Steel Hangers and Anchorages	Major	$ 300.00	EA	H&A WCI ≥ 2.5 or %CS4>0%
10080	Steel Hangers and Anchorages	Replace	$ 1,300.00	EA	Life < 0% and WCI ≥ 2.5 **or %CS4>25%**
10042	Tile Lined Concrete Panels	Minor	$ 15.00	SF	Wall Panels WCI ≥ 2.2 and < 2.5
10042	Tile Lined Concrete Panels	Major	$ 80.00	SF	Wall Panels WCI ≥ 2.5
10042	Tile Lined Concrete Panels	Replace	$ 65.00	SF	Life < 0% and WCI ≥ 2.5 **or %CS4>40%**

Thanks!

Questions?