



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

R06G Implementation

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AASHTO



**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

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)

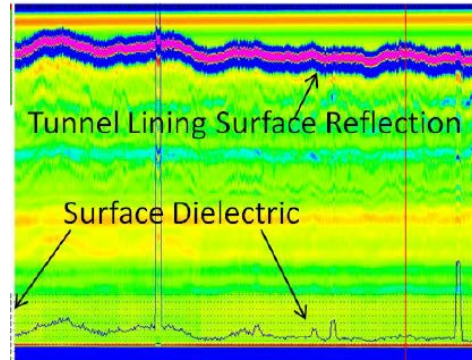
**So – USE the “traditional”
evaluation methods:**

- 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)

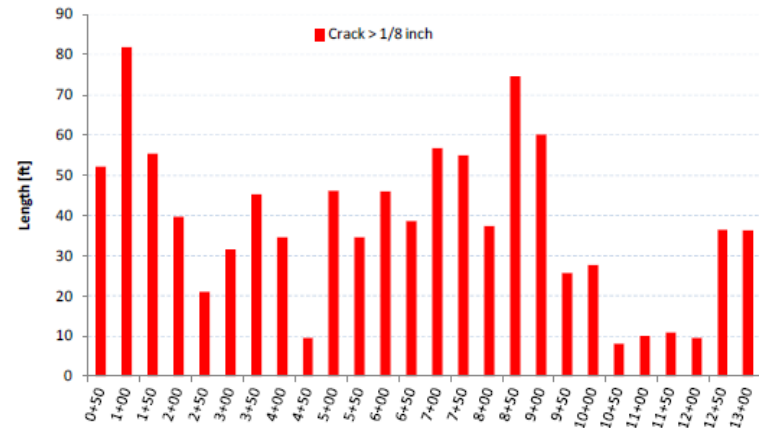
...And USE the Hand-Held Technologies:

- 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 $\geq 0\%$
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?