NEW TECHNOLOGY IN BRIDGES
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The Importance of Cost-Effectiveness: Long Term Funding Gap

Virginia’s 50 Year NBI Bridge Replacement Need vs. Available Funding (Billions)

Assumes Bridges Replaced at Age 70

Best Case Fund Availability (50 Years) vs. 50 Year Replacement Need

- $11B
- $54B
Working Toward Indefinite Service Life – Ideal Timeline for an Interstate Bridge

- **Initial Condition**
- **Timely Action**
- **Rehabilitation and Preservation**
- **Slowed Deterioration Due to Improved Materials and Details**
- **Second Intervention**
- **Possible Third Intervention**
- **Deterioration without Preservation**

Bridge Has Deteriorated Beyond The Point Where Rehabilitation Is Practical/Cost-Effective
Typical & Regular Joint Failure Leads to Deterioration

Deterioration of Concrete Supports

Corrosion of Steel Beams /Girders
Elastomeric Concrete Plug Joint
Fiber Reinforcement in Concrete

Steel with hooked ends

Polyvinyl alcohol

Polypropylene
FRC Used for Joint Elimination “Bendable” Concrete

Eliminate joints: place closure pours
ECC Culvert Repair

ECC: Bendable concrete with tight cracks
Metal Culverts are 10% of the bridge inventory

Spreading ECC over carbon fiber mesh
ECC Culvert Repair

ECC is Pumped into Culvert

5 weeks after repair
Centrifugal Spin Casting (Robotic Shotcrete)

Provides a Concrete Culvert in Place of Steel
Concrete Cracking Tunnels and Bridge Decks
The Importance of Preventive Maintenance - Decks
Fast Track Hydrodemolition
Project Example: I-64 Over Shockoe Valley

Cost to Reach and Sustain “FHWA Good” ~ 5 x Cost of Actual Treatment. Bridge is Currently “Fair” by both VDOT & FHWA Definitions

After Treatment (30 to 40 Year Service Life)

Prior to Treatment
Hand-Held Lasers for Removal of Lead Paint

surface roller beam delivery attachment

laser delivery head with water, fiber, and monitoring lines

handheld beam delivery attachment

CL 1000Q system

sweep scan
Lasers Safely Remove Lead-Based Coatings

Beams from Route 685 (Telegraph Road) over Stinking River
Robotic Hydromilling
Arresting Cracks in Steel Girders
Flying Devices

Drones & Remotely Operated Devices

Images below were taken after flooding and show active scour undermining with riprap countermeasures washed away.

Submersible Devices

High Mast Light Pole
Non-Destructive Tests for Bridge Decks
Infrared Thermography – Heat Signature
Non-Destructive Tests for Bridge Decks
Infrared Thermography - Delamination
Non-Destructive Tests for Bridge Decks
Ground Penetrating Radar – Delamination