Corrosion and Highway Infrastructure

A Federal Highway Administration Perspective

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Highway Infrastructure – Focus

• Although corrosion can impact concrete pavement performance, primary concern is with highway bridges and ancillary structures

• Highway bridges:
  – Concrete bridges and components
  – Steel superstructures

• Ancillary structures:
  – High-mast lighting
  – Cantilever signal and sign structures and sign bridges
Current Problems/Issues

- Concrete bridge components
  - Reinforcing steel
  - Prestressing steel
  - NDE technologies to assess condition
Current Problems/Issues, cont’d

- Steel bridge components
  - Protective coatings and systems
  - NDE technologies to assess multi-layered plates
Concrete Bridge Strategies

• Reinforcing steel in decks, girders, and substructures
  – Epoxy coatings
  – Corrosion-resistant alloys and cladding
  – Corrosion inhibitors in concrete
  – Better quality concrete thru material admixtures, improved construction practices, overlays or membranes, maintenance strategies
  – Cathodic protection (rehabilitation of major strategic bridges)
Concrete Bridge Strategies, cont’d

• Prestressing steel in girders, box beams, and decks
  – Ducted and grouted strand

  Problems occur, however, when the ducts or anchorages leak, or the protective grout does not perform as intended (e.g., partially grouted, soft grout, corrosive grout)
Steel Superstructure Strategies

• Coating systems for carbon steels
  – Labor intensive and costly, life limited to <25 years
• Weathering steels
  – Salt spray
• Next generation corrosion-resistant steels
  – Cost
  – Toughness and weldability
• Multiple plate connections
  – Corrosion between plies
  – Inspection and condition assessment
Current “Hot Topics”

• Corrosive Grout
  – Sampling plan for affected structures
  – Allowable chloride threshold
  – Soft grout
Current “Hot Topics”

• “Uninspectable” connections and details
  – Ducted prestressing strand and cable condition assessment
  – Parapet-to-deck connections
Current “Hot Topics”

• Bridge deck inspection, assessment, and repair
Opportunities

• Better materials
  – ECR with enhanced adhesion
  – Low permeability (and self healing?) concretes
  – Corrosion resistant structural steels
  – 100 year coatings(?)

• Cost-effective long-life preservation strategies
  – Corrosion mitigation and repair techniques

• Condition assessment
  – Reliable/robust corrosion sensors
  – Reliable chloride concentration/penetration sensors
  – NDE techniques for structural components
  – Tools to assess coating performance
Comments or Questions?