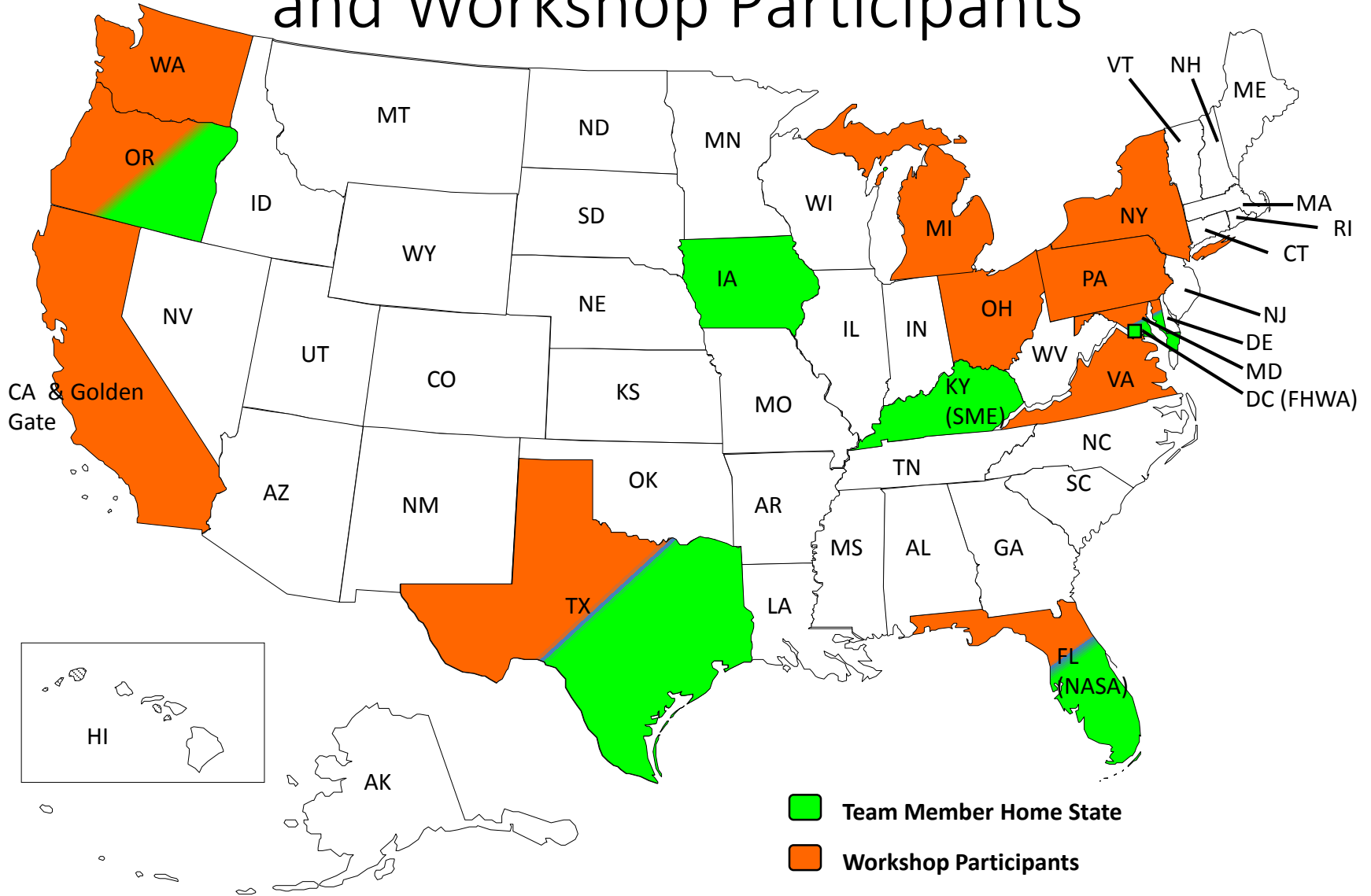


Domestic Scan 15-03
Successful Preservation Practices
For Steel Bridge Coatings
Desk Scan Summary Report

Transportation Research Board

Washington, DC

Scan 15-03 Team Members Home State and Workshop Participants



Cost of Corrosion In the US

- Cost of Transportation Related Corrosion in US ~ \$276 Billion in 1998
- Cost of Corrosion in US Transportation Bridge Industry ~ \$30 Billion

Scope of Domestic Scan

- Determination of Agency Funding Levels
- Evaluation Practices For In Situ Coatings
- Surface Preparation
- Coating Option Decision Making
- Use of Performance-based Contracts
- Performance Evaluation of Overcoat And Replacement Coatings
- Specifications For Coating Systems Including:
 - Removal And Replacement
 - Overcoating
 - Spot/Zone Coating
- Quality Assurance Coating Inspection Requirements
- Quality Control Inspector Qualifications
- Contractor Qualifications
- Agency Commitment To Supporting Future Preservation of Coatings

Goals of Domestic Scan

- Best practices for selecting materials and identify test methods to qualify coatings for spot/zone painting, overcoating, and total removal and recoat on bridges.
- Best practices for painting on bridges incorporating the selection process, proper materials handling, cleaning, soluble salt remediation, mechanical surface preparation, verification of ambient conditions, coatings application and compliance with worker safety and environmental regulations,
- Best practices for writing contracts and coating specifications

Definition of Bridge Preservation

“Extending Bridge Service Life by
Doing the Right Thing to the Right
Bridge at the Right Time”

Painting

- In FHWA Bridge Preservation Guide listed as Preventive Maintenance (PM) action along with debris cleaning, bridge washing, etc.
- Due to cost and repairability, paint is considered a bridge “element”

Determination of Agency Funding Levels

- 11 State Highway Agencies – Preventive Maintenance Programs
- 6 Owners – Steel Bridge Preservation Programs
- Use Life-cycle costs for effective coating decisions
- Dedicated funding for bridge painting – An algorithm
 - Inventory
 - Structure condition
 - Other structure specific attributes
 - ADTs
 - User costs
 - Safety

Evaluation Practices for In-Situ Coatings

- All SHAs performed assessments before making maintenance painting decision by following NBIS
- Two year frequency – Bi-annual in-service bridge safety inspections
- Coating Assessment Tools
 - SSPC VIS 2
 - Custom photographs
 - Tensile adhesion testers
 - Tape/knife adhesion
 - Soluble salt kits
 - Tooke gage
 - Coating thickness gages
 - Steel thickness gages
 - Pit depth gages

Evaluation Practices for In-Situ Coatings (cont.)

- SHAs use element-level bridge inspection for coatings - Agency-developed elements
- Virginia SHA – Agency-developed elements
 - Condition of beam ends
 - Beam end coating systems
- Oregon SHA – Agency-developed element
 - Rate condition of coating system of the entire superstructure
- Iowa SHA – Micro-environment to identify localized areas of a bridge

Surface Preparation

- SHAs specified SSPC SP-10 for total removal and replacement
- Surface preparation varied for spot and overcoating
- SHAs utilized SSPC Guide 6 for containment
- SHAs moving away from overcoating
 - Environmental and safety regulations
 - Cost advantages with total removal and replacement
- California SHA
 - In-house painting crews to perform overcoating
 - Extend service life of lead based coatings thru overcoating

Surface Preparation (cont.)

- Oregon SHA
 - Ultrahigh pressure washing (>20,000 psi) to remove pack rust
- Texas SHA
 - Water blast (SSPC SP WJ4) before any mechanical surface preparation
- New York SHA
 - Hot pressure washing (180° F) at 3,000 psi to remove surface contaminants

Coating Option Decision Making

- Expected service life of coatings
 - Total removal and replacement -15 to 30 years
 - Overcoat – 10 to 20 years
- High performance coating systems
 - Lack of US historical data
 - Current coating evaluations/test methods/results
- Testing high performance (Ultra Weatherable) coatings
 - Modified accelerated weathering
 - Outdoor exposure
 - Different topcoat colors
- Metalizing
 - New York and Ohio SHAs

Use of Performance-Based Contracts

- Warranty Contracts

- Maryland & Michigan SHAs – 2 year coating condition performance warranty
- Oregon SHA – 3 year
- Golden Gate Bridge District – 5 year on contracted work for labor and materials only

- Bonding Amounts

- Maryland & Michigan SHA – 25% of total project value
- Oregon SHA – 90% of line items
 - Surface preparation
 - Temporary work platforms & containment
 - Pack rust removal
 - Coating materials and application

- Inspection frequency and enforcement language in specifications

Performance Evaluation of Overcoat and Replacement Coatings

- SHAs used AASHTO's NTPEP/NEPCOAT program
 - Pass/fail criteria
 - Create Approved Products Lists
- SHAs perform in-house testing of coating systems
 - Chemical composition characterization of coatings samples from project site
 - Texas and California SHAs have in-house formulations

Specifications for Coating Systems

- All SHAs Specifications

- Standard field cleaning and painting specifications
- Standard special notes
- Paint material specifications
- Containments
- Illumination requirements
- Qualifications for contractors and consultant inspectors
- Record keeping requirements
- Hold points for QC/QA inspections
- Stripe coating
- Safety, waste designation and removal
- Traffic control requirements
- Some included bridge plans

Quality Assurance Coating Inspection Requirements

- 1 SHA had in-house personnel perform all QA inspections
- 5 SHAs had consultants for QA inspections
- 6 SHAs had a mix of in-house personnel and consultants for QA inspections
- Minimum Qualifications/Certifications
 - NACE CIP Level 1
 - SSPC BCI Level 1
 - Some SHAs specified higher levels
- Requirements for in-house personnel varied

Quality Control Inspection Qualifications and Contractor Qualifications

- QC Inspection Training
 - All SHAs required some training before assigned to a project
 - Training of in-house personnel was on-the-job
 - Industry based training to a lesser extent
 - In-house instructor-led training
- Contractor Qualifications
 - 9 SHAs required QP1 and QP2
 - 3 SHAs required QP3 for shop painting
 - 1 SHA did not need any QP certification
 - 1 SHA allowed QP 7 for new contractors

Agency Commitment to Supporting Future Preservation of Coatings

- Asset Management
 - Dedicated groups/personnel
 - Overall maintenance budgets on a system level
- Bridge Management System (Pontis/BrM)
 - Network level trends
 - Bridge needs based on system wide constraints
- Bridge Maintenance Management System (BMMS)
 - Project level needs
- Establish performance measures for maintenance painting

Recommendations from Scan Team

- Determination of Agency Funding Levels
 - Dedicated Bridge Painting Funds – Algorithms to appropriate funds based on inspection data
- Evaluation Practices for In-situ Coatings Prior to Recoating
 - Inspection Elements
 - Agency Developed Elements
- Surface Preparation
 - Ultrahigh pressure washing to remove pack rust
 - Crevice sealer to inhibit corrosion
 - Laser Coating Removal (investigative)
- Coating Option Decision Making
 - Duplex Systems (Painting over HDG) and Metalizing
 - Ultra Weatherable Coatings (investigative)
 - Fluoropolymers
 - Smart Release Corrosion inhibitor
 - Un-topcoated IOZ

Recommendations from Scan Team (cont.)

- Use of Performance-Based Contracts
 - Warranties – Length of contract and bonding amount
 - Inspection frequency
 - Specification language
- Performance Evaluation of Overcoat and Replacement Coatings
 - Modify national test protocols
 - Incorporate Colorimetry into testing protocols
- Specifications for Coating Systems
 - SSPC SP 10 or better for total removal and replacement
 - Paint beam ends (Weathering steel)
 - Incorporate hold points for inspection
 - Full time inspection/inspectors
 - Stripe coating
 - Bridge Washing – Remove surface contaminants

Recommendations from Scan Team (cont.)

- Quality Control Inspection Qualifications and Contractor Qualifications
 - Specify NACE CIP and/or SSPC BCI
 - Specify SSPC QP1 or QP2 for contractors
- Agency Commitment to Supporting Future Preservation of Coatings
 - Tracking coating information for bridges
 - Communication with SHAs
 - Joint elimination
 - Waste disposal – Specify as hazardous

Acknowledgements & Questions

- Domestic Scan 15-03 Team Members
 - Paul Vinik – Chair – Florida SHA
 - Charlie Brown – Maryland SHA
 - Ray Bottenberg – Oregon SHA
 - Justin Ocel – FHWA
 - Tom Schwerdt – Texas DOT
 - Mike Todsens – Iowa DOT
- 12 Workshop Participating SHAs and Owners

Maryland State Highway Administration Successful Preservation Practices for Steel Bridge Coatings



Overview

- Maryland State Highway Administration's (SHA) Painting Program Consists of:
 1. Capitol Budget
 2. Paint Team
 3. Coatings Evaluations - Element Level Inspection
 4. Paint Specification
 5. Paint Inspection – 3rd Party, QA & QC
 6. Contractor Certification

Overview – Cont'd

7. Paint Warranty's
8. Material Specification
9. Paint Systems
10. Data Tracking
11. SHA's Core for a Successful Paint Program

Capital Budget

- SHA's Capital budget consists of the following:
 1. Capital Budget is \$12 million per year for paint
 2. In the \$12 million we have room to maneuver for placing repair work in with paint contracts
 3. Within our remedial repair side we can also address paint in emergency situations

Paint Team

1. Dedicated paint design team inspecting bridges and putting together specifications
2. Dedicated paint construction inspection team with 3rd party paint inspection in the field on all paint projects
3. Dedicated Environmental Inspection on all paint projects
4. SHA oversight on all aspects of the paint program for the entire state

Coating Evaluation Element Level Inspection

1. Coatings evaluations start with an element level inspection done by our bridge inspection staff
2. All element level inspections which list a condition state 3 or 4 are automatically selected by our design team to perform a visual inspection
3. Remedial engineers can request the paint design team to do a visual inspection on specific structures they feel need to be addressed

Coating Evaluation Element Level Inspection – Cont'd

4. The public may make requests and the paint design team will review and inspect structure(s) based on those requests
5. Our new bridge design team may ask for a paint survey or estimate for a new bridge or existing bridge that is being rehabilitated or built

Paint Inspection – 3rd Party Quality Assurance Inspection

SHA's 3rd party paint inspection program performs Quality Assurance Inspections on all paint contracts in the State.

1. SHA has approx. 12 full time inspectors
2. Inspectors job duties are to document all aspects of the paint job to ensure contractor is performing to the contract requirements
3. Paint Inspector maintains daily IDR's, paint reports, and blast cleaning reports

Paint Inspection – 3rd Party Quality Assurance Inspection - Cont'd

4. Documents containment installation, ambient conditions, paint mixes, basically all aspects of the painting operation
5. Performs visual inspection on steel to verify cleanliness prior to painting
6. Verifies paint is applied in the correct sequence
7. Performs DFT inspections
8. Documents Hazardous waste and its storage

Paint Inspection – 3rd Party Quality Assurance Inspection - Cont'd

9. Informs remedial engineers of any defects found on the bridge such as heavy section loss, missing bolts, missing shim pads etc.
10. MOT inspection as needed or required by job

Paint Inspection – 3rd Party Quality Assurance Inspection - Cont'd

- Qualifications of Paint Inspectors
 1. Nace Level 1 or SSPC BCI Level 1 or approved equal
 2. SSPC C-3 Competent person for Deleading of Industrial Structures
 3. SHA Traffic Manager Certification
 4. Preferable 3 years experience

Contractor Certification

The Contractor/subcontractor removing or applying paint shall be SSPC QP-1 certified.

When the paint being removed contains toxic metals, the Contractor/subcontractor removing the paint shall be SSPC QP-2 certified.

All certificates shall be effective prior to Award of Contract and shall remain in effect for the duration of the Contract. Refer to 436.03.01.

Paint Warranty's

- **Bond and Liability Insurance.** Furnish a Warranty Performance Bond equal to 25 percent of the total Contract price for all items prior to the date of acceptance of the Construction Phase of the project by the Administration.

Paint Warranty's – Cont'd

PERFORMANCE CRITERIA TABLE	
THRESHOLD LEVEL	REMEDIAL ACTION
Less Than 1 Square Foot Failure of a Bridge Element	No action required
1 Square Foot to Less Than 20 Square Feet Failure of a Bridge Element	Remove defective paint, rust, etc., and repaint defective area of Bridge Element.
20 Square Feet or More Failure of a Bridge Element	Totally reclean and repaint entire Bridge Element.

Material Specification

- **GENERAL.** SHA's Office of Materials Technology (OMT) will maintain a list of Approved Paint Manufacturers. Only manufacturers on this list will be acceptable.

Data Tracking

1. MD SHA uses a worklist to track all work done to individual bridges. This history is per bridge and includes all work including cleaning and painting with type of paint system, cleaning method, color and approx. square footage of bridge.
2. We also use warranty inspections and past contracts to track and maintain what work has been done to each bridge in MD.

Data Tracking Cont'd

3. We also keep a master list of all bridges that have been inspected by the paint team and a master list of all bridges that have been on a paint contract.
4. The master list of painted bridges covers type of paint job i.e. zone or complete, type of paint system used, color of finish coat and year it was painted.

SHA's Core Items for a Successful Paint Program

1. Dedicated Budget
2. State wide program for needs & inspection
3. Dedicated paint team for design and QA inspection
4. Dedicated year round consistent paint inspection forces
5. Consistent enforcement of specifications

Common Problems/ Issues

1. Blast Clean Profile – What to do when it does not meet spec.
2. Caulking – when and where
3. Hazardous waste – Storage issues with bags and secure locations
4. Contractor performing according to submittals

ANY QUESTIONS

