“SUCCESSFUL PRESERVATION PRACTICES FOR STEEL BRIDGE COATINGS”

Prepared By Paul Vinik, Florida DOT

Presented to SCOM, Jeff Milton, Virginia DOT
How Much Does Corrosion Cost?

• Total Direct Cost ~ $276 Billion in 1998 – 2001
• $8.3 billion just for bridges
• Highway Trust Fund (HTF) income 2001 = $29.1 billion
Scope of Domestic Scan:

- Funding Levels
- Evaluation Practices For In Situ Coatings
- Surface Preparation
- Coating System Decision Making
- Warranties
- Coating Inspection Requirements
- Inspector Qualifications
- Contractor Qualifications
- Scan Team Recommendations

Shop coating specifically excluded!
Acknowledgements

• 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 Todsen – Iowa DOT

• 12 Workshop Participating SHAs and Owners
Agency Funding Levels

- All 13 agencies have preventive maintenance programs
- 6 agencies have dedicated steel bridge preservation programs
- Most organized / effective implementers seem to be based on inventory size

Maryland Mandates - no more repairs to beam ends!!
Painting

• In FHWA Bridge Preservation Guide paint is listed as Preventive Maintenance (PM) action along with debris cleaning, bridge washing, etc.

• Due to cost and reparability, paint is considered a bridge “element”
Evaluation Practices for In-Situ Coatings

• All SHAs performed assessments before making maintenance painting decision by following NBI Regs
• Two year frequency – Bi-annual in-service bridge safety inspections
Selecting Coating Candidates

Triage using NBI or element-level inspection data

Conduct special coating inspection

Prioritize
Selecting Coating Candidates

Leverage agency-defined elements!
\textit{(AASHTO Element 515 isn’t a panacea)}

Oregon
- Condition of entire superstructure coating system

Virginia
- Condition of beam ends
- Beam end coating systems
Overcoating

- Agencies 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

- All agencies specified SSPC SP-10 for total removal and replacement
Surface Preparation

- Varied for spot and overcoating
- All utilized SSPC Guide 6 for containment
Surface Preparation

Oregon
- UHP washing (>20,000 psi) to remove pack rust

Texas
- Water blast (SSPC SP WJ4) before any mechanical surface preparation

New York
- Hot pressure washing (180 °F) at 3,000 psi to remove surface contaminants
Coating Option Decision Making

**3-coat, zinc-rich is the workhorse**
- Expect 15-30 years for total removal and replacement
- General satisfaction with these systems

**Ultra-weatherable coating systems**
- Siloxane, Polyurea, Fluoropolymer
- Lack of data to justify cost, none submitted to AASHTO NTPEP

**Metalizing**
- New York and Ohio have multi-decade experience
- No rusting, though not aesthetic, cost
## Warranties

<table>
<thead>
<tr>
<th>Location</th>
<th>Warranty Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland / Michigan</td>
<td>• 2 yr. / 25% total project value</td>
</tr>
<tr>
<td>Oregon</td>
<td>• 3 yr. / 90% of coating line items</td>
</tr>
<tr>
<td>Golden Gate</td>
<td>• 5 yr. (contracted labor and materials)</td>
</tr>
<tr>
<td>Virginia</td>
<td>• 1 yr.</td>
</tr>
<tr>
<td>Ohio</td>
<td>• 3 yr. in the past</td>
</tr>
</tbody>
</table>

### Sweet Spot

- Leverage in-service inspection
- Not so long you forget
- If quality bad, it will appear in 2 yrs.
- Defining “failure” is tricky
Coating Inspection Requirements:

In-house Personnel QA Inspections
- 1 agency

Consultant Personnel QA Inspections
- 5 agencies

Blended In-house/Consultant QA Inspection
- 6 agencies

Minimum Consultant Certifications
- All at least NACE CIP Level 1 / SSPC BCI Level 1
- Some used NACE CIP Level 3 / SSPC BCI Level 2

Minimum In-House Certification
- Varied
Coating Inspection Requirements

Hold Points

• Maximize

100% QA inspection

• Verification leads to quality

Striping

• Tint the stripe
• Which coat varied by agency and coating
Inspector Qualifications

All agencies required training before assigned a bridge project

Primarily on-the-job training

Industry-based (NACE or SSPC) training

In-house instructor-led training
Contractor Qualifications

9 agencies required SSPC QP1 and QP2

3 agencies required SSPC QP3 for shop painting

1 agency did not require SSPC QP certification

1 agency allowed SSPC QP 7 for new contractors

QP 1 = Prepare and apply coatings in field
QP 2 = Hazardous paint removal in field
QP 3 = Prepare and apply coatings in shop
QP 7 = Introductory program for contractor less than 6 months experience
Other Findings

- Eliminate Deck Joints
  - Add continuity
  - Link slabs
  - Move joint behind abutment
Other Findings

One-Coat IOZ

Agencies preferred IOZ to OZ
Scan Team Recommendations

- Agency Funding Levels
  - Dedicated Bridge Painting Funds
  - Evaluation Practices for In-situ Coatings Prior to Recoating
  - Inspection Elements
- Surface Preparation
  - Ultrahigh pressure washing to remove pack rust
  - Crevice sealer to inhibit corrosion
- Coating Option Decision Making
  - Duplex Systems (Painting over HDG) and Metalizing
  - Ultra Weatherable Coatings (investigative)
  - Un-topcoated IOZ
Scan Team Recommendations

- Use of Performance-Based Contracts
  - Warranties – Length of contract and bonding amount
  - Specification language

- 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
Scan Team Recommendations

• Quality Control Inspection Qualifications and Contractor Qualifications
  • Specify NACE CIP and/or SSPC BCI
  • Specify SSPC QP1 or QP2 for contractors
• Agency Commitment to Support Future Preservation of Coatings
  • Track coating information on bridges
• Joint elimination
• Waste disposal – Specify as hazardous
TSP2 Bridge Preservation

- [https://tsp2bridge.pavementpreservation.org/technical/coatings/](https://tsp2bridge.pavementpreservation.org/technical/coatings/)

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### Painting Costs $/M2

<table>
<thead>
<tr>
<th></th>
<th>Pb</th>
<th>No Pb</th>
<th>Expected Service Life</th>
<th>Maintenance of Traffic Required (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot Paint</td>
<td>19</td>
<td>7</td>
<td>4.5</td>
<td>30</td>
</tr>
<tr>
<td>Over Coat</td>
<td>5</td>
<td>3</td>
<td>9</td>
<td>75</td>
</tr>
<tr>
<td>Remove &amp; Replace</td>
<td>8</td>
<td>5</td>
<td>28</td>
<td>180</td>
</tr>
</tbody>
</table>

*Green = Input Parameters  
Red = Calculated Parameters

#### 20 year Coating Maintenance Combinations

<table>
<thead>
<tr>
<th>Remove and Replace</th>
<th>Overcoat</th>
<th>Paint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

### Example Conditions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>630</td>
<td>Maintenance of Traffic Cost ($/dag)</td>
</tr>
<tr>
<td>150,000</td>
<td>Area of Steel (ft²)</td>
</tr>
<tr>
<td>95%</td>
<td>Pb Present</td>
</tr>
<tr>
<td>19%</td>
<td>Corrosion</td>
</tr>
<tr>
<td>3%</td>
<td>Annual Percentage Rate of Change (APR)</td>
</tr>
<tr>
<td>3</td>
<td>Average Motorist Delay (mins)</td>
</tr>
<tr>
<td>20,000</td>
<td>AADT (total)</td>
</tr>
<tr>
<td>3%</td>
<td>AADT that is trucks</td>
</tr>
<tr>
<td>0.5</td>
<td>Passenger vehicle pay factor</td>
</tr>
<tr>
<td>25</td>
<td>Average hourly wage ($/hr)</td>
</tr>
</tbody>
</table>

### 20 year analysis

<table>
<thead>
<tr>
<th>Remove and Replace</th>
<th>Total Future Value Cost to Remove and Replace</th>
<th>Future Value of User Delay Cost</th>
<th>Future Value of MOT at yr 20</th>
<th>Present Value Cost to Paint without MOT</th>
<th>Present Value Cost to Paint with MOT</th>
<th>Present Value User Delay Cost to remove and replace</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>($4,765,826.20)</td>
<td>($2,344,222)</td>
<td>($118,234)</td>
<td>($1,200,000)</td>
<td>($1,265,000)</td>
<td>($1,287,500)</td>
</tr>
</tbody>
</table>
ANY QUESTIONS

- http://www.domestiscan.org/15-03-successful-preservation-practices-for-steel-bridge-coatings

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