SESSION #2: Steel Bridge Corrosion Protection Discussion Topics

1. When addressing Preservation Projects what are the preferred methods?
2. What do you paint?
    - Spot paint only
    - Beam ends only (first 5 feet from Bearings)
    - Fascia Beams only
    - Full Structure
    - Is a special treatment used for bearings only?
3. Do you overcoat or remove the existing coating to bare metal?
4. What requirements for removal are most common?
    - Hand Tools
    - Power tools
    - Full Blast
5. What are your most common environmental concerns and hurdles that must be overcome?
6. What Paint Systems are used?
    - One coat
    - Two Coat
    - Three Coat
7. Do you consider Metalizing?
8. If your state uses weathering steel, what issues are you encountering and how are you addressing them?
9. Has anyone used Cathodic Protecting to address corrosion of steel members?

Table 1 - SESSION 2

Steel Bridge Corrosion

Maryland – Paint the whole bridge, full containment. Cleaned to SP – 10.

Spot paint – good since little money.

Preparation is very important. Pontis 357 – procedure for getting rid of pack rust.
Maine - Fluidfilm. Torpedo grease. Maryland does some limited.

2 factors, how prep, what to put on.

Difference between 5 years and 20 years. Environments are different.

Some specs are looking a road closure issues as the driving force.

Inspection is every 2 years. Look at Pontis element – candidates for paint.

Maryland – full containment when deck replacement.

Maine, etc. follows NEPCOAT. 2 coat system, 3 coat system. Zinc primer, epoxy, urethane overcoat.

Low is $15, and up to $20/SF for high end.

Pack rust can accelerate if covered up.

Knowledgeable inspectors of paint is key.

$.31 per pound without transportation. Maine uses about .40.

DC – paint the end of beams. Thermarust. Hot water system that evaporates. Less carry away. 80 % evaporation. Methodology of collection discussed.

Maryland using prestressed over water. Using painted paint of reg roads. RR – weathering.

Watson Bowman – Joe Becker, metalizing bearing request.

KTA – shop metalizing components. Kittery bridge.
DC – Using some weathering.

Group number: 2 & 4	Discussion topic: Steel bridge Corrosion

Discussion Highlights

- **Some states are using water blasting on weathering steel and lead. It depends on the environmental restrictions in the state**
- **CT has used sponge blast to restore concrete**
- **ME has a stronge program in just painting beam ends, using powered handtools**
- **DE 2 coat moisture cured system, some overcoating.**
- **CT & NJ have standard 3 coat system**
- **When do you paint?**
  CT: paint program is being resurrected, considering what parts to paint. Lost of structures with lead paint. Address joint bearing, and steel repair first. Most paint jobs done through contract.
  ME: Augusta memorial deck truss, stimulus paint contract was $9 million. Most other painting done in house including beam ends
  DE: Use paint index, a formula that prioritizes when to paint. Have inspectors clean corrosion, take measurements, then apply primer cold galv spray which has been somewhat successful. Full paint jobs done through contractors
- **Life on paint jobs: Depends on how closely its inspected when painted. If spec is good, and contractor adheres to spec, much higher rate of success. Fracture critical bridges get much less life out of painting because of little nooks and crannies**
- **Cleaning as a preservation tool for the paint system:**
  ME uses low pressure flushing from a tanker (high volume, low pressure)
  CT: Pilot program to clean (not wash) specific points on any non-lead paint coated structure

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

- **3 coat system (primer counted as coat) is seen generally as the best approach**
- **DE: Yearly program focused only on painting in close geographical locations, get better costs per contract**

Action Items *(Note recommendations for research, leadership, communication, facilitation, technical assistance, etc)*

- **Research a maintenance friendly 1 coat system with non-blasting prep (example: moisture cure urethane typically used in auto industry and navy)**

Group number: 3 and 7	Discussion topic: Steel Corrosion Protection

Discussion Highlights *(note main discussion items)*

- **When is the right time to paint?**
- **CT – Mostly Beam Ends – Backlogged**
- **CT Repairs lasting – State Maint. (Carboline) single coat 7-8 years w/urethane topcoat (exposed)**
- **DC – Paint When Loosing Top Coat – cheaper – All Contractors**
- **DC – Wash & Termarust**
- **ME – Fluid Film on ends – cheap, fast, better than nothing, 4-5 years**
- **STOPAQ – Hand Press On – Intro**
- **Cable Stays ?????**
- **Like to find product where containment & expertise minimized!!**
- **Metalized ??**
- **Weathering Steel – ME, NH Paint Beam Ends**
- **Maint. Fix – Steel – ME (Galvanize), CT (Single Coat), DC (3 Coat Paint Systems)**
- **Cathodic Protection – Anodes – below water**
- **Barnacles, ect. providing protection**
-

Group number: 5	**Discussion topic:**

Discussion Highlights *(note main discussion items)*

- **<u>COATINGS</u>**
- **Long Term:**
- **SP-10 surface prep is used, abrasive, water jet, sponge jet.**
- **Me uses Shermon Williams Zinc paint, Wasser Paints, Fluid Film**
- **Abrasive treatment before coating will outlast other preperations.**
- **Short Term:**
- **NJ uses Rust Stop to coat over rust.**
- **NY uses Calcium Solphinate for a shorter term system.**
- **SP-10 expectations of 20-25 Yrs of life cycle.**
- **Fluid Film expectations of 3-10 Yrs of additional life.**

Me uses troughs under the finger joints along with "mud flaps" to protect bearings.

Maine has instituted an additional inspection requirement – if it is a leaking or open joint you must get hands on to fully inspect for section loss.

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

#9 Has anyone used Cathodic Protecting to address corrosion of steel members?

Maine has Hockey Pucks, but haven't used them very much.

NY uses polymer patches that alleviates the Hallow Effect.

Group number: 6	**Discussion topic:Steel corrosion problems**

Discussion Highlights *(note main discussion items)*

- **Bridge painting programs.**
- **Maine-not allot deferring capital mostly due to finances. Maine maint. Has full crews 100% ($22 square foot). Conn – adds to capital projects more contracts for beam ends. New Hampshire has no full paint crews, but still do spot painting. Limited full paint. Sometimes cheaper long term to replace entire deck/ superstructure. Delaware full paint projects 3-5 structures per year. Spot painting per structure maint. contract. Uses PONTIS to choose full paint candidates.**
- **Unfreezing of bearings is should be addressed during painting projects.**
- **Section loss is often an afterthought during contract.**
- **Lots of beam end coating being done (fluid film).**
- **Paint systems: New Hampshire used 3 part moisture cured urethane. Same with Maine & Delaware. Delaware is looking into other systems. Approximately 20 years of paint service on standard bridge, allot less on built up members. Conn – moisture cured.**
- **Most states due not have an in house expert in painting. Could states combine in house experience with rgards to specs.**
- **The documentation of paint systems is not currently easily available. Details should be in Bridge file.**

Attendees:
Dennis – FHWA
Tom – Mainedot
Scott – Maine dot
Julie –
Bruce – Fallproof
Joe – Mainedot
Tim – NH dot
Tom – Collins
Calvin – Delaware dot
Ted – Sponge jet

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

-

Action Items *(Note recommendations for research, leadership, communication, facilitation, technical assistance, etc)*

- **A database or register of States and there painting systems and procedures may be a good tool. Expertise or contact in this field per state could be utilized by networking.**
- **Add details of paint system & coating upgrades to State Bridge file for future evaluation of products and performance.**

Group number: 8	**Discussion topic: Steel Bridge Corrosion**

Discussion Highlights *(note main discussion items)*

- **Rubber pads and Dielectric best practice to prevent corrosion between different types of steel**
- **Zinc needs to be applied to completely clean steel to be effective**
- **Best method to quantify section loss at beam ends for NBI rating. Maine blocks diaphragms as a back up.**
- **Corrosion accelerates the worse is gets. Need to take action when section loss approaches quarter of an inch.**
-

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

- **PENDOT uses 3 coat paint system**
- **Maine DOT uses surface prep with 2 coat system and full blast with 3 coat system**
- **Maine DOT removes and refurbishes bearings instead of applying anti-corrosion system**
- **Maine DOT still has one complete paint crew left. Still uses lead paint to spot paint**
- **NHDOT used to blast with paint crew. Now only aloud SP3 with power hand tools with a 3 coat system.**
- **NHDOT having issues with weathering steel. MaineDOT and NHDOT paint beam ends of weathering steel**
- **MaineDOT has had success using fluid film on weathering steel**
-

Table 9 Preferred Methods Painting and Concrete Repair

Painting

- Full paint system is the best method: blast clean - three coat paint system (if money is no object)
- Pack rust removal using high ratio calcium sulfate Terma-Rust
- New steel - galvanize and then paint for new steel, Oregon
- Maine Spot Paint 9 (specific locations), Maryland “zone” paint (all the beam ends and fascias)
- Cold galvanize with minimal removal, Vermont, Oregon
- Fluid film – lanolin “oil”, penetrating oil, been used for the past five years Maine

Concrete Repair

- Use regular cast-in-place concrete, some use of epoxy coated rebar so just black bar
- Overhead repairs are not done using “quick/rapid’ setting concrete, Maine

What do you paint?

- SSPC 3 Spot paint
- SSPC 10 Full paint

Common environmental Concerns

- Lead containment systems
- Long duration painting, short duration painting there are different levels of containment requirements

Metalizing

- no one uses

September 24, 2013 – Table #10

- VT has $500k budget per year to "grease" bridges. Remove loose lead paint and may do ends, fascia beams or whole bridge. Environmental constraints are less because only loose paint is removed. Economical solution. Similar looking to paint, so inspectors can still see the girder to perform their inspection. 20 years of life in a single application. After you grease it you can't paint it. Can be applied over streams – but the area is tarped during application. Bridges are chosen to be painted vs. greased had been contractor driven, but the results are better for grease. Deck has to be above 5 and paint below 7 to be considered for grease. $10-12 / sq. ft for finished product on greased girders – a little more compared to traditional paint, but they are getting more life out of the greased bridges. Girders are primed first with a standard primer. Specs are available.
- Discussion about inspections /inspectors being subjective. MaineDOT does training/inspections together to try to make it less subjective.
- MaineDOT does bridge ends and bearings with fluidfilm. Use hand tools to prep. New bridges are getting bridge ends painted as well. No contractor work, MaineDOT staff doing the work. Joint rehabbing may be done at the same time, depending on the location, but all the work is done by the same crew. Workplans based off of inspections.
- NJ Turnpike Maintenance did zero painting – done by contractors. Tried overcoating existing but did not work. Had annual paint program for small bridges - $1-2M per year. Has a lot of weathering steel – has held up well except for at joint areas. In mid 90s did zone painting of weathering steel. Addressed with deck repair and joint repair projects.
- NJDOT has almost eliminated lead based paint on bridges.
- Maine Turnpike paints beam ends and has a painting program to address bridges that need to be repainted.
- Concrete beams – states seeing corrosion issues at bearings. Discussion about using impermeable material for patching.
- NJ Turnpike used cathodic protection on a project.

SESSION 2 - TEAM 11

Cannot paint over rust as it will encapsulate it and accelerate that corrosion by 50%. So never paint over rust.

Brine used and other deicers cause corrosion. Old days of sand had its problems in causing issues that needed care also. Indirect costs need to be considered for a full study

Wells contaminated by salts…big problem to replace artesian wells.

Other assets such as vehicles and equipment such as plows get corroded.

Salt reduction areas.

Metalizing may be expensive but has its purpose for flat surfaces.

Mentione of the FHWA and NACE and SSPC

Weathering steel good but not in certaqin locations such as near overspray and water leaking joints.

Chlorides are a generic term from the industry but sulphates from fossil fules and nitrates from vegetation also contriutte to hydrochloric acid and sulrphuric acid and nitric acid.

VT and NH do small repairs but not paint. Rely mostly on contractor

Paint inspections are key and consultants needed as a separate entity to validate quality control. This is similar to requirements about manufaxturer requirements being installed.

NH can do small repairs with hand tools and quick fix, but not even spot painting.

Oregon does spot painting and uses inhibitors.

3 coat zinc system…zinc primer, moisture cure urethane top coat….

K bridge onject. And design build.

SSCP dis a survey about coating failures….80% related to bad surface preparation and 80% of those are directly related to soluble salts

Specifications need to be precise and need to be honored in the field. Contractors take shortcuts.

Group number: 12	Discussion topic: Determination of Scope of Work

Discussion Highlights *(note main discussion items)*

- **Galvanic chemical**
- **Paint**
- **Scope of Work**

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

- **MaineDOT: Visual inspection – In house painting**
- **Conn: Bridge Safety Inspections from Manual – Based on priority letters – Maintenance is in house or contractor**
- **PennDOT : If over 100ft – cost benefit – plan of action – critical evaluation – overcoat evaluation – spot evaluation**
- **PennDOT: Painting is contracted out**
- **Mass: 4 on NBI inspections put on paint list**
- **Just end of beams with spot painting**
- **Mass: Overcoat almost never happens**
- **PennDOT: depends on paint condition, look at overcoat evaluation**
- **A lot of cost to get into midspan painting of beams: close down lane, do night painting**
- **PennDOT: Spot painting: $20-30 per sq foot; Full paint: $10-15 per sq foot**
- **PennDOT: Combine scopes of work on smaller bridges to be more cost efficient.**
- **PennDOT: Painting program generates out of material testing: 3 guys – 1 scientist, 2 asst. scientists**
- **Mass: One paint guy**
- **Mass: coatings don't get funded**
- **MaineDOT: a few people that have been trained; maintenance does coatings. Each region does their own.**
- **DBI: Use best coatings as possible that first year – A monthly contract**
- **Mass: Needle gun – Seal it off – If peeled back put high strength bolts to get back in shape – Nothing has lasted more than 3 years before bleeding reappears.**
- **MaineDOT: Do bearings and plates while deck is off to be efficient.**
- **Get moisture and oxygen out of there is most important**

- **PennDOT: primer, intermediate, final coat**
- **MaineDOT: 3 coat system**
- **Spalling around the perimeter of the patches is seen sometimes, but not all the time.**
- **5 to 7 years on concrete patches (variable)**
- **Hockey pucks can work – don't space them too much – need certain amount of moisture content to work**
- **Federal Long Term Performance Monitoring – (Rutgers University)**
- **Do bridges on the corridor differ from those off the corridor - NBI doesn't have the level of detail to be able to tell those kind of things.**
-

Action Items *(Note recommendations for research, leadership, communication, facilitation, technical assistance, etc)*

- **Get ahead of the curve – Proactive instead of reactive**
- **Need emphasis on doing it right when installing**
- **Concentrate on ends of beams and joint**
- **Do spot painting while cleaning the bridge to be more efficient**
- **Document the data – share it with others**
- **Need to collect the data to see where it works and how well it works and share that**
- **Collect data on when repairs were made, what the repairs were, and how they look a certain amount of years later**

Group number: 13	**Discussion topic: STEEL BRIDGE CORROSION PROTECTION**

Discussion Highlights *(note main discussion items)*

- **Poor Paint condition on the highway bridges does not put a good image of the state in the minds of the traveler.**
- **Washing & Cleaning bridges cleans off the chlorides and minimizes degradation of bridge elements such as joints, drains, bridge bearings & Beam ends, however there are environmental concerns**
- **Environmental agencies are in some cases requiring blocking drains & catch basins during cleaning operations which is not too intrusive, but in some states you still can't do such cleaning.**
- **Taking care of our crew personnel through respirator fit testing and utilizing a lower level of lead allowed in blood stream is a couple of ways we take care of environmental concerns and the safety of our people, we need them not only for today, but for tomorrow and the next days also.**
- **Rhode Island uses a two or three coat paint system, Maine uses three coat system on full paint projects that are not on lead painted bridges**
- **Rhode Island has utilized metalizing in coastal areas and some of their signature structures as well as using a two coat paint system over the metalizing – cost is significant.**
- **Rhode Island & Maine utilize weathering steel in proper locations and tend to paint the beam ends to protect the beam ends from possible seal failure and to prevent the bleed of the weathering steel onto the substructure units**
- **Rhode Island and Maine have used cathodic protection by using anodes on steel pipe piles in corrosive environments and has tried cathodic protection for reinforcing steel, but not for other structural steel members**
-

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

- **State of Maine puts on a "Bridge College" that emphasizes preservation of Bridges and Bridge Elements to our crew personnel who do not have much experience in bridges.**

Group number: 14	**Discussion topic:**

Discussion Highlights *(note main discussion items)*

- **Preferred Methods**
  - **Spot painting/ Beam ends**
  - **Full structure recoating**
- **Overcoating – not a preferred method**
- **Requirements for removal**
  - **Spot painting – hand and power tools**
  - **Recoating – blast cleaning**
- **Paint systems**
  - **3-coat system – zinc, epoxy, polyurethane**
- **Metallizing not a common practice**
- **Weathering steel – some few examples in both Maine & NYC**
  - **NYC concerned about corrosion on at least one bridge based on inspection reports; decision to coat full structure**
  - **Maine – corrosion problems at beam ends; clean and coat beams ends**

Notable Practices *(Note practices, strategies, policies, products, etc that are working well)*

- **Scheduling painting projects**
  - **Maine- spot painting tied to other activities – for example, joint repair followed by spot painting of beam ends**
  - **Uses temporary solution until spot painting can be done - application of rust retardant product (same as used on undersides of cars); retards corrosion until spot or full recoating can be scheduled**
  - **NYC – spot painting done by in-house crews; 3 – 4 year cycle desirable**
  - **NYC – recoating large bridges done under contract with a desired cycle of 12 years**
- **Coating Systems**
  - **Regions in Maine use different systems depending on preference and regional considerations such as coastal environment; same system used for spot painting and recoating**
  - **NYC uses NYSDOT QP List: 3-coat system – zinc, epoxy, polyurethane**
-
-
-
-
-
-

- **Weathering steel**
    - **Both agencies have had some limited use of weathering steel; experience has been mixedd**
        - **NYC – inspection reports raised concern of corrosion – decision made to coat entire structure**
        - **Maine - one structure experienced excessive corrosion of the beam ends** and significant rust flaking- decided to coat beam ends where deterioration was occurring

Action Items *(Note recommendations for research, leadership, communication, facilitation, technical assistance, etc)*

- **<u>General recommendation that a planned program of steel coating maintenance is more effective that a reactionary approach</u>**