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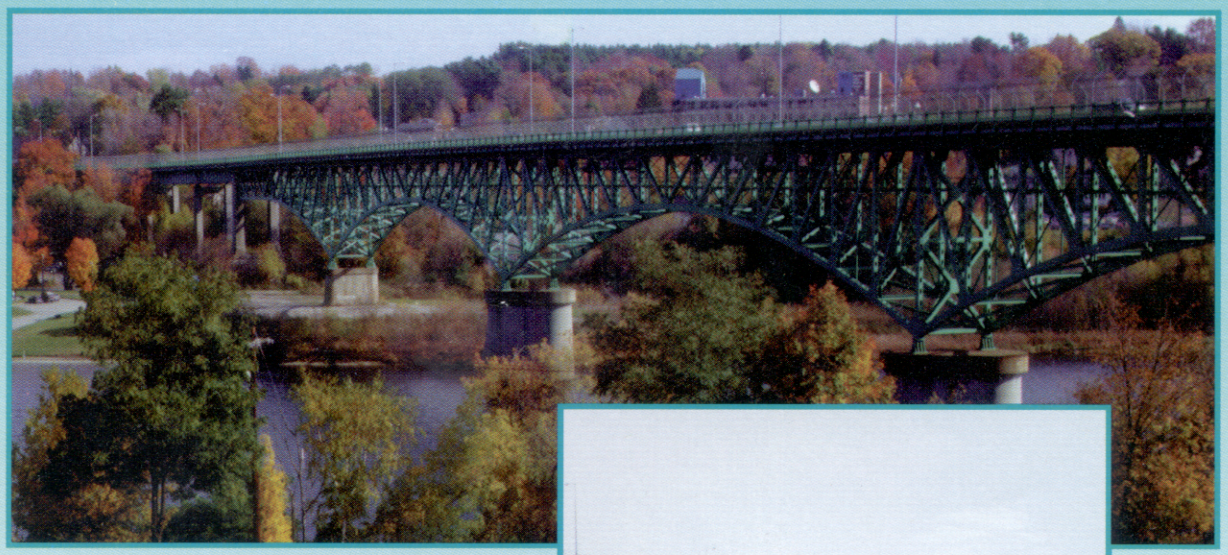

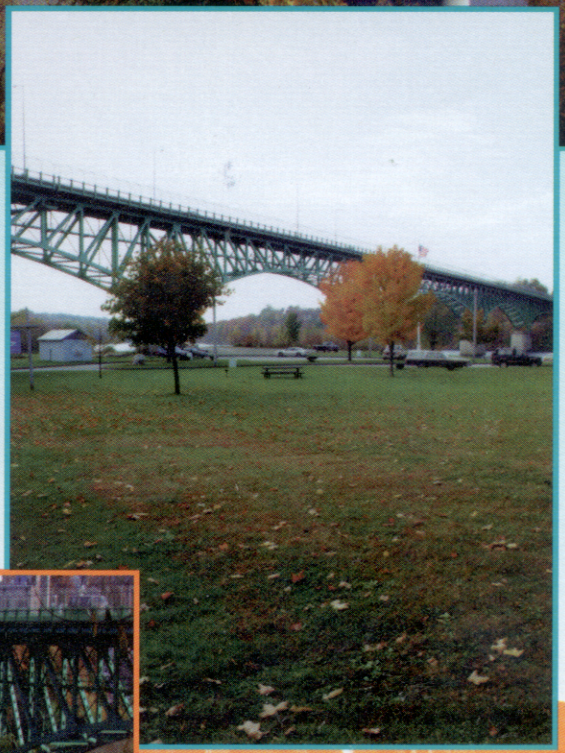

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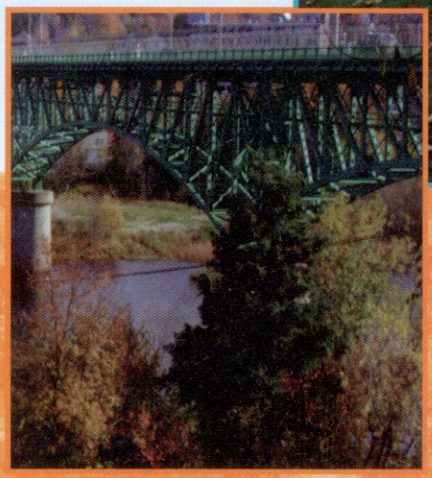

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Testing Coatings for Bridges: An Update on NEPCOAT

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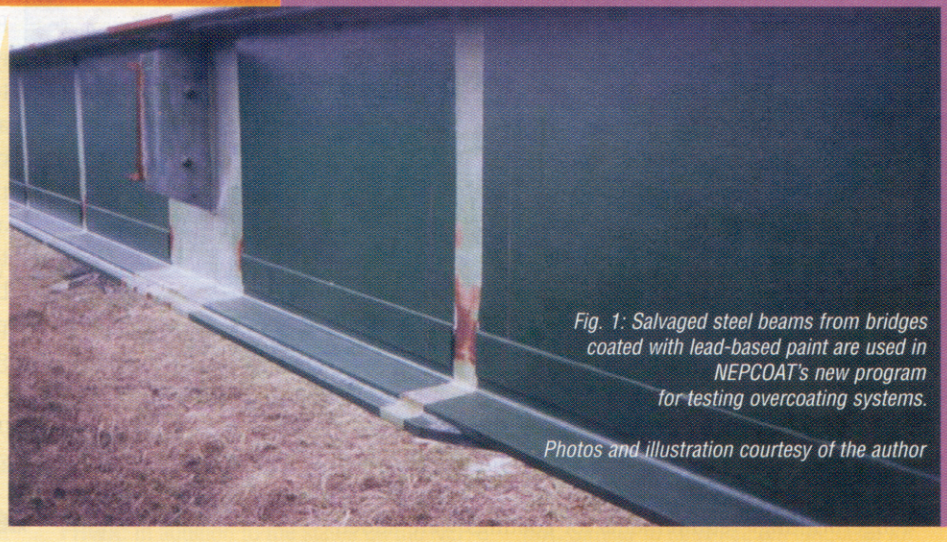

Fig. 1: Salvaged steel beams from bridges coated with lead-based paint are used in NEPCOAT's new program for testing overcoating systems.

Photos and illustration courtesy of the author

An article in the February 1995 *JPCL* ("New England DOTs Develop Program for Selecting Coating Systems" by Richard S. Haupt, VT AOT) described how the Northeast Protective Coating Committee (NEPCOAT) and its testing program for bridge coatings developed from an informal meeting of representatives from three states that had gathered to discuss common bridge paint issues. This informal meeting grew to include the six New England states and Pennsylvania. The article also presented an overview of the testing required for coatings to be included in the NEPCOAT Qualified Products List (QPL) for protecting bare steel. Since then, NEPCOAT has gained two members: New Jersey and New York. NEPCOAT continues to set regional standards in the Northeast for qualifying protective coatings for bridges. The present article provides an update on NEPCOAT's work, including the addition of a program for qualifying overcoating systems.

Objective and Scope of Program

The primary goal of NEPCOAT thus far has been to develop and maintain a QPL of coatings applied on bare steel. Products are qualified through a series of NEPCOAT-approved laboratory tests. Facilities that perform the lab tests must meet minimum qualifications and be approved by NEPCOAT. The testing specification was issued June 15, 1994. Response from the industry was immediate. By January 1997, ten coating systems were conditionally qualified.

NEPCOAT members agreed at the onset to limit the scope of products it would consider. The qualification of coatings is limited to three-coat systems, namely, zinc-rich primers, epoxy or urethane intermediates, and aliphatic urethane topcoats. Initially, only new steel was considered; the scope was quickly broadened to include fully cleaned existing steel. NEPCOAT recognized that some one- and two-coat systems performed well, but decided that the best system for overall performance was a three-coat system. To deal with the possibility of using one- and two-coat systems, testing was established for each coat in the system (i.e., primer, primer plus intermediate, and the complete system); this way, the results could provide a basis for an owner to choose one- or two-coat systems, if needed.

Initial Test Spec Developed with Industry Help

From the beginning, NEPCOAT worked with industry representatives to develop the test specification. Input was received from coating manufacturers, testing laboratories, consultants, test equipment manufacturers, the Federal Highway Administration (FHWA), and other states. This spirit of cooperation with other industry representatives contributes to maintaining an equitable and realistic standard. NEPCOAT members continually listen to comments from the industry to ensure that the criteria remain reasonable and realistic; this has caused the specification to change and be refined since it was first introduced.

When NEPCOAT first developed the test criteria, it did not know how well coatings would stand up to the rigors of testing to 5,000 hours (salt fog [ASTM B 117] and cyclic weathering [ASTM D 5894]). The strategy was to set high standards for lab testing to obtain the best coatings available while accepting a range of performance that made sense in terms of real world exposure. The initial acceptance limits were set after consultation with experts in the industry, recognizing that adjustments might be needed af-

ter the first round of testing was completed. As anticipated, adjustments were needed to the original 1994 specification, and they were implemented on June 5, 1996.

Revisions to Testing Specification

Revisions to the specification in 1997 were significant enough to warrant designation as a new version of the specification.

- The predominant change was to replace the UV condensation test with a cyclic salt fog/UV condensation test that meets the requirements of ASTM D 5894, Cyclic Weathering Resistance Test. The cyclic test was adopted because it more nearly correlates with field performance, according to FHWA.
- All slip coefficient testing was to be done with the primer applied on a surface that is abrasive blasted with 100% shot. Previously, testing was done with surfaces that were blasted with 95% shot and 5% grit. Using 100% shot is considered the worst case.
- Maximum VOC level values were changed to 420 g/L (Class 5 in SSPC-PS COM).
- "Fingerprinting" requirements for coatings were added. These included x-ray diffraction of extracted primer pigment and a submittal by the manufacturer certifying the chemical nature of the coating system. Epoxide and amine values are examples of the data requested from manufacturers.
- A freeze-thaw stability test was added. This test has a duration of 30 days with a daily cycle consisting of freeze, thaw, and immersion in tap water. At the end of freeze-thaw testing, adhesion is tested in accordance with ASTM D 4541, Annex A2. No reduction in adhesion values is allowed when comparing results with the adhesion test.

The cooperative spirit and responsiveness to industry feedback is constantly improving the specification. As an example, NEPCOAT recently received observations from manufacturers' representatives concerning two issues in the test protocol: 1) acceptance criteria for the cyclic weathering test; and 2) cure time before topcoating. NEPCOAT members discussed both issues at the annual meeting and made appropriate changes to the specification.

Benefits of the Program

NEPCOAT's influence is growing in the industry. New coatings are being tested, and the QPL for bare steel continues to expand. Sixteen systems are now listed. NEPCOAT has been involved with the review of related programs and specifications from FHWA and the American Association of State Highway Transportation Officials (AASHTO). NEPCOAT has also had considerable input in the National Transportation Product Evaluation Program (NTPEP), which is operated under the auspices of AASHTO.

NEPCOAT has also assisted AASHTO's Subcommittee on Materials (SOM). Furthermore, NEPCOAT provides guidance and review of coatings issues for states in the Northeast.

Fig. 2: Salvaged bridge steel at one of NEPCOAT's overcoating test sites

The NEPCOAT process benefits the coating manufacturer and the owner. For the manufacturer, it can provide relatively short turnaround time for testing when formulation changes are necessary because of changing environmental regulations. Repetitious testing is eliminated, and broad acceptance is achieved with reduced testing and cost. The owner benefits because using NEPCOAT's program reduces the amount of testing a single state needs to conduct to approve coatings. NEPCOAT's program also provides a basis for establishing a QPL and verifying production lots at the job site.

Related Programs

AASHTO Test Procedure for Structural Steel Coatings

AASHTO is also developing a program to evaluate bridge coating systems. AASHTO's Technical Section 4C on Materials has drafted a test protocol, designated PP30, which is modeled after the NEPCOAT protocol. The document was initially balloted by AASHTO in September 1996 for national acceptance as a provisional guide specification for testing coatings.

Meanwhile, NEPCOAT adopted most improvements from PP30, essentially merging the two documents. There are, however, some exceptions. NEPCOAT has replaced the original weathering test with the cyclic/UV condensation test as described above. PP30 eliminates the humidity cabinet test. NEPCOAT still has this test. PP30 also includes a two-year atmospheric test. Otherwise, the two specifications are the same.

National Transportation Product Evaluation Program

In addition to the test procedure PP30, NTPEP is initiating a program to evaluate coatings against the test procedure.

NTPEP will play a major role in the evaluation process as the testing program moves to a national level. NTPEP will oversee consolidated testing. This is expected to be beneficial for manufacturers and owners alike, with significant cost savings anticipated for both. Under NTPEP management, states receive test results but without acceptance recommendations. States must set acceptance

criteria for their use.

NTPEP has responded to requests from states and is now drafting a final version of the structural steel coating evaluation process that will be used to contract with a selected qualified laboratory. Ms. Greta Smith of the Kentucky Transportation Cabinet chairs the NTPEP Structural Steel Coating Project Panel. Kentucky has also agreed to be the lead state to oversee all testing of structural steel coatings under NTPEP.

Under NTPEP management, coating manufacturers would

How Some State DOTs Are Using NEPCOAT Test Results

NEPCOAT members are committed to the QPL and other efforts of this organization. Responses to questions from members and the FHWA that illustrate the importance of NEPCOAT's mission follow.

QUESTION: How does your state use the current NEPCOAT QPL (for coatings on bare steel)?

Responses from Members

ME: All contracts that require shop coating of new steel and all contracts for field coating of totally cleaned existing steel must use a NEPCOAT QPL product. Denis Dubois, MDOT, Fabrication Engineer

NH: The NHDOT QPL is converging over time to reflect only NEPCOAT QPL products.

VT: We use it as the basis of our QPL. We rely on the testing through NEPCOAT to be the determining factor in our state approval. In other words, if NEPCOAT approves, we put it on our list. Craig Graham, VT AOT, Materials

RI: The NEPCOAT QPL is used for new steel and 100% bare existing steel on all projects requiring a three-coat system of the types listed. D. Munroe, RIDOT Research & Technology Development (R&TD)

CT: All contracts that require a three-coat protective coating system on bare steel, in the shop or field, must use a NEPCOAT QPL system. L. Brian Castler, CONNDOT, Manager of Construction Operations

MA: The new specification currently under revision will include language to use three-coat, non-lead, non-chromate, low-VOC paint systems as approved by NEPCOAT. Clement Fung, MA, Department of Highways, Materials & Research

PA: Pennsylvania is currently implementing the NEPCOAT QPL. Difficulties in obtaining field references, vendor submittals to PennDOT, and internal specifications to current PennDOT specs have slowed implementation. Dave Kuniega, PennDOT, Chief Chemist

NJ: NJ does not mandate the use of the NEPCOAT QPL. However, a coating system that is approved by NEPCOAT (i.e., on the QPL) and generically meets NJDOT specifications (i.e., three-coat inorganic zinc system for new steel, or three-coat organic zinc system for existing steel) qualifies for New Jersey's QPL. Fred Lovett, NJ Materials Lab.

NY: Though New York has been predominantly using moisture-cured urethane coatings since 1997 for both overcoating and bare steel, we feel there are cases where certain structures could benefit from a zinc-rich primer system. For these, we would refer to the NEPCOAT QPL. Willie Feliciano, NYSDOT, Materials Supervisor

FHWA: In addition to the states on the NEPCOAT committee, several other bridge owner agencies have used the NEPCOAT QPL. Rather than including specification language that mandates the use of NEPCOAT qualified coatings, these other agencies are using the NEPCOAT list as a supplement to their own or as justification for "or equal" status when requested by a contractor or vendor. The NEPCOAT list has received significant attention nationwide in this regard, particularly among smaller agencies that do not have the in-house resources to generate their own test data. Bob Kogler, FHWA

QUESTION: How does your state intend to use the new NEPCOAT overcoat results-QPL?

Responses from Members

ME: For maintenance overcoat applications, we plan to use only those systems listed on the QPL. Everett Barnard, MDOT, Bridge Maintenance Engineer

NH: The NEPOVERCOAT program will be the principal element in the NH DOT maintenance overcoating selection process.

VT: We are unsure how this will be used at this time. I can see a "companion" overcoat QPL being developed for use by our maintenance forces as one outcome. We could also add a new category to our current QPL, but that might make the list unwieldy. At any rate, we will be using the results in some fashion. Craig Graham, VT AOT, Materials

RI: The NEPCOAT overcoat results-QPL will be used for all existing previously painted steel projects with reduced surface preparation requirements. D. Munroe, RIDOT, R&TD

CT: We are planning on using only NEPCOAT-qualified systems on any overcoating contract. L. Brian Castler, CONNDOT, Manager of Construction Operations

MA: Similar to specification language for coating bare steel, specification language will specify the use of a three-coat, non-lead, non-chromate, low-VOC paint system as approved by NEPCOAT. Clement Fung, MA, Department of Highways, Materials & Research

PA: PennDOT will use NEPOVERCOAT to develop case-specific QPLs for overcoating for spot/zone/maintenance under conditions of SSPC-SP 6 cleaning or less. Dave Kuniega, PennDOT, Chief Chemist

NJ: NJ currently has a "remove all old lead" policy for existing steel. Therefore, overcoat systems are currently not used. Fred Lovett, NJ Materials Lab.

NY: NYSDOT has laboratories that perform testing of MCU coatings for both overcoating and bare steel applications in our state. However, the NEPCOAT overcoat QPL may be used in the near future to augment NY's Approved List of Coatings to reduce redundancy of testing of MCUs. The performance of other types of overcoat systems will be carefully noted and taken into consideration when developing future coating specifications. Willie Feliciano, NYSDOT, Materials Supervisor

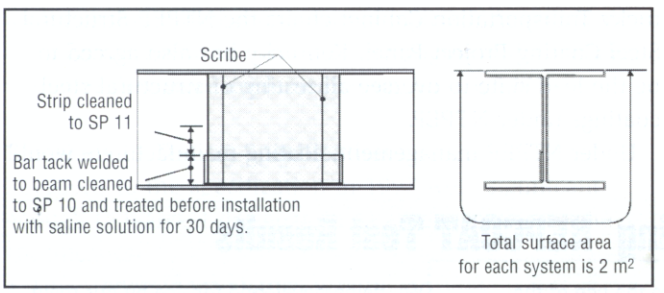

Fig. 3: Typical NEPCOAT overcoat test patch. Half of test patch is cleaned to SP 2; other half is cleaned to SP 3.

pay a fee to NTPEP to have their systems evaluated. NTPEP would then contract with private qualified laboratories to provide these testing services. NTPEP planned to have this program implemented by the end of 2000.

NTPEP will oversee the testing program on a national level, but since it will only provide test results and not set acceptance criteria, NEPCOAT and individual states need to determine acceptance standards and issue a qualified list. Setting coating acceptance levels for the Northeast will continue to be one of NEPCOAT's functions.

NEPCOAT Adds Overcoating Test Program

NEPCOAT is administering a new program to evaluate maintenance overcoating products. Through the Maine DOT, NEPCOAT has contracted with a private coatings testing firm to conduct a field overcoating test program. The purpose of the program is to develop a qualified list of products suitable for topcoating existing alkyd/lead coating systems—one approach to managing lead paint abatement on bridges, at least temporarily.

Overview of the Program

The program is a three-year study of the coatings. Up to three test cycles of three years each are being considered. Cycles are sequential and concurrent. The test protocol was developed by NEPCOAT.

The program is to be funded by coatings manufacturers who submit their products for testing. It is to be managed by a consultant agency that will also be responsible for evaluating the existing coatings, soliciting manufacturers, preparing surfaces, applying test products, and evaluating the applied coatings annually.

Salvaged bridge steel members (Figs. 1 and 2) at multiple sites (ME, CT, PA) were acquired to represent various field conditions. In-service structures were considered, but, because of the higher costs associated with coating in-service structures, salvaged steel was selected.

Test Protocol

- The program uses four sites: two coastal sites—Scarborough, ME, and New Haven, CT, and two inland sites—Farmington, ME, and Pittsburgh, PA.
- Four test patches are applied at each site; two patches are on steel beams that are covered to simulate a deck, and two patches are on uncovered steel beams.
- Multiple surface conditions are produced on each test patch (Fig. 3). First, the entire existing coating area is power washed (SSPC-SP 1). Half of each test area is power tool cleaned (SSPC-SP 3); the other half is hand tool cleaned (SSPC-SP 2).
- A 6-inch (15-centimeter) strip is cleaned to bare steel by rotary peening (SSPC-SP 11).
- A new bare steel strip 8 to 9 in. (20 to 23 cm) wide is included. This strip has been pretreated with a saline solution for 30 days. This strip is also cleaned as noted above by power washing and hand/power tool cleaning. The coating systems are applied in accordance with the manufacturers' instructions. Coating products are each applied by brush or roller.
- Two vertical scribes are cut through the finished coating for additional evaluation.
- The minimum area of the test patch is not less than 20 ft (6 m).
- The program is three years' long with yearly evaluations. The evaluation period may be extended.

Nine manufacturers submitted systems for evaluation the first year. The contractor is waiting to see if there is enough interest to include more systems in the next test cycle. Member states are eagerly awaiting results so maintenance systems may be added to the QPL.

Conclusion

At a time of tremendous change in bridge coatings, the NEPCOAT evaluation process offers a relatively quick means for evaluating and fingerprinting proprietary coating systems for application to bare bridge steel. NEPCOAT members expect a similar benefit with the overcoat program. NEPCOAT members will continue to work together and with other industry representatives to share information and address other coating issues. There have been many requests to evaluate other types of coatings, and NEPCOAT, AASHTO, and NTPEP have had significant discussions on this topic. It would seem likely that it is only a matter of time before additional types of testing come about.

Acknowledgements

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