

The NEPCOAT Story- Bridge Paint Selection in the Northeast

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ABSTRACT

What is the best paint to use when long-used lead-containing paint is no longer permitted, when VOC limits are lowered, when manufacturers are developing new systems, and coating performance is expected to last decades? Such were the questions in 1992 when NEPCOAT, the New England (now Northeast) Protective Coating Committee, was founded to evaluate and qualify the best performing paint systems. For thirty years NEPCOAT has persevered in this purpose and biannually publishes a Qualified Products List. Their testing specification grew from regional to national significance when AASHTO adopted and expanded it to administer lab testing by the National Testing Product Evaluation Program (NTPEP). NTPEP makes test result data available through DataMine. Today many states use the NEPCOAT QPL and NTPEP DataMine in the selection of bridge paint systems. This paper unfolds the story of NEPCOAT.

Key words: bridge, paint, Qualified Products List, NEPCOAT, NTPEP, DataMine

INTRODUCTION

NEPCOAT stands for the Northeast Protective Coating Committee and is comprised of ten member Departments of Transportation, from Connecticut, Delaware, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. NEPCOAT was founded in 1992 and has for thirty years evaluated and qualified paint systems for use on bridges, both for shop-applied new steel, and field-applied totally cleaned existing steel. Establishing acceptance criteria and publishing a Qualified Products List is based upon a program of accelerated lab testing under the auspices of AASHTO NTPEP.

THE NEED FOR COATING SELECTION

The need for coating selection was keenly felt at the New Hampshire Department of Transportation in 1991. NHDOT was highly motivated to find a solution because of the need to

paint the I-95 Piscataqua River bridge (Figure 1), the largest bridge in NH, located on the NH-ME state line, the principal highway entry into the State of Maine.

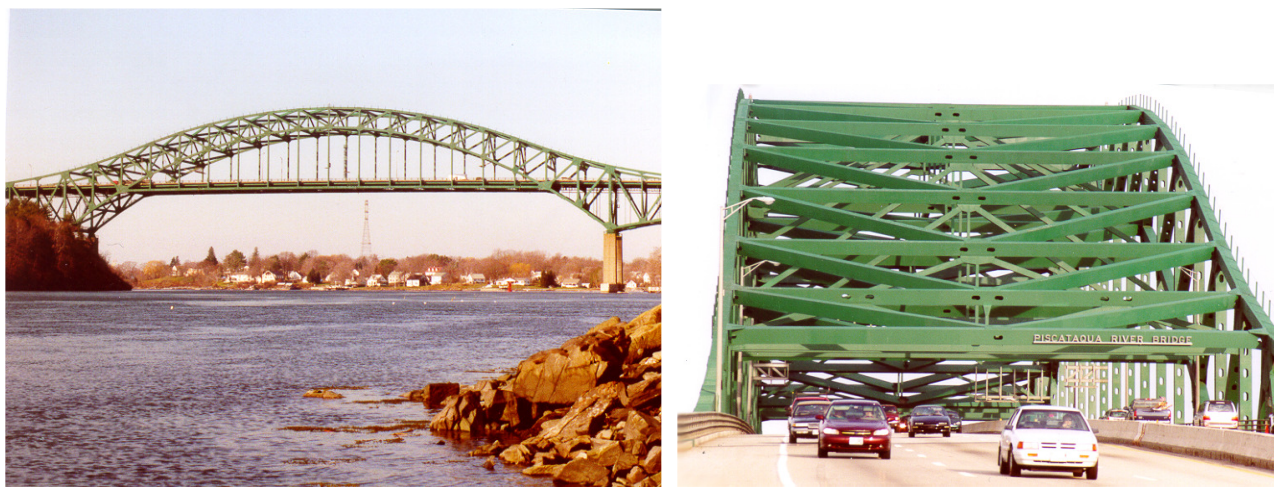


Figure 1: I-95 Piscataqua River Bridge (1991)

Coating selection was caught up in a swirl of major issues involving bridge painting, made complicated by the transition from alkyd paint systems to zinc/epoxy/urethane three-coat systems, the elimination by FHWA ⁽¹⁾ in 1993 of lead-containing paints, lowered Volatile Organic Compounds (VOCs) in 1991, and the industry-shaking OSHA ⁽²⁾ *Lead in Construction Standard* in 1993.

NEPCOAT deals only with coating selection, and none of the other bridge painting related issues, such as application, contractor qualification, quality assurance inspection, hazardous lead paint containment, collection, storage, and waste disposal.

At the time, the only available guidance to NHDOT was an Approved Paint List by the Michigan DOT, and the recommendations of many visiting coating manufacturer representatives.

REGIONAL RESPONSE

All six New England states independently wrestled with coating selection. Connecticut DOT did something about it managing its own startup testing program. The regional response to this great need was the formation in 1992 of a consortium of New England DOT representatives meeting, for the first time on May 20, 1992, to discuss the CT testing and evaluation program managed by Peter Barlow. This consortium soon came to be named, NEPCOAT (Figure 2).

The 1992 founding members of NEPCOAT were Alan Rawson (NH), Richard Haupt (VT), Martha Shu (ME), Peter Barlow (CT), Leo Stevens (MA), and Don Greenough (RI). In 1995 the New England part of the NEPCOAT name morphed to the Northeast as Dave Kuniega (PA) and Fred Lovett (NJ) joined, followed in 2000 by Willie Feliciano (NY), and in 2006 by Waseem Fazal (DE).

NEPCOAT sought the advice and comments from industry experts and consultants as it developed testing protocols and acceptance criteria. The first NEPCOAT *Specification Criteria for Protective Coatings* was issued on June 15, 1994. Coating manufacturers responded in a major way as 24 systems were submitted, nine of which were accepted, and published in the

(1) Federal Highway Administration, Washington, DC.

(2) Occupational Safety & Health Administration, Washington, DC.

first Qualified Products List (QPL) on June 5, 1996. The specification was revised in 1997 and over the next five years 21 more systems were submitted and tested, and 11 were accepted. By 2001, 20 of 45 systems tested were accepted.



REGIONAL TO NATIONAL

Figure 2: NEPCOAT Logo

During the period 1997-2001, there was considerable collaboration between NEPCOAT and AASHTO ⁽³⁾. AASHTO adopted, clarified, and improved the NEPCOAT specification, sending it through the balloting and final approval process, with final acceptance in 2002 as R31 ⁽⁴⁾.

In addition to the R-31 specification being written to AASHTO standards, AASHTO also incorporated the lab testing portion into a new program called NTPEP (National Transportation Product Evaluation Program). Within NTPEP is the technical committee, Structural Steel Coatings (SSC), which oversees the program. AASHTO is responsible for coordinating lab testing, coating submissions, payment, and distribution of test results to a national audience.

NEPCOAT ended its supervision of all testing in 1991 and no longer deals directly with coating manufacturers, labs, etc. but does continue to evaluate testing results posted on DataMine, develop acceptance criteria, and publish a QPL.

AASHTO also launched DataMine in 2003, an online storehouse of lab test results. DataMine is a great service, making test result data conveniently available to all DOT's and the public after it is released by the coating manufacturer. As a policy NEPCOAT will only accept and review test data that is posted on DataMine.

The lead state (Missouri) is in the organizational loop for the SSC program, and oversees the approved Work Plan for lab testing, which follows the governing R-31 specification. The entire program is underwritten from fees paid by the coating manufacturers, and some annual fees paid by the DOT's as part of AASHTO.

LAB TESTING

The original NEPCOAT Testing Standard and the AASHTO R31 Specification used by NTPEP provided seven principal lab tests for a submitted coating system to pass in order to be accepted. These tests are presented and explained as follows:

Panel Preparation

The test panels are 4x6-inch steel plates and are prepared for lab testing by blasting to an SSPC SP5, White Metal Blast Cleaning, with a 60-40 shot-grit mixture of metallic abrasives to produce a sharp profile of 2.5-3.5 mils. Panels are then sprayed using a semi-automatic spray process that insures uniformity among the panels. Most panels



Figure 3: Panel (typ.)

⁽³⁾ American Association of State Highway and Transportation Officials, Washington, DC

⁽⁴⁾ Standard Practice for Evaluation of Protective Coating System for Structural Steel

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are cut on the face with two parallel 4-inch scribes to the steel surface (Figure 3) for evaluation of rust-resistance, however, some panels are un-scribed for evaluation of adhesion, gloss, and color. The finish panel color is gray.

Test 1 - Slip Coefficient

In bridge construction it is very important to have structural integrity at bolted connections. AASHTO design specifications require primary bridge members achieve a friction-type connection, meaning that the contact (faying) surfaces of bolted plates will not slip. Best practice for painted bridges is that the contact steel surfaces be painted to eliminate rust formation inside the bolted connection. The usual degree of design requires a Slip Coefficient Class B rating.

The Slip Coefficient test, along with a companion Tension Creep test, is the accepted means of ensuring this degree of certainty.

The Slip Coefficient Test is a five-minute test in which three plates are bolted and clamped together with the standard 49-kip force (for a 7/8-inch diameter fastener) and a compression force is applied to the center plate until it slips (Figure 4). The load at which the center plate slips relative to the sandwich plates determines the Slip Coefficient. The protocols for this test are established and illustrated below by the RCSC Standard ⁽⁵⁾.

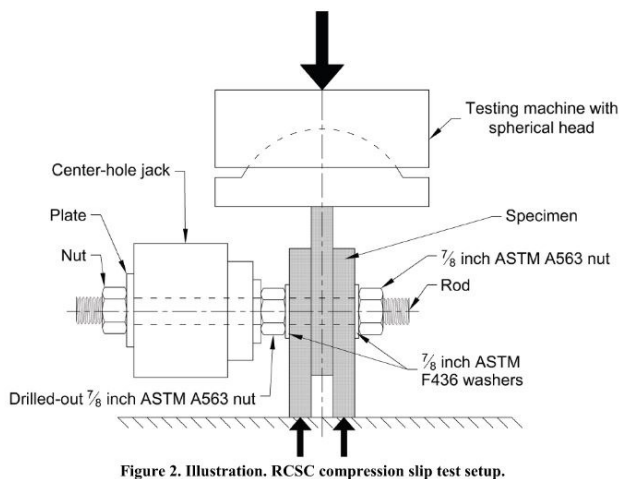


Figure 2. Illustration. RCSC compression slip test setup.

Figure 4: Slip Coefficient Test

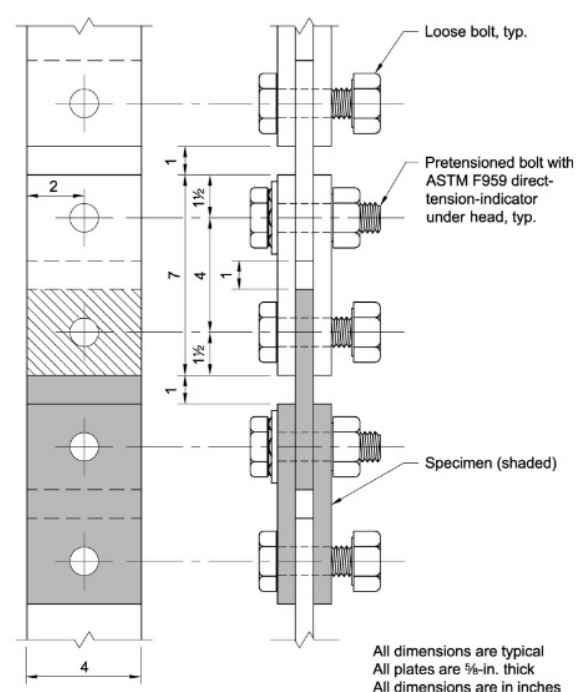


Figure A-2. Creep test specimen assembly.

Figure 5: Tension Creep Test

The companion Tension Creep Test lasts 1,000 hours (42 days) and consists of three sets of clamped plates in a train (as shown) loaded by a 32.7 kip axial force in such a way that monitoring instruments are able to detect relative slippage in the plates (Figure 5).

⁽⁵⁾ Research Council on Structural Connections, *Specification for Structural Joints Using High-Strength*

Bolts, June 11, 2020.

A coated bolted connection must pass both the Slip Coefficient Test as well as the Tension Creep Test in order for a coating to be rated as Class B and be accepted for use with main members in bridge construction. Coating application in the shop and in the field at bolted connection surfaces must follow the limitations stated in the certification documentation from the test, for coating thickness, amount of thinning, and duration of primer cure.

Test 2 – Salt Fog Resistance

The Salt Fog Resistance test, ASTM B117 ⁽⁶⁾, consists of a constant mist spray of 5% sodium chloride (salt) solution onto the steel panels at an elevated cabinet temperature of 95 degrees F. This test has been used for many years but is often criticized that it is too harsh and does not represent real-world weathering exposures. While this may be true, this test is still used by NEPCOAT because test results can be compared to older systems, it can make distinctions between systems based on performance, and because New England uses a considerable amount of road salts and brines which subject bridge steel to severe salt exposures.

Test 3 – Cyclic Weathering

The Cyclic Weathering Test, ASTM D5894 ⁽⁷⁾, attempts to mimic actual weathering conditions and requires two cabinets to do so. Test panels are placed in one cabinet for 7 days then rotated to the second cabinet, together comprising one cycle of 14 days. The test extends through 15 cycles (210 days, 7 months) to completion and the panels are evaluated.

The QUV cabinet continuously cycles through four hours of UV light (to simulate sun exposure) at 140 degrees F. followed by four-hours of water condensation at 77 degrees F (to simulate rain).

The QFog cabinet continuously cycles panels through one hour of an atomized salt fog/mist at ambient temperature, and one hour of dryness at 95 degrees F. The salt fog solution is 0.05% sodium chloride and 0.35% ammonium sulfate.

Non-scribed panels endure the same testing as the scribed panels, and are then evaluated for color and gloss retention, although recently the gloss readings were discontinued by the SSC Technical Committee from the Work Plan.

Test 2 & 3 – Measurement of Rusting at the Scribe

The scribed panels for Test 2 (Salt Fog) and Test 3 (Cyclic Weathering) are evaluated and photographed by the lab every 1,000 hours (42 days) up to the limit of testing at 5,000 hours (210 days). After the 5,000 hour photos are taken, the scribes are manually scraped (Figure 6) with a steel instrument to remove loose rust and loose paint, yielding an accurate view of the final results.

The lab evaluation is primarily measuring the rust at the scribe and how far it extends perpendicular out from the center of the scribe. The R31 specification terms this measurement ‘rust creepage’ or ‘rust cutback’, referring to the undercut, loss of adhesion, deterioration, and disbondment of the paint to the steel. The lab operator visually examines each 4-inch scribe

⁽⁶⁾ Standard Practice for Operating Salt Spray (Fog) Apparatus

⁽⁷⁾ Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal