

New Jersey Department of Transportation
Bureau of Research

Technical Brief



Evaluation of Different Paint Systems for Over-Coating Existing Structural Steel

This project was undertaken to identify a procedure to accept new coating systems for over-coating of steel surfaces. The practices used by various state transportation agencies, and test methods for accelerated testing of coatings with primary focus on ASTM and FHWA guidelines were reviewed. It was concluded that a new protocol for accepting new systems that will provide results in a timely manner is required. Therefore, a new protocol for evaluating durability of coatings and their effectiveness in reducing corrosion of steel structures was developed.

Background

NJDOT needed a protocol for accepting new coating systems that can be added to the approved coating systems. Based on an extensive literature search, it was concluded that a new protocol for accepting new systems is needed. This new protocol should provide results in a timely manner, preferably within nine months and cost for conducting the tests should be reasonable. Using these basic parameters, a new protocol for evaluating durability of coatings and their effectiveness in reducing corrosion of steel structures was developed.

Research Objectives and Approach

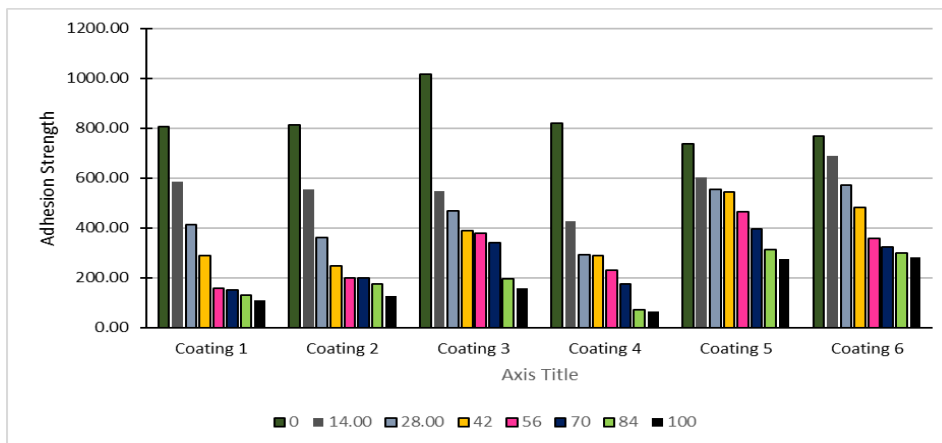
The primary objective of this study was to identify a protocol for accepting new coating systems. Based on literature it was concluded that a new protocol is needed. Results presented in this report provides the details of a new protocol for evaluation under accelerated corrosion, recommendations for acceptance and a plan for implementation. Basic parameters of relevant ASTM specifications and guidelines provided in FHWA publications are incorporated in the test method. The major difference between the proposed method and the current practice is the way the corrosion creep from a coating-damaged location is measured after exposure to accelerated corrosive conditions. The proposed method is based on direct pull-off (adhesion) strength at various stages of corrosion. In the area of accelerated exposure conditions, deep freezing is incorporated as part of the accelerated degradation process. These two measures provide significant and clearly measurable degradation within three months of accelerated exposure. Coatings that are known to provide excellent and weak corrosion protection were tested using the proposed protocol and the results show a clear difference between the best and the poor coatings. The test results also correlate well with results of the long-term field study. As

expected, corrosion creep from a damaged-coating location is the primary contributor to degradation of coatings. Other degradation indicators such thinning, color change, influence of welding and bolt hole locations were also evaluated. Acceptance criteria for these degradation mechanisms are also incorporated in the acceptance criteria. In the area of quality assurance, this study evaluates correlation coefficients for structural steel paints by performing Infra-Red (IR) scan using ASTM specifications E 2937. Chemical signatures have established for the components of six coating systems that are currently approved for use by New Jersey Department of Transportation (NJDOT).

Findings

The following are the findings of this investigation.

- The new test protocol does provide quantitatively measurable results for measuring corrosion vulnerability and the results also correlate with the field results of New Jersey Department of Transportation study (Mathis Bridge).
- Of the coating systems currently in use, those containing an inorganic zinc or organic zinc primer performed best. The epoxy systems and aluminum-mastic systems performed worst.
- The newly developed protocol for accepting new over coating systems is based on the concept of currently used scribe but applies an O-ring during painting to form the outline of the scribe. After the over coating paint cures, the O-rings are removed, exposing the steel with no damage to the over coating paint or steel specimen.
- The new testing procedure provides a guideline to estimate the average corrosion creep based on the specimens pull off strength. There is no scraping of the specimen's paint or subjective corrosion creep measurement required.
- The effectiveness of an over coating system can be analyzed within three months.
- Acceptable correlation coefficients were established based on four scans from two batches for each steel paint for quality assurance.
- The correlation coefficients for structural steel paints were more consistent and had less variation. With the exception of paint system Interplast 356 Part A, steel paint correlation factors were all higher than 0.98.



Adhesion Strengths of tested Coating Systems versus Number of Cycles

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A final report is available online at: <http://www.state.nj.us/transportation/refdata/research/>.
If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us.

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NJDOT Research Report No: FHWA-NJ-2018-006