ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 4, 2006.
- The guidance presented supersedes the guidance in EI 97-029.
- The information included in this EI is intended to stand alone outside of any other document until a suitable final disposition is determined.

PURPOSE: This EI includes guidance for selection of bridge painting candidates and courses of action for various conditions.

TECHNICAL INFORMATION:

- This EI is being issued concurrently with EI 05-038 Structural Painting Standard Specifications and EI 05-039 Incidental Painting Standard Specifications.
- The guidance presented is revised from that issued in 97-029. The guidance includes additional painting options and field evaluation techniques for structures to be painted.
- The information presented should be used for present and future design of bridge painting projects.
- For bridges classified as requiring Total Removal by abrasive blasting, the structure will be blasted to an SP-10 cleanliness using recyclable steel grit, and painted with an organic zinc-epoxy/urethane system. The steel grit used provides a more predictable anchor, reduces the amount of hazardous waste generated, and reduces dust levels inside containments. The SP-10 cleanliness standard required by EI 05-002 specifies a more stringent surface cleanliness which is a major contributor to the success of a coating. The organic zinc-epoxy/urethane system is a widely used coating system for protecting steel. The system offers the barrier coating characteristics of epoxy paints while also offering the cathodic protection of a zinc-rich primer to resist corrosion.
- When maintenance overcoating is used, delaminations caused by urethane-to-urethane incompatibility are addressed by abrading the tightly adherent existing coating prior to painting.
- Paint application, and application conditions will be defined by the paint manufacturer’s recommendations.
- Improved design guidance is provided to designers to determine proper maintenance painting programs. The new guidance will likely result in fewer bridges being overcoated, and more bridges requiring total paint removal.
- When moisture-cured urethanes are used, an additional coat of primer will be required on areas cleaned to bare steel.
- Shop-painted steel will now have an organic zinc-rich primer. These will be the same paints as those used in the field. This uniformity will be particularly useful on rehabilitation jobs where new steel will be shop painted and existing steel field painted.
In addition to a total removal or overcoating option, a localized paint specification in EI 05-038 has been introduced.

TRANSMITTED MATERIALS:
- Bridge Paint Evaluation Checklist
- Field Painting Decision Process.

BACKGROUND:
As the cost and effort involved in bridge painting has increased due to stringent employee health and environmental considerations, the performance of the coatings has become increasingly important.

The previous strategy calling for the use of a Moisture Curing Urethane (MCU) system for all maintenance painting provided limited success. Problems inherent to MCUs, and maintenance painting in general include premature corrosion of previously rusted steel, paint delamination, existing coating instability, and unrealistic life-cycle expectations and specifications.

Experience has shown that many premature coating failures can be attributed to one of three problems:
1. The Moisture Cured Urethane (MCU) systems, applied under less than the optimal conditions, are prone to early failure. If optimal conditions are not met, the performance is severely compromised.
2. Maintenance overcoating has had unrealistic expectations. It was assumed that an MCUs applied as an overcoat system under a broad range of conditions would perform similarly to coatings applied over bare steel. This was not the case and many painting contracts experienced failures.
3. Previous design guidance for bridge painting was inadequate.

Bridge Painting Program Impact. Accurate bridge painting estimates have been difficult to obtain. This is due to a wide range of contractor bid prices, and various field conditions unique to each structure. Further complicating the analysis is the lump sum method of payment.

A recent analysis examined surface preparation, containment, environmental protection, and hazardous waste generation items for both Total Removal and overcoating contracts. The results showed that total removal using Class A containments typically ranged from $90/m² to $145/m². Overcoating contracts generally cost half of what a total removal contract would, usually ranging from $40/m² to $80/m². Factors contributing to the high variation of bid prices were geographic location, structure size, degree of corrosion, and structure detail. These figures are presented to provide a starting point for estimating. Regions should continually monitor paint related bid prices for various structures in order to produce an accurate Engineer’s Estimate.

Designers should also note that overcoating costs will increase due to the new requirement of having to abrade the sound existing paint prior to painting. The cost increase associated with this additional work cannot be estimated at this time, however, it is expected that the increase will be considerable.

Total Removal contracts can be estimated to provide a service life of 12-15 years. Overcoating contracts have an estimated service life of 6-7 years. These are conservative estimates based on a well scoped and constructed job. It is possible that the coating may well exceed the performance described here. Future recommendations for repainting cycles will be made based on experience with field performance.

The guidance provided with this EI will most likely result in more Total Removal contracts. Although there will be an impact to Regional programs due to the higher relative cost of the total removal jobs, the annualized cost of the work will be comparable if not lower than the cost for an overcoat cycle of...
painting. Total removal contracts also offer benefits such as reduced risk of failure and fewer traffic disruptions.

It is unclear at this time whether a structure that has undergone a total paint removal is still capable of generating hazardous waste. Environmental Analysis Bureau (EAB) is currently evaluating this topic. Regions should maintain a list of structures that have undergone full removal. If EAB finds that the paint waste is no longer hazardous, this could be an area for potential cost savings.

**CONTACT:** Direct questions regarding this issuance to Orlando Picozzi via e-mail at OPicozzi@dot.state.ny.us or William Feliciano via e-mail at WFeliciano@dot.state.ny.us or at the Materials Bureau at (518) 457-4595.
FIELD PAINTING DECISION PROCESS.

**Structure Evaluation.** Typically, bridges are identified for painting based on the paint rating given in the biennial bridge inspection, or clusters of bridges in a county or corridor are chosen. These structures should then be examined to determine the proper course of action. The attached Bridge Paint Evaluation Checklist should be used to determine basic conditions of the structure. This form requires that the designer gather the coating history of the structure and conduct a site visit. Asbestos coating information associated with this history requires consideration in association with all course of action determinations. As noted in the checklist, Regional Environmental groups shall be contacted for all asbestos presence determinations and handling procedures.

**Design Guidance.** The following information is presented as general guidance. Each structure may have special circumstances that may require a different course of action based on engineering judgment.

Pay Items 570.01, 570.02, 570.03, and 570.04 must be included on all projects involving extensive painting of structures. They should also be used on projects where rehabilitation, repair, or demolition of structures is a major item of work defined by § 109-16. They should not be used on projects with only minor or incidental work involving lead exposure. On these projects, worker protection will be required by § 107-05.

**Strategy 1: Total Removal of all corrosion/paint.** “Structural Steel Painting: Field Applied – Total Removal”, “Class A Containment” are required for this selection. This strategy has the most predictable performance. It will have a relatively higher present-value cost, but a lower annualized cost as compared to traditional overcoating jobs. This strategy should be chosen if one or more of the questions identified below from the Bridge Paint Evaluation Checklist is answered as shown:

- “NO” for “Simple Structure” – Question #3. Complicated surfaces are most effectively cleaned with open abrasive blasting.
- “Prior to 1970” for “Year Built” - Question #6. If the structure was built prior to this date, it can be assumed that mill scale was not removed from the steel prior to fabrication. Mill scale is cathodic relative to steel, which causes the steel to sacrifice itself to protect the mill scale. Aged mill scale is a highly unpredictable substrate it should be completely removed. NOTE: If the structure was built after 1970, but the answer to Question 4 is “YES” then the mill scale has probably been removed.
- “Greater Than 10%” for “% Corroded” - Question #9. When there is greater than 10% of corroded areas on the structure, it is too labor intensive to clean this area by power-tool methods and the most effective form of cleaning will be a total removal.
- “YES” for “Soft or Chalked Coating” - Question #11. If the coating is soft or chalked, it is a high risk for an overcoat. Structures with this condition must have a total removal.
- “YES” for “Peeling Paint” - Question #12. Peeling paint is another sign of a distressed coating. Widespread peeling on the structure makes it a high overcoat risk.
“Greater than 25 mils” for “Coating Thickness” - Question #13. If a structure has greater than 25 mils (typically 6-8 coats), the probability of a delamination increases substantially if overcoated.

“NO” for “Well Adhered Coating” - Question #14. If the coating easily comes off the steel substrate, the bridge is a poor overcoat candidate.

“YES” for “Significant Impact” - Question #17 or #18. If there are significant impacts to the traveling public or a major risk associated with a failure, the most predictable painting strategy should be selected.

The above conditions make the choice clear in terms of selecting Strategy 1. Other factors to be considered are:

“YES” for “Sensitive Work Location” - Questions #1 or #2. If a Class A containment is required due to the location and environmental impact of the work, a total removal should always be considered. The cost of a Class A containment is a considerable portion of any painting project.

“YES” for “Specific Areas Corroded” - Questions #10. Although there may be only a small section of the structure displaying corrosion, if corrosion is aggressive in these areas, power tools may not be effective. This should be considered with Question 17 and 18.

“NO” for “Ease of Contractor Access” - Question #15 and #16. Difficult contractor access clearly increases project costs. If there is no plan to return to this structure/corridor in the near future, performance of the system applied is imperative. These questions must be weighed with cost/benefit in mind.

Strategy 2: Maintenance Overcoat. “Structural Steel Painting: Overcoating - Lump Sum”. Typically, “Class B” or “Environmental Ground/Water Protection” containments will be required. Class B containment should be used in urban or sensitive environments.

If all of the following conditions are true, then the structure may be considered a candidate for overcoating.

“YES” for “Simple Structure” - Question #3. Power tools are most effective when cleaning simple, flat surfaces.

“After 1970” for “Year Built” - Question #6. If the structure was fabricated after this date, it can be assumed that the structure has had mill scale removed.

“YES” and “After 1970” for “Cleaning History” - Question #4 and #5. If the structure had a total removal of all paint, it can be assumed that the structure has had mill scale removed.

“Less than 10%” for “% Corroded” - Question 9. Although a structure may be less than 10%, this does not mean a total removal should not be considered based on other circumstances.

“No” for “Soft or Chalked Coating” - Question 11.
➢ “No” for “Peeling Paint” - Question 12. Limited peeling of a top coat should not make the answer to this question a ‘Yes’. If the substrate is still protected, and if tightly adhered paint can be found near peeling areas, these areas can still be successfully overcoated.

➢ “Less than 625 mils” for “Coating Thickness” - Question 13.

➢ “Yes” for “Well Adhered Coating” - Question 14.

Even with positive answers for the above questions, overcoating has a higher possibility of failure than that of a total removal or incidental painting. The predicted life cycle of the overcoating can be expected to be less. The answers to Questions 18 through 21 should be carefully reviewed for projects of this scope.

**Strategy 3: Incidental and Spot Painting.** “Structural Steel Painting: Localized.” Typically, “Class B” or ‘Environmental Ground/Water Protection’ containments will be required. Class B containment should be used in urban or sensitive environments.

This strategy is developed as an inexpensive alternative to Strategies 1 or 2. This will only involve cleaning and painting corroded areas. This strategy can be applied to any structure. It should be noted however that the conditions of the structure and corrosion will determine the success of the maintenance painting.

Areas painted will most likely have a different gloss and color than the existing coating.

Estimates should be based on the area of steel to be cleaned and painted.

A structure may be a candidate if one or more of the following conditions are present.
• Corrosion is not aggressive and is present over a small percentage of the structure.
• Structural repairs requiring paint removal are required.
• Corrosion is typically limited to areas that are not easily visible to traffic.
• Aesthetic concerns for the structure are minor.
• It is acceptable to revisit the structure for further paint maintenance.
• A color change is not required.

**Strategy 4: Facia Beam Overcoat/Spot Paint.** “Structural Steel Painting: Overcoat - Square Meter” and “Structural Steel Painting: Localized”. Typically, “Class B” or “Environmental Ground/Water Protection” containments will be required. Class B containment should be used in urban or sensitive environments.

This hybrid strategy addresses aesthetic concerns for the traveling public, while reducing costs and risk by reducing the area of steel to be overcoated. The designer should detail the scope of work intended in the special note entitled “Structural Painting Details.”

Estimates should be based on the area of steel to be cleaned and overcoated and areas to be spot cleaned and painted.
The same criteria used for determining Strategy 2 should be used for deciding whether the fascia beams are capable of being overcoated.

The scope of the overcoating work can be expanded to include the bottom flange, railings, etc.

**Strategy 5: Null Alternative.** A structure may not clearly fall into one category. For example, a structure is exhibiting moderate corrosion. The corrosion is not causing the structure to be placed at risk due to section loss. The designer may choose to postpone painting the structure until it is clear that it requires an abrasive-blast Total Removal (Strategy 1).

The designer should also consider other proposed work in the corridor. Painting projects should not be let if there are structural repairs, steel replacement, bridge joint repairs, or other work slated to be performed on the structure in near future. Coordinating painting projects with other work will mitigate traffic concerns and produce a better finished product.

The remaining service life of the structure should be considered when determining the painting strategy. A structure near the end of its service life may not be a good candidate for paint work.

**Additional Information.** Regions should maintain an inventory of steel area for structures and painting history, including whether the bridge has had lead paint removed.

**IMPORTANT:** It should be noted that a factor contributing to the success of a coating is the condition of the bridge joints. Leaky joints must be addressed prior to the beginning of work to ensure that the coating can be applied and provide the service life expected.
Determining Cleaning Percentage

Total Beam Length: 40 m
Sections 1, 2, 4, 5 Length: 5 m
Section 3 Length: 20 m

Flange Width: 0.5 m
Beam Depth: 2 m
Flange Height: Negligible

Areas Requiring Cleaning:
Section 1 & 4: 30% of all surfaces. Section 2 & 5: 5% of the bottom of lower flange. Section 3: 50% of bottom of lower flange, 10% of one web side.

Calculations:
Total Area of Beam = (3 x Flange Width + 2 x Beam Depth) x Beam Length
(3 x 0.5 m + 2 x 2 m) x 40 m = 220 m²

Total Area of Section 1: 27.5 m², With 30% estimated for cleaning, cleaned area = 8.25 m²

Area of Bottom Flange of Section 2: (Flange Width x Length)
(0.5 m x 5 m) = 2.5 m², With 5% being corroded, cleaned area = 0.125 m²

Area of Bottom Flange of Section 3: (Flange Width x Length)
(0.5 m x 20 m) = 10 m², With 50% being corroded, cleaned area = 5 m²

Area of Web of Section 3: (Beam Depth x Length) – per side
(2 m x 20 m) = 40 m², With 10% being corroded, cleaned area = 4 m²

Total Area Of Entire Beam To Be Cleaned
Section 1 = 8.25 m²
Section 2 = 0.125 m²
Section 3 = 9 m²
Section 4 = 0.125 m²
Section 5 = 8.25 m²
Total = 25.75 m²

Area of Beam = 220 m²
% Of Cleaning Area For Structure = 11.7%

*NOTE: ASTM D610 offers guidance for determining corrosion percentage.
BRIDGE PAINT EVALUATION CHECKLIST

BIN:_________ LOCATION:______________________________________________

1. Is the structure in a populated area? Yes □ No □

2. Is it near a sensitive location such as a stream, a school, farm, or homes. Yes □ No □

STRUCTURE CHARACTERISTICS

3. Is the structure simple with uncomplicated details? Yes □ No □
   (i.e., large, flat surfaces easy for a laborer to clean as opposed to lattice work, built-up plates, riveted pieces, complex angles)

4. Has the structure had 100% removal of coating since being placed in service? Yes □ No □

5. If yes, when was the 100% removal performed? __________________

6. When was the structure built? __________________

7. What is the surface area of the steel? ________________ sqm

8. Has the structure been identified as having asbestos or “dum-dum” paint present? *Note 1 Yes □ No □

CONDITION OF PAINT

9. What approximate percentage of the structure is corroded? __________________
   See section (Determine Cleaning Percentage)

10. Is the corrosion limited to specific areas (i.e., bridge joints, bearings, bottom flanges over the travel way)? Yes □ No □

11. Does the existing coating appear soft or chalked? Yes □ No □

12. Is there peeling paint? Yes □ No □
13. How thick is the existing paint? *Note 2

____________________ microns

14. Is the paint well adhered? *Note 3

Yes ☐  No ☐

OTHER CONSIDERATIONS

15. Will the Contractor have easy access to the structure?

Yes ☐  No ☐

16. Is there a plan to return to do work on this structure in the near future? (i.e. Bridge Joint Repair, Structural Repair)

Yes ☐  No ☐

17. Will Contractor’s activities during work cause a significant traffic impact to the traveling public?

Yes ☐  No ☐

18. Are there major public/financial risks associated with a coating failure? *Note 4

Yes ☐  No ☐

OBSERVATIONS AND NOTES:

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

*Note 1: If the answer to this question is yes, special work will be required not covered by this EI. The Regional Environmental Group should be contacted for assistance in determining presence of, and handling of asbestos containing coatings.

*Note 2: It is highly recommended that a Dry-Film Thickness Gauge (DFTG) be used to determine the coating thickness. Gauge readings should be taken in several locations on the structure to give a representative average.

*Note 3: Adherence testing is commonly determined in accordance with ASTM D3359,

*Note 4: This question, although considerably subjective, is intended to have the designer consider the consequences of the failure of a coating on a particular structure.

** The Materials Bureau is available to assist in the evaluation of the above topics/questions.