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New York State Department of Transportation
ENGINEERING INSTRUCTION

EI 97-029

Title: **BRIDGE MAINTENANCE PAINTING POLICY**

Distribution:
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Approved:

R. J. Clark, Design Division — Date 12/01/97

P. T. Wells, Construction Division — Date 12/1/97

This Engineering Instruction supersedes Engineering Instruction EI 93-020, and modifies Engineering Instruction EI 94-019.

This Engineering Instruction is effective with the letting of April 23, 1998. These requirements may be substituted for on-going work by order-on-contract.

Purpose: This Engineering Instruction establishes new policy and transmits new specifications and procedures for painting existing structures in the field. These requirements specify a single component, moisture-curing urethane paint system, and three different painting methods for use on bridges with good, moderate, and poor paint conditions. Guidelines are presented for the designer to select the most appropriate painting method, based on the condition of the existing paint, and the location and complexity of the structure selected for painting. Specifications for a new Class B type containment enclosure for use on bridges cleaned using power tools are included.

The following ***new*** items are being transmitted:

1. Item 18573.1010 M & 18573.1011 M (Spray Prohibited) - Field Cleaning and Overcoating - SSPC -SP11
2. Item 18573.1012 M & 18573.1013 M (Spray Prohibited) - Field Cleaning and Overcoating - SSPC - SP6
3. Item 18573.1014 M & Item 18573.1015 M (Spray Prohibited) - Field Cleaning and Painting - Total Removal
4. Item 18574.1010 M - Class B Containment System
5. Revision to Section 571 - Treatment and Disposal of Paint Removal Waste - This specification revision changes Section 571 of the 1995 Standard Specifications, and will be inserted into contract proposals beginning with the effective date of this instruction, for projects containing the new pay items 18573.1010 M through 18573.1015 M. The revision pertains to the requirement for bridge washing waste to be separated from paint removal waste.

6. Shelf Note - Bridge Washing Wastes - This shelf note will be inserted into contract proposals beginning with the effective date of this instruction, for projects containing the new pay items 18573.1010 through 18573.1015 M.

The following ***old*** items are being deleted:

1. ***Delete*** Item 18570.8611 M & 18570.8612 M (Spray Prohibited) - Maintenance Cleaning and Epoxy Priming

2. ***Delete*** Item 18570.8613 M & 18570.8614 M (Spray Prohibited) - Maintenance Painting Epoxy Intermediate Coat

3. ***Delete*** Item 18570.8615 M & Item 18570.8616 M (Spray Prohibited) - Maintenance Painting Urethane Finish Coat

4. ***Delete*** Item 18570.2502 and Item 18570.2502 M - Containment System for Localized Steel Repair and Painting. (The new Item 18574.1010 M that is being transmitted with this Engineering Instruction is to be substituted whenever the deleted items, that were previously transmitted with Engineering Instruction EI 94-019, would have been used).

The following ***existing*** items are unchanged and are referenced in this EI:

1. Standard Specification Items 570.09 M and 570.10 M, Environmental Ground Protection and Environmental Waterway Protection

2. Item 18570.1503 M, Class A Containment System for Paint Removal

Background: The cost and effort needed to repaint in-service structures has increased significantly in recent years. Strict EPA regulations are applied to bridge painting projects that involve the removal of existing paint. These regulations control the emissions of dust alone, and dust containing lead debris into the environment. Ambient air quality standards that regulate the release of particulate and lead particles must be complied with. In addition, OSHA has introduced new and stringent regulations for worker safety, i.e. Interim Standard for Lead in Construction (Title 29 of the Code of Federal Regulations, Part 1926.62).

To meet these standards and regulations, in 1993 the Department issued requirements and guidelines for the use of a negative pressure, Class A containment system. The Class A containment has been successful in containing dust and lead paint debris on bridge painting projects that specify open abrasive blasting as the method of surface preparation. To address worker safety, a lead health and safety program, exposure control plan, and monitoring requirements have been developed for bridge painting work.

Air quality and worker health issues are expected to significantly affect how we conduct bridge painting work. There have, however, been some new developments within the painting industry which will both have an effect on and give direction to our painting program.

1. A single component moisture-curing urethane paint system has been developed for structural steel work. In laboratory and field tests performed by the Materials Bureau and others, moisture-curing paint systems have performed as well as the current standard epoxy mastic/urethane system.

   Because this paint dries by reacting with moisture in the air, painting work can be performed in conditions of high humidity and damp weather. Multiple recoats are possible within the same work day, and over a greater temperature range.

   Moisture-curing paints are somewhat tolerant of imperfectly cleaned surfaces. Although the greatest service life will occur on steel cleaned by abrasive blast cleaning, satisfactory performance can be achieved on certain bridges cleaned to a lesser standard using power tools.

2. New research has indicated that abrasive blast cleaning alone will not remove de-icing salts and other soluble pollutants. When left in place these contaminants create active corrosion cells which can lead to early coating failures. The most efficient way to eliminate these corrosion causing residues is to pressure wash all surfaces before surface preparation and painting work begins.

   The use of pressure washing requires that a revision to Section 571 of the Standard Specifications, and a Special Note entitled "Bridge Washing Waste," be included in the proposal to alert the contractor to the proper handling of the waste generated. Copies are attached to this instruction.

3. A negative pressure, Class A containment system is necessary when performing open abrasive blasting operations. This will usually be the case on bridges with moderate to severe corrosion (e.g. greater than 25% rust), or when cleaning bridges with more complicated designs (e.g., trusses), or when all the existing paint is removed from the structure.

4. A Class B containment system is a simple enclosure design consisting of drapes and covers suspended around the work area. A negative pressure is not specified. Ventilation in the containment is usually by natural means. Filtering or treatment of exit air is not required. In populated areas and in sensitive locations (e.g. near schools and over water), a Class B containment system has proven to be effective for containing paint waste and dust when vacuum shrouded power tools and vacuum blasters are used for paint removal work. A Class B containment is <u>not effective</u>, nor can it be used to contain paint waste and dust generated by <u>open abrasive blast cleaning</u> operations.

5. In unpopulated locations, when vacuum shrouded power tools and vacuum blasters are used for paint removal work, containment for paint waste may be provided by using the simple ground and water protection specified under Items 570.09 M and 570.10 M (Environmental Ground and Water Protection).

6. Paint that is applied in the winter and seasons of cool weather does not perform well. Painting work should not usually be allowed in the winter months of December through March. If absolutely necessary to complete a project, for example, paint applied during this time period must be allowed to fully dry in a heated enclosure.

7. On structures with significant corrosion and paint deterioration, on complicated structures such as trusses and built-up plates, and on certain other structures in sensitive and highly populated areas, consideration should be given to removing all of the existing lead paint.

8. Paint life is dependent on surface preparation and coating thickness. Research indicates that in over 85% of the investigations performed, premature paint failures are a result of improperly prepared surfaces, or thin coating thicknesses. In general, for spot-cleaning and overcoating, a moisture-cure paint system will perform for 10 years on surfaces cleaned using power tools, and for 15 years on surfaces cleaned by abrasive blasting. When all of the paint is blast cleaned from existing structures, the moisture-cure paint system will provide 20 years of service. These paint lives assume that the cleaning standard specified for the method of surface preparation is achieved, and that the specified coating thickness is applied.

   The present preventive maintenance requirement for repainting on a 12-year cycle will be re-evaluated as additional experience with the moisture-curing urethane paint system is obtained. Recommendations for 10, 15, and 20 year repainting cycles will be made based on actual field performance.

9. Paint life is dependent on the quality of paint inspection. In the past few years, with the use of a Class A containment system, workers perform their duties within an enclosure, and inspectors cannot always easily inspect painting activities. The contractor is ultimately responsible for making sure that surfaces are properly cleaned and that coatings are properly applied. However, whenever possible, no painting should be allowed unless the cleaned surfaces have been inspected and approved, and the thicknesses of the applied coatings have been measured and approved.

10. Abrasive blast cleaning is the most efficient way to remove rust, millscale, and deteriorated paint from the structure. Blast cleaning is the most productive method of cleaning. It is the best method for cleaning small and complicated shapes (e.g. lattice pieces, heads of nuts and bolts, edges of bearings and plates), and for cleaning marginally accessible surfaces such as the tops and backsides of structural shapes. Production rates for blast cleaning to a commercial standard (SP-6) are estimated at 1000 - 1500 sf/blast nozzle/day. Abrasive consumption rates for commercial blasting to a bare metal condition are estimated at 4 lbs/sf for non-reusable slag.

11. Cleaning with vacuum shrouded power tools, needle guns, grinders, rotary impact hammers, and vacuum blasters is a less efficient and a more labor intensive way to remove rust and deteriorated paint. For this reason, its use is better suited to structures with uncomplicated designs (e.g. highway grade crossings), structures with large, flat surfaces, and structures with minimal coating deterioration. Areas of limited accessibility are difficult to clean with power tools. Production rates are slow. It is not practical to expect a worker using heavy, vibrating power tools to work continuously for a full 8-hour day. Experience has shown that three to four productive hours can reasonably be expected. Depending on the condition of the surface being cleaned, and the type of power tool used, production rates can be from 100 - 400 sf/worker/day. A HEPA filtered vacuum attachment on the power tool captures dust and helps to control the collection of debris by channeling it to a container.

12. It may not always be possible to erect and use a Class A or Class B containment system. Bridges over active railroad lines, restricted highways, and roadways with heavy traffic volumes may require special consideration. The designer must be aware that whenever a Class A or a Class B containment

enclosure is specified, traffic may be disrupted beneath structures with low or inadequate clearances. If lane closures cannot be maintained for practical time periods, normally an 8-hour work day, it may not be possible to use a containment system on the portion of the structure that spans the obstruction. In this case the designer must specify that spot cleaning and painting be performed on those spans, or portions of the structure, over the railroad or highway using vacuum shrouded power tools, regardless of the condition of the existing painted surface. Ground or water protection must be specified beneath the work area to collect falling paint chips. Spilled paint chips and other waste must be collected. To obtain the longest lasting paint life, spans and areas adjacent to the obstructed area should be cleaned and painted in the normal manner, using an appropriate containment system.

Site Evaluation: Three basic painting methods are presented in this Engineering Instruction. The designer/engineer must perform an on-site evaluation of each structure that is being considered for painting. On larger and more complicated bridges it may be necessary to use "lift" equipment to gain access. Materials Bureau personnel are available to assist if requested.

When the evaluation is performed, the following should be considered:

1. Location. Is the structure in a rural or populated area? Is it in a sensitive location, such as over a stream, or near schools, playgrounds, homes, or public places? Is it near a farm or livestock? This information will be used to select the appropriate containment to control paint waste.

2. Type of Structure. Is this bridge a simple structure, such as a girder or stringer bridge, that has uncomplicated details, with accessible flat surfaces that will be easy to clean with power tools? Or is this a truss bridge consisting of small, riveted pieces, or a structure constructed of built-up plates that will be difficult to access, and may require cleaning using open abrasive blasting methods?

3. Condition of Existing Paint. What is the condition of the existing paint? The extent of surface area on the bridge that needs cleaning to remove corrosion (rust) and deteriorated paint should be estimated as follows:

   Good - less than 25% of surface;
   Moderate - 25 to 50% of surface;
   Poor - greater than 50% of surface.

   On structures in "good" condition, are the corroded and deteriorated areas easily accessible for power tool cleaning, or will abrasive blast cleaning be required?

4. Other Considerations. How thick are the coats of existing paint, and how well are they adhered? Use a dry film gage to measure paint thickness. Use a putty knife, or a pocket knife, or similar tool to get an idea of the adhesion of the existing coats of paint. If the paint is difficult to remove it is probably suitable to overcoat. There are other procedures to test paint adhesion, such as the "crosshatch and tape test," but these require considerable experience by the "tester" and are not recommended for general use. If the thickness of existing coatings

exceeds 1 mm (30 mils), or if the coating can be easily removed, or if there are large areas of peeling and delaminating paint, then total removal should be considered.

Bridges that span sensitive streams (e.g. trout streams) are susceptible to thermal shock and pollutants. These structures may only be pressure washed when adequate flow in the stream exists to dilute possible contaminants. Streams categorized by the Department of Environmental Conservation (DEC) as"CT" and "CT(s)" must be washed prior to July 1, and bridges located at DEC yearling trout stocking sites shall not be washed during April. In addition, when washing operations are performed on bridges over a public water supply, e.g., any reservoir or on bridges in the New York City water supply, the spent washwater must be diverted, or collected for disposal at another location. The designer must indicate and include in the Contract Documents all date restrictions for pressure washing over streams categorized as "CT" and "CT(s)", and for the collection of spent wash water. Additional information is available from the Environmental Analysis Bureau (518-457-5672).

Should the spray application of new paint be prohibited? The performance or service-life of the applied paint coating is not affected by the method of application and the difference in cost between paint application using brushes/rollers and spray is only around ten cents per square meter ($0.01/SF). When spray painting is performed up to 20% of the sprayed paint material will be lost as overspray. Unless the structure is located in a remote location where damage from overspray is not a concern, or unless spray paint application is performed in a containment, spray painting should be prohibited.

In the 1980's coal-tar epoxy paint was often used to protect the steel from corrosion on surfaces beneath, and 1.5 meters (5') back (in all directions) from transverse bridge joints, and beneath open steel grates. Coal tar coatings are difficult to overcoat and they should be removed or checked carefully to ensure that they are well adhered. Tightly bonded coal-tar in good condition can be painted over. If the coal-tar is loosely adhered or deteriorated it should be removed before new paint is applied.

Throughout the late 1950's, 1960's and early 1970's, an asbestos-coating product called "dum-dum" was used as a fireproofing and waterproofing. The primary use of this material is believed to have been on bridges crossing railroads, and on bridges constructed with open steel grates. On bridges over railroads the entire structure or those spans over the rail lines may have been coated. Typical locations beneath open steel grates would include the steel surfaces of the interior girders and girder fascia immediately below the grating. Dum-dum may also have been used to a lesser extent on some bridges on the steel surface beneath transverse bridge joints, and on steel girders, 1.5 to 3 meters (5' to 10') back in all directions from piers and abutments.

Many of the structures where dum-dum was applied have since been repainted and it is unlikely that many bridges still contain this application. However, the designer should be aware of its existence and evaluate the structure for its presence.

Preliminary identification of dum-dum is by close inspection of the steel. It is approximately 3 mm to 6 mm thick (1/8" to 1/4") and will likely be in good condition with existing layers of paint covering it. Visual confirmation of its presence will require close inspection of the steel.

Dum-dum may have an exterior appearance similar to coal-tar because it typically will be painted, however, areas where there is damage or where the edges are exposed should indicate a silver and/or rust colored interior with a visible asbestos fiber matrix. By comparison, coal tar is typically black or dark red, throughout the interior, with no fibrous matrix.

If dum-dum material is found or suspected on any structure scheduled for painting it will require prior abatement by a licensed contractor subsequent to any other work. To help determine this need, when this material is identified on projects, the Environmental Analysis Bureau should be contacted at 518-457-5672.

Selecting A Painting Method: Using the information from the site evaluation, the designer should now select a paint method to perform the work. The following three methods (Table 1) are general requirements that should satisfy most project work. There will however be structures that will need special requirements, or that will need more than one procedure to produce a satisfactory job. Using the information in this EI, and some engineering judgement, the designer should be able to recognize and specify the appropriate specification requirements to develop a "customized" painting method, when one becomes necessary.

Paint Method #1: This painting method is for bridges with simple, uncomplicated designs, that have been rated in "Good" condition with less than 25% rust and deteriorated paint. Bridges that are considered for this painting method will normally be girder or stringer bridges with uncomplicated details and flat surfaces, that will be accessible for cleaning using power tools. This method may also be considered for use on individual spans of structures with more extensive paint deterioration when traffic considerations preclude the use of Class A or Class B containment. All structures meeting this definition should be cleaned and painted using vacuum shrouded power tools and vacuum blasters. The quantity of paint debris and dust from cleaning operations will be minimal as it will not contain abrasive. In non-sensitive rural locations, simple ground and water protection items should be specified to contain dust and debris. In urban settings and sensitive locations (over reservoirs, trout streams, near schools and housing) a Class B containment system must be used. The quantity of paint waste generated by cleaning with power tools will be small. Typically, on a structure with a total surface area of 2300 m^2 (25,000 SF), with 25% of the paint deteriorated (575 m^2 or 6250 SF), the quantity of waste generated from power tool cleaning work will be less than a cubic meter (yd^3). The treatment and disposal of the paint waste will be paid for as each cubic meter (yd^3) of waste material generated.

Paint Method #2: This painting method is for bridges that have been rated as "Moderate." Corroded or deteriorated paint is present on 25 - 50% of the surface area on the structure. This method should also be used on structures with complicated detail designs and less than 25% rust and deteriorated paint, when power tool cleaning is not practical because of the complexity of the bridge. Cleaning with power tools on a structure with this quantity of deterioration is not practical because of the slowness of the cleaning operation, and because power tools will be less able to access marginally accessible surfaces. Cleaning on this structure will require abrasive blasting. A Class A containment must be included to contain waste and debris. Spot blasting and painting is the recommended choice for use on this bridge, but total removal may be appropriate in special cases, such as in heavily populated and sensitive locations. Moderate quantities of waste will be generated by spot blasting. The treatment and disposal of paint waste will be paid as each cubic meter (yd^3) of waste material generated.

Paint Method #3: This painting method is for bridges rated "Poor," with corroded and deteriorated paint present on 50% or more of the surface area, and for any other structures where 100% paint removal is justified. Surface preparation will require abrasive blasting to achieve 100% removal. A

Class A containment must be used to contain paint removal waste. Large quantities of waste material will be generated by the cleaning operation. The treatment and disposal of paint waste will be paid for as each cubic meter (yd^3) of waste material generated.

This paint method may also be considered for use in densely populated and sensitive locations where it may be desirable to remove all of the lead paint; for structures with significant impacts on high volume traffic such as bridges over interstate highways with high AADT's; for major structures for which containment costs will be high and the longest possible repainting cycle is desired, such as river crossings; and for individual bridges where there is a programmatic benefit to eliminating the lead paint or extending the repainting cycle, such as a single painted bridge along a highway segment with weathered steel bridges.

Table 1 summarizes the typical painting methods and items. It is important to note that Table 1 only includes the items that directly pertain to the painting work (cleaning, painting, containment, and waste disposal). Items for M&PT, worker health and safety, engineers office, phones, and related items are to be included in the project by the designer, as necessary.

TABLE 1
TYPICAL PAINTING METHODS

% Deterioration	METHOD #1 (<25%)		METHOD #2 (25%-50%)	METHOD #3 (>50%)
Location	**Urban (Sensitive)**	**Rural (Non-sensitive)**	**All Locations**	**All Locations**
Containment:				
Item 570.09 M/570.10 M	-	x	-	-
Item 18570.1503 M	-	-	x	x
Item 18574.1010 M	x	-	-	-
Cleaning & Painting:				
Item 18573.1010 M/.1011 M	x	x	-	-
Item 18573.1012 M/.1013 M	-	-	x	-
Item 18573.1014 M/.1015 M	-	-	-	x
Paint Removal Waste:				
Item 571.01 M	x	x	x	x

Note: 1. Method #1 is for use on simple structures. For complex structures Method #2 is to be used even for <25% deterioration.
2. Method #3 is for use whenever 100% paint removal is required, regardless of the extent of deterioration.
3. Item 570.09 M/10 M, Environmental Ground Protection/Water Protection
Item 18570.1503 M, Class A Containment System for Paint Removal
Item 18574.1010 M, Class B Containment
Item 18573.1010 M/.1011 M, Field Cleaning and Overcoating - SSPC-SP11
Item 18573.1012 M/.1013 M, Field Cleaning and Overcoating - SSPC-SP6
Item 18573.1014 M/.1015 M, Field Cleaning and Painting - Total Removal
Item 571.01 M - Treatment and Disposal of Paint Removal Waste

Painting Costs: Reliable estimates of bridge painting costs have always been difficult to obtain. The Department has historically bid bridge painting on a lump sum basis, rather than by a more meaningful "dollar per square meter ($/SF)." Accurate determinations of steel surface area are often not made, or available, and contractor bid prices cover a wide range.

In a report issued by the Design Quality Assurance Bureau, the cost for bridge painting using the epoxy mastic and urethane type paint system with a Class A containment was analyzed. A majority of cost data considered in this analysis was represented by 232 Type 2 girder bridges that were bid on 35 different contracts. The analysis included costs for five bid items - Class A containment, cleaning and epoxy priming, painting the epoxy intermediate coat, painting the urethane finish coat, and treatment and waste disposal. The report concluded that the total average cost for these five items was about $41.90/m² (3.88/SF). This cost data is shown in Table 2, Column 1.

To evaluate the cost impact of the new painting methods included in this Engineering Instruction, the Materials Bureau has developed cost estimates using data from industry and the Steel Structures Painting Council. These estimates, which are for Type 2 girder bridges, are included in Table 2, Columns 2, 3, 4, 5 and 6. Column 2 is the Materials Bureau estimate of the current epoxy mastic and urethane paint system with a Class A containment, and represents the same items of work as analyzed in the DQAB report. It is presented to confirm the accuracy of the data used to assess the cost of the new painting methods, using the moisture-curing paint system. Because there is no historical data to determine the cost of the new painting methods, the cost for this work must be based on estimates. The Materials Bureau estimate in Column 2 of $36.39/m² (3.37/SF) is within 13% of the actual bid estimate of $41.90/m² ($3.88/SF) reported by DQAB. Considering the disparity and wide range of bid prices for bridge painting work, the cost estimates can be considered reasonably consistent.

In Table 2, using the Materials Bureau estimates, the current cost of painting using the epoxy mastic and urethane system with a Class A containment is shown to be $36.39/m² (3.37/SF). The new paint Method 1 (Column 3) using the moisture-curing paint system with simple ground and water protection has the lowest initial cost of $17.28/m² ($1.60/SF), and Method 1 (Column 4) with a Class B containment has a slightly higher initial cost of $21.06/m² ($1.95/SF). Method 2, which is similar to the current epoxy mastic/urethane painting system, but with moisture-curing paint and Class A containment, has a first cost of $36.07/m² ($3.34/SF), which is comparable to current costs. The total paint removal Method 3, using moisture-curing paint and a Class A containment has the highest first cost of $44.60/m² ($4.13/SF).

Program Impact: It is anticipated that this policy will result in an increase in the Statewide average painting cycle and a decrease in the annual average cost for maintenance painting, based on the technical and cost information currently available (assuming all other factors remain constant), due to:

- Use of a durable and surface tolerant paint system
- Reduced effort for surface preparation (in some cases)
- Reduced use of Class A containment system

Results may vary considerable among Regions and from year-to-year due to individual project conditions, program management strategies and other factors.

Technical Assistance: Questions and requests for technical and project assistance should be directed to the Materials Bureau at 518-457-4285.

TABLE 2
ESTIMATED PAINTING COSTS FOR TYPE II BRIDGES
(1997 DOLLARS)

Item	Current Standard Epoxy Mastic & Urethane Paint System		New Moisture-Cure Paint System			
	1	2	3	4	5	6
	DQAB	Materials	Method 1	Method 1	Method 2	Method 3
Class A Containment	$14.58/m^2	$14.58/m^2	-	-	$14.58/m^2	$14.58/m^2
Ground/Water Prot.	-	-	$1.62/m^2	-	-	-
Class B Containment	-	-	-	$5.40/m^2	-	-
Clean and Prime	$14.04/m^2	$10.69/m^2	$8.21/m^2	$8.21/m^2	$12.53/m^2	$19.44/m^2
Intermediate Coat	$6.26/m^2	$4.32/m^2	$3.56/m^2	$3.56/m^2	$3.56/m^2	$3.56/m^2
Finish Coat	$6.05/m^2	$4.64/m^2	$3.78/m^2	$3.78/m^2	$3.78/m^2	$3.78/m^2
Waste Treatment and Disposal	$0.97/m^2	$2.16/m^2	$0.11/m^2	$0.11/m^2	$1.62/m^2	$3.24/m^2
Total	$41.90/m^2	$36.39/m^2	$17.28/m^2	$21.06/m^2	$36.07/m^2	$44.60/m^2

Note:
1. To convert cost estimate to $/SF divide by 10.8
2. This estimate is for Type II, plate girder bridges. Trusses, lift bridges, and structures with complicated designs will have added costs.
3. All costs represent $/m^2 of steel surface area.

ITEM 18573.1010 M FIELD CLEANING AND OVERCOATING - SSPC-SP11
ITEM 18573.1011 M FIELD CLEANING AND OVERCOATING - SSPC-SP11 (SPRAY PROHIBITED)

DESCRIPTION

This work shall consist of pressure washing, power tool and vacuum blast cleaning, touch-up priming, and overcoating structural steel surfaces with two full coats of paint, where indicated by the Contract Documents.

MATERIALS

1. **Paint and Thinner.** Paint and thinner shall be selected from the Department's Approved List, "Moisture-Curing Urethane Paint Systems". No substitutions will be allowed.

   The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. All acceptances of paint shall expire within 12 months from the date of manufacture.

   All paint (primer, intermediate, and finish coats) used on any one structure shall be produced by the same manufacturer.

   Each single coat of paint shall be a color different from the others. The color of the primer and the intermediate paints shall be at the contractor's option, and shall provide contrast with the underlying substrate. The color of the finish paint shall be as specified in the Contract Documents, or as ordered by the Engineer.

2. **Water for Washing.** Water for pressure washing shall be clean, fresh water. Cleaners, detergents, or other additives will not be allowed. Salt water will not be allowed.

3. **Abrasive for Blast Cleaning.** Abrasive material for vacuum blast cleaning may be selected by the contractor. All abrasive shall be free of lead and corrosion producing contaminants. The abrasive selected for use shall be designed to leave a profile of approximately 40 μm to 65 μm in a dense, uniform pattern of depressions and ridges. Silica sand and other types of non-metallic abrasive containing more than 1.0% crystalline (free) silica, by weight, will not be allowed.

4. **Basis of Acceptance.** All primer, intermediate, and finish paint, and thinner material, shall be accepted on the basis of the manufacturer's name, and the product name appearing on the Department's Approved List.

   Water for washing and abrasive material for vacuum blast cleaning shall be approved by the Engineer.

   Only paint and thinner arriving at the work site in new, unopened containers shall be used.

   Containers of paint shall be labeled with the manufacturer's name, product name, batch number and date of manufacture. Paint that has not been used within 12 months from the date of manufacture shall be removed from the work site.

ITEM 18573.1010 M FIELD CLEANING AND OVERCOATING - SSPC-SP11
ITEM 18573.1011 M FIELD CLEANING AND OVERCOATING - SSPC-SP11 (SPRAY PROHIBITED)

CONSTRUCTION DETAILS

All structural steel members, railings, downspouts, and other miscellaneous steel items as indicated by the Contract Documents shall be prepared and touched-up with primer, and then painted with two full coats of paint, the intermediate coat and the finish coat.

1. **Surface Preparation.** Steel surfaces shall be prepared for painting by a combination of pressure washing, and power tool and vacuum blast cleaning.

   Pressure washing to remove dirt and debris shall be performed first. Power tool and vacuum blast cleaning of corroded and deteriorated surfaces shall be performed second.

   a. Pressure Washing. All steel surfaces to be painted shall first be pressure washed using equipment operating at a minimum pressure of 21.5 MPa, and with a minimum flow rate of 9.5 L/minute. The pressure washer shall be operated at a distance of 150 mm to 300 mm from the surface. Water may be heated. After washing, the steel surface shall be allowed to dry before subsequent cleaning and painting work is done.

      Pressure washing shall be performed to remove all dirt, dust, animal waste, and water soluble contaminants. Clean, fresh water shall be used with sufficient pressure to remove surface contaminants and loose material. Hand scraping and hand scrubbing with a stiff bristled brush will be required as necessary to remove debris. When necessary, oil and grease shall be removed by hand-wiping, using solvents.

      After pressure washing, the cleaned surfaces shall be visually free of dust, dirt, oil and grease, animal waste, salts, and other debris.

      Pressure washing will only be allowed when ambient air temperatures are greater than 4.5 °C and rising. In no case shall pressure washing be performed when in the opinion of the Engineer spent wastewater will freeze on roadway or bridge surfaces, or in any other way create a hazardous situation.

      During washing operations, containment shall be suspended around and beneath the work area to contain all paint chips, corrosion residue, and other solid particles that become dislodged by pressure washing (see *Note*[1]). All such solid residue shall be contained, collected, and allowed to air dry for treatment and disposal as hazardous paint removal waste

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[1] ***Note:*** *The containment for pressure washing in intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. The containment may be constructed of water permeable or water impermeable materials. Spent washwater will not require collection and will be allowed to fall to the underlying road, ground, or waterway, providing the other requirements of this specification are met. The exception for the collection of spent washwater will be for structures over a public water supply. When a bridge crosses a water supply the spent washwater must be diverted, or collected, and disposed of on the adjoining land mass, at a location away from the waters edge.*

under Item 571.01 M, or as directed by the Engineer. The containment provided shall also prevent all spray and residue from falling on or interfering with traffic, pedestrians, or surrounding property, above or below the structure. Extreme care shall be exercised to ensure that vehicles, pedestrians, and property are not exposed to the cleaning process.

All structures over water courses shall be washed during the seasonal periods indicated in the Contract Documents. If no schedule is provided, washing shall occur only when adequate flow in the stream exists to dilute possible contaminants. Operations shall be sequenced so as to clean structures over small bodies of water or small streams in the spring of the year, or in a period when flows are greatest. Streams categorized by the Department of Environmental Conservation (DEC) as "CT(s)", i.e. trout spawning, shall be washed prior to July 1 and bridges located at DEC yearling trout stocking sites shall not be washed during April. When washing operations are performed on bridges over a public water supply, e.g., reservoir or on bridges in the watershed area of the New York City water supply, the spent washwater shall be diverted, or collected, and disposed of on the adjoining land mass, at a location away from the waters edge.

To minimize contamination of the washed surfaces, subsequent cleaning, priming and painting work shall be performed within 14 calendar days of the completion of washing work. If more than 14 days pass by, or if the steel surfaces become dirty, they shall be rewashed in accordance with this specification, at no additional cost.

b. Power Tool and Vacuum Blast Cleaning

Surfaces which have become visibly corroded or upon which the existing paint has peeled, flaked, blistered, or otherwise become deteriorated shall be cleaned to bare metal in accordance with SSPC-SP 11, Power Tool Cleaning To Bare Metal.

Rust, paint, and millscale shall be removed using vacuum shrouded power tools and vacuum blasters. Vacuum equipped needle guns and vacuum equipped rotary impact assemblies shall be of a type that is capable of producing a bare metal surface and of producing a surface profile as defined in SSPC-SP11, Power Tool Cleaning to Bare Metal.

The vacuum assembly on all tools shall be capable of containing all visible dust and debris produced by the operation of the cleaning equipment. Air passing through the vacuum assembly shall be exhausted through a HEPA filter. A HEPA filter shall be defined as a filter that is at least 99.97% efficient for particles that are 0.3 μm in diameter, or larger.

The surface of the area power tool cleaned in any one day shall be no greater than the surface area of steel that can be prime coated in the same working day.

ITEM 18573.1010 M FIELD CLEANING AND OVERCOATING - SSPC-SP11
ITEM 18573.1011 M FIELD CLEANING AND OVERCOATING - SSPC-SP11 (SPRAY PROHIBITED)

For the purpose of this specification, vacuum blast equipment shall be considered a power tool, and shall be used with needle guns and rotary impact flap assemblies to clean rusted and deteriorated surfaces.

The edges of intact paint shall be feathered back and the adjoining paint must be tightly adhered. Ragged edges on adjoining paint will not be allowed. Adherence will only be considered satisfactory if the adjoining paint is smoothly feathered back, and cannot be removed by lifting with a dull putty knife.

Special attention shall be given to the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, and similar surfaces that are marginally accessible and difficult to clean. These surfaces are often difficult to access, and are labor intensive and hard to clean.

In general, heavy deposits of rust and rust scale should be removed using needle guns. Hand pounding, using a hammer to loosen heavy rust and scale prior to needle gun cleaning may be necessary. Rotary impact assemblies should be used to remove pinpoints and spots of rust, on the flat surfaces of webs and flanges, the edges of angles and plates, bearings, and lattice members, etc. With the proper attachments, vacuum blasters can be used to clean larger, flat and uncomplicated surfaces, edges of angles and plates, to remove mill scale, and to remove heavy deposits of rust. Normally, a combination of these methods will be needed to provide the required degree of cleanliness.

After cleaning operations are completed, all residue generated by the cleaning work shall be removed by vacuuming using HEPA filtered vacuums.

Corroded and deteriorated surfaces that have been cleaned to bare metal using power tools shall be accepted by visual comparison to a project prepared standard(s) for each structure. The contractor shall prepare a project standard by power tool cleaning a representative area on the structure that is being prepared for painting. The prepared standard shall generally conform to SSPC VIS3 ,"Visual Standard for Power- and Hand-Tool Cleaned Steel", Pictorial Standard E SP 11, F SP 11, and G SP 11, as applicable, and shall be approved by the Engineer before the start of general cleaning work. At least one standard shall be prepared for each structure that is being specified for cleaning. More than one standard may be necessary if the cleaned steel differs significantly from the photographic standards due to surface conditions or other factors. Each standard shall be at least 300 mm x 300 mm in size, and shall be located in an area of the structure that is accessible to, and approved by the Engineer. The contractor shall protect the work standard from corrosion and contamination throughout the duration of work by applying a clear coat of polyurethane. At the completion of cleaning work the project standard shall be recleaned and painted in accordance with this specification. If in the opinion of the Engineer the project standard becomes deteriorated, or otherwise ineffective, it shall be re-established in accordance with this specification at no additional cost.

2. **Painting.** Painting shall consist of striping, spot-priming all surfaces cleaned to bare metal, and then applying two full coats of paint, the intermediate coat and the finish coat, to all steel surfaces designated for painting.

   a. Material Storage. Paint in storage shall be protected from damage and maintained between 4.5°C and 29.5°C.

   b. Specifications and Inspection Equipment. Prior to the start of and throughout the duration of work the contractor shall supply the Engineer with the following specifications and equipment.. *No work shall begin until these materials have been delivered to, and accepted by the Engineer.*

      1. One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 11, Power Tool Cleaning To Bare Metal.

      2. One bound copy of the Steel Structures Painting Council pictorial standards, SSPC-VIS 3, Visual Standard For Power- And Hand-Tool Cleaned Steel.

      3. One bound copy of the Steel Structures Painting Council method SSPC-PA2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness With Magnetic Gages.

      4. One Air Thermometer, pocket type, -10°C to +40°C.

      5. One Surface Thermometer, -10°C to +40°C.

      6. One Magnetic Dry Film Thickness Gage, Type 2 (fixed probe), with a digital readout display capable of measuring 0 μm to 1500 μm in 1 μm increments..

      7. Two Wet Film Thickness Gages, Prong Type, capable of measuring 25 μm to 125 μm in 25 μm increments.

   c. Atmospheric Conditions. No paint shall be applied when the receiving surface and ambient temperatures are less than 1.5°C or greater than 38°C, but there will be no restriction for humidity or for dew point-temperature differential.

      In general, no paint shall be applied in the months of December, January, February, or March. If the contractor requests approval to apply paint in winter months, and if in the Engineer's opinion satisfactory results can be achieved, then the substrate shall be enclosed, painted under cover, and protected from the surrounding air. The interior of the enclosure

shall be heated and the steel painted when the surface temperature is 10°C, or greater. Direct application of heat to the steel surface will not be allowed. The painted steel shall remain enclosed and heated for a minimum of eight hours, or until the applied coating is dry, whichever is longer. No additional payment will be made for the cost of enclosing, heating, and protecting paint that has been applied in conditions of cool weather.

When painting inside an enclosure adequate mechanical ventilation shall be supplied to meet OSHA regulations for worker exposure to solvents, fumes, lead, and other provisions. When mechanical ventilation is provided, filtration of the exit air will not be required. No additional payment will be made for the cost of ventilation.

d. Mixing Paint. All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing the bottom of the container shall have no unmixed pigment.

e. Solvents and Thinners. Paint may be thinned if recommended by the manufacturer and only if approved by the Engineer. Only approved thinner shall be used and added up to a maximum of 60 ml/L.

Thinning shall be performed by pouring one-half of the thoroughly mixed paint into a empty, clean container. The required thinner is then added to one of the half-sized portions, and the two portions are remixed to obtain a homogenous mixture.

The paints specified for this work have a limited pot life because of their reaction with the moisture in the atmosphere. The paint will gel when it nears the end of its pot life. Thinning to reduce the viscosity of gelled paint will not be allowed. The pot life of the paint can be extended by covering open containers to reduce exposure to moisture, and by keeping containers of paint cool.

Unauthorized use of solvents and thinners shall result in recleaning and repainting of the surface in accordance with this specification, at the contractor's expense.

f. Paint Application. No painting shall begin until cleaned surfaces have been inspected and approved by the Engineer. The contractor shall provide safe, stable, and direct access to the work area for the Engineer's inspection.

Paint may be applied using brush, roller or spray methods, unless spray painting is prohibited by the Contract Documents. When spray painting is prohibited, paint shall be applied using brushes or rollers only. All paint shall be applied so as to produce a uniform, even coating free of runs, sags, drips, ridges or other defects.

To ensure adequate paint film thickness, stripe painting using primer shall be required on the following surfaces, whether cleaned to bare metal or coated with existing paint: all welds,

rivets, bolts, nuts, and edges of plates, angles, bearings, lattice pieces or other shapes, and corners and crevices. To provide contrast, primer paint for stripe coating shall be a color that is different from the color of the receiving surface. On areas cleaned to bare metal, the stripe coat may be applied before or after touch-up primer is applied. On surfaces with existing paint the stripe coat shall be applied before the first full coat of intermediate paint is applied. Such striping shall extend a minimum of 25 mm from the edge. To prevent removal of the stripe paint by the following coat of paint, the stripe coat shall be allowed to set-to-touch before the next paint coat is applied. However, on bare metal surfaces the stripe coat shall not be permitted to dry for a period long enough to allow rusting of the unprimed steel, and on existing paint surfaces, the stripe coat shall not be allowed to dry longer than 14 days before overcoating with the intermediate coat.

Paint that curls or lifts after application of new paint shall be removed by hand scraping and the area shall be repainted. Wet paint shall be protected against damage until thoroughly dry.

Complete protection against paint spatter, spillage, overspray, wind blown paint, or similar releases of paint shall be provided. Covers, tarps, mesh, and similar materials shall be placed around the work area to protect public and private property, pedestrian, vehicular, marine or other traffic, all portions of the bridge, highway appurtenances, waterways, and similar surrounding areas and property, upon, beneath, or adjacent to the structure.

g. Paint Film Thickness. Paint shall be applied in such a quantity so as to produce the minimum specified dry film thickness for the type of paint material being used (see Approved List - Moisture-Curing Urethane Paint Systems).

The dry film thickness shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness with Magnetic Gages, using a Type 2 fixed probe magnetic gages, equipped with a digital readout display.

Areas failing to meet the specified minimum dry film thickness shall be overcoated with the same type of paint to produce at least the total dry film thickness required.

h. Painting Schedule. Primer shall be applied to bare metal surfaces within twelve hours of the cleaning operation and before visible rust appears on the cleaned surface. Failure to apply primer to a bare metal surface within twelve hours or before the appearance of visible rust shall result in recleaning the surface in accordance with this specification, at no additional cost.

All coats of paint shall be overcoated with the subsequent coat in accordance with the time period specified for the paint material that is being used (see Approved List - Moisture-Curing Urethane Paint Systems). To prevent intercoat adhesion failure, recoating with the next coat of primer, intermediate, and finish paint, must be performed within the maximum

specified time period, or 14 days, whichever is shorter. If the contractor fails to recoat within the specified time period the surface to be painted shall be lightly abraded, using power sanders, prior to applying the next coat of paint. The purpose of power sanding will be to improve adhesion by lightly roughening the surface of the existing paint, not to remove it.

METHOD OF MEASUREMENT

Payment shall be made by the lump sum price bid.

BASIS OF PAYMENT

The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work. The cost of providing protection against damage during pressure washing and paint application shall be included in the bid price. Payment for the containment and disposal of dust and paint waste generated by surface preparation work will be paid for under other items, however, payment for the accumulation of paint removal waste for deposition in the paint waste containers shall be included in this item. Progress payments will be made based on the percentage of the structure cleaned and primed and painted with two full coats of paint in accordance with this specification.

Payment will be made under:

Item No.	Item	Pay Unit
18573.1010 nn M	Field Cleaning and Overcoating - SSPC-SP11	Lump Sum (for each structure)
18573.1011 nn M	Field Cleaning and Overcoating - SSPC-SP11 (Spray Prohibited)	Lump Sum (for each structure)

Note: nn denotes serialized pay item. See §101-53

ITEM 18573.1012 M FIELD CLEANING AND OVERCOATING - SSPC-SP6
ITEM 18573.1013 M FIELD CLEANING AND OVERCOATING - SSPC-SP6 (SPRAY PROHIBITED)

DESCRIPTION

This work shall consist of pressure washing, abrasive blast cleaning, touch-up priming, and overcoating structural steel surfaces with two full coats of paint, where indicated by the Contract Documents.

MATERIALS

1. **Paint and Thinner.** Paint and thinner shall be selected from the Department's Approved List, "Moisture-Curing Urethane Paint Systems". No substitutions will be allowed.

   The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. All acceptances of paint shall expire within 12 months from the date of manufacture.

   All paint (primer, intermediate, and finish coats) used on any one structure shall be produced by the same manufacturer.

   Each single coat of paint shall be a color different from the others. The color of the primer and the intermediate paints shall be at the contractor's option, and shall provide contrast with the underlying substrate. The color of the finish paint shall be as specified in the Contract Documents, or as ordered by the Engineer.

2. **Water for Washing.** Water for pressure washing shall be clean, fresh water. Cleaners, detergents, or other additives will not be allowed. Salt water will not be allowed.

3. **Abrasive for Blast Cleaning.** Abrasive material for blast cleaning may be selected by the contractor. All abrasive shall be free of lead and corrosion producing contaminants. The abrasive selected for use shall be designed to leave a profile of approximately 40 μm to 65 μm in a dense, uniform pattern of depressions and ridges. Silica sand and other types of non-metallic abrasive containing more than 1.0% crystalline (free) silica, by weight, will not be allowed.

4. **Basis of Acceptance.** All primer, intermediate, and finish paint, and thinner material, shall be accepted on the basis of the manufacturer's name, and the product name appearing on the Department's Approved List.

   Water for washing and abrasive material for blast cleaning shall be approved by the Engineer.

   Only paint and thinner arriving at the work site in new, unopened containers shall be used.

   Containers of paint shall be labeled with the manufacturer's name, product name, batch number and date of manufacture. Paint that has not been used within 12 months from the date of manufacture shall be removed from the work site.

ITEM 18573.1012 M FIELD CLEANING AND OVERCOATING - SSPC-SP6
ITEM 18573.1013 M FIELD CLEANING AND OVERCOATING - SSPC-SP6 (SPRAY PROHIBITED)

CONSTRUCTION DETAILS

All structural steel members, railings, downspouts, and other miscellaneous steel items as indicated by the Contract Documents shall be prepared and touched-up with primer, and then painted with two full coats of paint, the intermediate coat and the finish coat.

1. **Surface Preparation.** Steel surfaces shall be prepared for painting by a combination of pressure washing and abrasive blast cleaning.

   Pressure washing to remove dirt and debris shall be performed first. Abrasive blast cleaning of corroded and deteriorated surfaces shall be performed second.

   a. Pressure Washing. All steel surfaces to be painted shall first be pressure washed using equipment operating at a minimum pressure of 21.5 MPa, and with a minimum flow of 9.5 L/minute. The pressure washer shall be operated at a distance of 150 mm to 300 mm from the surface. Water may be heated. After washing, the surface shall be allowed to dry before subsequent cleaning and painting work is done.

      Pressure washing shall be performed to remove all dirt, dust, animal waste, and water soluble contaminants. Clean, fresh water shall be used with sufficient pressure to remove surface contaminants and loose material. Hand scraping and hand scrubbing with a stiff bristled brush will be required as necessary to remove debris. When necessary, oil and grease shall be removed by hand-wiping, using solvents.

      After pressure washing, the cleaned surfaces shall be visually free of dust, dirt, oil and grease, animal waste, salts, and other debris.

      Pressure washing will only be allowed when ambient air temperatures are greater than 4.5 °C and rising. In no case shall pressure washing be performed when in the opinion of the Engineer spent wastewater will freeze on roadway or bridge surfaces, or in any other way create a hazardous situation.

      During washing operations, containment shall be suspended around and beneath the work area to contain all paint chips, corrosion residue, and other solid particles that become dislodged by pressure washing (see *Note*[1]). All such solid residue shall be contained, collected, and allowed to air dry for treatment and disposal as hazardous paint removal waste under Item 571.01 M, or as directed by the Engineer. The containment provided shall also

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[1] ***Note:*** *The containment for pressure washing in intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. The containment may be constructed of water permeable or water impermeable materials. Spent washwater will not require collection and will be allowed to fall to the underlying road, ground, or waterway, providing the other requirements of this specification are met. The exception for the collection of spent washwater will be for structures over a public water supply. When a bridge crosses a water supply the spent washwater must be diverted, or collected, and disposed of on the adjoining land mass, at a location away from the waters edge.*