



**CONSTRUCTION SPECIFICATION FOR
COATING STRUCTURAL STEEL SYSTEMS**

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911.01	SCOPE
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This specification covers the requirements for the surface preparation and coating of structural steel and railing systems.

911.01.01 Specification Significance and Use

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

911.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

911.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 919 Formwork and Falsework

Ontario Provincial Standard Specifications, Material

OPSS 1704 Paint Coating Systems for Structural Steel

Ontario Ministry of Transportation Publications

Designated Sources for Materials (DSM)
Structural Manual

CSA Standards

S6-06 Canadian Highway Bridge Design Code

ASTM International

A 123/A123M-12	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A143/A143M-07	Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
A153/A153M-09	Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A 780/A780M-09	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
B 833-13	Standard Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) for the Corrosion Protection of Steel
C 566-13	Test Method for Total Evaporable Moisture Content of Aggregate by Drying
D 4285-83 (2012)	Test Method for Indicating Oil or Water in Compressed Air
D 4417-11	Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
D 4541-09	Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion Testers
D 4940-10	Test Methods for Conductimetric Analysis of Water Soluble Ionic Contamination of Blasting Abrasives
D 6386-10	Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
D 7091-12	Non-Destructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

The Society for Protective Coatings (SSPC)

Good Painting Practice, SSPC Painting Manual Vol.1, 4th Edition, 2002

AB 1, April 2013	Mineral and Slag Abrasives
PA 1, November 2004	Shop, Field, and Maintenance Painting of Steel
PA 2, May 2012	Procedure for Determining Conformance to Dry Coating Thickness Requirements
SP 1, November 2004	Solvent Cleaning
SP 8, November 2004	Pickling
SP 11, July 2012	Power Tool Cleaning to Bare Metal
VIS 1-02	Visual Standard for Abrasive Blast Cleaned Steel
VIS 3-04	Visual Standard for Power-and Hand-Tool Cleaned Steel

SSPC and National Association of Corrosion Engineers (NACE) Joint Publications

SP 5/NACE No. 1, January 2007	White Metal Blast Cleaning
SP 6/NACE No. 3, January 2007	Commercial Blast Cleaning
SP 10/NACE No. 2, January 2007	Near-White Blast Cleaning

SSPC, American Welding Society (AWS), and NACE Joint Publications

SSPC-CS 23.00 / AWS C2.23M/NACE No.12-2003	Application of Thermal Spray Coatings (Metalizing) of Aluminum, Zinc, and Their Alloys and Composites for Corrosion Protection of Steel
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Others

Federal Standard 595C Colors, 2008 - Published by U. S. General Services Administration

911.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Coating means a liquid, liquefiable, or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer.

Coating System means a number of coats of metallic or paint coating, or both, separately applied in a predetermined order at suitable intervals to allow for setting, drying, or curing.

Dry Film Thickness means the thickness of a coating after it has dried throughout, after all the solvent has evaporated, and the coating has cured.

Escape means any visible emission or settlement of dust or debris, including abrasive media, paint chips, and coating material, outside the limits of the enclosure resulting from surface preparation or coating application.

Faying Surface means the mating surface of a member that is in contact with the mating surface of another member when joined together.

Final Surface Preparation means surface preparation as specified in the Contract Documents.

Interim Surface Preparation means an incomplete surface preparation that does not meet the requirements for the final surface preparation.

Metallic Coating means hot dip galvanizing or thermal sprayed metal coating.

Metallizing means application of thermal sprayed metal coating.

Paint Coating means a liquid or mastic composition that upon drying or curing is converted to a solid protective, decorative, or functional adherent film after application as a thin layer.

Paint Coating System means a number of coats of paint coating separately applied in a predetermined order at suitable intervals to allow for setting, drying, or curing.

Power Washing means the use of low pressure water to remove contaminants from the surface without damaging the coating. The water pressure shall be within the range of 7 to 10 MPa.

Railing System means steel tube rails, steel panels, steel posts, steel caps, steel panel anchorages, and steel splash guards, including all steel connections.

Recoat Time means the time recommended by the manufacturer for drying, curing, or setting of paint coating prior to application of subsequent coat.

Seal Coat means a paint coating used to seal thermal sprayed metal coating.

Slip Critical Connection means a connection where slippage cannot be tolerated, including those subject to fatigue or to frequent load reversal, or where the resultant deflections are unacceptable.

Spent Material means the spent abrasive, removed coating material, rust, or other debris or a mixture thereof generated during surface preparation.

Spot Measurement means the average of the three gauge readings taken per spot.

Structural Steel means the steel components of a structure, including lighting poles, traffic signal poles, bearing assemblies, deck drains, piles, and all other steel appurtenances and connections, excluding railing systems.

Surface Profile means the surface contour of a blast or power tool cleaned substrate, when viewed from the edges of the surface.

Sweep Blasting means a process of rapid movement of abrasive blast nozzle over a surface to remove deleterious substances and to roughen its surface profile.

911.04 DESIGN AND SUBMISSION REQUIREMENTS

911.04.01 Design Requirements

Design of enclosures and temporary supports shall be according to CAN/CSA-S6, Structural Manual, and OPSS 919.

911.04.02 Submission Requirements

911.04.02.01 General

Except for the material certification for the coating material, 5 sets of each of the following submissions shall be submitted to the Contract Administrator at least 3 weeks prior to commencement of coating operations, for information purposes only.

911.04.02.02 Written Notices

Written notice submissions shall include:

- a) Details of the methods, procedures, and sequence of operations to be employed to complete the work, including Working Drawings and schedules.
- b) Details of surface preparation and coating of areas that are difficult to access and the method of application.
- c) Details of the proposed method for management of excess materials including collection, containment and disposal of all solid and liquid wastes.

911.04.02.03 Working Drawings

911.04.02.03.01 Environmental Protection

When the Contract contains a tender item for environmental protection, the Working Drawings shall include a detailed description of the environmental protection to be employed, including details of the enclosure, erection of the enclosure, and relocation procedure for the enclosure and equipment.

911.04.02.03.02 Restriction on Construction Loads

Working Drawings shall show the location and magnitude of all applied construction loads.

The Working Drawings shall state that the bridge, including all components that the Contractor requires to support the enclosure system can safely support all loads, including construction loads according to CAN/CSA-S6 and the Structural Manual and shall bear the seals and signatures of two Engineers who shall also verify the actual field condition of the structure prior to certifying the Working Drawings.

Where the applied construction loads exceed the limits specified in the Construction Load Limits clause, two Engineers shall be retained who shall act as an evaluation Engineer and a design-checking Engineer to carry out a structural evaluation. Such evaluation shall ensure that the bridge can safely support all loads according to CAN/CSA-S6 and the Structural Manual, including construction loads imposed on the bridge based on the Contractor's method of construction. A synopsis of the evaluation, including detailed calculations and notes, shall be prepared and, when requested, be made available to the Contract Administrator. The documents shall bear the seals and signatures of both the evaluation Engineer and the design-checking Engineer. Documentation of such evaluation shall be retained for a period of six years after the Contract Administrator has issued a Certificate of Completion.

911.04.02.03.02.01 Construction Load Limits

a) Slab on Girder Structures

- i. 400 kg per support point with a maximum of two support points loaded per girder per span, or
- ii. The specified uniformly distributed load per linear metre of the girder.

b) Truss or Arch Structures

- i. 400 kg per panel point with a maximum of two panel points loaded on a truss or arch, or
- ii. The specified load per panel point.

911.04.02.04 Product Data Sheets

Product data sheet submissions shall include the manufacturer's product data sheets showing the following:

- a) Recommended maximum dry film thickness.
- b) The mixing and thinning directions.
- c) The recommended spray nozzles and pressures.
- d) The recommended temperature range and acceptable humidity levels for application.
- e) The minimum acceptable recoat time period for temperatures in the intervals of 5 °C from 0 to 30 °C.

911.04.02.05 Material Certification

911.04.02.05.01 Coating Manufacturer's Certification

Before commencement of the coating application, the Contract Administrator shall be supplied with written certification from the coating manufacturer stating that all materials supplied are as specified in the Contract Documents and the manufacturer's current product data sheets.

911.04.02.05.02 Certification of Abrasive Media

Prior to abrasive blasting, the Contract Administrator shall be supplied with written certification from a laboratory certified by an organization accredited by the Standards Council of Canada stating that the abrasive media meets the material requirements specified in this specification.

911.05 MATERIALS

911.05.01 Paint Coatings

Paint coating shall be according to OPSS 1704 and as specified in the Contract Documents.

Only paint coatings contained in the original containers sealed by the manufacturer shall be used.

911.05.01.01 Seal Coat

The seal coat shall be as specified in the Contract Documents.

911.05.01.02 Paint Coating Systems for Coating Galvanized Surfaces

Where specified in the Contract Documents, one of the approved paint systems for coating galvanized surfaces from the ministry's DSM shall be applied to hot dipped galvanized components that require subsequent paint coating.

The colour of the finish coat shall be equivalent to 16307 grey according to Federal Standard 595C, unless otherwise specified.

D911.05.01.03 Rapid Deployment Coating Systems for Structural Steel

Where specified in the Contract Documents, one of the approved paint systems for rapid deployment coating systems from the ministry's DSM shall be applied to structural steel.

911.05.02 Metal Coatings

911.05.02.01 Hot Dip Galvanizing

Purity of the zinc and the galvanizing bath composition for hot dip galvanizing of structural steel shall be according to ASTM A 123/A123M.

Material for repair of galvanized surfaces shall be either zinc-tin-copper solder for repair by soldering or metallizing wire for repair by metallizing.

In addition to the above materials, the use of the following paint coatings is permitted for repair of galvanized surfaces on new structural steel sign support structures and sectional steel high mast lighting poles:

- a) For the repair of overhead trusses by paint coating, all three coats of the epoxy zinc/epoxy/polyurethane system shall be included on the ministry's DSM. The colour of the finish coat shall be equivalent to 17178 aluminum according to Federal Standard 595C colors.
- b) For the repair of sign support columns and sectional steel high mast lighting poles that are specified to receive a subsequent paint coating, epoxy zinc primer shall be included on the ministry's DSM.

911.05.02.02 Thermal Sprayed Metal Coatings

Thermal sprayed metal coatings shall be according to SSPC-CS 23.00/AWS C2.23M/NACE No.12. The metallizing wire shall be an alloy consisting of 85% zinc and 15% aluminum that conforms to the requirements of ASTM B 833

911.05.02.03 Zinc-Tin-Copper Solder

The zinc-tin-copper solder shall be 50% zinc, 49% tin, and 1% copper used with the manufacturer's recommended flux.

911.05.03 Abrasive Media

911.05.03.01 General

Abrasive media shall have a conductivity not exceeding 1,000 micro Siemens (μS)/cm, when tested according to ASTM D 4940.

Except for abrasive blast cleaning of galvanized surfaces, the abrasive media shall have a hardness of 6 or greater on the Mohs scale. There shall be no presence of oil.

The testing for hardness and presence of oil shall be according to SSPC-AB 1.

The maximum moisture shall be 0.5% by weight, when tested according to ASTM C 566.

911.05.03.02 Thermal Sprayed Metal Coatings

Blast abrasive media used for the surface preparation for thermal spray metal coating application shall be sufficiently hard and sharp to produce an angular surface profile on to the steel substrate such that the subsequent metal coating shall meet the bond strength requirements specified. Shot or other abrasives producing a rounded or peened profile shall not be used.

911.05.03.03 Paint Coating on Galvanized Surfaces

The abrasive media used for surface preparation of galvanized surfaces prior to receiving paint coating shall be of such hardness that the galvanized coating is not damaged.

911.05.04 Compressed Air

Compressed air used during all work operations shall be clean, dry, and free from oil residues, when tested according to ASTM D 4285.

911.06 EQUIPMENT

911.06.01 Scaffolds

The coated areas of the structure coming into contact with rollers, clamps, and other parts of the scaffolding and access facilities shall be protected using rubber or other material to prevent damage to the coating.

911.06.02 Spray Pot

The agitators in the spray pot shall extend to within 25 mm of the bottom of the pot to ensure proper mixing of paint components prior to spray application.

911.07 CONSTRUCTION

911.07.01 General

The extent of work, cleaning requirements, surface preparation, environmental protection requirements, and type of coating system shall be as specified in the Contract Documents.

Where there is a conflict between the manufacturer's recommendations and the Contract Documents, the more stringent requirements shall apply as determined by the Contract Administrator.

All components coated off-site shall be protected from handling or shipping damage by using padded slings, separators, and tie downs or other similar devices. Loading procedures shall be designed to protect coated surfaces from any possible damage to the coating.

Components of structural steel sign support structures and sectional steel high mast lighting poles that are to be hot dip galvanized shall be according to the Contract Drawings. Components of structural steel sign support structures and sectional steel high mast lighting poles that are to be hot dip galvanized and subsequently paint coated shall be according to the Contract Drawings.

The Contract Administrator shall be granted access to the galvanizing and painting shops where components are being cleaned and coated, during all hours of work.

911.07.02 Operational Constraints

The Contract Administrator shall be informed when the surface preparation and each subsequent phase of work of coating application are completed and ready for inspection. Subsequent work shall not commence until the Contract Administrator has completed the inspection of the work completed and given permission in writing to proceed.

Welding, cutting, or drilling of existing structural steel shall not be done unless approved by the Contract Administrator.

All structural rehabilitation work shall be completed prior to commencing the coating operations.

Surfaces adjacent to areas to be cleaned and coated shall be protected from damage during surface preparation and coating application.

When there is partially completed coating work at seasonal shutdown, the following operations shall be carried out immediately prior to commencement of coating application in the next construction season:

- a) Areas that have been coated but have not received the finish coat shall be power washed using potable water and allowed to dry thoroughly.
- b) Partially completed coating exhibiting rust or rust stains shall be removed, and the surface shall be cleaned to the original surface preparation standard as specified in the Contract Documents and re-coated with the specified coating system or an alternative coating system acceptable to the Contract Administrator.

911.07.03 Surface Preparation and Surface Profile

911.07.03.01 General

Fins, slivers, burred, or sharp edges weld spatter; or slag shall be removed by power grinding prior to the surface preparation and coating application. Edges of all structural steel specified to be cleaned and coated shall be ground to a smooth radius of at least 3 mm by hand or power tools prior to abrasive blast cleaning.

Faying surfaces of existing and new structural steel components to be connected by bolts shall be cleaned to the surface preparation standard required for the coating system specified.

Final surface preparation for coating application shall only be carried out when the temperature, moisture, and humidity satisfy the criteria specified in SSPC-PA 1 for coating application.

The temperature, moisture, and humidity limitations do not apply to interim surface preparation. The Contract Administrator shall be notified of the Contractor's intention to do interim surface preparation work prior to commencement of the work.

911.07.03.02 New Structural Steel

New structural steel specified to be cleaned and paint coated shall be abrasive blast cleaned to the requirements of SSPC-SP 10/NACE No. 2. The abrasive blast cleaning shall provide a surface profile height of a minimum of 40 µm and a maximum of 75 µm.

911.07.03.03 Existing Structural Steel and Railing System

Existing structural steel that has been specified to be cleaned and paint coated in the Contract Documents, shall be abrasive blast cleaned to the requirements of SSPC-SP 10/NACE No. 2. The abrasive blast cleaning shall provide a surface profile height of a minimum 40 µm and a maximum of 90 µm for paint coating application.

The steel components in the handrail panels shall be cleaned to the requirements of SSPC-SP 8. The steel components in the posts, caps, and panel anchorages on steel posts shall be abrasive blast cleaned to the requirements of SSPC-SP 5/NACE No.1. The abrasive blast cleaning shall provide a surface profile height of a minimum of 50 µm and a maximum of 100 µm for thermal sprayed metal coating application.

The steel panel anchorages on concrete posts shall be abrasive blast cleaned to the requirements of SSPC-SP 10/NACE No.2.

911.07.03.04 Paint Coating on Galvanized Surfaces

Galvanized surfaces to be paint coated shall be prepared according to ASTM D 6386.

Thick edges due to excess liquid zinc run-off during the galvanizing process; high spots; and rough edges, such as metal drip line, shall be removed by clean hand or power tools to ensure smooth surface. The excess zinc shall be removed until it is flush with the surrounding area. Any oil or grease on the surface shall be removed by solvent cleaning according to SSPC-SP 1. Surface preparation shall be performed by sweep blasting to roughen the surface using an abrasive of such hardness that the galvanized coating is not damaged.

After sweep blasting and prior to the application of the paint coating, the galvanized surface shall be examined and repaired, as required. The dry film thickness of the zinc coating after sweep blasting shall be according to ASTM A123/A123M.

911.07.03.05 Thermal Sprayed Metal Coating

Structural steel surfaces specified to receive a thermal sprayed metal coating shall be abrasive blast cleaned to the requirements of SSPC-SP 5/NACE No.1. The abrasive blast cleaning shall provide a surface profile height of a minimum of 50 µm and a maximum of 100 µm.

911.07.03.06 Hot Dip Galvanizing

Existing structural steel specified to be hot dip galvanized shall be first abrasive blast cleaned to SSPC SP 6/NACE No.3 to remove the existing paint coatings and rust and then the components shall be cleaned to the requirements of SSPC-SP 8 prior to being galvanized.

New structural steel shall be cleaned to the requirements of SSPC-SP 8 prior to galvanizing.

The length of time that all steel components are immersed in the pickling solution shall be kept to an absolute minimum to achieve the specified surface preparation condition prior to hot dip galvanizing. The galvanizer shall employ proper pickling and galvanizing procedures as precautionary measures to safeguard against embrittlement, as specified in ASTM A143/A143M.

911.07.03.07 Surface Preparation of Areas Difficult to Access

Surface preparation of areas specified in the Contract Documents as difficult to access shall be carried out to the extent practical from the access opening as detailed on the Contractor's submission for methods, procedures, and sequence of work. The surface preparation standard for these areas shall be based on reasonable effort demonstrated in the field acceptable to the Contract Administrator.

911.07.04 Application of Coating

911.07.04.01 General

The Contract Administrator shall be notified by the Contractor 48 hours in advance of mixing and applying a paint coating or coating system.

New atmospheric corrosion resistant steel shall be coated with a low Volatile Organic Compound (VOC) epoxy zinc/epoxy/polyurethane system. All other steel shall be cleaned and coated with the coating system as specified in the Contract Documents.

All new A 325 bolts to be used on coated areas of structural steel after the application of coating shall be galvanized.

Prepared surfaces shall have no dust prior to the application of coating.

Paint coating shall be smooth, continuous, and free of runs and sags. No pinholes or holidays of the paint coating on galvanized components shall be allowed.

911.07.04.02 Paint Coating Systems

911.07.04.02.01 General

All paint coating systems shall be stored, thinned, handled, mixed, and applied according to SSPC-PA 1 and the recommendations on the manufacturer's product data sheets.

When there is a drop in temperature after the coating has been applied, the recoat time period shall be according to the manufacturer's product data sheets for the lower temperature.

Exterior surfaces of the bolted connections within a distance of 25 mm around the edge of the bolt holes and against which the bolt head or washer is going to be bearing shall receive only the prime coat. Any exposed areas of primer not covered by the bolt head or washer after the installation of the bolts shall be touched up with the second and third coats of the specified coating system.

All rivets, bolts, nuts, washers, and pitted areas shall be stripe coated with the primer and with the top coat material by brush, in addition to spray application. Stripe coating with the primer shall be carried out after the spray application of the primer. For projects where the inorganic zinc primer is specified, an epoxy-zinc primer from the same manufacturer shall be used for stripe coating. Stripe coating with the top coat material shall be carried out prior to the spray application of the finish coat.

Bearing shoe plates or bevelled plates or both at girder locations where coating of the girders has been specified shall also be coated using the specified coating system.

For each coat of paint the initial pass of the spray gun shall be directed at the outside edges of the steelwork prior to completely coating all surfaces.

All runs and sags shall be brushed out as the application progresses.

Application related failures in coatings, as described in the Coating Failures chapter of the SSPC Painting Manual, shall be corrected prior to application of a subsequent coat and, in the case of the top coat, after the application of the top coat.

Where excessive coating thickness produces "mud cracking" in zinc rich coating materials, the coating shall be scraped back and sanded to a soundly bonded coating and the area recoated to the required thickness.

All dry spray shall be removed by sanding and the coating reapplied as specified in the Contract Documents.

911.07.04.02.02 New Structural Steel

All new structural steel including diaphragms, excluding surfaces in contact with concrete and the faying surfaces of bolted joints, shall be coated to the extent as specified in the Contract Documents. Faying surfaces of bolted joints shall have only the prime coat applied.

The maximum time between final surface preparation and prime coat application inside the shop shall be 24 hours. Structural steel subjected to outdoor exposure after final surface preparation shall be prime coated within 10 hours.

All coats of the specified paint coating system shall be shop applied.

Prior to assembly, surfaces not in contact with other steel surfaces, but that are inaccessible after assembly shall have all coats applied.

Surfaces inaccessible for coating after erection shall be coated prior to erection.

At least 100 mm of bare metal and 100 mm of each coat of the new system shall be left exposed for lapping of subsequent coats, where the continuous application of paint or final surface preparation is interrupted in a section.

911.07.04.02.03 Existing Structural Steel

Except for metallizing and hot dip galvanizing, the maximum time between final surface preparation and the prime coat application shall be 10 hours.

When work operations require bolt connections of structural steel components, faying surfaces of exiting structural steel shall have only the prime coat applied, prior to assembly.

When tying into existing coatings, that portion of the existing coating within 300 mm of the edge of the new coating shall be power washed using potable water to remove all contaminants. The edges of the existing coating shall be feathered into areas cleaned to bare steel so that at least 4 mm of each coat of the existing coating is exposed.

911.07.04.02.04 Paint Coating on Galvanized Surfaces

All coats of the paint system shall be shop applied.

When surface preparation is done indoors and the galvanized steel component remains indoors at all times until coating is completed, the maximum time allowable between surface preparation by sweep blasting and prime coat application shall be 24 hours provided that the relative humidity within the shop is maintained at 50% or below 50% for the entire 24 hour period. If the prepared galvanized steel component is exposed outdoors or if it is kept indoors and the relative humidity is above 50%, the maximum time between final surface preparation by sweep blasting and prime coat application shall be 4 hours.

911.07.04.02.05 Slip Critical Connections

At slip critical connections on paint coated components, the surface within the bolt pattern and for a distance of 50 mm beyond the splice plates shall receive only the prime coat of paint, prior to assembly. Prime coated surfaces that are exposed after assembly shall receive the second and third coats of the paint system after cleaning of the surfaces according to manufacturer's recommendations.

Faying surfaces of galvanized components of slip critical connections shall be roughened either by hand wire brushing or by sweep blasting prior to assembly to provide the required frictional resistance as specified in the Contract Documents. These faying surfaces shall not be subsequently paint coated.

911.07.04.02.06 Dry Film Thickness

An epoxy-zinc, water-based acrylic, water-based acrylic coating system shall consist of three coats with dry film thickness according to Table 1.

An epoxy-zinc, epoxy, polyurethane coating system shall consist of three coats with dry film thickness according to Table 2.

An inorganic-zinc, water-based acrylic, water-based acrylic coating system shall consist of three coats with dry film thickness according to Table 3.

An inorganic-zinc, epoxy, polyurethane coating system shall consist of three coats with dry film thickness according to Table 4.

Three-coat moisture-cured polyurethane (MCU) coating system with zinc-rich primer shall consist of three coats with dry film thickness according to Table 5.

A coal tar epoxy coating system shall consist of two coats with dry film thickness according to Table 6.

High build epoxy, aliphatic polyurethane coating system for coating galvanized surfaces shall consist of two coats with dry film thickness according to Table 7.

Modified aluminum epoxy mastic, aliphatic polyurethane coating system for coating galvanized surfaces shall consist of two coats with dry film thickness according to Table 7.

911.07.04.02.07 Repair of Paint Coatings on New and Existing Structural Steel

Damaged areas of paint coated surfaces shall be prepared to the original surface preparation standard specified and by feathering the edges of sound coatings. For damaged areas of less than 100 cm², power tool cleaning to SSPC SP 11 may be used for surface preparation. The prepared surfaces shall be recoated with the originally applied materials, except for inorganic zinc primer, which shall be recoated with an epoxy zinc primer from the same manufacturer. The dry film thickness of all the three coats in the repair area shall be as specified for the initial application.

911.07.04.02.08 Repair of Paint Coatings on Galvanized Surfaces

Painted galvanized surfaces where the paint coating has been damaged shall be carefully prepared by hand or power tool cleaning and the edges, including at the interface of the uncoated areas of the faying surfaces, shall be feathered. The prepared surfaces shall be recoated with the specified materials according to the manufacturer's product data sheets.

In areas where the galvanized coating beneath the paint coating is also damaged, the repair of paint coating shall be performed upon completion of the repair of galvanized coating.

911.07.04.03 Metal Coatings

911.07.04.03.01 Hot Dip Galvanizing

At least 72 hours prior to commencement of galvanizing, the Contract Administrator shall be given written notice of the intent to hot dip galvanize including a schedule for hot dip galvanizing of various components. Hot dip galvanizing done without this prior notification may be rejected.

Galvanized surfaces that are to receive a subsequent paint coating shall be identified when delivered to the hot dip galvanizer. These surfaces shall be air cooled. Passivation treatment or water quenching shall not be permitted.

Hot dip galvanizing shall be according to ASTM A123/A123M. Hot dip galvanizing of structural bolts and steel hardware that are to be centrifuged or otherwise handled to remove excess zinc shall be according to ASTM A153/A153M.

Girders, diaphragms, and all other structural steel components shall be handled in such a manner to ensure that the components do not get warped or distorted during or immediately after hot dip galvanizing. The lifting system during handling of girders shall consist of a spreader beam providing support to the girder being galvanized at spacing not greater than 6 metres.

Web of girders shall be kept vertical during the galvanizing process and supports at spacing not greater than 6 metres shall be provided for placing of the components during cooling after galvanizing.

Two copies of the galvanizer's coating thickness readings shall be submitted to the Contract Administrator after galvanizing and prior to the installation of the component in the structure.

911.07.04.03.02 Thermal Sprayed Metal Coatings

Written notice shall be given to the Contract Administrator 48 hours in advance of Contractor's intention to carry out surface preparation and thermal metal spray coating application.

The application of thermal sprayed metal coating shall be according to SSPC-CS 23.00/AWS C2.23M/NACE No.12 to provide a coating thickness of minimum 200 µm. Thermal sprayed metal coating shall have a bond strength of minimum 4.8 MPa to the steel substrate when tested according to ASTM D 4541 using either Type III or Type V self-alignment tester.

Immediately prior to metallizing, all prepared surfaces shall be cleaned by vacuuming to remove dust, debris, and other surface contaminants. At least one layer of thermal sprayed metal coating shall be applied within 4 hours of blast cleaning or before flash rusting occurs, whichever is sooner. This layer shall cover the peaks of the surface profile. Prior to applying additional sprayed metal to the specified thickness, the first layer of coating shall be visually inspected to verify that the coating surface has not become contaminated. Any contamination between coats shall be removed according to the manufacturer's instructions before any additional material is applied. The coating shall be sprayed to obtain the specified thickness, as soon as possible.

Before starting the work, a 300 x 300 mm steel sample plate similar in composition and thickness to the steel to be coated shall be submitted to the Contract Administrator. This plate shall be cleaned and sprayed on site according to the Contract Documents. The metal coating on the sample plate shall be checked by the Contract Administrator for compliance with the Contract Documents. This plate, when accepted by the Contract Administrator, shall be used as the visual standard to determine the acceptability of the thermal spray metal coating for the entire work.

All thermal metal spray applicators shall demonstrate proficiency in applying the thermal sprayed metal coating on a test patch to the satisfaction of the Contract Administrator prior to commencing full-scale application. The first 600 mm square block pattern application shall be used for this evaluation by the Contract Administrator.

The equipment shall be operated according to the manufacturer's latest written instructions, including air pressure, gun distance to work surface, and gun angle relative to the work surface.

Thermal metal spraying shall be done in a block pattern, typically 600 mm square. The sprayed metal shall overlap 50% on each pass to ensure uniform coverage. The required coating thickness shall be obtained in multiple layers. Each layer shall be applied at right angles to the previous layer. The semi-molten or molten particles of metallizing wire shall be firmly adhered to the substrate; free from lumps, chips, blisters, or loosely adhering particles; and have a fine-sprayed texture.

911.07.04.03.03 Seal Coating of Thermal Sprayed Metal Coatings

All thermal sprayed metal coated surfaces shall be seal coated within 6 hours after application of thermal sprayed metal coating according to SSPC-PA 1.

Contamination on thermal sprayed metal coated surfaces, including dust and moisture, shall be removed to the satisfaction of the Contract Administrator prior to the application of the seal coat. The seal coat materials shall be mixed and applied according to the manufacturer's instructions. Thinning shall not be done, unless approved in writing by the manufacturer and by the Contract Administrator.

The minimum dry film thickness shall be 100 µm.

911.07.04.03.04 Repair of Hot Dip Galvanizing

The Contract Administrator shall be notified 24 hours in advance of their intention to carry out the repair of damaged coatings.

Damaged and uncoated areas in galvanized coating shall be repaired, only if the cumulative total of the damaged and uncoated areas does not exceed 2% of the total area of a fabricated assembly or 0.02 m², whichever is smaller. If the cumulative total of the damaged or uncoated area exceeds the above, then the damaged coating shall be stripped and the component re-dipped in a galvanizing bath according to ASTM A123/A123M.

Damaged and uncoated areas shall be cleaned of all rust and other contaminants and repaired using one of the following methods:

a) Soldering Method Using Zinc-Tin-Copper Solder

The surface preparation of damaged and uncoated areas and the application of the flux and zinc-tin-copper solder shall be according to ASTM A 780 and the manufacturer's recommendations. The finished thickness of the metal coating in the repaired area shall be a minimum of 90 µm. The repaired surface shall be ground flush with the surrounding galvanized coating.

For components that are to be subsequently paint coated, repair by soldering shall be performed prior to surface preparation for paint coating application.

b) Thermal Metal Spraying

The surface preparation and application of thermal spray metal coating shall be done according to SSPC-CS 23.00/AWS C2.23M/NACE No.12 to provide a thickness of minimum 200 µm, applied in two separate coats.

The metal coating on the repaired areas shall have an adhesion of minimum 2.8 MPa when tested according to ASTM D 4541 using either Type III or Type V self alignment tester.

When metallizing is to be used for repair of damaged galvanized coating of structural components that are to be subsequently painted, it shall be performed immediately after the surface preparation of the repair area to the specified surface preparation standards and sweep blasting of the entire component, prior to the application of the prime coat of the paint coating system. The prime coat of the paint coating system shall be applied within 6 hours of repair by metallizing.

c) Epoxy Zinc/Epoxy/Polyurethane Paint System

This method of repair of metal coating is permitted on sign support structures and sectional steel high mast lighting poles when:

- i. The individual damaged and uncoated area with exposed steel is less than 625 mm²,
- ii. The dry film thickness of the galvanized coating of a structural member in localized areas does not meet the specification requirements but exceeds 60 µm, and
- iii. The number of repair spots does not exceed 6 per galvanized overhead truss or a column or a section of sectional steel high mast lighting pole.

All three coats given for the system listed on the ministry's DSM shall be used for repair of galvanized coating defects on overhead trusses.

Only the epoxy zinc primer listed on the ministry's DSM shall be used for repair of galvanized coating defects in sign support columns and sectional steel high mast lighting poles. Defects shall then be top coated with the same paint coating system used for top coating of the structural component.

Surface preparation of the damaged or uncoated areas shall be by hand or power tool cleaning using clean equipment, scraping of the edges of galvanized coating to remove loose edges, feathering of the edges of intact coatings, and abrading of surface followed by solvent cleaning according to SSPC-SP 1. Where coating damage has exposed the base metal and the width is larger than 6 mm, the damaged area shall be cleaned according to SSPC-SP 11 prior to the application of the epoxy zinc primer.

All paint coating materials shall be brush applied according to manufacturer's product data sheets.

When paint coated galvanized surfaces are damaged, the paint coating on and around the galvanized surfaces that are to be repaired shall be removed by sanding to a sufficient distance from the repair area to prevent heat damage to the paint during metal coating repair process, followed by repair of damaged metal coating. The specified paint coating system shall then be applied over the repaired area according to manufacturer's product data sheets.

911.07.04.03.05 Repair of Thermal Sprayed Metal Coatings and Seal Coat

The Contract Administrator shall be notified 24 hours in advance of their intention to carry out the repair of damaged coatings.

Damaged metal coating and uncoated areas of structural steel surfaces shall be cleaned of all rust and other contaminants and repaired by thermal metal spraying according to SSPC-CS 23.00/AWS C2.23M/NACE No.12 to provide a thickness of minimum 200 µm, applied in two separate coats. The surfaces shall be brought to the original surface preparation standard specified prior to thermal metal spraying.

For repair of seal coated metallized surfaces, the seal coating on and around the metallized surfaces that are to be repaired shall be removed by sanding to a sufficient distance from the repair area to prevent damage to seal coating during the metal coating repair process. The repaired area shall then be coated with the specified seal coating system according to the Seal Coating of Thermal Sprayed Metal Coatings clause.

911.07.04.04 Coating of Areas Difficult to Access

Coating of areas specified in the Contract Documents as difficult to access shall be done from the access opening, as detailed in the Contractor's submission for methods, procedures, and sequence of work. Quality of coating application for these areas shall be based on reasonable effort demonstrated in the field acceptable to the Contract Administrator.

911.07.04.05 Existing Steel Railing Systems

911.07.04.05.01 General

Steel handrail panels shall be removed from the structure, delivered to the galvanizer, cleaned and prepared, galvanized, delivered to the site, and reinstalled.

Steel posts, steel post caps, and steel panel anchors shall be metallized after removal of and prior to reinstallation of the handrail panels.

The structural steel in the steel panel anchorages on concrete posts shall be coated with the low VOC epoxy-zinc/epoxy/polyurethane system.

911.07.05 Field Sampling and Testing of Coating Materials

911.07.05.01 Paint Coating Materials

Field samples of 250 ml of each batch of each component of all paint coating materials used shall be obtained for testing.

For multicomponent paint coat, there shall be enough samples of each paint component so that different batches could be combined to form the complete coat for testing.

The coating supplier shall be consulted for the sampling procedure prior to obtaining samples of moisture sensitive materials. Solvent shall not be added to the field samples. Containers for field samples shall be supplied by the Contract Administrator.

The following information on coating samples shall be provided:

Product Name and Code:

Component information:

Product Batch #:

Contract #:

Location and name of the structure:

Sampling date:

The contact info for the person sampling the coating material:

(Company name, their name, email address, and phone number)

Field samples shall be delivered within one week from the date of sampling for testing to:

Head, Concrete Section
Ontario Ministry of Transportation
Room 15, Building C
1201 Wilson Avenue
Downsview, Ontario, M3M 1J8

911.07.05.02 Metallic Coating Materials

When the application of thermal sprayed metal coating is specified in the Contract Documents, a 1.0 m long metallizing wire from the same batch used in the work shall be submitted to the Contract Administrator.

911.07.06 Access for Inspection

Access for inspection to all portions of the work shall be provided and maintained by the Contractor.

911.07.07 Quality Control

Ongoing quality control of the cleaning and coating application operations, including measurements of temperature, humidity, dew point, surface profile, and coating thickness shall be performed. Quality control measurements shall also include monitoring of the air change and the existence of negative pressure within the enclosure for projects that require surface preparation by abrasive blast cleaning or other high dust generating methods. The existence of negative pressure within the enclosure by instrument measurements or by visual assessment shall be demonstrated as often as requested by the Contract Administrator. Written documentation of measurements taken, including dry film thickness (DFT) measurements taken using Type 2 constant pressure probe magnetic gauges, shall be provided to the Contract Administrator on a weekly basis, minimally, or more often as requested by the Contract Administrator. Dry film thickness readings for quality control shall be measured according to ASTM D 7091 using a Type 2 magnetic gauge.

The magnetic gauge shall be calibrated according to the procedures in SSPC-PA 2. To facilitate the calibration procedure, a 75 x 75 mm area of the prepared steel at a location selected by the Contract Administrator shall be masked off. After all tests are completed, this area shall be coated as specified in the Contract Documents. As an alternative to calibrating the Type 2 magnetic gauge on the prepared surface, the Contractor may provide an uncoated 300 x 300 mm reference plate sample of steel of similar composition; thickness, $\pm 10\%$; and surface preparation for gauge calibration.

911.07.08 Environmental Protection During Surface Preparation and Coating of Structural Steel and Steel Railing Systems

911.07.08.01 General

During the work of surface preparation and coating of structural steel and steel railing systems, the total cumulative time of random escapes to the environment shall not exceed 15 minutes over an 8 hour work shift. For shorter or longer work shifts, the allowable cumulative time of escape shall be prorated by proportioning, based on the duration of the work shift to 8 hours.

Operation shall cease immediately in the event that the random escapes exceed the specified limits or any escape extends beyond the right-of-way.

Operation shall not resume until remedial action and cleanup has been completed.

911.07.08.02 Application of Coating Material Without Spray Equipment

When coating material is applied without spray equipment, an enclosure is not required, provided escape of coating material is prevented. A method of containment shall be provided to protect the surrounding areas from unwanted spills and drips of paint coating materials.

911.07.08.03 Application of Coating Material with Spray Equipment

When coating material is applied with spray equipment, a full enclosure that prevents the escape of coating material shall be installed and maintained.

911.07.08.04 Low Dust Generating Surface Preparation

Partial enclosures may be used to prevent escape of material, including substrate material, paint chips, and localized dust, from low dust generating surface preparation methods such as cleaning with hand or power tools.

911.07.08.05 Abrasive Blasting or Other High Dust Generating Surface Preparation

911.07.08.05.01 General

Except as specified below for the vacuum abrasive blasting and filtration or similar vacuum and filtration systems, a full enclosure with a negative pressure system shall be installed and maintained around all surface preparation activities when abrasive blasting is carried out.

911.07.08.05.02 Vacuum Abrasive Blasting

At work areas where vacuum abrasive blasting is used, a full enclosure with negative pressure system is not required, provided the vacuum blasting equipment can satisfy the random escape limits stipulated in this specification. A partial enclosure with ground covers and skimmers on waterways shall be installed as a minimum to prevent incidental escape.

911.07.08.06 Enclosures

911.07.08.06.01 General

Enclosures shall be installed, operated, and maintained to limit the random escape of material.

When openings or tears occur in the enclosure, surface preparation operations shall cease until repairs have been made.

The enclosures shall be removed from the right-of-way at the completion of the work.

Work platforms and the ground surface, where work is being conducted from the ground, shall be covered with tarps with overlapping sealed edges or other means to protect the ground from contamination and to permit recovery of the spent material.

Deck drains shall be fully sealed when the deck surface forms the floor of the enclosure. Where the enclosure extends below the deck, deck drains shall be temporarily extended or redirected to avoid road run off discharging into the enclosure.

There shall be no escape of dust or materials while dismantling or moving the enclosure. Walls, floors, and joints of the enclosure shall be cleaned by vacuuming prior to moving or dismantling it. All dust and material not previously accessible or found in cracks and joints during dismantling shall be immediately vacuumed.

911.07.08.06.02 Partial Enclosures

Partial enclosures shall be installed to prevent the escape of all materials, including localized dust.

A partial enclosure is not an appropriate containment system for high dust generating surface preparation operations such as abrasive blast cleaning. Partial enclosures may consist of vertical and floor tarps, provided the tarps are overlapped and securely fixed together at the seams.

911.07.08.06.03 Full Enclosure

Full enclosures shall be impervious to dust and wind and prevent the escape of all materials, including dust. A full enclosure on its own is not an appropriate containment system for high dust generating surface preparation operations such as abrasive blast cleaning. Full enclosures shall be free of any openings and shall have joints, seams, and overlaps fully sealed.

911.07.08.06.04 Full Enclosure with Negative Pressure

A full enclosure with negative pressure shall consist of the full enclosure, as described in the Full Enclosures clause, equipped with a mechanical ventilation system capable of effecting complete air change for the enclosure in less than one minute. The mechanical ventilation system shall be in operation during abrasive blast cleaning, clean up activities, and surface blow down or other high dust generating surface preparation operations to ensure effective removal of dust and other materials from the air inside the enclosure.

911.07.08.07 Dust Collector

Air evacuated from an enclosure shall be conveyed in fully sealed conduits to a dust collector appropriately sized for the material and airflow. There shall be no escape of materials from conduits and dust collectors.

911.07.08.08 Recycling Equipment

When spent abrasive material is recycled, there shall be no escape of dust or material during the mobilization, operation, clean-up, or demobilization of abrasive recyclers, conduits, dust collectors, and associated equipment. The collectors and filters should arrive on site undamaged, empty, and free of all dust and debris.

911.07.08.09 Handling and Storage of Spent Material

Spent materials and dust in the immediate vicinity of the area where structural steel is to be coated shall be removed prior to paint coat application. Spent materials from an enclosure shall be collected daily. Spent material from recycling equipment and dust collectors shall be collected on a regular basis to maintain the effective performance of the equipment. All spent material shall be stored in rigid containers with tight sealing lids. The containers shall be made of steel, rigid plastic, or similar material and shall be in sound condition. The containers shall keep the material dry at all times and prevent its escape. There shall be no escape of material during transfers to and from containers, enclosures, recycling equipment, or dust collectors.

Measures shall be taken to prevent vandalism of stored spent material.

911.07.08.10 Containment around Equipment and Materials

If the Contractor parks or stores any equipment or materials on the bridge deck, approaches, or adjacent surfaces, the surfaces under such equipment shall be covered with tarps to contain any spills or leaks from the equipment or operations involving the equipment.

Tarps shall be sufficiently overlapped, impervious to water, and free of holes and openings.

All spills accumulated on the tarps shall be prevented from escaping onto the surrounding surface and be cleaned up immediately.

911.07.08.11 Remedial Work

Remedial work related to the environmental protection shall be carried out to rectify work that does not meet the requirements as specified in the Contract Documents. A remedial work scheme shall be submitted to the Contract Administrator and work shall not proceed until written permission to do so is received from the Contract Administrator.

911.07.09 Management of Excess Materials

Management of excess materials shall be according to the Contract Documents.

911.08 QUALITY ASSURANCE

911.08.01 Inspection

Each phase of the work shall be inspected by the Contract Administrator and approved before work is to commence on to the next phase.

911.08.02 Surface Preparation

Acceptability of the surface preparation by the Contract Administrator shall be based on the applicable SSPC surface preparation specifications and pictorial standards given in SSPC-VIS 1 and SSPC-VIS 3.

911.08.03 Measurement of Surface Profile

Surface profile measurements shall be made by the Contract Administrator on a random basis using a spring micrometer and an extra coarse pressure sensitive replica tape according to ASTM D 4417, Method C.

911.08.04 Testing for Cleanliness

The work shall be randomly tested by the Contract Administrator for cleanliness to determine contamination of surfaces by the presence of visible dust, oils, grease, or other foreign matter.

911.08.05 Measurement of Temperature, Humidity, and Dew Point

Random testing of ambient and surface temperature, relative humidity, and dew point by the Contract Administrator shall be done by means of a thermometer, surface thermometer, or recording hygro-thermograph and digital or sling psychrometer with recognized psychometric tables.

911.08.06 Measurement of Coating Thickness

Measurement of the coating thickness shall be made by the Contract Administrator. The dry film thickness shall be measured according to ASTM D 7091 using a Type 2 magnetic gauge.

Determination of the acceptability of the dry film thickness of each coat shall be made according to SSPC-PA 2, Coating Thickness Restriction Level 3

The specified maximum dry film thickness used to determine acceptability of coating thickness according to SSPC-PA 2 shall be the manufacturer's recommended maximum, as shown in the submitted product data sheets.

The Contractor shall be present when the Owner's magnetic gauges are being calibrated by the Contract Administrator.

911.08.06.01 Measurement of Coating Thickness on New Structural Steel Sign Support Structures and Sectional Steel High Mast Lighting Poles

The dry film thickness shall be measured by Type 2 constant probe magnetic gauges according to ASTM D 7091 and SSPC-PA 2, except that 5 separate spot measurements at representative locations of each galvanized sign support columns or legs and each sectional steel high mast lighting pole, as determined by the Contract Administrator, shall be taken after the application of individual coats of the paint coating system.

911.08.07 Testing Adhesion of Paint Coatings

Paint coatings may be tested for adhesion at the discretion of the Contract Administrator.

911.08.08 Testing Adhesion of Thermal Sprayed Metal Coatings

During thermal metal spraying, the Contract Administrator shall perform random adhesion tests according to ASTM D 4541 using either Type III or Type V self alignment tester. The minimum acceptable adhesion strength shall be 4.8 MPa. All non-conforming areas and areas damaged by the test shall be re-blasted and re-sprayed to conform to the requirements as specified in the Contract Documents.

Adhesion measurements on repaired areas may be made on a random basis according to the above method.

911.08.09 Testing of Coating Materials

The submitted field samples of paint coatings shall be tested according to OPSS 1704 and as specified in the Contract Documents. Samples of metallic coating materials shall be tested as specified in the Contract Documents.

911.08.10 Frequency of Tests and Inspection

Except as specified above, the frequency of tests shall vary as conditions require.

911.08.11 Performance Warranty for Coating of Existing Structural Steel

When the area of existing structural steel to be cleaned and coated is more than 200 m², the coating system shall be unconditionally warranted for a period of 24 months from the date of the Contract Completion Certificate that it has been applied as specified in the Contract Documents, and will be free from defects, as specified below.

The coating system shall be considered defective if any of the following conditions exist, as defined by SSPC Painting Manual, Volume 1, Good Painting Practice, Fourth Edition, 2002, pp. 553-567:

- a) Visible corrosion products, except at locations defined in the Contract Documents as difficult to access, blistering, bubbling, checking, cracking, wrinkling, delaminations, dry spray, pinholes, sagging, flaking, mud cracking, peeling, scaling, or undercutting.
- b) Coating applied over dirt, debris, blasting debris, corrosion products not removed during surface preparation, or steel projections.
- c) Incomplete coating.
- d) Damage to the coating caused by the Contractor's operations or excessive blast dust on the finish coat.

In the two months immediately preceding the last month of the warranty period, the Owner shall inspect the coatings for the defects listed above. The Contractor shall be given a minimum of 72 hours' notice prior to the inspection and may be present during this inspection. The Owner at his expense shall arrange for traffic control and access for the inspection.

All defective areas identified by the inspection shall be repaired as specified in the Contract Documents. All repair work shall be completed within eight weeks of the Contractor receiving notification of the results of the inspection, unless prevented by seasonal shutdown, in which case the repairs shall be completed in the first five weeks of the following construction season.

911.10 BASIS OF PAYMENT

- 911.10.01 Coating Existing Structural Steel - Item**
- Coating New Structural Steel - Item**
- Coating Steel Railing System - Item**
- Environmental Protection During Coating of Structural Steel and Steel Railing Systems - Item**
- Coating New Structural Steel Sign Support Structures - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

Remedial work on environmental protection shall be completed by the Contractor at no additional cost to the Owner.

911.10.02 Progress Payments

911.10.02.01 Coating Items

Progress payments for the coating items shall be made on the following basis:

a) Coating Existing and New Structural Steel

i. Paint Coatings:

Surface preparation and prime coat	80% for 2 coat systems 70% for 3 coat systems
2 nd coat	15% for 2 coat systems 10% for 3 coat systems
3 rd coat	15% for 3 coat systems
Cleanup and final coating repair	5%

ii. Hot Dip Galvanizing and Hot Dip Galvanizing with Paint Coatings:

Surface preparation and hot dip galvanizing	90% for hot dip galvanizing only application 55% for hot dip galvanizing with paint coatings
Sweep blasting and all coats of paint coating	35%
Cleanup and final coating repair after erection	10%

iii. Thermal Sprayed Metal Coating with Seal Coat:

Surface preparation, metallizing, and seal coat	90%
Cleanup and final coating repair	10%

b) Coating Steel Railing System:

Dismantling, delivery to galvanizer, surface preparation, galvanizing, and coating of posts and anchors	80%
Delivery to site and erection	15%
Cleanup and final coating repair after erection	5%

911.10.02.02 Environmental Protection Items

Progress payments for environmental protection shall be made on the same percentage basis as the coating items for which the environmental protection is required.

TABLE 1
Epoxy-Zinc, Water-Based Acrylic, Water-Based Acrylic Coating System

Coat	Dry Film Minimum Thickness µm
Prime	90
Second	90
Third	90

TABLE 2
Epoxy-Zinc, Epoxy, Polyurethane Coating System

Coat	Dry Film Minimum Thickness µm
Prime	90
Second	100
Third	50

TABLE 3
Inorganic-Zinc, Water-Based Acrylic, Water-Based Acrylic Coating System

Coat	Dry Film Minimum Thickness µm
Prime	75
Second	90
Third	90

TABLE 4
Inorganic-Zinc, Epoxy, Polyurethane Coating System

Coat	Dry Film Minimum Thickness µm
Prime	75
Second	100
Third	50

TABLE 5
Three-Coat Moisture-Cured Polyurethane Coating System with Zinc-Rich Primer

Coat	Dry Film Minimum Thickness µm
Prime	90
Second	100
Third	50

TABLE 6
Coal Tar Epoxy Coating System

Coat	Dry Film Minimum Thickness µm
Prime	200
Second	200

TABLE 7
Paint Coating Systems for Coating Galvanized Surfaces

Coat	Dry Film Minimum Thickness µm
High Build Epoxy Prime Coat	100
Aliphatic Polyurethane Topcoat	75
Modified Aluminum Epoxy Mastic Prime Coat	125
Aliphatic Polyurethane Topcoat	50

**Appendix 911-A, November 2014
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.