CONSTRUCTION SPECIFICATION FOR COATING STRUCTURAL STEEL SYSTEMS

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911.01 SCOPE

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 has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

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

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.

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

Structural Manual

CSA Standards

G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles
G189-1966 (R2003) Sprayed Metal Coating for Atmospheric Corrosion Protection
S6-06        Canadian Highway Bridge Design Code
ASTM International

D 4285-83 (2006) Test Method for Indicating Oil or Water in Compressed Air
D 4417-03 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
D 4541-02 Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion Testers
D 6386-99(2005) Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

The Society for Protective Coatings (SSPC)

AB 1, September 2000 - Mineral and Slag Abrasives
PA 1, April 2000 - Shop, Field, and Maintenance Painting of Steel
PA 2, May 2004 - Measurement of Dry Coating Thickness with Magnetic Gauges
SP 1, September 2000 - Solvent Cleaning
SP 8, September 2000 - Pickling
SP 11, November 2004 - 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, September 2000 - White Metal Blast Cleaning
SP 6/NACE No. 3, September 2000 - Commercial Blast Cleaning
SP 10/NACE No. 2, September 2000 - Near-White Blast Cleaning

Others

Federal Standard 595C Colors - 2008 Published by U. S. General Services Administration
Environmental Protection Act, Ontario Regulation 347, General - Waste Management - R.R.O. 1990

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.

**Engineer** means a professional engineer licensed by the Professional Engineers Ontario to practice in the Province of Ontario.

**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 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 before 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.

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**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, the Contractor shall submit 5 sets of each of the following submissions 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 spent material.

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 the 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, the Contractor shall retain two Engineers 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. The Contractor shall retain documentation of such evaluation 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 Contractor shall supply the Contract Administrator 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 Contractor shall supply the Contract Administrator 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.

911.04.02.06 Documentation for Management of Spent Material

911.04.02.06.01 Test Results

Where abrasive blast cleaning of existing structural steel and railing system is required, test results from testing for management of spent material shall be provided to the Contract Administrator a minimum of 2 Days prior to shipment of the material tested.

For each sample tested, original documentation shall be provided by the selected Canadian Association for Environmental Analytical Laboratories (CAEAL) accredited laboratory indicating the following:

a) Laboratory name and address and identification of the individual responsible for accuracy of test results.

b) Sample identification, including contract number and date sampled (i.e., yyyy,mm,dd).

c) Laboratory report of analysis containing the analytical results.

d) A certificate specifying the analysis performed, methodology used for analysis of each parameter, and instrumentation.
e) A quality control certificate indicating:

   i. The test results.
   ii. The upper and lower limits for process per cent recovery and matrix spike recovery.
   iii. A statement indicating that each test result is acceptable relative to the upper and lower limits.

A record of all test sample numbers and sample dates shall be kept and made available to the Contract Administrator upon request.

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 coating systems for coating galvanized surfaces 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.

911.05.02 Metal Coatings

911.05.02.01 Hot Dip Galvanizing

Hot dip galvanizing shall be according to CAN/CSA G164M.

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 from the MTO’s pre-qualified products list or, when specified in the Contract Documents, the Owner’s pre-qualified products list. 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 from the MTO’s pre-qualified products list or, where specified in the Contract Documents, the Owner’s pre-qualified products list,
911.05.02.02 Thermal Sprayed Metal Coatings

Thermal sprayed metal coatings shall be according to CSA G189. The metallizing wire shall be an alloy consisting of 85% zinc and 15% aluminum.

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 microsiemens, 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 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 Contractor shall allow access by the Contract Administrator 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 specified in the Contract Documents and recoated 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.
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

Sharp edges of 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.

New structural steel 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 specified to be cleaned and 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 CAN/CSA G164M.

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 paint coatings and rust shall be removed by abrasive blast cleaning according to SSPC SP 6/NACE No.3 and then the components shall be cleaned to the requirements of SSPC-SP 8 prior to being galvanized.

Sharp edges including the edges of bolt holes of components specified to be paint coated after hot dip galvanizing shall be ground to a smooth radius of at least 3 mm by hand or power tools, prior to pickling.

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.

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.

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 given a prime coat and finish coat by brush in addition to the spray application. When inorganic zinc primer is specified, the brush application shall be carried out with an epoxy-zinc primer from the same manufacturer after the spray application of the prime coat. The finish coat shall be brush applied prior to 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 scrapped 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.

911.07.04.02.02 New Structural Steel

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.

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

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 specified in the Contract Documents. Faying surfaces of bolted joints shall have only the prime coat applied.

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 the 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. If the prepared galvanized steel component is exposed outdoors, 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 according to 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.

A coal tar epoxy coating system shall consist of two coats with dry film thickness according to Table 5.

High build epoxy, aliphatic polyurethane coating system for coating galvanized surfaces shall consist of two coats with dry film thickness according to Table 6. Modified aluminum epoxy mastic, aliphatic polyurethane coating system for coating galvanized surfaces shall consist of two coats with dry film thickness according to Table 6.

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 conforming 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.

Hot dip galvanizing shall be according to CAN/CSA G164-M.

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

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. Support at spacing not greater than 6 metres shall also be provided during cooling after galvanizing.

The Contractor shall submit two copies of the galvanizer's coating thickness readings 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 CSA G189 to provide a minimum coating thickness of 200 µm. Thermal sprayed metal coating shall have a minimum bond strength of 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. Before 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.

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 50 µm.

911.07.04.03.04 Repair of Hot Dip Galvanizing

The Contractor shall notify the Contract Administrator, 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 structure re-dipped in a galvanizing bath according to CAN/CSA G164M.

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 CSA G189 to provide a minimum thickness of 200 µm, applied in two separate coats.

The metal coating on the repaired areas shall have a minimum adhesion of 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 in the MTO’s pre-qualified products list or, when specified in the Contract Documents, the Owner’s pre-qualified products list shall be used for repair of galvanized coating defects on overhead trusses.

Only the epoxy zinc primer listed in the MTO’s pre-qualified products list, or when specified in the Contract Documents the Owner’s pre-qualified products list, 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 Contractor shall notify the Contract Administrator, 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 CSA G189 to provide a minimum thickness of 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 cured, dried, or set paint coating materials on steel or aluminium panels from each individual paint coat from each batch of paint coatings used in coating operations are required for testing. The details of samples required are as follows:

a) Cured primer only samples on 2 clean steel or aluminium panels from each batch.

b) Cured mid coat only samples on 2 clean steel or aluminium panels from each batch.

c) Cured topcoat only samples on 2 clean steel or aluminium panels from each batch.

In addition to the cured, dried, or set samples of paint coating materials, at Contract Administrator's discretion, the Contractor shall sample 250 mL liquid samples of each component of the paint coating materials of the system used.

The above samples shall be prepared in the field and delivered by the Contractor to:

Head, Concrete Section
Ontario Ministry of Transportation
Room 15, Building C
1201 Wilson Avenue
Downsview, Ontario  M3M 1J8
Samples of steel or aluminium panels and 250 mL metallic sample containers for liquid paint coatings shall be supplied by the Contractor to the Contract Administrator.

Clean, bare steel or aluminium panels measuring not less than 305 mm long by 152 mm wide and having a minimum thickness of 0.8 mm shall be used as the coating substrate. The coating material shall be applied to the entire panel surface at a minimum thickness of 75 µm. The coated panel shall be removed from the work area and allowed to dry, cure, and set on a flat surface. Information from the coating manufacturer's product data sheets shall be used to ensure proper curing of the material. The coated panels shall be protected from possible contamination from the time of preparation to shipping. The manufacturer's name, product code, batch number, contract number, and the name of the structure on which the coating is being applied shall be clearly identified at the back of the panel before submitting the coated sample panels to the Contract Administrator.

911.07.05.02 Metallic Coating Materials

When the application of thermal sprayed metal coating is specified in the Contract Documents, the Contractor shall submit a 1 m long metallizing wire from the same batch used in the work 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

The Contractor shall execute ongoing quality control of the cleaning and coating application operations, including measurements of temperature, humidity, dew point, surface profile, and coating thickness. 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 Contractor shall demonstrate the existence of negative pressure within the enclosure by instrument measurements or by visual assessment 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.

The magnetic gauge shall be calibrated according to the procedures in SSPC-PA 2. To facilitate the calibration procedure, the Contractor shall mask off a 75 x 75 mm area of the prepared steel at a location selected by the Contract Administrator. 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, ± 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 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 Spent Materials

Management of spent material shall include sampling, testing, documenting, transporting, and disposing of spent material and may include re-use or recycling according to the Contract Documents.

Spent material that is tested to be leachate toxic (i.e., waste class 146 T) shall be managed as subject waste according to the Contract Documents.

Spent material that is tested to be non-leachate toxic (i.e., non-hazardous solid) shall be managed by disposal as non-hazardous solid industrial waste or by re-use or recycling according to the Contract Documents.

911.07.09.01 Sampling and Testing

Prior to transportation from the work site, samples of spent material shall be collected and submitted to an analytical laboratory for analysis.

Samples taken to determine waste classification shall be representative of the spent material to be managed, such that they accurately characterize the variation that may exist throughout the waste pile or container (e.g., vertically and horizontally). This may be achieved by collecting multiple samples using a grain sampler, auger, or other similar sampling equipment or technique.

One 500 gram representative composite sample of spent material shall be prepared for the first 12 m³ or less of material. An additional sample is required for every additional 12 cubic metres or less of material.

The Contractor shall notify the Contract Administrator a minimum of 24 hours prior to collecting each sample of spent material.

Samples shall be prepared as follows:

a) Prior to each sampling, the sampling equipment shall be thoroughly cleaned with a detergent solution; rinsed with clean water, preferably distilled water; and allowed to air dry.

b) For every 12 m³ or less of spent material, a minimum of one 500 gram sub-sample shall be collected from each container (e.g., drums and barrels) of waste that represents the specified volume to be tested. For larger size containers (e.g., lugger bins) a minimum of two 500 gram sub-samples shall be collected (i.e., one from the centre and one from either end).
c) A composite sample of the specified volume of material to be tested shall be prepared by combining individual sub-samples into a clean plastic or steel bucket.

d) The combined sample shall be thoroughly mixed.

e) The sample shall be piled into a cone while placing it on a clean plastic sheet. As the material is emptied from the bucket, it shall be placed at the cone’s apex and allowed to run down the sides of the cone.

f) The cone shall be flattened into a rough circle of uniform thickness. The circle shall be divided into four quarters and two opposite sides shall be rejected.

g) The procedure of coning and quartering (i.e., steps e) and f)) shall be repeated to obtain a single composite 500 gram sample for analysis.

h) Each composite sample shall be divided into two halves and placed into laboratory cleaned jars or zip sealed plastic bags and labelled with the following information:

   i. Sample ID (i.e., spent material from abrasive blasting of structural steel)
   ii. Sample number.
   iii. Date sampled (i.e., yyyy-mm-dd).
   iv. Name of sampler.
   v. Name of contractor.
   vi. Work project number.

One half of each sample shall be submitted to the analytical laboratory, and the other half shall be retained by the Contract Administrator in a secure location.

The samples shall be tested according to the Toxicity Characteristic Leaching Procedure under Ontario Regulation 347 to determine the concentration of arsenic, barium, boron, cadmium, chromium, lead, mercury, selenium, silver, and any other parameter specified by Ontario Regulation 347 that may be associated with any previous use of the blasting medium.

Management of spent material shall be based on the laboratory test results and shall be subject to the approval of the Contract Administrator.

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 hygrothermograph and digital or sling psychrometer with recognized psychrometric 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 by Type 2 constant pressure probe magnetic gauges according to SSPC-PA 2.

Determination of the acceptability of the dry film thickness of each coat shall be made according to SSPC-PA 2.

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 SSPC-PA 2 except that 5 separate spot measurements at representative locations of each galvanized sign support columns (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 contract requirements.

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 the Contract Documents. Samples of metallic coating materials shall be tested according to the Contract Documents.
911.08.10 Frequency of Tests and Inspection

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

911.10 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.

Payment at the contract price for the tender items Coating Existing Structural Steel and Coating Steel
Railing System shall include full compensation for all labour, Equipment, and Materials for the
management of spent material, except waste class 146T.

Any costs for the disposal of spent material as waste class 146T, that are additional to those for disposal
as a non-hazardous solid industrial waste, shall be paid as Extra Work provisions of the Contract.

Remedial work on environmental protection shall be completed by the Contractor at no extra 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
60% for 3 coat systems
2nd coat 15% for 2 coat systems
10% for 3 coat systems
3rd coat 15% for 3 coat systems
Clean up 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

<table>
<thead>
<tr>
<th>Coat</th>
<th>Dry Film Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>90 µm</td>
</tr>
<tr>
<td>Second</td>
<td>90 µm</td>
</tr>
<tr>
<td>Third</td>
<td>90 µm</td>
</tr>
</tbody>
</table>

### TABLE 2
Epoxy-Zinc, Epoxy, Polyurethane Coating System

<table>
<thead>
<tr>
<th>Coat</th>
<th>Dry Film Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>90 µm</td>
</tr>
<tr>
<td>Second</td>
<td>100 µm</td>
</tr>
<tr>
<td>Third</td>
<td>50 µm</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Coat</th>
<th>Dry Film Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>75 µm</td>
</tr>
<tr>
<td>Second</td>
<td>90 µm</td>
</tr>
<tr>
<td>Third</td>
<td>90 µm</td>
</tr>
</tbody>
</table>

### TABLE 4
Inorganic-Zinc, Epoxy, Polyurethane Coating System

<table>
<thead>
<tr>
<th>Coat</th>
<th>Dry Film Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>75 µm</td>
</tr>
<tr>
<td>Second</td>
<td>100 µm</td>
</tr>
<tr>
<td>Third</td>
<td>50 µm</td>
</tr>
</tbody>
</table>

### TABLE 5
Coal Tar Epoxy Coating System

<table>
<thead>
<tr>
<th>Coat</th>
<th>Dry Film Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>200 µm</td>
</tr>
<tr>
<td>Second</td>
<td>200 µm</td>
</tr>
</tbody>
</table>

### TABLE 6
Paint Coating Systems for Coating Galvanized Surfaces

<table>
<thead>
<tr>
<th>Coat</th>
<th>Dry Film Minimum Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Build Epoxy Prime Coat</td>
<td>100 µm</td>
</tr>
<tr>
<td>Aliphatic Polyurethane Topcoat</td>
<td>75 µm</td>
</tr>
<tr>
<td>Modified Aluminum Epoxy Mastic Prime Coat</td>
<td>125 µm</td>
</tr>
<tr>
<td>Aliphatic Polyurethane Topcoat</td>
<td>50 µm</td>
</tr>
</tbody>
</table>
Appendix 911-A, April 2010  
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

The designer should specify the following in the Contract Documents:

- Type of paint coating system to be applied. (911.05.01)
- Type of seal coating system to be applied. (911.05.01.01)
- Galvanized surfaces to be paint coated. (911.05.01.02)
- Extent of work (i.e., surfaces (new and existing) to be cleaned, prepared, and coated). (911.07.01)
- Difficult access areas. (911.07.03.07)
- Laboratory requirements. (911.07.05.01)

The designer should determine if the following is required and, if so, specify it in the Contract Documents:

- A tender item for environmental protection requirements. (911.04.02.03.01, 911.10.01)
- Owner’s pre-qualified products list for coating system for repair of metal coating on sign support structures and sectional high mast lighting poles. (911.05.02.01, 911.07.04.03.04 c))

OPSS 911 contains information that is not used by municipalities in their Contracts. To ensure completeness of the municipal Contract Documents, the designer should invoke Appendix 904-B. The appendix contains information that modifies OPSS 911 so it can be used by a municipality on its Contracts.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.
Supplemental Requirements for Using OPSS 911 in Municipal Contracts

OPSS 911, Coating Structural Steel Systems, is amended as follows:

911.07.05.01 Paint Coating Materials

The sixth and seventh paragraph of clause 911.07.05.01 (i.e., from “The above samples” to “M3M 1J8”) are deleted in their entirety and replaced with the following:

The above samples shall be prepared in the field and delivered by the Contractor to the laboratory specified in the Contract Documents.