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## **MATERIAL SPECIFICATION FOR CORRUGATED STEEL STRUCTURAL PLATE**

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This specification covers the requirements for corrugated steel structural plates.

#### **1805.02 REFERENCES**

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

##### **Ontario Provincial Standard Specifications, Construction**

OPSS 911 Coating Structural Steel and Railing Systems  
OPSS 960 Buried Corrugated Steel Structures with Span Greater than 3.0 m

##### **Ontario Ministry of Transportation Publications**

Structural Manual

MTO Forms:

PH-CC-701 Request to Proceed  
PH-CC-702 Notice to Proceed  
PH-CC-821 Manufacturer's Certificate of Conformance

##### **CSA Standards**

G401:24 Corrugated Steel Pipe and Buried Structures  
S6:25 Canadian Highway Bridge Design Code

## **ASTM International**

A780/A780M-20	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
E376-19	Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Testing Methods

### **1805.03 DEFINITIONS**

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

**Buried Corrugated Steel Structures** means as defined in OPSS 960.

**Corrugated Steel Structural Plate** means as defined in OPSS 960.

**Certification Body** means an independent 3<sup>rd</sup> party agency accredited by the Standards Council of Canada that has the qualifications, skills, and expertise required to confirm that a corrugated steel structural plate manufacturer produces corrugated steel structural plate products to the quality and requirements of an accepted standard and that has the mandate to certify the corrugated steel structural plate products produced.

**Certified** means that a manufacturer of corrugated steel structural plate products has received a certificate of compliance from a certification body verifying that production of the product is according to the quality and requirements of CSA G401.

**Deep Corrugated Structural Plate** means as defined in OPSS 960.

**Rise** means as defined in OPSS 960.

**Span** means as defined in OPSS 960.

**Structural Plate Corrugated Steel** means as defined in OPSS 960.

### **1805.04 DESIGN AND SUBMISSION REQUIREMENTS**

#### **1805.04.01 Design Requirements**

##### **1805.04.01.01 Corrugated Steel Structural Plate**

The design shall meet the requirements of CSA S6 the Structural Manual, Division 1 and the Contract Documents.

#### **1805.04.02 Submission Requirements**

##### **1805.04.02.01 Steel Mill Certificates**

The mill certificate for the steel material shall be submitted to the Contract Administrator at least 14 Days prior to fabrication of the corrugated steel structural plates.

##### **1805.04.02.02 Certification of Production Facility**

A valid certificate, verifying the manufacturer is certified as specified in the Fabrication subsection, shall be submitted with the OPSS 960 Working Drawings submission.

If coating of the corrugated steel structural plates is to be completed by a separate manufacturer, prior to commencement of coating application, a certificate from the coating manufacturer shall be submitted stating that all materials supplied are as specified in the Contract Documents and the manufacturer's current product data sheets.

The valid certificate of compliance shall be issued by the certification body as specified in the Fabrication subsection. The certificate of compliance shall be no older than 3 years, identify the manufacturer that is certified, and identify materials and coating that have been verified.

Copies of plant certification audit reports and related documentation issued by the certification body shall be submitted to the Owner upon request.

For multi-year Contracts, verification that the plant continues to hold valid certification as issued by the certification body shall be submitted to the Contract Administrator annually for all plants supplying the work.

## **1805.05 MATERIALS**

### **1805.05.01 Corrugated Steel Structural Plate**

All corrugated steel structural plates shall meet the general requirements of CSA G401 for the corrugation profile specified in the Contract Documents. The minimum nominal plate thickness shall be 5 mm. The minimum yield strength of steel prior to fabrication shall be 195 MPa for structural plate corrugated steel or 275 MPa for deep corrugated structural plate.

Plate fabrication tolerances shall satisfy the requirements of CSA G401.

Corrugated steel structural plate shall be hot dip galvanized after fabrication to provide a coating mass according to CSA G401, when specified in the Contract Documents. The coating mass shall be determined in accordance with CSA G401 by using the non-destructive magnetic test methods according to ASTM E376.

The corrugated steel structural plate shall be coated with a thermoplastic copolymer coating according to CSA G401, when specified in the Contract Documents.

The corrugated steel structural plate shall be coated with an epoxy duplex system coating according to OPSS 911, when specified in the Contract Documents.

## **1805.07 PRODUCTION**

### **1805.07.01 Fabrication**

The corrugated steel structural plate shall be according to the Working Drawings and as specified in the Contract Documents.

All corrugated steel structural plates used on the Contract shall be supplied from a manufacturer that produces the corrugated steel structural plates according to CSA G401. The manufacturer shall be certified as capable to produce corrugated steel structural plate according to CSA G401 by an independent certification body accredited by the Standards Council of Canada.

### **1805.07.02 Coatings**

The plates shall be coated by one of the following coating types as specified by the Contract Documents:

- a) Hot dip galvanizing;
- b) Thermoplastic copolymer coating; or
- c) Epoxy duplex system coating.

### **1805.07.03 Markings**

All corrugated steel structural plate products shall be marked according to the requirements of CSA G401.

The structure shall be permanently marked at both ends with the MTO site number and name or trademark of the manufacturer. If the manufacturer has more than one plant, there shall be identification of the fabrication plant.

Markings for the MTO site number shall be located on the outside face of the structure on both ends of the structure such that all numbers and letters shall be readily visible for inspection after the completion of the Work. Markings shall use numbers and letters 30 mm wide and 35 mm high according to the Contract Documents.

Markings for the name or trademark of the manufacturer shall be located on the inside of the structure on both ends of the structure.

#### **1805.07.04 Defects, Deficiencies, and Repairs**

##### **1805.07.04.01 Inspection**

After fabrication and coating, all plates shall be routinely inspected for any defects or deficiencies by the Contractor.

The Contract Administrator shall be notified immediately in writing if any of the plates contain any defects or deficiencies.

Any corrugated steel structural plate coatings with defects or deficiencies meeting the conditions identified in Table 1 shall be repaired according to the repair method specified. Such repairs do not require proposals or Owner approval prior to repair.

Any other type of repair requires a repair proposal, according to the Repair Proposal subsection, to be submitted to the Contract Administrator. Repairs shall not be carried out until the repair proposal is accepted by the Owner.

All cut ends fabricated by a mechanical cutting process shall be excluded from the repair requirement.

##### **1805.07.04.02 Documentation of Inspection and Repairs**

Documentation of repairs shall include the following for each defect or deficiency and repair:

- a) The type of defect or deficiency, location, size, and frequency.
- b) Causes of the defect or deficiency
- c) Preventative actions taken to address the causes for future production.
- d) Details of repairs, including:
  - i. Type of defect or deficiency that is repaired.
  - ii. Identification of the limits of repair for each area.
  - iii. Repair method and materials used.
  - iv. Colour photographs, with date, of the defect or deficiency prior to and after the repair.

##### **1805.07.04.02.01 Repair Proposal**

The proposal for repairs shall include the following as a minimum, and shall be signed and sealed by an Engineer:

- a) Identification of the element and description of the defect(s) or deficiencies, including the cause of the defect or deficiency.
- b) High resolution photographs and detailed sketches showing the width, length, depth, location, nature and frequency of any defect(s) or deficiencies.

- c) An assessment of any impact of the repaired defect(s) or deficiencies on durability, structural adequacy, and integrity of the element or on the structure.
- d) A detailed repair plan, including materials, method, and equipment to be used.
- e) Verification that the repair plan complies with the applicable standards for the type of work.
- f) All relevant supporting information, including material test results, field measurements and observations, production records, photographs, and structural analysis calculations, used for determining that the performance and function originally expected from the element shall be met.
- g) Cause(s) of the defect or deficiency and corrective action to be taken to prevent recurrence of the defect in future production, delivery, or installation.

If the repair proposal is deemed acceptable by the Owner, the element shall be repaired according to the proposal. Repairs shall not be carried out without the prior written acceptance of the proposal by the Contract Administrator.

#### **1805.07.04.03            Assessment of Repair**

At the discretion of the Owner, additional visual inspection or other investigative measures may be required to assess the acceptability of the repair.

#### **1805.07.05            Access for Quality Assurance**

Electrical power, scaffolding, protection from the weather, and unhindered access for inspection and testing of all the work, including assessment of repairs, shall be provided to the Contract Administrator or Owner's representative throughout the duration of the work.

Any debris and obstructions shall be removed to allow access for the purposes of inspection.

#### **1805.07.06            Storage**

Storage of the buried corrugated steel structural plate elements shall be according to CSA G401, the Working Drawings and supporting documentation in OPSS 960, and as specified in the Contract Documents.

Corrugated steel structural plates, when stored, shall be stored in such a manner to avoid damage or distortion.

Storage of corrugated steel structural plates during the winter shall be in a **weatherproof facility or shipping container that provides ventilation without moisture accumulation.**

Storage includes, but is not limited to, storage at the fabrication plant, storage while awaiting delivery in temporary locations, or storage at the Working Area.

#### **1805.07.07            Manufacturer's Certificate of Conformance**

A MTO form PH-CC-821, Manufacturer's Certificate of Conformance shall be submitted to the Contract Administrator with the Contractor's MTO form PH-CC-701, Request to Proceed after fabrication of the corrugated steel structural plates and at least 3 Business Days prior to transportation to the Working Area.

The Certificate of Conformance must confirm that the elements satisfy the requirements of the Contract Documents and adheres to the Working Drawings and supporting documentation.

#### **1805.07.08            Delivery**

A MTO form PH-CC-701, Request to Proceed shall be submitted to the Contract Administrator 3 Business Days prior to delivery of each shipment of elements to the Working Area.

The elements shall not be delivered to the Working Area until the Contract Administrator has received the Manufacturer's Certificate of Conformance, the Request to Proceed, and the Contractor has received a MTO form PH-CC-702, Notice to Proceed.

The Contract Administrator shall be notified in writing a minimum of 3 Business Days prior to delivery of the corrugated steel structural plates.

Corrugated steel structural plates shall be loaded for shipping in such a manner that they can be transported and unloaded at their destination without being damaged or exposed to stresses for which they were not designed.

Lifting, transporting, and delivery shall be as specified in the Working Drawings or supporting documentation in OPSS 960.

Advertising by means of removable signing on corrugated steel structural plates shall not be permitted within the Working Area. Any permanent markings on the surface of plates that would be visible after structural installation shall not be permitted.

## **1805.08 QUALITY ASSURANCE**

### **1805.08.01 Inspection**

The Owner reserves the right to carry out inspections at such times as the Owner may consider necessary to ensure that the corrugated steel structural plates supplied are as specified in the Contract Documents.

Corrugated steel structural plates failing to comply with the requirements specified in the Contract Documents shall be rejected and replaced.

The Contract Administrator shall be permitted free entry to the fabrication plants, as well as the finished product storage and loading areas for inspection purposes.

### **1805.08.02 Acceptance**

#### **1805.08.02.01 General**

Acceptance shall be according to this specification, including satisfactory completion of all replacement and repair actions associated with identified deficiencies.

#### **1805.08.02.02 Coating**

All corrugated steel structural plates meeting the coating requirements as specified in the Contract Documents shall be considered acceptable. Corrugated steel structural plates that do not meet the coating requirements as specified in the Contract Documents are deemed rejectable.

### **1805.08.03 Defects and Deficiencies**

#### **1805.08.03.01 Defects and Deficiencies Repairable by Standard Methods**

All corrugated steel structural plate coatings having one or more of the defects and deficiencies identified in Table 1 shall be deemed unacceptable and shall be repaired according to Table 1.

#### **1805.08.03.02 Defects and Deficiencies Causing Rejection**

Corrugated structural plates having any one or more of the following defects and deficiencies shall be removed and replaced:

- a) Distortion from intended cross-sectional shape exceeding the tolerance requirements specified in the Contract Documents;

- b) For corrugated steel structural plates coated with thermoplastic copolymer coating, if the damaged area of coating exceeds a width of 50 mm;
- c) For corrugated steel structural plates coated with epoxy duplex system coating, if the damaged area of coating exceeds a width of 50 mm;
- d) Three or more occurrences of defects and deficiencies repairable by standard methods, as described in Table 1, are present in the same corrugated steel structural plate;
- e) Any cracks, skips, blistering, bubbling, checking, cracking, wrinkling, delaminations, dry spray, pinholes, sagging, flaking, mud cracking, peeling, scaling, or undercutting;
- f) Coating applied over dirt debris, blasting debris, corrosion products not removed during surface preparation, or steel projections;
- g) Incomplete coating;
- h) Illegible marking;
- i) Dents or bends in the steel;
- j) Holes not punched and free of burrs;
- k) Permanent plate markings are unclear; and
- l) Dimensional tolerances of the element do not meet the requirements of the Contract Documents.

#### **1805.08.03.03 All Other Defects and Deficiencies**

Any individual elements having defects or deficiencies that are not identified as rejectable or specified as repairable by standard methods in Table 1 shall be deemed unacceptable and shall be repaired.

A proposal for repair shall be submitted to the Contract Administrator for review as specified in the Defects, Deficiencies, and Repairs subsection. The Contractor shall not proceed with repairs until approval of the proposal has been received.

#### **1805.08.04 Acceptance of Repairs**

Acceptance of corrugated steel structural plates shall be based on the satisfactory completion of all repairs, if applicable.

The Contract Administrator shall conduct a visual inspection and/or any other testing deemed necessary to assess the effectiveness and acceptability of the repairs.

**TABLE 1**  
**Damage to Corrugated Steel Structural Plate Coating Repairable by Standard Methods**

Repairable Damage to Structural Plate Coating	Condition	Repair Method
<b>Hot Dip Galvanizing Coating</b>		
Damage to Coated Surface	Small, localized areas of damage or storage stain <sup>1</sup> , scratches, or burns where metallic coating has been damaged by welding or other procedures.	Damage shall be repaired according to OPSS 911.
Uncoated surfaces of steel received from the mill or surfaces damaged from welding or handling.	An area with a width greater than 3 mm and up to and including 50 mm, excluding saw-cut ends.	Uncoated area shall be repaired according to OPSS 911.
	An area with a width greater than 50 mm.	Uncoated surfaces shall be redipped according to CSA G401 or zinc metallized according to ASTM A780.
<b>Thermoplastic Copolymer Coatings</b>		
Damage to Coated Surface	a) An area with a width up to and including 50 mm. b) Damage located on outside (external side) of structural plate.	Use Denso Butyl 35 Tape, or equivalent approved by Owner.
	a) An area with a width up to and including 50 mm. b) Damage located on inside (internal side) of structural plate.	Denso Butyl 35 Tape, or equivalent approved by Owner.
<b>Epoxy Duplex System Coatings</b>		
Damage to Coated Surface	a) An area with a width up to and including 50 mm. b) Damage located on inside or outside of structural plate. Any area of damage	Repair according to OPSS 911.
<p><b>Note 1: Refer to CSA G401 for identification and assessment of storage stain damage.</b></p>		