IOWA DEPARTMENT OF TRANSPORTATION

To Office:	Specification Committee	**Date:**	January 3, 2024
Attention:		**Ref. No.:**	305
From:	Eric Johnsen, P.E.		
Office:	Specifications		
Subject:	Agenda for January 11, 2024, Specification Committee Meeting		

The Specification Committee will meet on Thursday, January 11, 2024, at 9:00 a.m.

The agenda is as follows:

1. Article 2301.03, H, 4, b, Smoothness (Portland Cement Concrete Pavement).

The Construction and Materials Bureau requests to eliminate an obsolete reference to Section 2316.

2. Article 2303.03, D, 6, e, Smoothness (Flexible Pavement).

The Construction and Materials Bureau requests to eliminate an obsolete reference to Section 2316 and clean up redundant language.

3. Article 2408.02, Q, 2, Painting (Steel Structures).
Section 2508, Removal of Paint and Painting Steel Bridge Structures.

The Bridges and Structures Bureau requests to update specifications for correlation with referenced external specifications, current environmental requirements, and industry standards.

4. Article 2529.02, B, 9, Concrete Mixtures (Full Depth Finish Patches).
Article 2529.03, G, 4, Placing Full Depth Portland Cement Concrete Finish Patches (Full Depth Finish Patches).

The Construction and Materials Bureau requests to allow rapid set patch materials in full depth finish patches.

5. Article 2529.02, B, 10, Dowel Bars and Tie Bars (Full Depth Finish Patches).
Article 2556.02, A, 1, Epoxy Coated Dowel Bars (Dowel Bar Retrofit).

The Construction and Materials Bureau requests to clarify that GFRP dowels are allowed for patches and dowel bar retrofits.

6. Article 4116.05, Class V Aggregate for Portland Cement Concrete.

The Construction and Materials Bureau requests to add Type IL cement to a table.

7. DS-23049, PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control And Acceptance For Local Systems (Non-Federal Aid).

The Local Systems Bureau requests approval of revisions to the Developmental Specifications for PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control And Acceptance For Local Systems (Non-Federal Aid).

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Jeff De Vries	**Office:** Construction & Materials	**Item 1**
Submittal Date: 12/15/2023	**Proposed Effective Date:**	
Article No.: 2301.03, H, 4, b **Title:** Smoothness (Portland Cement Concrete Pavement)	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2301.03, H, 4, b.

Replace the Article:

Apply Section 2317 to all PCC Pavement bid items of a Primary project ~~if any individual PCC Pavement bid item for that project is 5000 square yards or greater. Apply Section 2316 to all other Primary projects~~ or when specifically required for other projects.

Comments:

Member's Requested Change: (**Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.**)

2301.03, H, 4, b

b. Apply Section 2317 to all PCC Pavement bid items of a Primary project ~~if any individual PCC Pavement bid item for that project is 5000 square yards or greater. Apply Section 2316 to all other Primary projects~~ or when specifically required for other projects.

Reason for Revision: Eliminating reference to section 2316.

New Bid Item Required (X one)	**Yes**	**No**
Bid Item Modification Required (X one)	**Yes**	**No**
Bid Item Obsoletion Required (X one)	**Yes**	**No**

Comments:

County or City Comments:

Industry Comments:

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/Jeff De Vries	**Office:** Construction & Materials	**Item 2**
Submittal Date: 12/15/2023	**Proposed Effective Date:**	
Article No.: 2303.03, D, 6, e **Title:** Smoothness (Flexible Pavement)	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2303.03, D, 6, e, Smoothness.

Replace the Article:

~~Construct pavement to have a smooth riding surface according to the following:~~

~~**1)**~~ Apply Section 2317 to HMA surface mixture bid items of a Primary project ~~if any individual HMA mixture bid item is 1000 tons or greater or 5000 square yards or greater. Apply Section 2316 to all other Primary projects with a surface course and~~ or when specifically required for other projects.

~~**2)** When neither Section 2316 nor Section 2317 is notapplied to a project, the Engineer may check the riding surface for defects using one of the following criteria:~~

- ~~The surface shall not deviate from a straight line by more than 1/8 inch in 10 feet when measured longitudinally with a 10 foot straightedge.~~
- ~~The surface shall not contain any bump or dip exceeding 1/2 inch over a 25 foot length when measured with a method in Materials I.M. 341.~~

~~The Engineer may either require the defects be corrected according to Article 2316.03, B, 2, or apply a price adjustment.~~

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

2303.03, D, 6, e

e. Smoothness.

Construct pavement to have a smooth riding surface according to the following:

1) Apply Section 2317 to HMA surface mixture bid items of a Primary project ~~if any individual HMA mixture bid item is 1000 tons or greater or 5000 square yards or greater. Apply Section 2316 to all other Primary projects with a surface course and~~ or when specifically required for other projects.

~~**2)** When neither Section 2316 nor Section 2317 is notapplied to a project, the Engineer may check the riding surface for defects using one of the following criteria:~~

- ~~The surface shall not deviate from a straight line by more than 1/8 inch in 10 feet when measured longitudinally with a 10 foot straightedge.~~
- ~~The surface shall not contain any bump or dip exceeding 1/2 inch over a 25 foot length when measured with a method in Materials I.M. 341.~~

~~The Engineer may either require the defects be corrected according to Article 2316.03, B, 2, or apply a price adjustment.~~

Reason for Revision: • Eliminating reference to section 2316 in 2303.03, D, 6, e, 1. • 2303.03, D, 6, e, 2 is redundant since 2317 provides the engineer the authority to check and identify 1/8" defects that shall be corrected.		
New Bid Item Required (X one)	**Yes**	**No**
Bid Item Modification Required (X one)	**Yes**	**No**
Bid Item Obsoletion Required (X one)	**Yes**	**No**
Comments:		
County or City Comments:		
Industry Comments:		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Mike Nop / Mike Todsen	**Office:** Bridges & Structures	**Item 3**
Submittal Date: 12/22/23	**Proposed Effective Date:** October 2024	
Article No.: 2408.02, Q, 2 **Title:** Painting (Steel Structures) **Section No.:** 2508 **Title:** Removal of Paint and Painting Steel Bridge Structures	**Other:**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2408.02, Q, 2, a, 1.

Replace the first sentence:

Perform shop painting only in a facility approved by AISC, ~~SSPC~~ AAMP, or the Engineer.

2408.02, Q, 2, b, Non-Weathering Structural Steel Applications.

Replace Articles 3 through 6:

3) Prime Coat.

a) Apply a coat of zinc silicate paint to all surfaces as soon as possible after blasting and before formation of any surface rust, and no later than 16 hours after blasting the surface. Approved paints are shown in Materials I.M. 482.02, Appendix A. Use a target average dry film thickness of 4 mils with no spot measurement below 3 mils or above 6 mils.

b) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

~~**b**~~ **c)** Perform repairs or build-up of the paint film as soon as possible, and no later than 24 hours from the initial application.

~~**c**~~ **d)** Completely reblast and repaint steel members with coating areas measuring less than 3 mils that have not been corrected within 24 hours.

~~**d**~~ **e)** Correct, to the Engineer's satisfaction, all defects in application such as runs, sags, mud cracking, over-spray, and dry spray.

~~**e**~~ **f)** Excessive coating thickness is as equally undesirable as unacceptably thin coating thickness, and both will be sufficient cause for rejection. Excessive thickness will be evaluated on a case-by-case basis in consultation with the coating manufacturer.

~~**f**~~ **g)** Inorganic zinc silicate paint film will be considered cured and ready for shipment after achieving a minimum resistance rating of 4 as verified by 50 Methyl Ethyl Ketone (MEK) rubs as per ASTM D 4752. Moisture misting and plastic tenting may be required during cold application temperatures and low relative humidity conditions to aid in prime coat curing.

4) Top Coat.

a) When designated by the contract documents, shop apply a topcoat of waterborne acrylic paint to all primed surfaces. Paint galvanized fasteners according to Article 2408.02, Q, 2, b, 5, after

bolting. It is recommended that application be initiated with a mist coat applied prior to full coat application. To avoid moisture condensation, keep the top coat under a roof, protected from dirt, dust, and moisture, in an area where the temperature is maintained above 40°F for a minimum 24 hours after painting is completed.

b) When a topcoat of waterborne acrylic paint is designated, apply a stripe coat prior to full topcoat application by brush to edges, welds, crevices, bolt heads, and other surface irregularities. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

~~**b**~~ **c)** Shield concrete at all junction points of concrete and steel so that application of paint on steel is complete without overspray on the concrete.

~~**c**~~ **d)** Approved paints are listed in Materials I.M. 482.05, Appendix A. Ensure the dry film thickness of the top coat is a minimum of 2 mils. Unless otherwise specified in the contract documents, use a topcoat color that is Iowa standard foliage green Federal Color Standard Number 14223.

5) Field Repair and Painting.

a) After erection, repair and repaint paint damage due to transportation, handling, or construction activities. Use an approved zinc rich epoxy paint listed in Materials I.M. 482.02, Appendix C, for repairing primer, priming un-galvanized fasteners, and any coating damage to galvanized fasteners.

b) Ensure areas to be repaired and repainted are clean, dry, and free from grease, oil, corrosion products, and other detrimental materials. Do not apply paint to surfaces unless they are free from moisture or frost and conform to the paint manufacturer's requirements for environmental conditions. Follow the paint manufacturer's recommendations for repair.

c) When designated by the contract documents, include a field applied waterborne acrylic topcoat.

6) Cleaning of Paint Surfaces.

Upon completion of concrete placement, clean exposed structural steel surfaces specified for painting to remove all concrete and laitance before the concrete sets up.

2408.02, Q, 2, c, Weathering Structural Steel Applications.

Replace Articles 1 and 2:

1) Prime Coat.

a) Apply a coat of zinc silicate paint to all surfaces as soon as possible after blasting and before formation of any surface rust, and no later than 16 hours after blasting the surface. Approved paints are shown in Materials I.M. 482.02, Appendix A and Appendix C. Ensure the minimum average dry film thickness is 4 mils with no spot measurement below 3 mils or above 6 mils.

b) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

c) Perform any repairs or build up to the applied prime coat as soon as possible and no later than 24 hours from the initial application.

2) Top Coat.

a) Apply a top coat of waterborne acrylic paint from the approved lists shown in Materials I.M.s 482.05, Appendix A; or 482.07, Appendix A, to the primed surfaces after the primer has cured to a minimum resistance rating of 4 as verified by 50 MEK rubs as per ASTM D 4752 for inorganic zinc rich primers. Use a top coat color matching Federal Color Standard Number 20045. Ensure the top coat covers all the primed surfaces, except faying surfaces of bolted joints, with a uniform film of paint.

b) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

c) Apply the top coat in the shop unless otherwise permitted in writing by the Engineer.

2508.01, A, 3, b, 2, a, 1.

Replace the Article:

Areas of deteriorated paint where the existing top coat is peeled or deteriorated and the underlying existing primer is in sound condition. In these cases, remove only the loose existing top coat by manual methods complying with SSPC-SP2 so the underlying existing primer is left

in place. Remove the deteriorated top coat back to the boundary of soundly adhering top coat. A soundly adhering top coat is defined as that which cannot be lifted from the primer with a putty knife according to SSPC-SP3.

2508.01, A, 3, b, 9, a.

Replace the second sentence:

Chloride ions after blasting and blow down shall be less than ~~15~~ 7 µg of chloride per ~~100 mm^2~~ square centimeter.

2508.01, A, 4, a, General.

Add the Article and **renumber** following Article:

3) Provide a written description, shop drawings, and calculations for the design and construction of work platforms, and containment and ventilation systems, including, but not limited to the following:

- Provide detailed drawings signed and stamped by a Professional Engineer licensed in the State of Iowa.
- Data, calculations, and assumptions used for the design of the containment and ventilation system, structural impact analysis, and the imposed loads (including wind loads) on the existing structure, signed by a Professional Engineer licensed in the State of Iowa. Include the design airflow within containment, and the locations and sizes of air inlets and exhaust.
- The plan for staging, installing, moving, and removing the containment, and the methods of attachment that will be used. Make attachment points to specific, substantial framing members only.
- Provide a written plan describing the rigging and staging for this project. Have the plan signed by a Professional Engineer licensed in the State of Iowa verifying the bridge's ability to support all loads imposed by the Contractors operations, including but not limited to, the containment, rigging, temporary access and materials storage.
- Include the methods of access that will be provided to work areas inside containment, locations of safety lines, and locations of containment entryways.
- The methods and procedures that will be used for cleaning and securing the containment at the end of each work day, and the cleaning undertaken prior to dropping or relocating the containment.
- Technical data sheets, specification sheets, any other information needed to thoroughly describe the containment plan and materials proposed for use. Provide the manufacturer's specifications for the proposed enclosure material(s), including information on light transmittance, flame spread, and fuel contributed, burst strength, abrasion durability, and unit weight of material. Only use materials that are flame retardant.
- A description of debris collection and air filtration equipment, including the equipment data sheets, airflow capacity, equipment weights and temporary utility service requirements.
- The methods of access that will be provided to work areas inside containment, and locations of safety lines.

~~3~~ 4) Suspend blasting if the Engineer determines that air expelled from containment or from the vacuum nozzle has noticeable dust or particulate matter. If the Engineer determines the containment measures are inadequate, alter the removal operation or the containment to meet the Engineer's requirement.

2508.01, B, 3, b, 4.

Replace the second sentence:

SSPC Technology Update No. 7 provides guidance on sampling methodology, however, ~~L~~locations where it is recommended to take samples include:

2508.01, B, 4, b, 2.

Add as the second sentence:

Ensure that all containment materials are flame retardant.

2508.01, B, 4, b, 3.

Add the Article:

e) When vacuum-shrouded power tool cleaning is performed, construct and use an SSPC Class 3P containment system, When power tool cleaning is performed without vacuum attachments, erect an SSPC Class 2P containment system.

2508.01, B, 5, c, 3.

Add to the end of the Article:

Prior to shipment of waste from the project site, provide the names, addresses, qualification/certifications, and permits for the proposed hauler of hazardous waste and waste disposal facility.

2508.02, E, 2, b, Prime Coat.

Replace Articles 3 and 4:

3) ~~Pay special attention to all rivets, bolts, edges of connections, areas of pack rust, and areas which may be difficult to access. These areas may require ringing/stripping.~~ Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

4) Allow the prime and stripe coats to cure according to the coating manufacturer's recommendations before the intermediate coat is applied.

2508.02, E, 2, c, Intermediate Coat.

Add the Article and **renumber** following Article:

2) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

~~**2**~~ **3)** The Zinc Silicate system does not require an intermediate coat.

2508.02, E, 6, b.

Replace the Article:

Seal cracks and seams less than 3/16 inch wide with the prime coat. Seal cracks and seams that cannot be sealed with the prime coat using caulk ~~before~~ after the intermediate coat and before the top coat is applied. In the case of Zinc Silicate, this will be after the primer and

before the top coat is applied.		
Comments:		
Member's Requested Change: (Do not use **'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.**) See attached.		
Reason for Revision: Update specifications for correlation with referenced external specifications, current environmental requirements, and industry standards.		
New Bid Item Required (X one)	**Yes**	**No** X
Bid Item Modification Required (X one)	**Yes**	**No** X
Bid Item Obsoletion Required (X one)	**Yes**	**No** X
Comments:		
County or City Comments:		
Industry Comments:		

Section 2408. Steel Structures

2408.01 DESCRIPTION.

A. Fabrication and erection of:

1. All types of bridge structures for which the main members spanning the various supports are composed of steel.

2. Other structures or parts of structures where the design or intended use of steel is based on physical or chemical properties of the steel.

B. The quality of work and finish is to be equal to the best practice in modern bridge shops. Perform shearing and chipping neatly and accurately. Neatly finish all portions of the work exposed to view.

2408.02 MATERIALS REQUIREMENTS, IDENTIFICATION, AND FABRICATION.

Unless modified elsewhere in the contract documents, all fabrication to which this section applies shall be done in the United States and in steel fabrication shops that are approved prior to the letting according to Materials I.M. 557. All main member fabrication shall be fabricated by plants certified as Simple, Intermediate, or Advanced Bridges according to the AISC Certification Program for Steel Bridge Fabricators. AISC categories are defined as follows:

- Simple bridges consist of unspliced rolled sections with no radius in the section.
- Intermediate bridges are typical bridges not requiring extraordinary measures. Typical examples include: (1) a rolled beam bridge with field or shop splices, either straight or with a radius over 500 feet; (2) a built up I-shaped plate girder bridge with constant web depth (except for dapped ends), with or without splices, either straight or with a radius over 500 feet; (3) a built-up I-shaped plate girder with variable web depth (e.g., haunched), either straight or with a radius over 1000 feet; (4) a truss with a length of 200 feet or less that is entirely or substantially pre-assembled at the certified facility and shipped in no more than three sub-assemblies.
- Advanced bridges require an additional standard of care in fabrication and erection, particularly with regard to geometric tolerances. Examples include tub or trapezoidal box girders, closed box girders, large or non-preassembled trusses, arches, bascule bridges, cable-supported bridges, moveable bridges, and bridges with a particularly tight curve radius.

Certification in a higher category qualifies all lower categories.

A. Base Materials.
Use materials meeting the requirements of Division 41 for the following:

1. Rolled Plates, Shapes, and Eyebars.
Apply Section 4152.

2. Forgings and Castings.
Apply Section 4153.

3. Bronze Metal (rolled or cast).
Apply Article 4190.03.

4. Bolts, Nuts, and Washers.
Apply Article 4153.06.

5. Bearing Pads.
Apply Article 4195.02.

6. Galvanizing.
Apply Article 4100.07.

B. Identification of Steel during Fabrication.

1. Main members of steel structures are defined to include the following. The contract documents may also designate other members as main members.
- Rolled sections or flange and web plates in main beams and girders,
- Floor beams,
- Stringers,
- Abutment diaphragms,

- Cross frames carrying direct live loads,
- Lateral bracing and cross frames in horizontally curved bridges,
- Cover plates, splice plates, and gusset plates,
- Bearing stiffeners, and
- Stiffeners connecting live load carrying members to main beam or girder webs.

2. Before steel, as received, is cut for fabrication, provide the Engineer two copies of certified mill test reports showing chemical and physical test results for the steel involved.

3. For all steels, use a record keeping system for individual pieces, and issue cutting instructions to the shop that will maintain identity of the mill test report number. Generally, this record keeping system consists of cross referencing assembly marks shown on the shop drawings with the corresponding item, covered on the mill purchase order. Provide the inspector with a copy of the cutting instructions.

4. The Contractor may furnish material from stock which can be identified by heat number and mill test report.

5. Identify main members and component parts thereof by heat number, unless the Engineer allows exception. Ensure each piece of steel (other than ASTM A 709 Grade 36 steel) clearly and legibly shows its proper color code. Maintain these identifications until the steel is cleaned for painting.

6. Provided the heat number or color code remains legible, individually marked pieces of steel may be used without further color coding if they are used in furnished size or reduced from furnished size only by end or edge trim that does not disturb the heat number or color code or leave any usable piece.

7. Before cutting, legibly mark pieces of steel (other than ASTM A 709 Grade 36 steel) which are to be cut to smaller size pieces with the proper color code.

8. Upon being removed from the bundle or lift, immediately mark with the proper color code individual pieces of steel (other than ASTM A 709 Grade 36 steel) which are furnished in tagged lifts or bundles.

9. Mark for grade by steel die stamping, or by a firmly attached substantial tag, pieces of steel (other than ASTM A 709 Grade 36 steel) which, prior to assembling into members, will be subject to fabricating operations, for example blast cleaning, galvanizing, heating for forming, or painting, that might obliterate paint color code marking.

10. During fabrication, up to the point of assembling members, ensure each piece of steel (other than ASTM A 709 Grade 36 steel) clearly and legibly shows its specification identification color code as shown in Table 2408.02-1:

Table 2408.02-1: Specification Identification Color Code

Section	Steel Grade	Color Code
ASTM A709/A 709M	100	Red
ASTM A 709/A 709M	100W	Red and Orange
ASTM A 709/A 709M	50	Green and Yellow
ASTM A 709/A 709M	50W	Blue and Yellow

11. Ensure other steels not covered above and not included in ASTM A 6 have an individual color code established and on record for the Engineer.

12. Provide an affidavit in the form of a cutting list, listing heat numbers and grade of steel, and a statement certifying that throughout the fabrication operation the identification of steel has been maintained according to this specification.

C. Fasteners.

1. Where indicated in the contract documents, "rough bolted connections" may be used. In these connections, bolts may be hex-head bolts meeting the requirements of ASTM A 307. Ribbed bolts may be used when specified in the contract documents. Under the nut of each ASTM A 307 hex-head bolt, fit one ANSI B18.21.1 helical spring lock washer, except for:

- Expansion joint bolts that are to be removed after the expansion joint is installed, or

- Anchor bolts through slotted holes where a cut washer is provided.

2. When rough bolts or ribbed bolts are to be used, furnish 5% more than the number of bolts of each size and length shown in the contract documents. When turned bolts or high strength bolts are to be used, furnish 2% more than the number of bolts and corresponding washers and nuts shown in the contract documents.

D. Pins and Rollers.

1. Turn pins and rollers to the specified dimensions. Ensure they are smooth, straight, and free from flaws.

2. Forge and anneal pins and rollers more than 9 inches in diameter.

3. For pins larger than 9 inches in diameter, longitudinally bore a 2 inch hole through the center after the forging has cooled below the critical range and before the forging is annealed. Reject pins showing a defective interior condition.

E. Bars and Plates.

1. Unless otherwise noted on the plans, and as excepted below, roll edges of all main stress carrying members composed of plates and all steel material designated on plans as "bar" or "UM plate". They may be thermal cut, provided that with thermal cut plates a smooth surface is secured by the use of a mechanical guide the Engineer approves according to Article 2408.03, B. Web splice plates and bearing stiffeners 5/8 inch or less in thickness may be made of sheared plates.

2. Unless otherwise noted in the contract documents, secondary stress members may be made of sheared plates. If sheared plates are used, dull their exposed sharp corners by grinding.

3. Cut plates so the direction of stress in main members is in the direction of rolling, except web splice plates.

4. For main stress carrying members, use members defined in Article 2408.02, B as main members.

F. Bent Plates.
Use unwelded, cold bent, load carrying, rolled steel plates complying with the following:

1. They are taken from the stock plates so the bend line is at right angles to the direction of rolling.

2. They are bent in such a manner that no cracking of the plate occurs. Minimum bend radii, measured to the concave face of the metal, are shown in Table 2408.02-2 for all grades of structural steel in this specification.

Table 2408.02-2: Minimum Bend Radii

	Thickness in Inches				
	Up to 1/2	Over 1/2 to 1	Over 1 to 1 1/2	Over 1 1/2 to 2 1/2	Over 2 1/2 to 4
Minimum Bend Radii for Metal Thickness (t)	2t	2.5t	3t	3.5t	4t
NOTE: Low alloy steel in thickness over 2 1/2 inch may require hot bending for small radii.					

a. Allowance for springback of ASTM A 709 Grade 100/100W steel should be about three times that for structural carbon steel. For brake press forming, the lower die span should be at least 16 times the plate thickness. Multiple hits are advised.

b. If a shorter radius is essential, hot bend plates at a temperature no greater than 1200°F, except for ASTM A 709 Grade 100/100W steel. If ASTM A 709 Grade 100/100W steel plates are bent at temperatures greater than 1125°F, they must be requenched and tempered in accordance with the producing mill's practice. For hot bent plates, conform to Article 2408.02, F, 1.

3. Before they are bent, round the plate corners to a radius of 1/16 inch throughout that portion of the plate at which the bending is to occur.

G. Sheared Edge Finish.
Plane, to a depth of 1/4 inch, sheared edges of plates more than 5/8 inch in thickness and carrying calculated stress. Grind, if necessary, to secure a finish equivalent to an ANSI 1000 surface roughness. Fillet re-entrant corners to a minimum radius of 1 inch before cutting.

H. Thermal Cutting.
Apply Article 2408.03, B. Thermal cut main stress carrying members only when the steel in the area of the cut is above 40°F and in a dry surface condition.

I. Stress Relief Heat Treatment.

1. For structural members which are indicated in the contract documents to be stress relieved, perform finish machining, boring, and straightening subsequent to heat treatment. Perform stress relief heat treatment according to Section 6.4 AASHTO/AWS D1.5.

2. Do not anneal or normalize members made of ASTM A 709 Grade 100/100W steel. Stress relieve only with the Engineer's approval.

3. For each furnace charge, maintain a record that identifies pieces in the charge and shows the temperatures and schedule actually used. Provide instruments, such as recording pyrometers, for determining the temperature of members in the furnace at any time. Submit the treatment operation records to the Engineer for approval.

4. Unless stated otherwise in the contract documents, stress relieve all members, such as bridge shoes, pedestals, rockers, or other parts, which are built up by welding sections of plate together.

J. Plate Girders.
Fabricate welded plate girders according to the following requirements:

1. Web Plates.
- **a.** Cut edges of a girder web true and straight or to camber and other detailed curvatures with the accuracy necessary to serve a correct fit up to the flange plate.
- **b.** Weld web plates completely in shop separately before assembly with the flange plates as shown in the contract documents.

2. Web Stiffeners.
- **a. Bearing Stiffeners.**
  - **1)** Ensure end stiffeners of girders and stiffeners intended as supports for concentrated loads have full bearing on the flanges to which they transmit load or from which they receive load.
  - **2)** Mill or grind these surfaces, or on weldable steel in compression areas of flanges, weld as shown in the contract documents.
- **b. Intermediate Stiffeners.**
  Ensure intermediate stiffeners (not intended to support concentrated loads) fit sufficiently tight to be in close contact with the flanges, unless shown or specified otherwise.
- **c. Stiffener Welding.**
  - **1)** Start the fillet welds connecting the stiffener or connection plate to the web at the end of the stiffener that is adjacent to the tension flange.
  - **2)** Progress toward the compression flange.
  - **3)** Before welding, ensure no gap exists between the web and the intermediate stiffeners, bearing stiffener, or connection plates in excess of 3/32 inch.

3. Flange Plates.
- **a.** Fabricate flange plates using universal mill plates or thermal cut plates which are cut according to Article 2408.02, H.
- **b.** Weld flange plates for welded girders completely in shop separately before assembly with the web plate as shown in the contract documents.

4. Tack Welding.
Submit tack welding and fit up procedures to the Engineer for review and approval.

K. Camber of Rolled Beam and Plate Girder Spans.

1. When specified in the contract documents, camber the rolled beams and plate girders constituting the main supporting members of a span. Unless specified otherwise in the contract documents, camber to a uniform, approximately circular curve for the entire length of the beam or between designated points. Compound or reverse curves may be required on special designs as shown on the plans.

2. Camber of beam spans may be produced either in the rolling mill or in the fabricating shop. Camber of beam spans may also be induced or corrected by local heating. In all cases, ensure beams conform to the specified shape within tolerance limits. Ensure beams are free from kinks, buckles, or other local imperfections. Improper heating or cooling which might affect grain structure, strength, or ductility of the metal are causes for rejection.

3. Rolled beams may be cambered by heating in the following manner:
- **a.** Complete welding of cover plates before commencing final heating operations.
- **b.** Support the beam near its ends in such a manner that the side to be made concave faces upward.
- **c.** Apply heat with an oxyacetylene, butane, natural gas, or other approved gas flame to areas so selected that distortion other than the required camber will not occur. Apply heat by playing the flame over the section to be heated until the metal attains a temperature of 1000°F to 1200°F. Use temperature indicating crayons, liquids, or bimetal thermometers to control the temperature. Notify the Engineer before any heating is done.

4. Use wedge or triangular shaped heated areas with an included angle between 20 and 45 degrees. Locate the vertex of the angle approximately 1 inch above the point on the web midway between flanges. Slowly play the flame from the torch (or torches) over the area to be heated. Commence at the vertex of the angle and finish at the widest part of the heated wedge, which extends across the width of the flange on the side to be made concave. Manipulate the torch (or torches) so that the total area of the heated zone is rapidly brought to the proper temperature at the same time as nearly as practical.

5. Uniformly space the heated sections at short intervals to produce uniform curvature. Heat no fewer than three sections. Heating of additional sections may be required in the case of unusually long or heavily cambered beams. Air cool the metal slowly and away from wind or drafts. Do not use water to cool the metal. Do not heat any area more than once.

6. Camber plate girders by cutting the web plate to the proper curvature to produce a camber within the allowable tolerance. When cutting the web plate, include an allowance to compensate for the effect of the heat of welding operations to be performed on the girder during fabrication.

7. Do not induce or correct camber in plate girders by local heating without the Engineer's prior approval. Do not heat ASTM A 709 Grade 100/100W steels.

L. Bolt Holes.

1. General.
- **a.** Drill, plasma cut (secondary members only), or punch all bolt holes. If utilizing plasma cutting, demonstrate ability to meet tolerance criteria prior to production. Do not punch holes in metal thicker than 3/4 inch for carbon steel and 5/8 inch for alloy steel. Instead, subdrill and ream holes, or drill holes to full size. Subpunch and ream, subdrill and ream, or drill full size holes in main stress carrying members. Full size punched holes (secondary members only) are allowed for metal no thicker than 3/4 inch for carbon steel and 5/8 inch for alloy steel.
- **b.** When reaming is required, subpunch or subdrill all holes. Subdrilling will be required if thickness limitations govern. Subpunch or subdrill holes 3/16 inch smaller than the nominal diameter of the bolts. After assembling, either ream holes to 1/16 inch larger or drill holes full size to 1/16 inch larger than the nominal diameter of the bolts.
- **c.** In steel templates, place hardened steel bushings in holes accurately dimensioned from the centerline of the connections as inscribed on the template. Use the centerline to accurately locate the template from the milled or scribed ends of the members.
- **d.** Ensure all bolt holes meet the following criteria:
  - **1)** Hole axis is square to faying surface within 1 in 20.
  - **2)** No tears, cracks, fins, burrs, or other anomalies that could result in stress concentration or impede intimate contact at the faying surface

3) Round within +/- 1/32 inch.
4) For bolt holes in primary members, within +1/32, -0 inch. For bolt holes in secondary members or in crossframes or diaphragm connection plates, within +1/16, -0 inch.
5) Maximum surface roughness of ANSI 1000 micro inches.

2. Punched Holes.
Limit the diameter of the die to at the most 1/16 inch more than the diameter of the punch. If any holes must be enlarged to admit the bolts, do so by reaming. Holes shall be clean cut without torn or ragged edges. The slightly conical hole that naturally results from punching operations is considered acceptable with the Engineer's approval.

3. Reamed or Drilled Holes.
Ream or drill holes cylindrical and perpendicular to the member. Where practical, use mechanical means to direct reamers. Perform reaming and drilling using twist drills, twist reamers or rotobroach cutters. Assemble connecting parts that require reamed or drilled holes and then securely hold while reaming or drilling. Match-mark parts before disassembling.

4. Accuracy of Holes.
Holes fabricated using a drill or reamer of the nominal diameter and not more than 1/32 inch larger in diameter than the true decimal equivalent of the nominal diameter are considered acceptable. Limit the width of slotted holes, produced by flame cutting or a combination of drilling or punching and flame cutting, to no more than 1/32 inch greater than the nominal width. Grind the flame cut surface smooth.

5. Accuracy Before Reaming.
Subpunch or subdrill all holes accurately enough that after assembling (before any reaming is done) a cylindrical pin 1/8 inch smaller in diameter than the nominal size of the hole may be entered perpendicular to the face of the member (without drifting) in at least 75% of the contiguous holes in the same plane. If the requirement is not fulfilled, the badly subpunched or subdrilled pieces will be rejected. Any hole that does not allow a pin 3/16 inch smaller in diameter than the nominal size of the subpunched or subdrilled hole to pass will be rejected.

6. Accuracy After Reaming or Drilling.
Ensure that at least 85% of reamed or drilled holes in a contiguous group show no offset greater than 1/32 inch between adjacent thicknesses of metal.

7. Misplaced Holes.
Misplaced holes may be a basis for rejection. Repair only with the Engineer's approval.

8. Removal of Burrs.
Remove burrs on outside or faying surfaces. If the Engineer requires, disassemble assembled parts to remove burrs.

M. Boring Pin Holes.
Unless otherwise required, bore pin holes to be: 1) true to detailed dimensions; 2) smooth; and 3) straight at right angles with the axis of the member and parallel with each other. Finish cut according to Article 2408.03, E.

N. Reaming Subpunched Field Connections.

1. When subpunched and reamed holes are required for field connections, fully assemble main members of the structure and firmly bolt together.

2. Adjust main members to line and fit before reaming holes in connecting joints.

3. Before parts are disassembled for shipping and handling, match-mark respective pieces with a low stress riser steel stamp so that they can be reassembled in the same position when the structure is erected in the field. Steel stamping on the edges of plates will not be permitted.

4. In lieu of subpunching and reaming holes, the fabricator may drill holes full size, while members are assembled, by any of the following procedures:
- By laying out the location of the holes on the outside plate with center punch marks and drilling full size, or

- By subpunching holes in the outside plate and enlarging subpunched holes by drilling full size, and drilling full size through the remaining plates, or
- By predrilling splice plates or plates full size and using these as a template to drill full size through the remaining plates.

5. Ensure the accuracy of drilled holes is as specified in Article 2408.02, L, 4.

6. Do not interchange reamed parts. Ream connecting joints (such as floor beam and stringer connections not assembled as provided above) to a metal template.

O. Pilot and Driving Nuts.
On pin connected spans, furnish pilot and driving nuts for each size pin, unless provided otherwise in the contract documents.

P. Mill and Shop Inspection.

1. General.
a. Provide the Engineer ample notice of the beginning of work at the mill and shop so inspection may be provided. Mill inspection of rolling will not be required unless the Engineer requests. If inspection of rolling is not requested, provide the Engineer complete test reports of mill inspections, showing chemical and physical tests for each heat of all structural steel sections as specified in Articles 2408.02, A and 4152.02.
b. Notify the Engineer before fabricating material.

2. Inspector's Authority.
a. The inspector has the authority to reject material or work which does not fulfill the requirements of these specifications. In cases of dispute, appeal to the Engineer, whose decision is final.
b. Inspection at the mill and shop is intended as a means of facilitating the work and avoiding errors, and it is expressly understood that it will not relieve the Contractor from any responsibility in regard to imperfect material or quality of work and the necessity for replacing the same.

3. Facilities for Inspection.
Furnish facilities for inspection of material and workmanship in the mill and shop. Allow inspectors free access to necessary parts of the premises.

4. Mill Orders and Shipping Statements.
Provide the Engineer with as many copies of mill orders and shipping statements (showing the weights of individual members) as may be requested.

5. Rejection.
Approval of any material or finished members will not be a bar to their subsequent rejection, if found defective. Promptly replace, or make good, rejected material and work.

Q. Shop Painting.
This portion describes surface preparation and shop painting of weathering and non-weathering structural steel and incidental parts, as well as the requirements for water washing of weathering structural steel. The work includes the following items: preparation of all surfaces to be painted, application of paint, protection, drying of paint coatings, and repairing and repainting of coating damaged in the shop or after erection, or both.

1. Surface Preparation.
a. General.
1) Provide a near white metal blast cleaning to steel surfaces to be painted according to SSPC-SP10. First clean bearing assemblies of any surface contamination using suitable solvents according to SSPC-SP1, and then provide a near white metal blast cleaning according to SSPC-SP10. The standard used for acceptance of the surface preparation will be SSPC-VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
2) Do not blast clean machined surfaces designated in the contract documents to have a surface roughness of ANSI 125 or less. Masking or other protection is required if these parts are subjected to the blast cleaning process.
3) Use a clean, dry abrasive free from organic contamination. After blasting, thoroughly clean the surface to be painted with dry, oil free, compressed air to remove all blast residue.

4) Achieve a sharp, angular blast profile of a minimum 1.5 mils and maximum 3 mils on all surfaces, including thermal cut edges. When shot is used for blasting, use a blast media containing at least 10% steel grit.

b. Non-weathering Structural Steel Applications.

1) Remove oily or greasy residues with solvent according to SSPC-SP1, Solvent Cleaning, before the top coat is applied.

2) Ensure surfaces to be top coated comply with the specifications and are dry.

c. Weathering Structural Steel Applications.

1) For weathering structural steel applications, provide a Commercial Blast according to specification SSPC-SP6 to surfaces not requiring painting.

2) After blasting, apply at least three uniform applications of water mist to all unpainted areas of outside surfaces of the fascia girders to ensure uniform weathering. Apply each application on dry surfaces. Apply each application on dry surfaces. Perform the water mist application within 48 hours after the painted surfaces have been properly cured. Ensure all water mist applications are witnessed by a representative of the Contracting Authority.

2. Painting.

a. General.

1) Perform shop painting only in a facility approved by AISC, ~~SSPC~~AAMP, or the Engineer. Allow only painters who are trained and certified by an independent outside agency for the type of work performed to apply the paint.

2) Prior to painting, ensure all surfaces are free of all moisture, dirt, oxidation products, oil, and other detrimental material, and is of a suitable temperature according to the manufacturer's recommendations. Follow the paint manufacturer's application recommendations regarding mixing, thinning, application, pot life, steel temperature, and weather conditions. Apply paint so the painted areas have a smooth, uniform, adhering coat that is free of over-spray, dry spray, mud cracking, runs, sags, cracks, holidays, or other defects.

3) Do not paint machined surfaces with small clearances between moving components, such as full circle pins and pin holes, partial circle pins and pin recesses in castings, and similar surfaces. Instead, shop coat these surfaces with an application of waterproof multipurpose grease complying with National Lubricating Grease Institute No. 3, or other approved protective coating. Thoroughly clean machined surfaces before applying grease. Apply protective coating as soon as practical after component parts have been machined, welded if required, and blasted.

4) Before erection, wipe machined surfaces clean and apply a second shop coat of the same grease used above.

b. Non-weathering Structural Steel Applications.

1) General.

a) Use prime coat and topcoat paints manufactured by the same company. Protect painted surfaces to prevent soiling during painting and through the tack-free stage. Take care not to damage the paint system during handling, delivery, storage, and erection of the structural steel. Repair prime coat damage attributable to shop activities according to the paint manufacturer's recommendations before shipment to the field. Repair topcoat damage according to the manufacturer's recommendations.

b) Shop apply a prime coat to structural steel surfaces, including faying surfaces of high strength bolt connections. Also shop apply a prime coat to all bearing assemblies, except galvanized masonry plates and galvanized swedged bolts unless specified otherwise in the plans.

2) Shear Studs.

a) When shear studs are welded to the top of the top flange of a beam or girder after the paint system is applied, grind the paint off in the areas of the weld to facilitate welding.

b) After welding, repair paint damage on the underside of the top flange. Touch-up on the top side of the top flange is not required (this will be covered with PCC).

3) Prime Coat.

a) Apply a coat of zinc silicate paint to all surfaces as soon as possible after blasting and before formation of any surface rust, and no later than 16 hours after blasting the surface. Approved paints are shown in Materials I.M. 482.02, Appendix A. Use a target average dry film thickness of 4 mils with no spot measurement below 3 mils or above 6 mils.

b) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

~~b)~~**c)** Perform repairs or build-up of the paint film as soon as possible, and no later than 24 hours from the initial application.

~~c)~~**d)** Completely reblast and repaint steel members with coating areas measuring less than 3 mils that have not been corrected within 24 hours.

~~d)~~**e)** Correct, to the Engineer's satisfaction, all defects in application such as runs, sags, mud cracking, over-spray, and dry spray.

~~e)~~**f)** Excessive coating thickness is as equally undesirable as unacceptably thin coating thickness, and both will be sufficient cause for rejection. Excessive thickness will be evaluated on a case-by-case basis in consultation with the coating manufacturer.

~~f)~~**g)** Inorganic zinc silicate paint film will be considered cured and ready for shipment after achieving a minimum resistance rating of 4 as verified by 50 Methyl Ethyl Ketone (MEK) rubs as per ASTM D 4752. Moisture misting and plastic tenting may be required during cold application temperatures and low relative humidity conditions to aid in prime coat curing.

4) Top Coat.

a) When designated by the contract documents, shop apply a topcoat of waterborne acrylic paint to all primed surfaces. Paint galvanized fasteners according to Article 2408.02, Q, 2, b, 5, after bolting. It is recommended that application be initiated with a mist coat applied prior to full coat application. To avoid moisture condensation, keep the top coat under a roof, protected from dirt, dust, and moisture, in an area where the temperature is maintained above 40°F for a minimum 24 hours after painting is completed.

b) When a topcoat of waterborne acrylic paint is designated, apply a stripe coat prior to full topcoat application by brush to edges, welds, crevices, bolt heads, and other surface irregularities. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

~~b)~~**c)** Shield concrete at all junction points of concrete and steel so that application of paint on steel is complete without overspray on the concrete.

~~c)~~**d)** Approved paints are listed in Materials I.M. 482.05, Appendix A. Ensure the dry film thickness of the top coat is a minimum of 2 mils. Unless otherwise specified in the contract documents, use a topcoat color that is Iowa standard foliage green Federal Color Standard Number 14223.

5) Field Repair and Painting.

a) After erection, repair and repaint paint damage due to transportation, handling, or construction activities. Use an approved zinc rich epoxy paint listed in Materials I.M. 482.02, Appendix C, for repairing primer, priming un-galvanized fasteners, and any coating damage to galvanized fasteners.

b) Ensure areas to be repaired and repainted are clean, dry, and free from grease, oil, corrosion products, and other detrimental materials. Do not apply paint to surfaces unless they are free from moisture or frost and conform to the paint manufacturer's requirements for environmental conditions. Follow the paint manufacturer's recommendations for repair.

c) When designated by the contract documents, include a field applied waterborne acrylic topcoat.

6) Cleaning of Paint Surfaces.

Upon completion of concrete placement, clean exposed structural steel surfaces specified for painting to remove all concrete and laitance before the concrete sets up.

c. Weathering Structural Steel Applications.

1) Prime Coat.

a) Apply a coat of zinc silicate paint to all surfaces as soon as possible after blasting and before formation of any surface rust, and no later than 16 hours after blasting the surface. Approved paints are shown in Materials I.M. 482.02, Appendix A and Appendix C. Ensure the minimum average dry film thickness is 4 mils with no spot measurement below 3 mils or above 6 mils.

b) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

c) Perform any repairs or build up to the applied prime coat as soon as possible and no later than 24 hours from the initial application.

2) Top Coat.

a) Apply a top coat of waterborne acrylic paint from the approved lists shown in Materials I.M.s 482.05, Appendix A; or 482.07, Appendix A, to the primed surfaces after the primer has cured to a minimum resistance rating of 4 as verified by 50 MEK rubs as per ASTM D 4752 for inorganic zinc rich primers. Use a top coat color matching Federal Color

Standard Number 20045. Ensure the top coat covers all the primed surfaces, except faying surfaces of bolted joints, with a uniform film of paint.

b) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

c) Apply the top coat in the shop unless otherwise permitted in writing by the Engineer.

3) Paint the following areas:

a) All the weathering steel for a distance of 1.5 times the girder depth on each side of the expansion joints.

b) All the bearing assemblies except galvanized masonry plates and galvanized swedged bolts unless specified otherwise in the plans.

c) Embedded girder ends over the entire embedment length plus an additional distance of 1.0 foot. Seal the crevice between the embedded steel and concrete by caulking with a neutral cure and non-sag silicone. Two products meeting these criteria are Dow 888 or CSL 342 joint seal.

d) Prepare exterior surfaces of all galvanized components indicated in the plans to be painted and all galvanized floor drains according to the written recommendations of the paint manufacturer. Paint with the same type of waterborne acrylic paint used for top coat as noted in this specification.

4) After erection of the bridge, prepare all fasteners in the painted areas using suitable hand tools, mechanical tools, or blasting equipment. Prime with a zinc rich epoxy paint from the approved list shown in Materials I.M. 482.02, Appendix C. Clean the primed surfaces and apply a top coat of waterborne acrylic paint from the approved list shown in Materials I.M. 482.05, Appendix A. Use a top coat color matching Federal Color Standard Number 20045.

5) After completing construction, prepare and repaint defects or damage to the paint system.

6) Ensure all steel surfaces are free of contaminants, including dirt or concrete.

R. Marking and Shipping.

1. Ship pins, small parts, and small packages of bolts, washers, and nuts in boxes, crates, kegs, or barrels. Do not allow the gross weight of any package to exceed 300 pounds. Plainly mark a list and description of the contained material on the outside of the shipping container.

2. Pack bolts of one length and diameter and loose nuts or washers of each size separately. Also pack items from different manufacturers or from different lots separately.

S. Shop Storage of Material.

Store structural material, whether plain or fabricated, above ground upon platforms, skids, or other supports. Keep it free from dirt, grease, and other foreign material.

2408.03 CONSTRUCTION.

Place the steel superstructure on a substructure constructed as provided in Section 2405. Apply the requirements of Sections 2403, 2404, 2410, 2411, 2412, 2413, and 2508 to the various types of construction.

A. Working Drawings, Shop Drawings, Changes, and Substitutions.

Submit detailed shop drawings according to Article 1105.03. Welding procedures will be considered an integral part of shop drawings and will be reviewed for each contract.

1. All material ordered or work done prior to review of the shop drawings is at the Contractor's risk. Ensure shop drawings for steel structures give detailed dimensions and sizes of component parts of the structure and details of all miscellaneous parts, such as pins, nuts, bolts, drains, etc.

2. Ensure shop drawings identify each piece that is to be made of steel required to be other than ASTM A 709 Grade 36 steel. Ensure pieces made of different grades of steel are not given the same assembling or erecting mark, even though they are of identical dimensions and detail.

3. Sections other than those shown on shop drawings reviewed by the Engineer may be used under the following provisions:

a. The substitute section is equal in strength and stiffness to the section originally shown.

b. The substitution is approved by the Engineer.

c. The substitution is made at no additional cost to the Contracting Authority.

4. Ensure shop drawings for steel structures show accumulated dimensions for each line of beams or girders in laydown. Ensure the accumulated dimensions are shown at the locations of the following details: bearings, welded or bolted splices, stiffeners, gusset plates, and drain connecting holes.

B. Welding.

1. Current AWS standards in effect at the time of letting are applicable.

2. Comply with ANSI/AWS D1.5 Structural Welding Code procedures and requirements for items in Article a below. Comply with ANSI/AWS D1.1 Structural Welding Code procedures and requirements for items in Articles b through e below.
- **a.** Bridge Components and Miscellaneous Items. This includes bearing assemblies, sole plates, expansion joint devices, pile and appurtenances, drainage system components, guardrail connections, metal railing, chain link enclosures and wire fence components, conduit systems, and tread plates.
- **b.** Traffic Signal Components.
- **c.** Sign Support Components.
- **d.** Lighting Structure Components.
- **e.** Pre-Engineered Pedestrian Bridges.

3. Comply with AASHTO/AWS D1.5, as modified by this specification, for welding and fabricating steel structures.

4. Each of the modifications in this article is referenced by the appropriate paragraph number in AASHTO/AWS D1.5, to which it is a modification.

Table of Contents for Modifications to ANSI/AASHTO/AWS D1.5 Bridge Welding Code

SECTION 1. General Provisions

1.3 Welding Processes

ADD the following Paragraphs after the existing 1.3.2:

1.3.2.1 Welding of main members and welding of attachments thereto shall be performed using only shielded metal arc, flux cored arc, submerged arc, and/or stud welding processes. Unless otherwise approved by the Engineer, all welding of butt splices and flange to web welds and stiffeners to web welds shall be done using the submerged arc process. Shielded metal arc welding may be used for repairs to butt splices and flange to web welds.

1.3.2.2 The WPS shall be initialed by the welder and posted at the welder's workstation at all times during welding operations.

REPLACE Paragraph 1.3.3 with the following:

Electroslag (ESW) and electrogas (EGW) welding are specifically disapproved for use.

SECTION 5. Workmanship

5.2 Preparation of Base Metal

ADD the following paragraph before the existing first Paragraph 5.2.2:

For main members, thermal cutting is limited to oxygen cutting except that plasma arc cutting of web and stiffeners may be used when approved by the Engineer.

DELETE the last sentence of Paragraph 5.2.10 which reads "Excess Camber may be corrected by heating without the engineer's approval."

5.5 Dimensional Tolerances

REPLACE all of the text and tables of Paragraph 5.5.3 with the following:

Camber of main members of continuous or simple span bridges with lines composed of rolled beams, beams and girders, or girders, shall be fabricated so that when the members are assembled in laydown with bearing points accurately positioned as shown on the erection diagram, points on any member shall not vary in the offset position from that indicated in the erection diagram by more than ± 1/2 inch.

The erection diagram on the shop drawings shall show camber offsets at bearing points and splice points, and at midpoints of individually cambered beams or girders.

REPLACE Paragraph 5.5.4 with the following:

Permissible variation in specified sweep for horizontally curved welded beams or girders is

$$\frac{\pm\ 1/8 \text{ in. x No. of ft. of total length}}{10} \qquad (\pm\ 1 \text{ mm/m of the total length})$$

provided the member has sufficient lateral flexibility to permit the attachment of diaphragms, cross-frames, lateral bracing, etc., without damaging the structural member or its attachments.

REPLACE Paragraph 5.5.14 with the following:

Mechanically connected joints and splices of main members with surfaces intended to be parallel planes shall be nearly parallel after connection, and the surfaces to be in contact shall have an offset no greater than 1/16 inch after all filler plates have been added, if any. The accuracy of the angle of connecting stiffeners, angles, or plates shall be ± 0.5 degrees, when measured at the hole locations.

5.7 Repairs

REPLACE Paragraph 5.7.4 with the following:

Prior approval of the Engineer shall be obtained for repairs to base metal, repair of major or delayed cracks, or for a revised design to compensate for deficiencies.

ADD the following paragraph before the existing Paragraph 5.7.7:

The approval of the Engineer is required for all corrections of mislocated holes.

ADD the following Paragraph after the existing 5.7.7:

5.7.8 The maximum number of repairs to unacceptable defects in a butt splice shall be three, i.e., the times a butt splice may be opened, welded closed, and resubmitted for NDT inspection, unless otherwise approved by the Engineer.

SECTION 7. Qualifications

Part A. General Requirements

7.2 Qualification Responsibility

ADD the following paragraph after the first paragraph of Paragraph 7.2:

To qualify welding procedures, the Contractor shall produce test weldments, perform nondestructive testing and machine specimens for mechanical testing in accordance with this code.

Part B. Welder, Welding Operator, and Tack Welder Qualification

7.21 General Requirements

REPLACE Paragraph 7.21.4 with the following**:**

Shop welder's, welding operator's, or tack welders qualification herein specified shall be considered as remaining in effect from the end of the month in which the tests were taken, for a period of 1 year. The qualification for the above may be extended annually, based on a letter from the fabricator/Contractor certifying that they have been engaged in the process(es) for which they qualified without interruption of more than 6 months during the preceding twelve months, or by requalification.

Field welder's qualification herein specified will be considered as remaining in effect from the end of the month in which the test was taken, for a period of 3 years.

7.21.6 Responsibility

REPLACE Paragraph 7.21.6.1 with the following:

To qualify shop welders, welding operators, and tackers, the Contractor shall, at no additional cost to the Contracting Authority, engage an outside firm or agency to witness production of test weldments and conduct mechanical tests. The acceptance of work performed by an outside firm or agency is the prerogative of the Contracting Authority. The engineer may require recertification if there is specific reason to question the welder’s ability.

Field welders shall be certified by a test facility with an accredited AWS Certified Welder Program as defined in the current AWS Standard QC 4. Welders shall be certified per the current QC 7 Standard for AWS Certified Welders. The code of acceptance shall be AWS Bridge Welding Code D1.5. Certification maintenance per applicable AWS Code of Acceptance shall be the responsibility of the certification holder. A copy of the current welder’s certification from the AWS test facility shall be available to the Engineer upon request. The Engineer may require recertification if there is specific reason to question the welder’s ability.

7.23 Qualification Tests Required

ADD Subparagraph 7.23.1 (5) after the existing 7.23.1 (4):
Plate weld tests may also be accepted for qualification of welding pipe piling of any diameter.

REPLACE Paragraph 7.23.3 with the following:

Tack Welder Qualification. A tack welder shall be qualified by fillet-weld-break specimen made using the same criteria as listed for plate-fillet welder qualification in Table 7.10. The tack welder shall make a 1/4 inch maximum size tack weld approximately 2 inches long on the fillet-weld-break specimen, as shown in Fig. 7.28.

SECTION 8. Inspection

Part A. General Requirements

8.7 Nondestructive Testing

REPLACE last sentence of 8.7.1 with the following:

When required, testing of CJP groove welds in butt joints in compression or shear shall be done by RT.

REPLACE Subparagraph 6.7.1.2(1) criteria in Table 8.1 with the following:

100% of each CJP joint subject to tension or reversals of stress, except that on vertical butt weld splices in beam or girder webs, only 1/3 of the web depth beginning at the point, or points, or maximum tension need be tested. If unacceptable discontinuities are found in the first 1/3, the remainder of the weld shall be tested.

50% of each CJP joint subject to compression or shear in each main member including longitudinal butt weld splices in beam or girder webs. If unacceptable discontinuities are found in the first 50% of joint, the entire length shall be tested.

Part B. Radiographic Testing of Groove Welds in Butt Joints

8.10 Radiographic Procedure

ADD the following Paragraph after existing 8.10.5.3:

8.10.5.4 Where areas being radiographed are adjacent to the edge of the plate, edge block shall be used.

C. Shop Assembly.
Assemble the various parts of the structure in the shop as follows:

1. If zinc silicate primer is to be used, clean and shop paint surfaces which will be in contact before assembly according to the contract documents. If zinc silicate primer is not to be used, carefully clean to be free from loose mill scale, dirt, or other foreign material, surfaces which will be in contact. Do not paint before assembly.

2. After assembly, paint and protect all surfaces, except those against which plastic concrete will be placed, as provided in Article 2408.03, X, and the contract documents.

3. Ensure members are free from objectionable twists, bends, or other deformations.

4. Bring members to be welded into correct alignment and hold in position by bolts, clamps, wedges, guylines, struts, tack welds, or other suitable devices, until welding is completed. Use jigs and fixtures where practical. Allow for warpage and shrinkage.

D. Drifting of Bolt Holes.
Allow drifting during assembling only to the extent of bringing the parts into position, but not sufficient to enlarge the holes or distort the metal.

E. Facing Bearing Surfaces.

1. Mill ends of columns and pedestals to true surfaces and correct bevels. Plane warped or deformed base and cap plates to fit accurately.

2. Attach connection angles for base and cap plates to columns before ends are faced. Perform milling only after the member has been fully assembled.

3. Mill bearing surfaces of warped or deformed base and cap plates that are not to be placed in contact with concrete after the plates are attached to the column. Ensure surfaces of base plates that are to be placed in contact with concrete are free from warps and other deformations.

4. All bearing surfaces of castings are to be machined flat. Ensure that:
   - Sole plates of beams, girders, and trusses have full contact with the flanges, and the bearing surface is smooth and true and is truly perpendicular to the web of the member.
   - Curved sole plates make full line bearing with masonry plates, which line (unless shown otherwise in the contract documents) is at right angles to the axis of the beam, girder, or truss, and with the web of the member.
   - Bottom surfaces of masonry plates are free from warps and projections.

5. For bearing material in contact with other material, except as otherwise indicated, apply the following tolerances for flatness:
   - 1/32 inch in 12 inches, and
   - 1/16 inch tolerance overall.

6. The degree of surface finish required will be indicated in the contract documents. Ensure the surface finish of bearing and base plates and other bearing surfaces that are to come into contact with each other or with concrete meet the surface roughness requirements as defined in ANSI B46.1, Surface Roughness, Waviness and Lay, Part 1. Unless indicated otherwise on the plans, finish the following parts to the degree indicated in Table 2408.03-1:

Table 2408.03-1: Surface Finish

Steel slabs including masonry plates and cast shoes in contact with concrete	ANSI 2000
Heavy plates in contact in shoes to be welded	ANSI 1000
Milled ends of compression members, stiffeners, and fillers	ANSI 500
Bridge rollers, rockers, and top surfaces of masonry plates in contact with rollers and rockers	ANSI 250
Pins and pinholes	ANSI 125
Slide bearings	ANSI 125

7. Ensure surfaces of bronze bearing plates intended for sliding bearings are smooth and free from surface projections.

8. In machining sliding bearing surfaces, set the cut of the tool to be in the direction of movement. In machining nonsliding bearing surfaces, set the cut of the tool to be either parallel or normal to the direction of movement.

F. Abutting Joints.

1. **Ends of Compression Members.**
   Accurately face abutting ends of compression members after the members are assembled, to secure an even bearing when assembled in the structure.

2. **Ends of Tension Members.**
   Neatly shear or cut ends of tension members at splices with openings not exceeding 1/4 inch.

3. **Splices of Continuous Beams and Girders.**
   Neatly shear or cut ends of beams and girders to be spliced with a minimum opening of 1/8 inch and a maximum opening not exceeding 1/4 inch for rolled beam spans and 1/2 inch for plate girder spans. This dimension shall be detailed on the shop drawings.

G. End Connection Angles.
Ensure end connection angles of floor beams and stringers are flush with each other and accurately set to position and length of member. In general, do not machine end connection angles unless indicated in the contract documents. However, faulty assembling may be cause for requiring them to be milled. In this case, do not reduce their thickness by more than 1/16 inch. Do not reduce their bolt bearing value below the design requirements.

H. Pin Clearance.
Ensure the diameter of the pin hole does not exceed that of the pin by more than 1/50 inch for pins 5 inches or less in diameter, or 1/32 inch for larger pins.

I. Finished Members.
Ensure pieces forming one built up member are straight and close fitting. Ensure finished members are true to detailed dimensions and free from twists, bends, open joints, or other defects resulting from faulty fabrication or defective work.

J. Shop Erection.

1. Completely assemble the main members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, and rigid frames for inspection in the shop when complete assembly is feasible. In lieu of complete assembly, at the option of the Contractor, progressive truss or girder assembly will be permissible, as follows:

a. Initially for each truss, arch rib, bent, tower face, or rigid frame:

- Assemble at least three contiguous shop sections, or
- In the case of structures longer than 150 feet, assemble all members in at least three contiguous panels, but no less than the number of panels associated with three contiguous chord lengths (i.e., length between field splices) and no less than 150 feet.

b. In order that the assembled portion of the structure is never less than specified above, include a sufficient number of sections or chord lengths in each laydown so the assembled portion will remain long enough when the rearward section or chord is removed after inspection of the laydown. At the Contractor's option, the portion of the structure which is retained may be disassembled and reassembled in a new location for the new laydown.

c. Initially for each continuous beam or plate girder line, assemble at least three contiguous shop sections. In the case of structures larger than 150 feet, assemble no less than 150 feet of structure. Accomplish each succeeding laydown in such a manner that at least one contiguous section is retained from the previous laydown, and no less than 150 feet of structure is assembled (except that the last laydown in a line may be less than 150 feet long). At the Contractor's option, the portion of the structure which is retained may be disassembled and reassembled in a new location for the new laydown.

2. As shop sections are progressively assembled and removed, place each retained section in the new laydown with the same relative orientation to the erection base line as it was found to have in the previous laydown.

3. As shop sections are progressively assembled and removed, scribe suitable marks on the sections remaining so that accurate center to center of bearing dimensions and overall length can be achieved.

K. Field Handling and Storage.

1. Load, transport, unload, and pile structural members so the metal will be kept clean and free from damage by rough handling. Pad shipping supports, lifting devices, and deck form support points to minimize paint damage.

2. Store material in a manner to prevent deterioration by rust or loss of minor parts. Do not pile material to rest upon the ground or in water; instead, place material on suitable skids or platforms. Place girders and beams upright and shore. Ensure skids beneath long members, such as columns or chords, are close enough to prevent damaging the members by deflection.

L. Falsework.

1. Provide detailed plans for falsework or centering, according to Article 1105.03. In no case is the Contractor relieved of responsibility for results obtained by use of these plans or safety of workers on

the project. Have the Engineer review and check the adequacy of falsework before erecting the structure which the falsework is to carry.

2. Design falsework for supporting steel during erection to carry, without appreciable settlement or deformation, the full load coming upon it. Use either full length pile bents or framed bents supported by piles or spread footings.

3. Determine bearing values of piles according to Article 2501.03, H, and set them to be at least equal to the loads imposed upon them during construction.

4. To determine the number and size of spread footings or mudsills to be used, use the load to be supported and the bearing value of the soil on which they rest, giving due consideration to soils softening during high water, frozen ground thawing, etc. Do not use mudsills on soils or in situations where scour may occur.

5. Use 1500 pounds per square foot as a safe bearing value for sand, gravel, firm clay, and other similar confined materials in beds thicker than the falsework footing width.

6. If necessary to extend falsework above the elevation to which piles are driven, cut off at least the majority of all piles in any bent at the same elevation and cap. Construct a framed bent to the required height. Cap each falsework bent transversely at the proper elevation with material of adequate size securely fastened to each pile or post in the bent. Securely brace all bents longitudinally and transversely with diagonal bracing.

M. Preparation of Bearing Area.

1. Ensure column bases, truss and girder pedestals, and shoes have a full uniform bearing upon the concrete of the substructure.

2. Correct bridge seats of piers or abutments which are improperly finished, deformed, or irregular within the bearing area of masonry plates before the plates are placed.

3. Bed the pedestals and shoes for truss and girder spans, as well as columns for steel viaducts, on the bearing area so as to have full and even bearing. Unless otherwise required, use a bedding consisting of a single layer of 1/8 inch sheet lead meeting requirements in Article 4195.01.

N. Handling Members.

1. Handle component parts of a structure using methods and appliances that does not produce damage to the member by twisting, bending, or otherwise deforming the metal.

2. Do not place any member that is slightly bent or twisted into its place until its defects are corrected.

3. Members that have been seriously damaged in handling may be rejected.

O. Straightening Bent Material.

1. When the Engineer permits straightening of plates, angles, other shapes, and built up members, straighten using methods that will not produce fracture or other injury. Straighten distorted members using mechanical means.

2. If the Engineer approves, distorted members may be straightened by the carefully planned and supervised application of a limited amount of localized heat, except perform heat straightening of ASTM A 709 Grade 100/100W steel members only under rigidly controlled procedures, with each application requiring the Engineer's approval. In no case allow the maximum temperature of ASTM A 709 Grade 100/100W steel to exceed 1125°F, or allow the temperature to exceed 950°F at the weld metal or within 6 inches of the weld metal. Do not apply heat directly on weld metal. In all other steels, do not allow the temperature of the heated area to exceed 1200°F (a dull red) as controlled by use of temperature indicating crayons, liquids, or bimetal thermometers.

P. Straightening Material and Placing Members.

1. Rolled material shall be straight when it is laid out for work. If straightening is necessary, do so by means which will not damage the metal.

2. Sharp kinks or bends is sufficient cause for rejection of the material.

3. Perform heat correction only when the Engineer approves. Heat straightening of ASTM A 709 Grade 100/100W steel will not be permitted.

4. Unless otherwise shown in the contract documents or ordered by the Engineer, place members which deviate from a straight line by an amount within the tolerance specified in ASTM A 6 in the structure in such a manner that the stress to be imposed will tend to straighten the member.

5. Heat straighten parts to be substantially free of stress and external forces, except stresses resulting from mechanical means used in conjunction with the application of heat.

6. Inspect metal surface following straightening of a bend or buckle for evidence of fracture. Repair or replace members showing fracture.

Q. Assembling Steel.

1. Accurately assemble parts as shown in the contract documents. Follow a match-marking system.

2. Handle material so that parts will not be bent, broken, or otherwise damaged. Do not hammer in a manner which will damage or distort the members.

3. Clean bearing surfaces and surfaces to be in permanent contact before the members are assembled.

4. Ensure important connections in trusses, girders, floor systems, and so forth have at least 25% of the holes on each side of the connection filled with drift pins, and another 25% of the holes on each side of the connection filled with temporary fitting up bolts drawn up snugly before the temporary support is removed. If the ultimate connection is to be made with high strength bolts, these bolts may be used as fitting up bolts. At milled connections of compression chords of truss spans, except the hip connection, the number of drift pins may be reduced to no less than 10% of the number of holes.

5. Do not weld on any steel during or after assembly unless welding is specified in the contract documents and with prior approval of the Engineer.

6. Unless otherwise specified in the contract documents, complete bolted and welded structural connections prior to subjecting the structural system to vehicle live load.

R. Alignment.

1. Before placing permanent bolts in field connections, adjust the structure to correct grade and alignment. For truss spans, block up the elevation of each panel point (ends of floor beams) on the falsework to the correct camber as shown in the contract documents and shop drawings. Leave this blocking in place until all tension chord splices are fully bolted and all other truss connections are pinned and bolted.

2. Support splice joints of continuous beams and girders using adequate falsework or other approved means as directed by the Engineer. Adjust as closely as possible to the required position before bolting is started.

S. Bolting.

Make main connections with high strength bolts, nuts, and washers meeting the requirements of Article 4153.06. All other fasteners will be considered non-high strength fasteners and may be used only where shown on the plans.

1. **Length of Bolts.**
   - **a.** Ensure the length of high strength bolts so that, when properly installed in a snug tight condition, the end of the bolt is flush with or outside the face of the nut.
   - **b.** Ensure the length of non-high strength bolts so that when tightened there is no less than 1/4 inch of bolt protruding from the nut.
   - **c.** Ensure the length of turned bolts so that when the nut is fully threaded there is no more than:

- 1/8 inch of thread within the thickness of metal to be gripped, and
- 1/4 inch of thread protruding from the nut.

d. Furnish ribbed bolts in a variety of diameters and lengths that:
- When installed will result in a drive tight fit, and
- When tightened will fill the nut and protrude no more than 3/16 inch.

2. Bolt Holes.
Ensure holes for non-high strength and high strength bolts permit free entry of the bolt without driving. Carefully ream holes for ribbed bolts to provide for a driving fit. Ream holes for ribbed bolts to be cylindrical and to permit entry of the bolts at right angles to the faying surfaces.

3. Storage of High Strength Fasteners.
Protect bolts, nuts, and washers from the elements.

4. Fastener Acceptance Testing.
a. Prior to steel erection and in the presence of the Engineer, test two representative fastener assemblies from each rotational-capacity test lot as described in Materials I.M. 453.06B. A fastener assembly consists of a bolt, nut, and washer from the same rotational-capacity lot as furnished by the supplier.
b. The Engineer may order additional rotational-capacity tests if there is reason to suspect any change in fastener condition or level of lubrication.
c. Failure of rotational-capacity tests will be cause for rejection of that fastener lot.

5. Installing High Strength Fasteners.
Assemble, tension, and inspect high strength fasteners as described below. In special cases other methods may be used with prior approval of the Engineer.

a. Assembly.

1) Ensure that:
- Surfaces of bolted parts adjacent to the bolt head and nuts are parallel.
- Bolted parts fit solidly together when assembled, without containing gaskets or any other flexible material.
- Holes are no more than 1/16 inch in diameter greater than the nominal bolt diameter.

2) For slotted holes, the dimensions will be shown on the plans or shop drawings.

3) For painted applications, clean and prime the faying surfaces with zinc silicate paint. For unpainted applications, blast clean faying surfaces to:
- Remove mill scale, and
- Be free from paint, lacquer, dirt, oil, burrs, pits, or other defects which would prevent the solid seating of parts or would interfere with the development of friction between parts.

4) Ensure the fastener assembly installed in the field is made up of bolts, nuts, and washers from the same rotational-capacity lot number. Assemble fasteners with one hardened washer under the turned element (either bolt head or nut). When galvanized fasteners are specified:
- Furnish nuts that are pre-lubricated with a dyed lubricant according to ASTM A 563, or
- Field lubricate fastener threads with beeswax or other approved wax-based lubricant.

5) Use high strength weathering fasteners for weathering structural steel. Use galvanized high strength fasteners for non-weathering structural steel, with or without a specified field top coat.

6) Properly tighten each fastener to at least the minimum bolt tension shown in Table 2408.03-2:

Table 2408.03-2: Minimum Bolt Tension

Bolt Dia. inches	Min. Bolt Tension, lbf.[a]	Bolt Dia. inches	Min. Bolt Tension, lbf.[a]
1/2	12,050	1 1/8	64,900
5/8	19,200	1 1/4	82,400
3/4	28,400	1 3/8	98,200
7/8	39,250	1 1/2	119,500
1	51,500		

[a] Equal to the proof load (length measurement method) given in F 3125.

7) Tighten high strength bolts using the turn-of-nut method.

8) Ensure impact wrenches (if used) are of adequate capacity and sufficiently supplied with air to develop the minimum tension of each bolt in approximately 10 seconds.

b. Turn-of-Nut Method.

1) Use the turn-of-nut method to provide the minimum bolt tension specified above.

2) Install bolts in all holes of the connection and bring to a "snug tight" condition. Consider bolts to be "snug tight" when tensioned to approximately 20% of the minimum bolt tension listed above and faying surfaces are in full contact. If full contact of faying surfaces is not achieved after all bolts have been tensioned to 20% of minimum tension, submit a corrective procedure to the Engineer for approval.

3) Systematically progress with snug tightening starting at the center of the connection and working out to the free edges. Check the fasteners of the connection in a similar systematic manner. Retighten as necessary until all fasteners are simultaneously in a "snug tight" condition and the faying surfaces are in full and continuous contact.

4) When all fasteners in the connection are "snug tight", match-mark the face of the connecting part, the nut, and the bolt point using paint, crayon, or other approved means to provide a reference for determining the relative rotation of the parts during final tightening.

5) Following this operation, tighten all fasteners in the connection further by the applicable amount of rotation specified in Table 2408.03-3. Systematically progress with tightening starting at the center of the joint and working out to the free edges. During this operation, do not rotate the part without using the wrench.

Table 2408.03-3: Nut Rotation from "Snug Tight" Conditions[a]
(Disposition of Outer Faces of Bolted Connections)

Bolt Length (Under side of head to end of bolt)	Both faces normal to bolt axis	One face normal to bolt axis and other slope not more than 1:20 (beveled washer not used)	Both faces sloped not more than 1:20 from normal to the bolt axis (beveled washers not used)
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters[b]	2/3 turn	5/6 turn	1 turn

[a] Nut rotation is relative to the bolt, regardless of the element (nut or bolt) being turned. For bolts installed using 1/2 turn and less, use a tolerance of ± 30 degrees. For bolts installed using 2/3 turn and more, use a tolerance of ± 45 degrees.

[b] For bolt lengths exceeding 12 diameters, the required rotation must be determined by actual field tests in a suitable tension measuring device which simulates conditions of solidly fitted steel.

c. Inspection.

1) Check bolted connections, after tightening, in the presence of the Engineer for proper installation, applicable rotation, and general joint condition. The inspection of fasteners, with a torque wrench, at connections of steel diaphragms to concrete beams will not be required.

2) Furnish and use an inspecting wrench which is calibrated and capable of measuring torque. Have an approved testing agency verify calibration of the inspection wrench at least every 12 months and if found to be out of tolerance, have it calibrated.

3) To determine the job inspection torque values:

a) Select a representative sample of no less than three bolts and nuts of each diameter, length, grade, and turned element, to be tensioned that day.

b) Check the samples prior to inspection in a device capable of indicating bolt tension. Turn the same element during testing that will be turned during actual work.
c) Use the inspecting wrench to tension the bolt and determine the torque necessary to achieve a bolt tension 5% greater than the specified minimum bolt tension.
d) Use the average of the three torque values for the job inspecting torque value(s).

4) Establish the job inspecting torque value(s) at least once prior to each day's inspection. Have an approved testing agency verify calibration of the tension measuring device at least every 12 months and if found to be out of tolerance, have it calibrated.

5) Inspect installed and tightened fasteners, represented by the above tests, for acceptance by attempting to tighten the fastener using the inspection torque wrench and the predetermined inspection torque value(s). Acceptance will be based on the random checking of at least 10% of the fasteners in each connection. A minimum of two fasteners per connection will be checked. The connection will be accepted as properly tightened if:
- The faying surfaces are in full and continuous contact, and
- No bolt or nut is turned at a torque value less than or equal to the inspection torque value(s).

6) If any bolt or nut is turned at torque values below the inspection torque value(s), check all fasteners in that connection. Tighten and reinspect all bolts or nuts which turn below inspection torque values.

7) Bolts tightened by the turn-of-nut method may reach tensions substantially above the values specified, but this is not cause for rejection.

d. Reuse of Bolts.

1) Do not reuse high strength bolts and nuts. Do not incorporate construction bolts or fit-up bolts into the final connection.

2) Tensioning of fasteners up to a snug-tight condition as described in Article 2408.03, S, 5, will not be considered as reuse.

3) Retightening (touching up) previously tightened bolts which may have been loosened by the tightening of adjacent bolts will not be considered as reuse.

6. Installing Stainless Steel Fasteners.

Install stainless steel fasteners using the following:

a. Install stainless steel fasteners to a snug tight condition. Snug tight is defined as the tightness attained with a few impacts (3-5) of an impact wrench or full effort with an ordinary spud wrench.
b. Tightening of bolts shall be performed in a manner that brings faying surfaces up evenly.
c. Do not use compressible materials such as gaskets, insulation, or metal shims between any bolted connections or flanges.
d. Visually ensure that plies of connected elements have been brought into firm contact.
e. Verify torque values as noted in Table 2408.03-4.
f. When in storage, protect bolts, nuts, and washers from the elements.

Table 2408.03-4: Minimum Bolt Torque

Bolt Dia. inches	Min. Bolt Torque, Type 304 ft-lb	Min. Bolt Torque, Type 316 ft-lb
1/4	6.0	7.0
5/16	11.0	12.0
3/8	20.0	21.0
7/16	31.0	33.0
1/2	43.0	45.0
9/16	57.0	59.0
5/8	93.0	97.0
3/4	128.0	132.0
7/8	194.0	203.0
1	287.0	333.0
1 1/8	413.0	432.0
1 1/4	480.0	504.0
1 1/2	703.0	732.0

T. Swinging the Span.

After permanent bolting of truss spans has been inspected and accepted, remove the centering and swing the span free on its permanent supports. Fully bolt all main connections before the span is swung, except permanently bolt milled compression chord connections after the span is swung.

U. Adjustment of Pin Nuts.
Adjust nuts on pins to the amount specified in the contract documents. Locate pins in the holes so the members take full and even bearing.

V. Setting Anchor Bolts.

1. Refer to Article 2405.03, H, for setting anchor bolts for bridge bearings.

2. Set anchor bolts, other than those for bridge bearings, in concrete with a polymer grout, according to Article 2405.03, H, or with a mechanical grip system. When the mechanical grip system is used:
- Ensure the diameter of the hole is suitable for the device used,
- Hold the anchor firmly in place using an expanding metal device approved by the Engineer, and
- Fill the annular space with cement grout or other material approved by the Engineer.

W. Setting Rocker Bearings.

1. Adjust rocker bearings at expansion ends of spans to provide for:
- Movement due to temperature,
- Elongation of bottom chord, and
- Probable substructure movement.

2. Assume a mean temperature of 50°F when determining temperature movements.

X. Field Painting.
Field paint steel structures or parts of structures as required in the contract documents.

Y. Shear Connector Studs.

1. When required by the contract documents, provide shear connector studs according to Article 4152.03. Achieve uniform quality and condition of completed studs, free of injurious laps, fins, seams, cracks, twists, bends, or other discontinuities. Replace studs that have radial cracks or bursts in the head of a stud. Use automatically timed stud welding equipment. Welding shall not be performed when base metal temperature is below 0ºF or when surface is wet or exposed to falling rain or snow. Set-up shall include stud gun, power source, total welding lead length, and stud diameter.

2. Test completed studs in accordance with Materials I.M. 558 and Section 9 of the latest ANSI/AWS Welding Code D1.5.

2408.04 METHOD OF MEASUREMENT.
The Engineer will compute the quantity of various items of structural concrete, steel reinforcement, structural steel, and incidental metal parts involved in construction of steel structures as follows:

A. Structural Concrete.
Article 2403.04 applies.

B. Steel Reinforcement.
Article 2404.04 applies.

C. Structural Steel and Incidental Metal Parts.

1. Structural Steel.
a. The weight of structural steel measured for payment includes the weight of:
- rolled shapes and plates, as fabricated, and
- incidental parts, such as castings, bearing plates, expansion devices, bolts, and incidental metal parts necessary for completion of the structure.

b. Unless the contract contains a separate item for metal railings, material for such railings is included with structural steel. Incidental materials, such as bronze, wrought iron, lead, castings, and so forth will be classed as structural steel unless covered by a separate item in the contract.

c. Reinforcement for concrete is not included in this item.

2. Weight.

a. The weight of structural steel as defined above, for which payment will be made, is the weight in pounds computed by the Engineer as shown in the contract documents. In the case of a substitution, by the Contractor, of a heavier section than that shown, the weight of the section shown in the contract documents is the measured quantity.

b. The weight of structural steel, computed by the Engineer and shown in the contract documents, is presumed to be correct and provides the basis of payment. If the Contractor presents evidence that the weight computed by the Engineer is in error by more than 0.50%, the weight will be recomputed.

3. Variation in Weight.

If the weight of any member is less than 97.5% of the computed weight, such member may be rejected.

4. Computed Weight.

a. The Engineer will compute the weight of structural steel on the basis of the following assumptions:

1) Steel: 490 pounds per cubic foot

2) Cast Iron: 450 pounds per cubic foot

b. The weight of rolled shapes and plates is computed on the basis of their nominal weights and dimensions as shown in the contract documents, deducting for copes and cuts.

c. The weight of welds is to be included in the computed weight, assuming the weights of fillet welds to be used as in Table 2408.04-1:

Table 2408.04-1: Weight (Mass) of Welds

Size of Weld in.	Wt. per Linear Ft., lb.	Size of Weld in.	Wt. Per Linear Ft., lb.
1/4	0.16	1/2	0.64
5/16	0.25	5/8	1.00
3/8	0.36	3/4	1.44

d. The weight of heads, nuts, single washers, and threaded stick through all high strength shop bolts is to be included in the computed weight (mass) on the basis of the weights shown in Table 2408.04-2:

Table 2408.04-2: Weight (Mass) of Bolts

Dia. Of Bolt in.	Wt. per 100 Bolts, lb.	Dia. Of Bolt in.	Wt. Per 100 Bolts, lb.
12	19.7	1 1/8	165.1
5/8	31.7	1 1/4	212.0
3/4	52.4	1 3/8	280.0
7/8	80.4	1 1/2	340.2
1	116.7		

e. The computed weight includes the total weight of field bolts as specified in Article 2408.02, C, and the total weight of shims required to be furnished for incorporation into the structure.

f. The weight of castings will be computed from the dimensions shown in the contract documents with an addition of 5% for fillets and overrun.

D. Surface Preparation, Galvanizing, and Painting Structural Steel.

Surface preparation, galvanizing, and painting structural steel will not be measured.

2408.05 BASIS OF PAYMENT.

Payment for various items of Structural Concrete, Steel Reinforcement, Structural Steel, and Incidental Metal Parts will be as follows:

A. Structural Concrete.

Article 2403.05 applies.

B. Steel Reinforcement.

Article 2404.05 applies.

C. Structural Steel and Incidental Parts.

1. Contract unit price per pound or lump sum for metal railing and structural steel.

2. Payment is full compensation for:
- Furnishing all materials.
- Preparation, including fabrication, nondestructive testing and inspection required by the contract documents, transportation, and erection.
- Furnishing all labor.
- Equipment.
- Repair and cleaning of the paint at the shop and after erection.

D. Surface Preparation, Galvanizing, and Painting Structural Steel.
Incidental to the structure.

Section 2508. Removal of Paint and Painting Steel Bridge Structures

2508.01 REMOVAL OF PAINT.

A. Non-Hazardous Paint Removal.

1. General.

a. Apply Article 2508.01, A, only to structures previously painted with "non-lead based" paints and to structures with scrape tests indicating a non-hazardous waste (as identified in 40 CFR 261) is expected to be generated during the project. Structures where scrape test results of total lead content of 5000 milligrams per kilogram (mg/kg) or greater will be handled under Article 2508.01, B unless additional sampling and analysis by Toxicity Characteristic Leaching Procedure (TCLP) is less than 5.0 mg/L for lead. OSHA may regulate other issues. Take whatever precautions are necessary to comply with Federal and State safety and health regulations.

b. To comply with Iowa Code 89B.8(1) scrape tests are provided elsewhere in the contract documents for information.

2. Bridge Cleaning.

This work involves removing accumulated foreign material and loose paint. It also involves water washing areas designated elsewhere in the contract documents.

a. Removal of Accumulated Foreign Material.

1) Prior to water washing, remove all accumulated foreign material from:

- Beams, member flanges, and gusset plates,
- Abutment bridge seats, pier tops, truss joints, and deck drains, and
- Other locations the Engineer orders.

2) Remove the accumulated foreign material using hand brooms, hand shovels, vacuum cleaners or other methods the Engineer considers acceptable. Collect the removed material and dispose of at an approved waste area according to Federal, State, and local regulations. Apply appropriate measures to ensure that at no time does removed material fall or be disposed in the water or on the land below the bridge.

b. Loosely Adherent Paint.

Prior to water washing, use hand tool methods, complying with SSPC-SP2, to remove loosely adherent paint in areas designated for painting. All paint removal operations will require containment as specified in Article 2508.01, A, 4.

c. Water Washing.

1) Prior to abrasive blast cleaning, use high-pressure water to wash steel surfaces to be repainted, abutment seats, pier caps, and other surfaces that may be designated elsewhere in the contract documents. Limit water pressure so that no paint is removed.

2) Ensure salt contaminants, dirt, bird excrement, and other detrimental foreign material are removed. Detergents or cleaners and scrubbing may be needed in conjunction with water washing. Use clear fresh water that is free of sediments and salt contaminants. After water cleaning, remove all oily or greasy residues using solvent according to SSPC-SP1.

3) Remove chalking from existing painted surfaces onto which paint is to be applied. Examples are transition zones for spot or zone painting and surfaces that will receive a top coat over an existing prime or top coat. In those areas, remove the chalked pigment by water washing.

4) Detergents or cleaners and scrubbing may be needed in conjunction with water washing. Use detergents or cleaners that are compatible with the existing paint system and pre-approved by the new paint manufacturer. Apply according to the product manufacturer's recommendations.

5) Submit SDS and any technical field guides for any detergent or cleaner to the Engineer for review and approval before using. If detergents or cleaners are used, thoroughly rinse the surface with water to remove all residue prior to painting.

3. Blast Cleaning and Surface Preparation.

a. Abrasive Blast Cleaning.

1) This work involves preparing all designated surfaces to be painted by either:

- Abrasive blasting using conventional equipment, and/or
- Vacuum blasting equipment.

2) Some hand-tool and/or power-tool cleaning may be required in areas not fully accessible to the other methods.

3) Use an abrasive blasting system that incorporates abrasive recycling to reduce waste volume to the greatest extent possible.

b. Standards For Surface Preparation.

1) Abrasive Blasting.

a) Prepare areas to be painted using a dry abrasive blast method to a level (SSPC-SP6 and/or SSPC-SP10) as designated elsewhere in the contract documents. The current SSPC-VIS1, Visual Standard for Abrasive Blast Cleaned Steel, will be used in conjunction with the appropriate written SSPC Standard for acceptance of final surface preparation. Prepare the surface profile (etched height) to be 1.5 to 2.5 mils as measured by replica tape or surface profile comparator.

b) Use hand-tool or power-tool methods, or both, to prepare small areas that cannot be cleaned using abrasive blasting equipment. SSPC Standards applicable to the method(s) applied will be used to evaluate surface preparation.

c) After blasting or mechanical preparation, thoroughly clean the surface to be painted with either HEPA vacuums or dry, oil free, compressed air, or both, to remove all adhering blast residue. Remove all oily or greasy residues with solvent complying with SSPC-SP1, Solvent Cleaning.

2) Removal of Existing Deteriorated Paint by Mechanical Methods.

a) The contract documents may designate areas to be painted which are to be cleaned by mechanical methods. These will be:

(1) Areas of deteriorated paint where the existing top coat is peeled or deteriorated and the underlying existing primer is in sound condition. In these cases, remove only the loose existing top coat by manual methods complying with SSPC-SP2 so the underlying existing primer is left in place. Remove the deteriorated top coat back to the boundary of soundly adhering top coat. A soundly adhering top coat is defined as that which cannot be lifted from the primer with a putty knife according to SSPC-SP3.

(2) Spot areas deemed too small to be effectively prepared by abrasive blasting.

b) Remove the deteriorated paint back to the boundary of soundly adhering existing primer. Regardless of the method used for cleaning, feather all edges of sites cleaned to a smooth transition between the existing paint and the cleaned area.

c) Use mechanical methods of surface preparation complying with SSPC-SP2 or SSPC-SP3, or both.

d) After mechanical preparation, thoroughly clean the surface to be painted with either HEPA Vacuums or dry, oil free, compressed air, or both, to remove all adhering blast residue. Remove all oily or greasy residues with solvent complying with SSPC-SP1, Solvent Cleaning.

3) Galvanized Elements.

Protect galvanized elements such as deck drain pipes and bearings. Blast clean only if directed by the Engineer. All galvanized elements which are to be cleaned and painted will be paid for as extra work according to Article 1109.03,B.

4) Rust Bloom or Flash Rust.

Rust bloom or flash rust is defined as the development of visible rust on bare metal surfaces after cleaning. Reblast the surface, or brush blast the surface and blow it down, just prior to the application of the first coat of paint if:

- Flash rust or rust bloom occurs after removal of existing paint, or
- A surface is cleaned and left unpainted for more than 24 hours

5) Pin Hole Rusting.

a) Pinhole rust areas may be designated for painting in the contract documents. In areas where there is pin hole rusting and associated staining, abrasive blasting may not be required if the existing paint is sound other than at the pin holes. Mechanical cleaning, according to SSPC-SP2, may be used in these areas prior to applying the spot primer.

b) If the mechanical methods do not remove heavy staining of sound paint adjacent to the pinholes, remove the stain to the degree recommended by the manufacturer of the primer. Use methods of removal recommended by the manufacturer. Provide a written copy of the recommendations to the Engineer prior to performing the work.

6) Feathering of Repair Areas.

For spot and zone painting work, feather the existing coating surrounding each repair location. A smooth, tapered transition of 1 to 2 inches onto the existing intact coating is required around each repair area. Roughen the existing coating by hand sanding or a solvent wipe in the feathered area to assure proper adhesion for the new paint. Verify soundness of the existing paint by probing the edges of coating around the periphery of the repair areas with a putty knife, according to the requirements of SSPC-SP3.

7) Protection of Unpainted Surfaces.

a) Use whatever precaution is necessary to ensure vehicular traffic, equipment, hardware, fixtures, concrete, and other surfaces are protected against abrasive impact, paint spillage, over-spray, and other damage during the project.

b) For spot or zone painting work, use protective coverings, shields, or masking as necessary to protect surfaces that are outside the designated painting areas. Maintain protection during the entire period work is being performed which could damage those surfaces.

c) Exercise extra care to avoid over-blast damage to the existing coating in non-designated areas. Correct damage to non-designated areas by cleaning, repairing, and repainting at no additional cost to the Contracting Authority. Repair procedures will be approved by the coating manufacturer's technical representative. Submit the manufacturer's approval to the Engineer for review and approval before the repair work is started.

8) Abrasives.

a) Use steel shot and/or grit, aluminum oxide, or garnet abrasives. This is to ensure hard durable abrasives are used, to encourage abrasive recycling, and to minimize waste generated by the project. Use clean, dry abrasives that are free from contamination. Do not use sand or coal slag.

b) If blasting with previously used or recycled abrasive:

- Obtain a representative sample of that abrasive,
- Have that sample analyzed for TCLP leachable levels of arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver, and
- Submit the laboratory's analytical report to the Engineer for approval prior to use.

c) The Engineer will accept used or recycled abrasives only if the leachable quantity of each metal tested is equal to, or less than, 1 ppm or 1 mg/L.

d) Clean and recycle abrasive used during this project to the greatest extent possible. Provide a written abrasive recycling workplan to the Engineer for approval. In this proposal list the equipment and process used for recycling and recovery of the abrasive and monitoring air dispelled from the recycling process.

e) Employ a method to monitor dispelled air from the recycling system that samples and tests for total lead and particulate matter of 10 microns or less (PM_{10}). Blasting will be suspended immediately if the Engineer deems visible dust or particulate matter is in the air expelled from recycling equipment.

9) Chloride Testing.

a) The Engineer reserves the option to test the blasted surface(s) for residual chloride ions. Chloride ions after blasting and blow down shall be less than 7~~15~~ µg of chloride per ~~100 m~~cm^2. Areas that are not equal to, or below, these criteria will need to be re-washed, brush blasted, and retested.

b) The Engineer will measure chloride contamination by using a Surface Contamination Analysis Kit or an equivalent analytical process.

4. Containment.

a. General.

1) Abrasive blasting using conventional equipment will require a system for total containment of the blast area. Containment includes all containment enclosures (where applicable), monitoring, recovery, and temporary storage of waste. For vacuum blasting, the "contained area" is defined as the area around the blast nozzle and any other connections or equipment where waste, dust, or exhausted air may exit into the environment.

2) Submit to the Engineer a plan for containment enclosures, an analytical report of the abrasives to be used, and a plan for monitoring air quality prior to starting work. A general guideline for containment evaluation abrasive blasting and/or vacuum blasting will be:

No visual or noticeable dust is to be observed escaping into the atmosphere or onto the ground from the contained area during blasting, blow down, or daily clean-up operations.

Provide a written description, shop drawings, and calculations for the design and construction of work platforms, and containment and ventilation systems, including, but not limited to the following:

- Provide detailed drawings signed and stamped by Professional Engineer(s) licensed in the State of Iowa.

- Data, calculations, and assumptions used for the design of the containment and ventilation system, structural impact analysis, and the imposed loads (including wind loads) on the existing structure, signed by a Professional Engineer(s) licensed in the

State of Iowa. Include the design airflow within containment, and the locations and sizes of air inlets and exhaust.

- The plan for staging, installing, moving, and removing the containment, and the methods of attachment that will be used. Make attachment points to specific, substantial framing members only.
- Provide a written plan describing the rigging and staging for this project. Have the plan signed by a Professional Engineer(s) licensed in the State of Iowa verifying the bridge's ability to support all loads imposed by the Contractors operations, including but not limited to, the containment, rigging, temporary access and materials storage.
- Include the methods of access that will be provided to work areas inside containment, locations of safety lines, and locations of containment entryways.
- The methods and procedures that will be used for cleaning and securing the containment at the end of each work day, and the cleaning undertaken prior to dropping or relocating the containment.
- Technical data sheets, specification sheets, any other information needed to thoroughly describe the containment plan and materials proposed for use. Provide the manufacturer's specifications for the proposed enclosure material(s), including information on light transmittance, flame spread, and fuel contributed, burst strength, abrasion durability, and unit weight of material. Only use materials that are flame retardant.
- A description of debris collection and air filtration equipment, including the equipment data sheets, airflow capacity, equipment weights and temporary utility service requirements.
- The methods of access that will be provided to work areas inside containment, and locations of safety lines.

3) Suspend blasting if the Engineer determines that air expelled from containment or from the vacuum nozzle has noticeable dust or particulate matter. If the Engineer determines the containment measures are inadequate, alter the removal operation or the containment to meet the Engineer's requirement.

b. Abrasive Blast Cleaning.

1) Use a system which ensures total containment and recovery of the material removed from the structure. Construct bridge containment enclosures over other roadways to allow traffic to be maintained on the bridge being cleaned as well as on the road under the bridge, according to traffic control requirements in the contract documents.

2) Removed material will be defined as paint chips, abrasive particles, and other blasting residues. Ensure the containment prevents removed material and abrasive from drifting or being deposited, or both, other than within the containment enclosure. The blasting operation will be suspended immediately if the Engineer deems waste cleanup or house keeping measures, or both, to be inadequate. If the Engineer rules the containment measures inadequate, alter the operation or the containment to meet the Engineer's requirement.

3) Use impermeable cover materials, such as tarpaulins, drop cloths, or other approved materials, on or above the ground, waterways, and other surfaces. Recover removed material from the covering materials. Highway pavements and paved surfaces under a structure may be used as a portion of the collection cover for that area providing traffic is maintained on the bridge and on the pavement under the bridge according to traffic control requirements in the contract documents.

4) All areas used for containment and recovery shall be thoroughly cleaned of all debris before work is begun. Close containment areas to the public. If paved surfaces are used for recovery areas, use only areas that are continuous and free of open cracks. Seal cracks to prevent infiltration of blast residue prior to commencing any blasting in that area.

5) Turn the edges of the impermeable cover material upward a minimum of 1 foot to minimize loss of waste materials. Ensure covers on or over roadways, railways, or waterways do not present a hazard nor remain in place overnight without the Engineer's written permission. Fasten the edges of the impermeable cover to the vertical drapes to ensure no loss of waste

materials. Ensure overlaps of the cover material are a minimum of 3 feet, securely tied together, and continuously taped to prevent loss of removed material.

6) Extend vertical drapes from above the blasting area to the bottom of the enclosure. Securely anchor them top and bottom and at the laps to prevent spilling or loss of removed material. Use material capable of withstanding wind forces without tearing or having a breach of integrity.

7) Containment enclosures shall be anchored to prohibit enclosure encroachment on open traffic lanes, railroad lanes, and waterways. Ensure removed material will not fall on to surface waters.

c. Monitoring.

1) During abrasive blasting, monitor air quality by conducting air sampling and testing. Perform this work under the direction of a certified Industrial Hygienist. Use a minimum sampling frequency of one sample of 8 hour duration per week.

2) One purpose of the sampling is to allow the Engineer to determine the effectiveness of the containment. Samples will be obtained from at least two locations outside and immediately down wind from the containment, according to 40 CFR 50.

3) Employ an air monitoring that identifies total lead and total suspended particulate (TSP) to evaluate site compliance with the requirements of 40 CFR 50. Provide the results of this monitoring to the Engineer as soon as they become available. Abrasive blasting will be suspended immediately if the Engineer determines expelled air quality measures to be above EPA standards for particulate matter.

4) Air quality sampling and testing will not be required for small localized containments when:

- Blasting operations have an expected duration of less than approximately 3 hours, or
- The expected duration of the total amount of blasting on the project is less than approximately 8 hours.

d. Cleaning by Other Methods.

1) At locations where abrasive blasting is not used, use a waste collection system that ensures containment and collection of the material removed from the structure. Removed material will be defined as paint chips and other residues. Ensure the containment prevents removed material from drifting or being deposited, or both, other than on the containment portion provided.

2) Use impermeable cover materials, such as tarpaulins or drop cloths, on or above the ground, waterways, surface waters, and other surfaces. Use these covering materials to recover removed material.

e. Clean-up Contingency.

1) Clean up any spills that result from the operations at no additional cost to the Contracting Authority. Provide a written plan for clean up of spills to the Engineer prior to removing paint.

2) For removal activities over water, have floating boom devices in place during removal operations. Ensure these devices are capable of preventing waste material from moving away from the site in the event of a breach in the containment system.

f. Recovery and Temporary Storage of Waste.

1) Deposit accumulated bridge cleaning waste in appropriately sized clean new or reconditioned containers with securely sealed lids meeting the requirements of 49 CFR 173.24. Recover wastes daily and deposit the wastes into these temporary storage containers. Securely seal the containers to shield the contents from the elements at all times. Consolidate all waste material to a minimum number of containers.

2) Recover all residues and carefully transfer, ensuring no release of residues into the air or contamination of surrounding surfaces. Keep all containers containing residue closed and secured, except during the addition of waste. Ensure residues do not remain on bridge surfaces or on the containment material overnight.

3) Clearly mark all bridge cleaning waste containers in no less than 1 1/2 inch block letters stating:

PAINT WASTE
NONHAZARDOUS
(Date)

The date shall indicate when waste was first put into the container.

4) Construct or furnish a secured temporary storage area of sufficient size for the contained waste material. Enclose temporary storage areas with an 8 foot chain link fence or a roll-off box with a lockable cover. Plans for other secured temporary storage areas may be submitted to the Engineer for approval.

5) Locate the temporary storage area within the right-of-way of the Contracting Authority at a location the Engineer approves. Ensure the base for waste storage is above the extreme high water elevation, if constructed within a flood plain.

6) For projects that will generate less than 55 gallons of waste, the fenced temporary storage area or roll-off box will not be required and the Contractor is responsible for securely storing the paint waste containers on-site during the project.

7) At, or prior to the conclusion of the work, obtain one representative sample of the waste material from each container. Combine samples so that one representative composite sample is made for every five waste containers. Submit composite sample(s) to a lab for a Toxicity Characteristic Leaching Procedure (TCLP) test for the eight priority metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Provide the laboratory analysis results to the Engineer upon receipt. Maintain wastes on site and do not dispose of them until the Engineer has reviewed analytical data and approved of the disposal method.

g. Disposal of Removed Material (Waste).

1) Transport waste materials in approved containers from temporary storage to a lined Subtitle D landfill (for non-hazardous wastes) or Subtitle C, Treatment, Storage, and Disposal Facility (TSDF for hazardous wastes) which accepts bridge painting wastes. Transport the wastes to the landfill facility within 5 calendar days of completion of surface preparation operations.

2) Provide the Engineer with copies of delivery tickets and landfill invoices for all waste material generated by this project.

3) Dispose of all bridge cleaning wastes according to Federal, State, and local regulations.

4) This project is based on the best information available that wastes generated will be non-hazardous for disposal per 40 CFR 261. Disposal of hazardous bridge cleaning wastes will be by extra work according to Article 1109.03.

h. Final Clean up.

1) Apply Article 1104.08.

2) In no case allow any foreign material or other painting related wastes to mix with the wastes generated from abrasive blast cleaning or paint cleaning by other methods.

5. Protection and Clean up.

a. For all work, use every reasonable means to protect the environment, human health and safety, adjacent property, and vehicles from damage resulting from the paint removal operations, according to Article 1107.07. Keep the project site in a neat, clean, and safe working condition.

b. At the end of each working day, clean up and properly containerize all waste material. Special attention is drawn to steel abrasive and its preponderancy to rust and stain surfaces where material is allowed to accumulate.

c. Clean up abrasive on a daily basis and remove any staining which occurs.

d. Protection and clean up will not be measured for payment, but will be considered incidental to all other pay items in this specification.

B. Hazardous Paint Removal.

1. General.

a. Apply Article 2508.01, B, only to structures previously painted with lead based paints and for structures with a scrape test for total lead of 5000 mg/kg or greater indicating a hazardous waste is expected to be generated during the project. Scrape tests are provided elsewhere in the contract documents for information per Iowa Code 89B.8(1).

b. Take responsibility for whatever precautions are necessary, to comply with Federal and State health, safety, and waste regulations.

2. Bridge Cleaning.

Apply Article 2508.01, A, 2.

3. Blast Cleaning of Structural Steel.

a. Waste Notification.

1) Evidence suggests this structure has previously been painted with coating materials which contained lead pigments or chromium pigments, or both. Analytical results from scrape tests of the existing paint system are provided elsewhere in the contract documents.

2) The waste produced is expected to contain paint chips with heavy metal constituents, spent abrasive, rust, and possible mill scale. Take whatever measures are deemed necessary to assure protection for human health and the environment.

b. Preconstruction Sampling and Testing.

1) Obtain representative waste samples from the existing paint system using the selected production blasting system and equipment. Have an accredited laboratory test waste material with the TCLP using EPA test method SW-6010B, TCLP; or an approved equal. Laboratories accredited by the American Industrial Hygiene Association of National Environmental Laboratory Accreditation Program, or any US EPA certified laboratory may perform the paint waste testing.

2) Have waste samples analyzed for, at a minimum, the eight priority metals. These metals are: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. No later than 12 calendar days following the first day of production blasting, provide the Engineer with the laboratory's analytical reports as well as reasonable estimated quantities of waste that are expected to be generated per month.

3) Conduct preconstruction and post-construction soil and river sediment sampling in the areas potentially impacted by blasting activities. At least 3 weeks prior to commencing work, provide a written program for sampling to the Engineer for review and comment. On the program, identify the number of samples proposed, the sampling locations, and sampling procedure to ensure all areas of potential impact are evaluated and that a statistical basis has been developed.

4) All sampling should be tested for total lead and chromium content using EPA Method SW-6010B, Totals, or approved equal. SSPC Technology Update No. 7 provides guidance on sampling methodology, however, ~~L~~locations where it is recommended to take samples include:

- At locations under and within the shadow of the structure,
- Storm sewer intakes and curb drains,
- Areas where ditches could carry debris laden storm water run-off to the river,
- Locations of equipment and waste storage, and
- Sediments along the bank and in water less than 5 feet deep.

5) Preconstruction sampling locations need to be marked and resampled at the same location upon completion of work. Refer to Article 2508.01, B, 6, for additional information.

6) Provide the Engineer with preconstruction analytical results from soil and sediment sampling at least 3 weeks prior to commencing production blasting or other paint removing activities. After final clean up, but before final acceptance of the project, provide the Engineer with post-construction analytical results from soil and sediment sampling.

c. Environmental Regulatory Permits.

1) The Contracting Authority will obtain and provide an US EPA hazardous waste generator identification number for this project if project specific waste sampling and testing indicate a hazardous waste will be generated.

2) The Engineer will use actual waste analytical results and estimated waste quantity data received from the Preconstruction Sampling and Testing to identify which type of identification number, if any, is required.

3) Obtain all other permits including any required for waste disposal. Apply Article 1107.03.

d. Site Working Documents.

Submit to the Engineer, for review and comment, an electronic copy of each site working document required in this section. Write each site working document to be specific for the issues associated with the blast cleaning alternatives selected. Revise any indicated sections of the site working documents to comply with the Engineer's comments and resubmit, if necessary.

1) Site Work Plan.

A minimum of 3 weeks prior to commencing work, provide a written site work plan to the Engineer for review and comment. On the site work plan include, at a minimum, a complete description of:

a) Paint removal methods selected, refer to Article 2508.01, B, 3, e.

b) The equipment and processes to be used including equipment catalog information from the manufacturers for major pieces of equipment.

c) The environmental protection plan including waste sampling procedures and methods used to control emissions into the air, water, and onto the soil.

d) Waste handling, storage, and disposal plan.

e) A preconstruction soil and river sediment sampling plan, refer to Article 2508.01, B, 3, b.

f) The Site Air Monitoring Plan. In this plan, describe the air sampling protocol and analytical procedures, sampling locations, frequency of sampling, and equipment, refer to Article 2508.01, B, 4, c. Use 40 CFR 50 as guidance when locating air monitoring equipment. Use a minimum frequency for sampling and monitoring that is in accordance with Federal and State requirements, and this specification.

2) Site Health and Safety Plan.

a) A minimum of 3 weeks prior to commencing work, provide a written Health and Safety Plan (HASP) to the Engineer for review and comment. In this plan detail the compliance program with regulatory requirements including, but not limited to:
- OSHA 29 CFR, 1910 and 1926,
- Resource Conservation Recovery Act (RCRA) and CERCLA 40 CFR, 261 through 300,
- TSCA 40 CFR, 700 – end, and
- Transportation 49 CFR, 100 through 199.

b) Give attention to 29 CFR 1926.62, Lead in Construction Standard. In addition, ensure the HASP specifically identifies:
(1) The Project Site Safety Officer who is to be on site at all times when work is in progress, and who has the Contractor's authority to effect an immediate operational change or to shut down production until a specification, regulatory, or safety deficiency is corrected. The Project Site Safety Officer has continuous site responsibility for assuring that all regulatory requirements are being met including, but not limited to, worker health and safety and waste management. This includes the duties of the "competent person" as required by 29 CFR 1926.62.
(2) The compliance program as required by 29 CFR 1926.62 which includes the following at a minimum:
(a) A description of each activity in which lead and/or chromium is emitted including the equipment and processes involved,
(b) Standard operating procedures for activities involving hazardous constituents,
(c) Maintenance schedules of equipment utilized for filtration of potentially hazardous constituents,
(d) Crew size and responsibilities,
(e) Description of engineering controls and processes used to control lead exposure or chromium exposure, or both,
(f) A report of the technology considered in meeting the Permissible Exposure Limit (PEL),
(g) Air monitoring protocol which will be used to document personnel exposure,
(h) Schedule for implementing the program,
(i) Work practice program including the personal protective equipment,
(j) Housekeeping and hygiene practices,
(k) An administrative control (job rotation) schedule if used, and
(l) A description of HASP compliance arrangements made between the Contractor and their subcontractors.
(3) Hazardous substances, that are expected to be encountered, PELs for these substances, and site personnel medical monitoring expected.
(4) The levels of personnel training, protection, and protective equipment required for different tasks performed at the site.
(5) Site control and restricted access policy to ensure unauthorized personnel or untrained personnel, or both, are not exposed to unnecessary risks.

c) The signature of a Certified Industrial Hygienist trained in worker environmental health and safety issues is required on the HASP.

3) Site Contingency Plan.

a) A minimum of 3 weeks prior to commencing work, provide, for the Engineer's review and comment, a written Site Contingency Plan (SCP) as discussed in 40 CFR 261 D. In this plan:
(1) Detail the procedures that will be implemented and corrective action that will be taken, should an emergency or unforeseen situation arise.
(2) Specify procedures to minimize hazards to human health and the environment should there be fires, explosions, vandalism, or any other unplanned sudden or non-sudden release of hazardous waste or hazardous constituents to the air, soil, or surface water.
(3) Detail contingency measures that will be available on site to prevent accidental releases and provide safety to the general public. For example: Security, preventative, and containment measures which will be used to prevent and/or contain:
(a) Spillage or loss of paint wastes.
(b) Spillage of bulk paint, solvents, and thinners during the painting operations,
(c) Spillage or leakage of equipment fuel, oil, or other fluids,
(d) River traffic from encountering floating booms or barge mounted equipment,

(e) Inadvertent public exposure to job site hazards, and
(f) Waste material, or spills on water, from migrating off site and to contain that material until it is cleaned up.

b) Follow current Federal and State regulations in preparing this plan. Have it on file in the locations specified by regulation.

e. Paint Removal.

1) Submit to the Engineer in writing the type of blasting equipment that will be used for the paint removal operations before starting work. Achieve the level of surface preparation specified. In no case will unproven technology or untested technology, or both, be allowed without prior review, testing, and written approval from the Engineer.

2) The blasting process and equipment is required to be part of the Site Work Plan, and the plan shall describe in detail the:

- Method of blasting,
- Work procedures and tasks for this removal method,
- The estimated production rate in square feet per hour,
- Estimated quantity of blasting abrasive utilized per production rate (hour or square foot), and
- Procedure and protocols for abrasive recycling.

3) Contain and collect all waste material generated during blast cleaning. Contain any fugitive emissions (solid particulate, fugitive dust). Protect the health and welfare of the public. Protect the environment. Employ adequate administrative and engineering controls to reduce worker exposures to all hazardous constituents present at the site to levels as low as feasible according to industry standards. Refer to Article 2508.01, B, 4, b for additional details.

f. Standards for Surface Preparation.

Apply Article 2508.01, A, 3, b.

4. Containment.

a. General.

1) This work includes the design, erection, maintenance, and removal of the enclosure or containment used to contain wastes generated during the surface preparation. The work also includes characterizing, collecting, and containing wastes generated during the project.

2) Ensure any enclosure complying with, or comparable to, an SSPC Class 3 or better is designed and sealed by a Professional Engineer licensed in the State of Iowa who is qualified in structures. Ensure ventilation in a Class 2 or better containment is designed and sealed by a Professional Engineer licensed in the State of Iowa who is qualified in ventilation.

3) Work required to decontaminate, clean, and test equipment and non-expendable materials or supplies shall be included in this section. Ensure, at a minimum, decontamination and cleaning do not allow debris or dust, or both, to be dislodged by winds or physical contact during handling and movement of a containment structure. In addition, establish a procedure to ensure all equipment and materials are essentially free from hazardous substances when delivered to and removed from the project site.

b. Enclosure.

1) Perform paint removal activities, except for vacuum blasting, within a full enclosure. Design the full enclosure as a system including:

- The frame work and outer covering,
- Attachments to the structure and supporting foundations,
- Waste handling, and
- Ventilation, if required.

2) Include in the enclosure submittal a method or process to catch, accumulate, and ultimately contain all spent abrasive and all paint waste. Ensure that all containment materials are flame retardant. Include in the enclosure details a description and catalogue cuts of:

- Containment materials and equipment used,
- Material strengths, permeability, and necessary seam closure details,
- Drawings of attachments to the bridge including abutments, piers, deck, parapet rails, and beams, and
- Calculations of superimposed dead and wind loadings.

3) Submit an electronic copy of this design to the Engineer for review and approval at least 3 weeks prior to erecting the enclosure. Use an enclosure that is:

a) Designed to transfer added wind and static loading safely to the bridge. Analyze the structure for gravity and wind loadings from the containment. Provide a copy of this analysis and all supporting calculations in the submittal. If the Engineer determines that

the proposed enclosure could have detrimental effects on the structural integrity of the bridge, modify the design of the enclosure at no additional cost to the Contracting Authority. A copy of the existing bridge plan is available from the Contracting Authority.

b) Designed and constructed to maintain negative pressures inside the enclosure during production blasting and to include an air filtering and dust collection system for all exhausted air, unless site specific data collected during actual blasting operations conclusively show a tight containment with negative air is not required.

c) Designed to employ adequate engineering controls, including ventilation, to reduce airborne contamination to levels as low as feasible.

d) Equal to, or comparable with, SSPC Class 2 or better for Conventional Open Abrasive Blasting.

e) When vacuum-shrouded power tool cleaning is performed, construct and use an SSPC Class 3P containment system, When power tool cleaning is performed without vacuum attachments, erect an SSPC Class 2P containment system.

4) Contamination of the ground, water, or river sediment from project activities is strictly prohibited. Project activities that shall be carefully monitored and controlled to avoid environmental contamination include, but are not limited to:

- The containment,
- Dust collector,
- Abrasive reclaimer,
- Waste accumulation points (storage areas),
- Satellite accumulation points,
- Refueling locations,
- Boat or barge access points, and
- Paint handling, transfer, and mixing operations.

5) Uncontrolled dumping of wastes is strictly prohibited. Immediately clean up spills at no additional cost to the Contracting Authority.

c. Air Emissions and Monitoring.

1) **General.**

a) Monitor air quality by using high-volume air monitoring equipment. Perform sampling protocol according to the provisions of 40 CFR 50 and its appendices. At a minimum, perform monitoring for total lead and total suspended particulate (TSP) and PM_{10}.

b) Use properly calibrated high-volume air sampling equipment at locations of maximum potential impact to the public plus at areas to provide background ambient samples.

c) Identify anticipated monitoring locations and monitoring protocol in the Site Air Monitoring Plan.

d) Have an American Industrial Hygiene Association (AIHA) accredited laboratory analyze all air samples collected.

e) Filter all containment and process air exhausted from air handling equipment or the abrasive recycling process, or both, to remove particulates and regulated constituents to a level below current air quality standards.

f) Capture and contain filtered material using a system designed for this purpose.

g) Establish regulated areas around the dust collector, abrasive reclaimer, containment, and other operations that potentially generate lead emissions or chromium emissions, or both.

h) Properly identify, post, and establish the perimeter of the regulated areas at the OSHA Action Level of 30 $\mu g/m^3$. Limit access within these areas to only those personnel who are properly trained and monitored according to the site Health and Safety Plan.

2) Site Air Monitoring Plan.

a) Ensure compliance with 29 CFR 1926; 40 CFR 50; 40 CFR 60; and 567 IAC 22 and 23, by including nomenclature in the plan for:

- Sampling equipment,
- Sampling procedure and protocol,
- Sampling frequency,
- Locating criteria, and
- Laboratory analysis of air samples.

b) Submit analytical report to the Engineer within 1 week of being received from the testing laboratory.

3) Containment Efficiency.

a) The Engineer will not routinely use opacity testing to evaluate a containment's efficiency, but will generally use a "no visible dust or blast media is to be observed escaping into the

atmosphere or onto the ground from the contained area during blasting, cleaning, or blow down" criteria.

b) The Engineer may conduct random opacity tests or use high volume or personal cassette samplers for verification monitoring. This monitoring, positioning of equipment, and times are at the discretion of the Engineer. Verification monitoring will be outside of the Contractor's regulated areas and involve the Engineer's sampling equipment. The Engineer's sampling equipment will not be made available for the Contractor's use.

c) Ensure the National Ambient Air Quality Standards for lead or PM_{10} or visible dust are not violated. If it is violated, an issuance of a Suspension of Work notice will be used until appropriate corrective action is taken.

d) Shut downs for noncompliance with environmental regulations or standards will not be cause for extensions in time, or considered for delay costs.

d. Paint Waste.

1) Paint wastes include all wastes generated by the project. These wastes include, but are not limited to:

- Blast waste,
- Material accumulated from filtering exhausted air,
- Spent abrasive,
- Containment material that cannot be decontaminated for reuse,
- Material containers such as paint and solvent containers, and
- Other wastes that fail the TCLP test and are categorized as a RCRA hazardous waste.

2) Consider all paint wastes as hazardous until after appropriate analytical data or SDS are available showing conclusive evidence that the waste is below any regulated level for hazardous constituents, or is not initially regulated.

3) During generation, accumulate all paint wastes and segregate by individual waste stream. Place in properly labeled storage containers. Use containers that comply with 49 CFR requirements. Follow the handling and storage requirements of 40 CFR 262 and 265. Waste streams may be combined after each has been sampled, tested, and characterized, provided wastes are compatible and combining is acceptable to the disposal facility.

4) As required by the SCP, have a designated, responsible, and trained person available for 24 hour emergency response when wastes are stored on the project. It is recommended the Site Health and Safety Officer be so designated. Ensure this person is available during non-working hours and work shutdowns within a reasonable response time whenever wastes are being stored. Post this person and an alternate's name, telephone numbers, and other required information in a prominent location at the accumulation point and list in the SCP.

a) Accumulation Point.

(1) Erect and maintain an accumulation point, or storage area, sized to accommodate the accumulation of wastes awaiting shipment to a disposal facility. Enclose the accumulation point with an 8 foot high chain link security fence with barbed wire top, lockable access gates, bermed sides, and properly posted warning signs. A secured and enclosed trailer or shipping container is an acceptable alternative to a fenced area. Obtain the Engineer's approval for the location of this accumulation point. Construct it within the existing right-of-way at the project, but out of areas prone to flooding.

(2) For projects that will generate minimal quantities of waste, make a detailed written request to modify this storage security requirement. Submit all requests to modify the security requirement to the Engineer a minimum of 3 weeks prior to commencing production blasting. The Engineer will respond to the Contractor within two weeks following the request. The Engineer will evaluate the proposal based on:

- The Contractor's estimated waste quantities,
- The proposal's intent to comply with storage regulations and these specifications,
- Expected waste classification (i.e., hazardous or non-hazardous), and
- Other site specific considerations and details which the Contractor provides.

b) Satellite Accumulation Point.

(1) If the Contractor requests in writing, the Engineer will consider a small satellite accumulation point, or points, in the work zone. The management of satellite accumulation areas is to comply with 40 CFR 262.15. At the conclusion of any working day, remove all containers containing accumulated wastes from any satellite accumulation point and place in the accumulation point storage area.

(2) Equipment which incorporates temporary storage of accumulation of wastes during operation will be considered a satellite accumulation point. As such, the equipment will be subject to proper labeling requirements. Waste materials contained within this

type of equipment will not be subject to the requirement for daily transfer to the accumulation point storage area.

(3) Secure all materials stored at the accumulation point and satellite accumulation points to prevent spillage or vandalism. Securely cover to protect from the elements. Ensure the Site Health and Safety Officer maintains a permanent record to account for the accumulation of all waste materials and to report the cumulative weekly volumes at the project's progress meetings. Ensure the volume of materials located in the accumulation points and the condition of the storage containers are recorded weekly in the log.

(4) Remove accumulation point and satellite accumulation points (if used) when the Engineer orders, or at the end of the project. Apply Article 2508.01, B, 6.

e. Decontamination Plan.

1) Provide the Engineer with a written Decontamination Plan a minimum of 3 weeks prior to commencing work. In this plan, outline procedures to follow to ensure non-expendable materials and equipment have been properly decontaminated prior to arriving on the project and before being demobilized from the site. Prior to in-bound mobilization, provide the Engineer with a written statement which includes the following:

a) Identification of project, location, owner reference, and contact information and type of wastes generated (hazardous or non-hazardous) at the previous project.

b) Certification that all equipment and non-expendable materials have been decontaminated and are clean. In this certification include analytical data verifying items have been decontaminated and are clean.

2) Before off-loading (or allowing in the right-of-way) equipment or non-expendable material, or both, that: 1) is mobilized to the site without being included in the certification; or 2) arrives at the site in an unacceptable condition, ensure it is:

- Decontaminated,
- Adequately sampled and tested, and
- Accepted as clean by the Engineer.

3) Evaluation of equipment and non-expendable material clean-up used on projects that generate hazardous wastes should include sampling (wipe or destructive).

4) For projects that generate no hazardous waste, use equipment that is, at a minimum, judged as visually clean. In addition, perform non-expendable material cleanup in a manner that is, at a minimum, judged as visually clean. No special testing will be required. Sample and test, or dispose of, items that cannot be visually evaluated.

5) If a particular waste stream can be identified as the sole source of hazardous materials, in an otherwise non-hazardous project, the Engineer has the discretion to:

- Separate out that process for a higher level of evaluation (for example sampling and testing), and
- Minimize visual evaluation on the other non-hazardous processes.

5. Paint Waste Transport and Disposal.

a. Waste Sampling and Testing.

1) Sample each waste stream during the project to ensure project goals are being maintained and that a disposal facility's need for waste characterization is being met.

2) Obtain all samples properly, prepare for shipment, and offer for transport using Chain-of-Custody procedures and protocol. Have an accredited laboratory analyze all samples. Refer to Article 2508.01, B, 3, b, for additional information.

3) Provide all laboratory reports to the Engineer as soon as they are received. Obtain an adequate number of samples and analyze them to ensure any waste stream generated during this contract is fully characterized.

4) Sample solid wastes and analyze using TCLP analysis for the eight RCRA priority metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Perform any additional analytical methods required by the disposal facility.

b. Disposal.

1) A minimum of 3 weeks prior to commencing production blasting, provide the Engineer with a written request to approve a designated disposal facility. Determine which of the following options or combinations are applicable to the job and selected removal process, or processes:

a) Permitted, Subtitle C, TSDF for any hazardous waste generated at the site.

b) Permitted, geosynthetic lined, Subtitle D landfill for non-hazardous waste generated at the site.

c) Treatment and disposal facility for waste water generated from personal decontamination wash water.

2) With this request include a letter of tentative commitment from the facility to accept and dispose of the project's waste or selected waste streams. Dispose of hazardous waste only in a permitted TSDF that has obtained and currently holds an US EPA, TSDF identification number. The Engineer may evaluate any facility submitted by conducting an environmental audit, records review, and reference check of that facility.

3) After receiving the Engineer's approval of the facility (or facilities), begin the formal process of obtaining final disposal authorization from that facility. Provide the Engineer with copies of all final documents pertaining to the disposal.

4) Clean all shipping containers for regulated raw materials or consumable supplies received at the project to "RCRA empty" as defined in 40 CFR 261.7. Properly recycle or dispose of at the appropriate disposal facility.

5) The Engineer, on a case-by-case basis, will consider proposals for beneficial reuse, reclamation, or recycling of waste products generated during the project. A minimum of 3 weeks prior to commencing work, provide a written Value Engineering Incentive Proposal, according to Article 1105.14, identifying a waste recycling program to the Engineer for consideration. In the submittal, provide the Engineer with ample detail to thoroughly and completely review and research the proposal.

c. Transportation and Manifesting.

1) Ensure that no waste leaves the site without a properly prepared waste manifest. Manifest all hazardous waste shipments using a Uniform Hazardous Waste Manifest, obtainable from the approved disposal facility. For all shipments of non-hazardous waste, propose a manifest. Obtain the Engineer’s approval for the manifest.

2) Have the Site Health and Safety Officer sign the manifest Have the Site Health and Safety Officer provide the Engineer and appropriate agencies, electronic copies of each manifest along with any supporting documents such as land disposal restriction forms and waste profiles within 1 working day of shipment.

3) When material is being transported or readied for transport, ensure all waste containers are properly labeled and marked according to 40 CFR 262 and 49 CFR 172. Ship all wastes with a permitted transporter holding a current EPA transporters identification number. Prior to shipment of waste from the project site, provide the names, addresses, qualification/certifications, and permits for the proposed hauler of hazardous waste and waste disposal facility.

4) Maintain a file of all waste shipped for disposal or recycling. Have the Site Health and Safety Officer coordinate with the Engineer to assure that the signed original of each Uniform Hazardous Waste Manifest is received from the designated facility by the Engineer within 35 calendar days of the date the waste was accepted by the initial transporter. For shipments of hazardous waste, if the signed TSDF copy is not received in 10 additional calendar days (45 calendar days total) have the Site Health and Safety Officer immediately:

a) Prepare and submit an Exception Report in accordance with 40 CFR 262.42 to the EPA Region VII Administrator, 11201 Renner Blvd, Lenexa, KS, 66219. Provide a copy of this report to the Engineer.

b) Initiate actions to track and locate that shipment (applicable for both hazardous and non-hazardous waste shipments).

5) Provide the Engineer with an electronic copy of the fully signed Designated Facility to Generator page from the Uniform Hazardous Waste Manifest within 1 working day of it being received from the disposal facility.

6. Protection and Clean-up.

a. **General.**

1) For all work, use every reasonable means to protect the environment, human health and safety, adjacent property, and vehicles from damage resulting from the paint removal operations, according to Article 1107.07.

2) Keep the project site in a neat, clean, and safe working condition.

3) At the end of each working day, clean up and properly containerize all waste material. Special attention is drawn to steel abrasive and its preponderancy to rust and stain surfaces where material is allowed to accumulate.

4) Clean up abrasive on a daily basis and remove any staining which occurs.

b. Site Environmental Evaluation.

1) Do not contaminate the soil or bodies of water with lead or other hazardous materials.

2) Soil or river sediments are considered to have been contaminated with lead or chromium from the project if either of the following two conditions occurs. Return the soil or river sediments to

back-ground levels by methods acceptable to the Engineer and all applicable regulatory authorities (at no additional cost to the Contracting Authority).

a) If the geometric mean pre-project level is less than or equal to 200 ppm (totals), and an increase in the post-geometric mean total content of 100 ppm or more occurs.

b) If the geometric mean pre-project level is greater than 200 ppm, and the post-geometric mean concentration exceeds the pre-job geometric mean plus two standard deviations, or increases in the post-geometric mean level of 100 ppm occurs, whichever is greater.

c. Final Clean-up.

1) Perform final cleanup of all work on this project according to Article 1104.08 and procedures established in Article 2508.01, B, 4.

2) No separate payment will be made for furnishing protection and cleanup. The costs for protection and cleanup are included in the contract unit prices bid for the various items of work in the contract.

7. Project Submittals and Written Plans.

The Contractor and Engineer shall adhere to the following requirements to ensure appropriate project paper work is submitted in a timely manner. No work will be allowed or progress payments made unless these items have been submitted, reviewed, corrected, and approved as necessary.

a. Three weeks prior to commencing work.

1) Site Soil and River Sediment Sampling Program, as described in Article 2508.01, B, 3, b.

2) Site Work Plan, as described in Article 2508.01, B, 3, d.

a) Environmental Protection Plan.

b) Waste Handling, Storage, and Disposal Plan.

c) Site Air Monitoring Plan.

3) Site Health and Safety Plan.

4) Site Contingency Plan.

5) Decontamination Plan, as described in Article 2508.01, B, 4, e.

6) Written proposal for Beneficial Waste Reuse, as described in Article 2508.01, B, 5, b.

b. Prior to in-bound mobilization.

Certification of Equipment Decontamination, as described in Article 2508.01, B, 4, e.

c. Three weeks prior to erecting containment.

Containment Design, as described in Article 2508.01, B, 4, b.

d. Three weeks prior to commencing production blasting.

1) Analytical results from soil and river sediment sampling, as described in Article 2508.01, B, 4, b.

2) Request to Modify Accumulation Point Security, if applicable, as described in Article 2508.01, B, 4, d.

3) Written request for Disposal Facility Approval, as described in Article 2508.01, B, 5, b.

e. Twelve calendar days following 1st day of production blasting.

1) Furnish analytical data from project sampling paint waste, as described in Article 2508.01, B, 3, b.

2) Furnish estimated waste production quantities.

f. Prior to painting.

1) Written paint mixing procedure, as described in Article 2508.02, E, 4.

2) Manufacturer's Recommendations, as described in Article 2508.02, B, 2.

3) Written designation of the paint manufacturer's technical representative, as described in Article 2508.02, E, 7.

2508.02 PAINTING OF STRUCTURAL STEEL.

A. General.

This work consists of fully repainting, zone painting, or spot painting (or any combination of these) structural steel at designated locations using a paint system designated elsewhere in the contract documents. The work includes:

- Furnishing the coating system specified,
- Application, protection, and curing of paint coatings,
- Protection of all parts of the structure from paint spatter,
- Environmental protection,
- Final cleanup, and
- Supplying all equipment, scaffolding and rigging, labor, and materials.

B. Material Acceptance.

1. Use paints that:
- Are equal to or less than 3.2 pounds per gallon for VOC. Calculation of VOC content shall account for thinning necessary for field application, and
- Contain pigments which are free from or have constituents at levels below a threshold that when disposed of would be regulated by 40 CFR 261.

2. Furnish an electronic copy of the coating manufacturer's certification document for each shipment intended for use on this project. Ensure the document includes the following information:
- Date of shipment to the project,
- Name of painting Contractor or company to which the shipment was made,
- Brand names and product identification numbers,
- The most current Technical Data sheets and SDS for coatings, thinners, and tints,
- Batch or lot numbers, and
- Batch or lot numbers and producer mill certificate for any zinc pigment, certifying compliance to at least the purity requirements of ASTM D 520 Type II.

3. Provide the Engineer with an electronic copy of the latest Technical Data Sheets, ~~M~~SDS ~~sheets~~, and coating manufacturer's written approval for caulking material to be used on this project.

4. Provide the Engineer with an electronic copy of the certification document prior to starting work. Make an additional copy available on-site.

C. Paint System.

The paint system, Epoxy, Moisture Cured Urethane, or Zinc Silicate, for this project is designated elsewhere in the contract documents. The different systems are as follows:

1. Primer Coat.
- **a.** Use a Zinc-rich Epoxy, Zinc-rich Aromatic Moisture Cured Urethane, or Zinc-rich Silicate applied at a rate that results in a targeted dry film thickness (dft) of:
  - 3 to 5 mils for Epoxy.
  - 3 to 4 mils for Moisture Cured Urethane.
  - 3 to 5 mils for Zinc Silicate.
- **b.** There is no color specified for the primer.
- **c.** Dry film thickness listed assumes a surface profile of 1.5 to 2.5 mils. If this is not the case, either because of previous blast cleaning operations or improper quality control on this job, additional dft of primer may be required. In those cases, contact the paint manufacturer to provide a written alternate primer and possible application modifications. Prior to applying additional alternate primer, provide the written alternative to the Engineer for review and approval. Ensure that in no case do surface peaks project above the primer coverage.
- **d.** The use of penetrating sealer, if required, will be designated elsewhere in the contract documents. A penetrating sealer may be required in any of the following areas:
  - Where there are cracks and seams,
  - In feathered (transition) areas,
  - Areas with surfaces prepared by mechanical methods.
- **e.** Apply the sealer at a rate that results in a targeted dft recommended by the paint manufacturer.

2. Intermediate Coat.
- **a.** Use an Aluminum Epoxy Mastic or Aromatic Moisture Cured Urethane applied at a rate that results in a targeted dft of:
  - 5 to 7 mils for Aluminum Epoxy Mastic.
  - 3 to 4 mils for Moisture Cured Urethane, pigmented with micaceous iron oxide.
  - No intermediate coat is required for a zinc-rich silicate system.
- **b.** Tint the intermediate coat to a different color than the primer and finish coats.

3. Finish Coat.
- **a.** Use an Aliphatic Polyurethane, Aliphatic Moisture Cured Urethane, or Waterborne Acrylic applied at a rate that results in a targeted dft of:
  - 3 to 5 mils of Aliphatic Polyurethane for the Epoxy system.

- 2 to 3 mils of Aliphatic Moisture Cured Urethane.
- 2 to 3 mils of Waterborne Acrylic for the Zinc Silicate system.

b. For the top coat use Federal Color Number 14223 for highway bridges or the color specified in the contract documents.

D. Acceptable Products.

1. **General.**
   a. Refer elsewhere in the contract documents for the system specified for this project. Acceptable suppliers and products for each system are listed in Materials I.M.s 482.02 through 482.06. Choose material for the paint system specified (including thinners, tinting, etc.) from one of the coating manufacturers.
   b. When specified in the contract documents, use a penetrating sealer that is:
   - Designated by the paint manufacturer for the system specified, and
   - Tinted to a different color than that of the primer.

2. Epoxy System.
Use a three coat epoxy paint system consisting of:
- A Zinc-rich Epoxy primer,
- A High-solids Aluminum Epoxy Mastic intermediate coat, and
- An Aliphatic Polyurethane top coat.

3. Moisture Cured Urethane.
Use a three coat moisture cured urethane paint system consisting of:
- A Zinc-rich Aromatic Moisture Cured Urethane primer,
- A Moisture Cured Urethane - pigmented with micaceous iron oxide intermediate coat, and
- An Aliphatic Moisture Cured Urethane top coat.

4. Zinc Silicate.
Use a paint system consisting of a single coat of Zinc Silicate primer with a Waterborne Acrylic top coat system.

E. Application.

1. General.
Apply paint using brush, roller, or spray methods. Apply paint in strict compliance with the coating manufacturer's latest written recommendations. Regardless of the method of application, ensure the specified minimum dft is achieved. Ensure the manufacturer's recommended maximum dft requirement for each coat is not exceeded without approval of the paint manufacturer's technical representative. Additionally:
a. Ensure product parameters, such as application, thinning, mixing, pot life, ventilation, curing, and so forth comply with the manufacturer's recommendations.
b. Ensure the prime, intermediate, and finish coats have a smooth, uniform appearance free from runs, sags, cracks, dry spray, over-spray, or other defects.
c. Shield concrete and galvanized products so that paint application on steel is full and complete without over-spray.
d. Upon completion, permanently stencil the word "painted" followed by the Contractor's name, the month, year, coating system, and manufacturer of the coating system applied. Stencil this information on an inconspicuous surface in a manner and location the Engineer approves.
e. Provide OSHA compliant access for the Engineer to check the surface preparation before painting and the dft after each coat is applied.

2. Painting.
a. Penetrating Sealer.
Apply penetrating sealer to areas designated in the contract documents. Allow to cure according to the coating manufacturer's recommendations before the prime coat is applied.
b. Prime Coat.
1) Apply a prime coat to all areas blasted clean or mechanically cleaned, or both. Apply this coat to areas of bare metal within 24 hours of being blast cleaned. Brush blast the entire prepared area before paint is applied if:
- The prepared surface shows any sign of flash rust, or

- The prime coat is not applied within 24 hours after blast cleaning.

2) Use methods acceptable to the Engineer to re-prepare areas which were prepared by mechanical methods and are showing flash rust.

3) ~~Pay special attention to all rivets, bolts, edges of connections, areas of pack rust, and areas which may be difficult to access. These areas may require ringing/stripping.~~ Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

4) Allow the prime and stripe coat to cure according to the coating manufacturer's recommendations before the intermediate coat is applied.

c. Intermediate Coat.

1) Apply the intermediate coat to all areas that received a prime coat. Allow to cure according to the coating manufacturer's recommendations before the finish coat is applied.

2) Apply a stripe coat by brush to edges, welds, crevices, bolt heads, and other surface irregularities when applying the primer coat. The stripe coat may be applied to the surface by spray as long as it is immediately and thoroughly worked into these areas by brush.

~~2)~~**3)** The Zinc Silicate system does not require an intermediate coat.

d. Finish Coat.

Fully cover the intermediate coat with the finish coat. Fully cover other surfaces with the finish coat if designated in the contract documents.

3. Recoating.

a. Surface Condition.

1) Ensure surfaces are free of dirt, oxidation products, oil, and other detrimental material prior to painting. Perform cleaning which may be necessary according to the coating manufacturer's recommendations.

2) Protect all painted surfaces to prevent soiling or detrimental weather conditions during painting and through the tack-free stage.

b. Minimum Time.

1) No additional coat(s) of paint may be applied until the preceding coat has dried. Recoat according to the coating manufacturer's recommendations for time, temperature (ambient and/or surface), and weather conditions.

2) If minimum recoat times are not given by the coating manufacturer, wait at least 24 hours, and until the previous coat is tack-free, before applying the next coat.

c. Maximum Time.

Do not exceed the coating manufacturer's maximum time between coats. If the maximum recoat time is exceeded for any coat, provide the Engineer with a written correction procedure, or approval to proceed without correction, obtained from the coating manufacturer's technical representative.

4. Mixing.

a. Mix paint according to the coating manufacturer's recommendations. Do not use previously opened or partially used containers of paint. Partial kit mixing will not be allowed.

b. Together with the coating manufacturer, provide a specific mixing procedure for the Engineer's review prior to performing the work. Follow this procedure unless the Engineer approves a written request to modify it.

5. Dry Film Thickness.

a. The Engineer will determine the dft of each coat and the total paint system using procedures described in SSPC-PA 2. Excessive coating thickness is as equally undesirable as unacceptably thin coating thickness, and both will be sufficient cause for rejection.

b. Targeted dft is specified herein. Touch up areas having less than specified dft to increase dft to at least that specified in this Article for the system specified. Depending on the condition of the steel substrate and paint system being used, it is possible these areas will require reblasting and repainting.

c. Excessive thickness will be evaluated on a case-by-case basis in consultation with the coating manufacturer. Depending on the condition of the steel substrate and paint system being used, it is possible these areas will require reblasting and repainting.

6. Cracks and Seams.

a. Use a best effort combination of blasting and possible hand or power tool cleaning to clean cracks and seams that are formed by junctions of joining members, splices, gusset plates, rivets, bolts, nuts, and similar surface irregularities. After application of any penetrating sealer and prior to

application of the prime coat, caulk all cracks and seams that are equal to, or greater than, 3/16 inch wide with a durable caulking compound recommended by the paint manufacturer.

b. Seal cracks and seams less than 3/16 inch wide with the prime coat. Seal cracks and seams that cannot be sealed with the prime coat using caulk ~~before~~ after the intermediate coat and before the top coat is applied. In the case of Zinc Silicate, this will be after the primer and before the top coat is applied.

c. Use lead free caulking compound, supplied with the latest technical data and SDS sheets. Obtain the paint manufacturer's and the Engineer's approval prior to incorporation into the project.

7. Technical Assistance.

a. Have the coating manufacturer whose products are used on this contract designate a qualified technical representative to support this project. The technical representative shall be available for on-site assistance and project coating consultation as may be required.

b. Difficulties in scheduling on-site technical assistance will not be considered a sufficient reason for approving time extensions to the contract period.

c. Ensure that, in all cases, application parameters are according to the product's Technical Data Sheet or the manufacturer's written recommendations, unless superseded elsewhere in this specification or in the contract documents.

F. Application Conditions.

1. Apply the manufacturer's published weather restrictions for each coating, except as modified below.

2. Paint only when weather conditions are such that the surfaces to be painted are entirely free from moisture, frost, ice, and snow. When painting in an area protected from the above conditions, protect the surface under cover until the paint is dry.

3. If wet paint is exposed to humidity, rain, snow, or condensation, allow it to dry. Remove damaged paint, reclean the surface, and repaint.

4. Moisture Cured Urethane coating may only be applied when:

- Surface temperatures are between 38°F and rising and 100°F.
- Relative humidity is less than or equal to 95%.

5. Bubbling or pinholing which may occur in Moisture Cured Urethane will be evaluated using SSPC-VIS2. Bubbling or pinholing shall be less than 0.1% as defined by SSPC-VIS2, Photographic Standard No. 8.

2508.03 COAST GUARD REQUIREMENTS.

Apply the following for contracts that require work in and over navigable waters.

A. Comply with the following requirements:

- Established by the Corps of Engineers, the US Coast Guard, and others relative to construction work in and over navigable waters, and
- Applicable to this project, but not covered by existing permits.

B. Construction work includes, but not necessarily limited to:

- Bridge washing, paint removal, cleaning structural steel by blasting, and painting structural steel,
- Containment enclosures, safeguards and temporary falsework or platforms, and lighting during construction, and
- Anchorage of barges and construction equipment, temporary restriction of channel width, and the removal of all temporary construction.

C. Ensure operations within or over the river comply with the requirements or directions of the US Coast Guard District Engineer.

D. The following precautionary measures shall be taken during the performance of this work:

1. Perform work so that the free flow of navigation is not interfered with and navigable depths are not impaired.

2. Ensure floating equipment working in the channel displays lights and signals as required by the current Inland Navigational Rules.

3. If scaffolding or nets are suspended below low steel in the navigation span, contact the Coast Guard Office in St. Louis, Missouri, so that the temporary reductions in clearance for river traffic can be checked and appropriate notices can be published. Remove such scaffolding or nets at night, if required by the Coast Guard.

4. Take positive precautions to prevent spark producing, flame producing, lighted, or other damaging objects from accidentally dropping onto barges or vessels passing beneath the bridge. Cease all flame cutting, welding, and similar spark-producing operations over the channel when vessels are passing beneath the bridge.

5. Ensure work does not interfere with displaying navigation lights on the bridge at night.

6. Immediately remove any material, machinery, plant, or appliance which is lost, thrown from the bridge, sunken, or misplaced during the progress of the work, and which in the Engineer's opinion may be dangerous or obstructive to navigation. Immediately notify the Engineer and provide a description and location of the obstruction. When required, mark or buoy such obstructions until the obstruction is removed.

E. The Federal Water Pollution Control act, as amended, prohibits the discharge of oil, including oil based paints, or hazardous substances into the waters of the United States. The law requires any person in charge of a vessel or facility from which oil or a hazardous substance is discharged shall immediately report the discharge to the US Coast Guard National Response Center at 800.424.8802.

F. The owner/operator of a vessel or facility from which the pollutant is discharged is subject to civil penalties and is liable for cleanup costs, if any.

G. Inform the US Coast Guard office in St. Louis, Missouri, the status of this work to enable them to issue cautionary notices to mariners. If the Contractor has a marine radio at the job site, furnish the Coast Guard the call sign and operating frequency so that the information can be included in their notices.

H. No changes in channel conditions or in river bank conditions from natural causes or by reason of channel improvements or other construction, nor methods of river control by the United States or the state are to be considered as having any bearing or effect on the obligations of the contract nor justification for any claim for additional payments or extensions of time.

I. In the event that the US Coast Guard or other constituted authorities should, during the progress of work, issue directions or orders affecting the Contractor's operations or order of procedure, promptly file with the Engineer a copy of such order or restrictions from the Corps of Engineers, US Army, US Coast Guard, and/or other authority having jurisdiction.

2508.04 METHOD OF MEASUREMENT.
Lump sum items. No method of measurement.

2508.05 BASIS OF PAYMENT.

A. Payment for the items below will be the lump sum contract price.

1. **Bridge Cleaning for Painting.**
   Payment is full compensation for furnishing materials, labor, and equipment to perform the work in accordance with contract documents.

2. **Blast Cleaning of Structural Steel.**
   Payment is full compensation for furnishing materials, labor, and equipment to perform the work in accordance with contract documents.

3. **Containment.**
   - **a.** Payment is full compensation for furnishing materials, labor, and equipment necessary to install and maintain the containment during blast cleaning operations or paint removal by other methods.
   - **b.** For non-hazardous paint removal, payment is also full compensation for monitoring, sampling, testing, reporting, temporary enclosures, temporary storage of waste, and disposal of waste.
   - **c.** For hazardous paint removal, payment is full compensation for:

- Furnishing all materials, labor, and equipment to perform all work necessary for containment enclosures,
- Air monitoring, sampling, and testing,
- Decontamination,
- Handling, sampling and testing, containerizing, and storage of paint waste, and
- Installing, maintaining, and removing the waste accumulation points.

4. Paint Waste Transport and Disposal.
Payment is full compensation for furnishing materials, labor, and equipment to perform all work necessary for:

- The proper transport of paint waste,
- The proper disposal of paint waste,
- Analytical testing of paint waste,
- Obtaining all necessary permits and manifests, and
- Preparation of permits and manifests.

5. Painting of Structural Steel.
Payment is full compensation for:

- All materials, labor, equipment,
- Providing material acceptance documents, and
- Providing technical assistance in accordance with contract documents.

B. Coast Guard Requirements will be incidental to the items of work for which they apply.

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/ Todd Hanson	**Office:** Construction & Materials	**Item 4**
Submittal Date: January 2024	**Proposed Effective Date:** October 2024	
Article No.: 2529.02, B, 9 **Title:** Concrete Mixtures (Full Depth Finish Patches) **Article No.:** 2529.03, G, 4 **Title:** Placing Full Depth Portland Cement Concrete Finish Patches (Full Depth Finish Patches)	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2529.02, B, 9, Concrete Mixtures.

Add to the end of the Article:

When earlier opening time is required, use rapid set patch materials in accordance with Materials I.M. 491.20 and manufacturers recommendations.

2529.03, G, 4.

Add as the fourth sentence:

Cure patches using rapid set patch materials a minimum of 3 hours.

Comments:

Member's Requested Change: (Do not use '**Track Changes**', or '**Mark-Up**'. Use ~~**Strikeout**~~ and **Highlight**.)

2529.02 B 9

9. Concrete Mixtures.

For PCC patches, use Class M mixtures with calcium chloride. Use Class M without calcium chloride for patches cured for 24 hours. When earlier opening time is required, use rapid set patch materials in accordance with Materials I.M. 491.20 and manufacturers recommendations.

2529.03 G 4

4. Cure PCC patches placed on multi-lane sections for a minimum of 10 hours before opening to traffic. Cure PCC patches placed on two-lane sections a minimum of 5 hours before opening to traffic. When allowed by the contract documents or Engineer, cure PCC patches without calcium chloride on multi-lane sections a minimum of 24 hours. Cure rapid set patch materials a minimum of 3 hours. These restrictions may be modified in the plans or by the Engineer for specific sections.

Reason for Revision: Already allowed in partial depth patches 2530. Have had requests to use in full depth patches when quicker opening is needed.		
New Bid Item Required (X one)	**Yes**	**No** x
Bid Item Modification Required (X one)	**Yes**	**No** x
Bid Item Obsoletion Required (X one)	**Yes**	**No** x
Comments:		
County or City Comments:		
Industry Comments: Request from ICPA and CPR contractors.		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove/ Todd Hanson	**Office:** Construction & Materials	**Item 5**
Submittal Date: January 2024	**Proposed Effective Date:** October 2024	
Article No.: 2529.02, B, 10 **Title:** Full Depth Finish Patches **Article No.:** 2556.02, A, 1 **Title:** Dowel Bar Retrofit	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

2529.02, B, 10, Dowel Bars and Tie Bars.

Add to the end of the Article:

Glass fiber reinforced polymer (GFRP) dowels meeting limitations and requirements of Section 4156 may be substituted.

2556.02, A, 1.

Add to the end of the Article:

Glass fiber reinforced polymer (GFRP) dowels meeting limitations and requirements of Section 4156 may be substituted.

Comments:

Member's Requested Change: (Do not use '**Track Changes**', or '**Mark-Up**'. Use ~~**Strikeout**~~ and **Highlight**.)

2529.02, B, 10

10. Dowel Bars and Tie Bars.
Use epoxy coated dowel bars meeting the requirements of Article 4151.02, C. Use tie bars cut from epoxy coated reinforcing bars as specified in Article 4151.03, C. Glass fiber reinforced polymer (GFRP) dowels meeting limitations and requirements of Section 4156 may be substituted.

2556.02 MATERIALS.

A. Epoxy Coated Dowel Bars.

1. Ensure epoxy coated dowel bars, 1.5 inches by 15 inches, conform to requirements of Section 4151. Uniformly coat dowel bars with approved bond breaker according to Article 4151.02, B. Glass fiber reinforced polymer (GFRP) dowels meeting limitations and requirements of Section 4156 may be substituted.

Reason for Revision: Article 4156 allows glass fiber reinforced polymers dowels in patches and dowel

bar retrofit, but not specified in 2529 or 2556.		
New Bid Item Required (X one)	**Yes**	**No** x
Bid Item Modification Required (X one)	**Yes**	**No** x
Bid Item Obsoletion Required (X one)	**Yes**	**No** x
Comments:		
County or City Comments:		
Industry Comments: ICPA contacted us to note missing language. Spec change sent to ICPA.		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove	**Office:** Construction & Materials	**Item 6**
Submittal Date: January 2024	**Proposed Effective Date:** October 2024	
Article No.: 4116.05 **Title:** Class V Aggregate for Portland Cement Concrete	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text:

4116.05, Cement Requirements.

Replace Table 4116.05-1:

Table 4116.05-1: Cement Types and Substitutions

Cement Type	Min. Required Substitution	Max. Allowable Substitution
Type I, ~~Type~~ II, IL	20% Class F Fly Ash	25% Class F Fly Ash
Type I, ~~Type~~ II, IL	25% GGBFS	35% GGBFS
Type IS, IP	---	20% Class C Fly Ash

Comments:

Member's Requested Change: (Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)

4116.05 CEMENT REQUIREMENTS.

For Interstate and Primary projects, use the cement types and substitutions of Table 4116.05-1 when Class V aggregate is used.

Table 4116.05-1: Cement Types and Substitutions

Cement Type	Min. Required Substitution	Max. Allowable Substitution
Type I, ~~Type~~ II, IL	20% Class F Fly Ash	25% Class F Fly Ash
Type I, ~~Type~~ II, IL	25% GGBFS	35% GGBFS
Type IS, IP	---	20% Class C Fly Ash

Reason for Revision: Type IL missing on table of cement replacement requirements

New Bid Item Required (X one)	**Yes**	**No** x
Bid Item Modification Required (X one)	**Yes**	**No** x

Bid Item Obsoletion Required (X one)	**Yes**	**No** x
Comments:		
County or City Comments:		
Industry Comments: sent to ICPA		

Form 510130 (08-15)

IOWA DOT

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Nicole Moore/Dillon Feldmann	**Office:** Local Systems	**Item 7**
Submittal Date: 1/3/2024	**Proposed Effective Date:** ASAP	
Article No.: **Title:**	**Other:** DS-23049, PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance For Local Systems (Non-Federal Aid)	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:**

Specification Committee Approved Text:

Comments:

Specification Section Recommended Text: See attached draft Developmental Specifications for PCC Pavement Non-Destructive Thickness Determination Contractor Quality Control and Acceptance For Local Systems (Non-Federal Aid).

Comments:

Member's Requested Change: (Do not use '**Track Changes**', or '**Mark-Up**'. Use ~~**Strikeout**~~ and **Highlight**.)
See attached document.

Reason for Revision: After conversation with FHWA, it was considered that the DS could apply to Non-NHS federal aid projects.

New Bid Item Required (X one)	**Yes**	**No** X
Bid Item Modification Required (X one)	**Yes**	**No** X
Bid Item Obsoletion Required (X one)	**Yes**	**No** X

Comments:

County or City Comments:

Industry Comments: Industry has requested use of MIT thickness as an option to coring. Counties agree.

DRAFT DS-23XXX
(Replaces DS-23049)

DEVELOPMENTAL SPECIFICATIONS
FOR
PCC PAVEMENT NON-DESTRUCTIVE THICKNESS DETERMINATION CONTRACTOR QUALITY CONTROL AND ACCEPTANCE FOR LOCAL SYSTEMS ~~(NON-FEDERAL AID)~~

Effective Date
March 19, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

This developmental specification is not to be used on contracts involving the National Highway System (NHS).

Replace Article 2301.04, A, 2 with the following.

2. Requirements for thickness do not apply to detour pavements, paved drives, and temporary pavements. The thickness of pavement constructed will be determined as follows:

a. The division of sections, lots, and thickness measurement locations will be ~~determined by the Engineer according to Materials I.M. 346~~ according to Appendix A.

b. ~~For Interstate and Primary projects, evaluate pavement thickness for sections of the same design thickness more than 3500 square yards using non-destructive testing according to Materials I.M. 346 Method A.~~ At locations determined by the Engineer.

~~**c.** For non-Primary projects evaluate pavement thickness for sections of the same design thickness more than 3500 square yards by coring according to Materials I.M. 346 Method B. The specification will be adopted in its entirety.~~

~~**d**~~ **c.** Determine thickness for sections of the same design thickness 3500 square yards or less, by probing plastic concrete in accordance with Materials I.M. 396.

~~**e**~~ **d.** Only sections which are evaluated for thickness will be included in the thickness index determination. Areas not evaluated for thickness will be paid for at the contract unit price.

APPENDIX A
EVALUATING PORTLAND CEMENT
CONCRETE PAVEMENT THICKNESS

SCOPE

Thickness measurements will be taken on Portland Cement Concrete (PCC) pavement, to determine the pavement thickness and the thickness index for each section. Refer to Specification DS-15xxx.

APPARATUS

1. An MIT Scan T2 or T3 gauge will be used to perform thickness measures.
2. Steel Targets will be 11.81 inches in diameter, 24 gauge, meeting ASTM A 653, commercial steel with a G90 coating (about 275 g/m^2 total both sides).

DEFINITIONS

Section: All Portland Cement Concrete in a project of the same bid item. Irregular areas, as defined herein, of the same bid item shall form a separate section. On multiple year projects, a separate section will be formed for each year. If less than 20,000 square yards are placed in one year, that section will be grouped with a previous or subsequent year.

Lot: A portion of a section normally 200 feet in length and 2 traffic lanes wide.

Regular area pavement sections:

- All mainline pavement for normal travel lanes. Includes middle (both direction) turn lanes
- Paved shoulder – if same thickness as pavement and part of pavement bid item include with pavement. If separate bid item, treat as separate section.
- Paved median - if same thickness as pavement and part of pavement bid item, and longer than 300 feet, include with pavement.
- Auxiliary lanes of full width longer 300 feet.
- Widening greater than 6 feet.

Irregular areas:

- Widening less than 6 feet.
- Side street connections.
- Ramps, including gore areas, and collector distributor roads.
- Deceleration and acceleration lanes.
- Turn lanes, including taper sections.
- Tapers.
- Radiuses.
- Median crossovers

PROCEDURES

The Engineer will determine the location of each lot, the random location of each metal target, and the random thickness measuring scheme for each section using an Iowa DOT developed MSExcel spreadsheet. Immediately prior to paving, the Engineer will place the target or observe the contractor place the target.

A. Target Location for Regular Areas

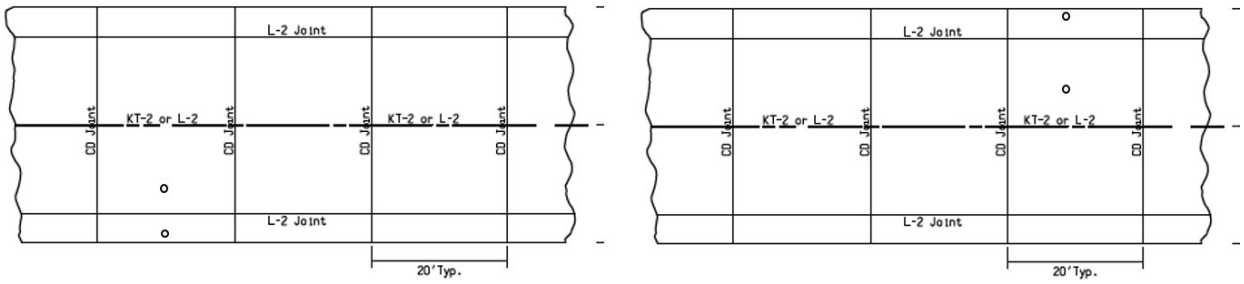
1. Divide the section longitudinally into 2000 square yard lots. One target will be located in each lot based on the spreadsheet selection. Beginning with the first station at +00, place a target from the edge of the pavement half way between dowel baskets~~)~~. See Figure 1. If the +00 station falls on a basket, move the target location ahead halfway between the dowel baskets. A minimum of ten targets will be tested. If a target location falls on a bridge or in an approach section, it will be eliminated.

2. The transverse location of the targets will be randomly determined by the spreadsheet program. The random locations will be 4 foot from edge of pavement, left or right. For ease of measuring, plates may be placed 18 inches from the edge if there is no tie steel or a work bridge is not available.

3. The program will randomly determine which targets to measure. If a measurement location falls on a bridge or bridge approach pavement, it will be eliminated and the next closest target not in the original random selection will be used for measurement.

4. Shoulders. Divide the section into 800 foot long lots including both shoulders. Beginning with the first station at +00, locate a target every 400 feet, alternating between the inside and outside shoulder (or every 800 feet on one side). On 6 foot shoulders or wider, the targets should be 4 feet from the edge of the pavement. On 4 foot shoulders, the targets should be 3 feet from the edge of the pavement.

Figure1. Target Location



B. Target Location for Irregular Areas

1. All irregular areas of the same design thickness will be grouped together for determining the number of lots. The Engineer may waive sections of the same design thickness that total less than 5000 square yards.

2. Place targets randomly in all irregular areas larger than 100 square yards. One target will be randomly located in each selected irregular area For irregular areas greater than 1000 square yards, randomly place a minimum of two targets. Targets must be placed at least 2 feet away from tie steel and 4 feet from dowel bars. A minimum of ten targets will be tested to represent each section of irregular areas. For projects with less than ten irregular areas larger than 100 square yards, select a minimum of three areas to place targets. All targets will be measured. If more than 20 targets are located in irregular areas, randomly select 50% to be tested.

C. Testing

Follow the manufacturer's instructions for operating the thickness gauge. It is important to avoid testing close to any steel including vehicles, equipment, steel toed shoes as well as tie bars, dowel bars and baskets, and manhole covers. When wearing steel toed shoes, always keep both toes at least 2 feet from the gauge during the test. Three total repeat readings will be taken. The readings should all be within 4 mm (0.15 in.) of each other.

D. Section Evaluation

1. Use the following formula to determine the mean thickness for the section:

$$\overline{X} = \frac{\sum X}{n}$$

Where: $\overline{X}$ = mean length for the section

$\sum X$ = sum of core lengths for the section

n = number of cores taken within the section

Round the mean thickness to two decimal places.

2. Use the following formula to determine the sample standard deviation of the thickness of the section:

$$S = \sqrt{\frac{\sum \left(X - \overline{X}\right)^2}{n - 1}}$$

Where:

S = thickness standard deviation for the section.
$\overline{X}$ = mean thickness for the section
X = individual thickness values for the section.
n = number of tests representing the section.

$\sum$ = sign indicating the sum of all values of $(X - \overline{X})^2$

Round the sample standard deviation to two decimal places.

NOTE: Calculations of the standard deviation are best made with an electronic calculator with standard deviation capability that uses the formula containing the quantity (n-1).

3. Use the following formula to determine the thickness index for the section of pavement thickness.

$$TI = (\overline{X} - S) - T$$

Where:

TI = thickness index for the section
$\overline{X}$ = mean thickness length for the section
T = design thickness, including subbase adjustment in IM 346
S = measurement thickness standard deviation (of the sample) for the section

Round the thickness index to two decimal places.

NOTE: If the mean thickness minus the standard deviation is less than T of the section, the thickness index will be a negative number.

4. Basis of Payment. Payment for the quantities of pavement in square yards in each section will be as shown in Article 2301.05 of the Standard Specifications and based on the thickness index as determined in accordance with these instructions.

E. Quality Assurance Testing
The Engineer will perform quality assurance testing by probing.

1. Probing – The Engineer may probe a minimum of one (1) test per seven (7) plates at random locations during paving operations in accordance with Materials IM 396. Plates may be moved to 18 inches from the edge of the pavement to allow easier testing.

2. The Engineer may utilize a MIT SCAN T2 or T3 gage, other than the one used by the contractor, to test a minimum of ten random locations.

3. The Engineer may also survey, to a minimum of 0.005 foot, on the plate prior to paving and on top of the pavement directly over the plate after placement to determine an accurate thickness verification.

F. Deficient Areas

1. If any measurement is deficient from T by 1 inch or more, the measurement should be rechecked to confirm the reading and the equipment. If the repeat measurement is also 1 inch or more below T, mark the location directly over the target. The Contractor shall drill a 4.0 inch diameter core at that location. If the core length confirms the pavement is deficient by 1 inch or more, continue to drill cores as described below.

2. Deficient areas, represented by cores deficient in length by 1 inch or more from design thickness, are to be replaced. These areas will be determined by drilling a core 60 feet in each direction longitudinally at the

same transverse location from the deficient core. Drilling will be continued at 60 feet intervals until a core is obtained which is not deficient by 1 inch or more from design thickness. Interpolate between this core and the adjacent core to determine the limits of the deficient area. This is the area to be removed and replaced at contractor's expense. These additional cores are to be used to define the deficient area and will not be used in the thickness index calculation. When an obstruction, such as a bridge, intersection, previous work, etc., prevents drilling a core at the required 60 feet interval in either direction longitudinally, continue the balance of the distance on the other side of the obstruction.

3. Any readings taken in the area for removal will be eliminated from the analysis for the entire section. A minimum of two plates will be placed on alternate sides prior to placement. After replacement, the contractor measure the thickness using the MIT SCAN to verify the thickness. The engineer will witness the measurement.

G. Final Pavement Thickness Measurement

1. Include all MIT SCAN measurements and probe measurements. The final pavement thickness will be determined by one of the following:
    a. If all the probe measurements are within ±0.25" of the MIT SCAN measurements, the MIT SCAN measurements will be considered validated. The Engineer will determine final thickness based on the average MIT SCAN measurements.
    b. If at any one location, the probe measurements are greater than ±0.25" difference from the MIT SCAN measurements, the contractor will core at the plate location and 2 feet away from the plate location. If the core at the plate location indicates that it has moved during placement, use the core thickness from the core taken two feet away as the pavement thickness. The Engineer will replace the MIT SCAN thickness at the location with the core thickness taken two feet away along with the average MIT SCAN measurements as final pavement thickness.
    c. If all of the probe measurements are greater than ±0.25" difference from the MIT SCAN measurements, the Engineer will randomly select a minimum of 10 random locations, at two feet from the plate location, for coring by the contractor. The Engineer will use the average core thickness, tested in accordance with IM 346, to determine final pavement thickness.