

## 500 STRUCTURES

### ITEM 514 – PAINTING OF STRUCTURAL STEEL

- 514.01 Description**
- 514.02 Material**
- 514.03 *Quality Control***
- 514.04 *Testing Equipment***
- 514.05 *Work Limitations***
- 514.06 *Protection of Persons and Property***
- 514.07 *Pollution Control***
- 514.08 *Safety Requirements and Precautions***
- 514.09 *Inspection Access Job Site Visual Standards***
- 514.11 *Surface Preparation***
- 514.12 *Washing Shop Primer***
- 514.13 *Handling***
- 514.14 *Mixing and Thinning***
- 514.15 *Coating Application***
- 514.16 *Removing Fins, Tears or Slivers***
- 514.17 *Caulking***
- 514.18 *Dry Film Thickness***
- 514.19 *Repair Procedures***
- 514. 20 Method of Measurement**
- 514. 21 Basis of Payment**

**514.01 Description.** This work consists of cleaning and painting all steel surfaces.

**514.02 Material.** *On existing steel, apply a 3-coat paint system consisting of an organic zinc prime coat, an epoxy intermediate coat, and a urethane finish coat. The coating system shall conform to 708.02.*

*On new steel, apply a 3-coat paint system consisting of an inorganic zinc prime coat, an epoxy intermediate coat, and a urethane finish coat. The prime coat shall conform to 708.01, and the intermediate and finish coats shall conform to 708.02. Supply the intermediate and finish coats from the same manufacturer. The Contractor may supply the prime coat from a manufacturer other than the manufacturer of the intermediate and finish coats.*

*For caulking, use a 2-component, non-sag, non-shrink 100 percent solids epoxy capable of filling voids up to 1 inch (25 mm) wide.*

**514.03 *Quality Control.*** *Quality control consists of designating quality control specialists to control the quality of work in each phase established by quality control*

*points (QCP). Control quality by inspection, tests, and cooperation with inspection and testing performed by the Engineer and the inspector.*

*Before starting work in the field, identify the individuals dedicated to performing duties as painting quality control specialists. Provide the Engineer with documentation that the individuals are NACE Certified or have received formal training from one of the following: KTA Tator, S.G. Pinney, or Corrosion Control Consultants. Provide the number of quality control specialists necessary to assign a maximum of 3 work sites with on-going field work to each quality control specialist.*

*For work in the fabrication shop, each fabricator shall identify a full-time individual dedicated to performing duties as the painting quality control specialist. Provide the Engineer with certification or training documents described above no later than the pre-fabrication meeting.*

*Do not use the painting quality control specialist to perform production duties including supervising, blasting, painting, waste disposal, mixing, operating or repairing equipment or other tasks not associated with the duties as the quality control specialists while production work is taking*

*Ensure that each quality control specialist is trained and is equipped with material safety data sheets, tools, and equipment necessary to provide quality control on all aspects of the work. The quality control specialists shall have a thorough understanding of the plans and specifications pertaining to this project. Duties of the quality control specialists include:*

- 1. Inspecting equipment, abrasive, at specified intervals.*
- 2. The work at all quality control points.*
- 3. Verifying the Contractor or fabricator performed work according to the specified work limitations.*
- 4. Cooperating with the inspection and testing performed by the Engineer and inspector.*
- 5. Documenting test results and comparing test results with the inspector's results.*
- 6. Notifying the foreman of nonconforming work.*
- 7. Stopping work when test equipment is not available and when necessary to ensure the work is performed according to contract.*

*The fabricator's quality control specialists shall provide the Engineer with a letter that includes specified information or check point data documenting acceptance of the work. The information or check point data consists of the following:*

1. Checks on the abrasive to ensure that it has not been contaminated with oil.
2. The profile of the blasted surface.
3. The air and steel temperature and dew point before blast cleaning and painting and at 4-hour intervals during the blasting and painting operation.
4. Readings of actual dry film thickness.
5. The lot and stock number of the paint and the date of manufacture.
6. TE-24 for the coating used in the shop.
7. Documentation that the paint mixer is functioning properly, that each spray operator has demonstrated the ability to paint, and that all spray equipment is used as per the manufacturer's recommendation.

**Quality Control Points.** QCP's are points in time when one phase of work is complete and ready for inspection by both the quality control specialists and the Engineer prior to continuing with the next phase or work. At the QCP, the Contractor or fabricator shall provide the quality control specialists and the Engineer access to inspect all affected surfaces. If inspection identifies a deficiency, correct the deficiency according to the contract before starting the next phase of work. Discovery of defective work or material after a QCP is past or failure of the final product before final acceptance, shall not, in any way prevent the City from rejecting the final product or obligate the City to final acceptance.

	<b>Quality Control Points</b>	<b>Purpose</b>	<b>New Steel</b>	<b>Existing Steel</b>
1.	<i>Solvent Cleaning</i>	<i>Remove asphaltic cement, oil, grease, etc.</i>	<i>Yes</i>	<i>Yes</i>
2.	<i>Grinding Flange Edges</i>	<i>Remove sharp corners</i>	<i>Yes</i>	<i>Yes</i>
3.	<i>Abrasive Blasting</i>	<i>Blast surfaces to receive paint</i>	<i>Yes</i>	<i>Yes</i>
4.	<i>Containment/Waste Disposal</i>	<i>Contain, collect, &amp; dispose of abrasive blasting debris</i>	<i>No</i>	<i>Yes</i>
5.	<i>Prime Coat Application</i>	<i>Check surface cleanliness, apply prime coat, check coating thickness</i>	<i>Yes</i>	<i>Yes</i>
6.	<i>Remove fins, tears, &amp; slivers</i>	<i>Remove surface defects and slivers</i>	<i>Yes</i>	<i>Yes</i>
7.	<i>Washing of Shop Primer</i>	<i>Remove all water soluble materials (salt, dirt, etc.)</i>	<i>No</i>	<i>Yes</i>

8.	<i>Intermediate Coat Application</i>	<i>Check surface cleanliness, apply intermediate coat, check coating thickness</i>	<i>Yes</i>	<i>No</i>
9.	<i>Caulking</i>	<i>Caulk areas not sealed by the intermediate coat.</i>	<i>Yes</i>	<i>Yes</i>
10.	<i>Finish Coat Application</i>	<i>Check surface cleanliness, apply finish coat, check coat thickness</i>	<i>Yes</i>	<i>Yes</i>
11.	<i>Final Review</i>	<i>Acceptance and check total system thickness</i>	<i>Yes</i>	<i>Yes</i>

**514.04 Testing Equipment.** *For the project duration, provide the Engineer with the test equipment listed below for the type of work at each work site with on-going work in the field. With the exception of the recording thermometer, the fabricator shall provide its quality control specialists with the test equipment listed below. The Contractor and fabricator shall maintain all testing equipment in good working order. When no test equipment is available, no work shall be performed.*

- A. *A camera with the following features and 5 (unless otherwise specified on the plans) packs of color film:*
  - 1. *Uses self-developing color print film.*
  - 2. *Lens with auto-focus system.*
  - 3. *Focuses from 2 feet (0.6 m) to infinity.*
  - 4. *Built-in flash.*
- B. *One spring micrometer and 3 rolls of extra-course replica tape.*
- C. *One Positector 2000 or 6000, Quanix 2200, or Elcometer A345FB11: and two sets of calibration plates. The first set shall be 1.5 to 8 mils and the second set shall be 10 to 25 mils (38 to 200  $\mu\text{m}$  and 250 to 625  $\mu\text{m}$ ). Both sets shall be as per the NBS calibration standards according to ASTM D 1186.*
- D. *One sling Psychrometer including Psychometric tables.*
- E. *Two steel surface thermometers accurate within 2 °F (1 °C).*
- F. *Flashlight 2-D cell.*
- G. *SSPC Visual Standard for Abrasive Blast Cleaned Steel (SSPC-VIS 1-89).*
- H. *One Recorder Thermometer capable of recording the date, time, and temperature over a period of at least 12 hours.*

**514.05 Work Limitations.** Apply the prime coat to new structural steel inside permanent buildings at the fabricator's facility. If inside permanent buildings, the fabricator may perform year-round abrasive blasting and painting. Perform abrasive blasting and painting in the field from April 1 to October 31. The City will not issue a time extension due to adverse weather during the month of April. The plans may require additional work limitations for specific bridges or projects.

**Temperature.** Except for inorganic zinc, apply paint when the steel, air or paint temperature is 50° F (10° C) or higher and expected to remain higher than 50° F (10 °C) for the cure times listed below. Apply inorganic zinc when the steel, air, or paint is 40° F (4° C) or higher. Cure inorganic zinc according to the minimum curing time and temperatures specified in the paint manufacturer's printed instructions.

	<b>50° F (10° C)</b>	<b>60° F (16° C)</b>	<b>70° F (21° C)</b>
<i>Primer (Organic Zinc)</i>	4 hrs	3 hrs	2 hrs
<i>Intermediate</i>	6 hrs	5 hrs	4 hrs
<i>Finish</i>	8 hrs	6 hrs	4 hrs

Monitor the temperatures listed above for cure times using the recording thermometer.

The Contractor may use a heated enclosure or building. Supply heat to continuously and uniformly maintain the required curing temperature within the enclosure or building until the coating has cured.

If combustion type heating units are used, vent the units away from the enclosure or building and do not allow the exhaust fumes to enter the enclosure or the building. Do not use open combustion in the enclosure or the building.

The fabricator may use radiant heat when painting new structural steel inside the permanent shop buildings. Locate radiant heaters at least 10 feet (3 m) above all surfaces to be painted. Vent exhaust fume to prevent fumes from contacting surfaces to be painted.

**Moisture.** Do not apply paint:

- A. If the steel surface temperature is less than 5°F (3 °C) above the dew point.
- B. If the steel surface is wet, damp, frosted, or ice-coated.

- C. *If the relative humidity is greater than 85 percent.*
- D. *During periods of rain, fog, or mist unless the above moisture criteria is met.*

*If steel was abrasive blasted when the temperature of the steel was less than 5° F (3° C) above the dew point, reblast the steel when the steel temperature is at least 5° F (3° C) above the dew point.*

**514.06 Protection of Persons and Property.** *Collect, remove, and dispose of all buckets, rags, or other discarded materials and leave the job site in a clean condition.*

*Except for both deck bottoms and backwalls which have not been sealed or are not to have a sealer applied, protect all portions of the structure, that are not to be painted from damage or disfigurement by splashes, spatters, and smirches of paint.*

*If the Contractor causes direct or indirect damage or injury to public or private property, the Contractor shall restore the property to a condition similar or equal to the condition existing before the damage or injury.*

**514.07 Pollution Control.** *Take the necessary precautions to comply with pollution control laws, rules, or regulations of Federal, State, or local agencies and requirements of this specification.*

**514.08 Safety Requirements and Precautions.** *Comply with the applicable safety requirements of the Ohio Industrial Commission and OSHA.*

*Provide Material Safety Data Sheets (MSDS) at the preconstruction meeting for all paints, thinners, and abrasives used on this project. Do not begin work until submitting the MSDS to the Engineer.*

**514.09 Inspection Access.** *In addition to the requirements of 105.11, furnish, erect, and move scaffolding and other appropriate equipment to allow the inspector the opportunity to closely observe all affected surfaces during all phases of the work and for at least 10 working days after completely painting each structure.*

*If scaffolding, or hangers attached to the scaffolding, is supported by horizontal wire ropes, or if scaffolding is directly under the surface to be painted, comply with the following requirements:*

- A. *If scaffolding is suspended 43 inches (1092 mm) or more below the surface to be painted, place two guardrails on all side of the scaffolding. Place one guardrail at 42 inches (1067 mm) above the scaffolding and the other guardrail at 20 inches (508 mm) above the scaffolding.*

- B. *If scaffolding is suspended at least 21 inches (533 mm) but less than 43 inches (1092 mm) below the surface to be painted, place one guardrail on all sides of the scaffolding at 20 inches (508 mm) above the scaffolding.*
- C. *If numbers A and B do not apply, place two guardrails on all sides of the scaffolding. Place one guardrail at 42 inches (1,067 mm) above the scaffolding and the other guardrail at 20 inches (508 mm) above the scaffolding.*
- D. *Provide scaffolding at least 24 inches (610 mm) wide if guardrail is used and 28 inches (711 mm) wide if guardrail is not used and scaffolding is suspended less than 21 inches (533 mm) below the surface to be painted. If using two or more parallel scaffolding to achieve proper width, rigidly attach the scaffolding together to prevent differential movement.*
- E. *Construct guardrail as a substantial barrier, securely fastened in place and free from protruding objects such as nails, screws and bolts. Provide a properly located opening in the guardrail to allow the inspector access onto the scaffolding.*
- F. *Construct rails and uprights of metal pipe, steel angles, or wood. If using pipe railing, provide a pipe with a nominal diameter of at least 1 ½ inches (38 mm). If using steel angle railing, provide 2 x 2 x 3/8 inch (50 x 50 x 9 mm) steel angles or other metal shape of equal or greater strength. If using wood railing, provide 2 x 4 inch (50 x 100 mm) nominal stock. Space uprights no more than 8 feet (2.4 m) on center. If using wood uprights provide 2 x 4 inch (50 x 100 mm) nominal stock.*
- G. *If the surface to be inspected is more than 15 feet (4.57 m) above the ground or water, and the scaffolding is supported from the structure being painted, provide a safety harness (not a safety belt) and lifeline for the inspector. The lifeline shall not allow a fall greater than 6 feet (1.8 m). Provide a method to attach the lifeline to the structure that is independent of the scaffolding, cables, and brackets supporting the scaffolding.*
- H. *If scaffolding is more than 2.5 feet (762 mm) above the ground, provide an access ladder and equipment to attach the ladder onto the scaffolding capable of supporting 250 pounds (113 kg) with a safety factor of at least four. Uniformly space rungs, steps, cleats, and treads no more than 12 inches (305 mm) on center. Extend at least one side rail at least 36 inches (914 mm) above the landing near the top of the ladder.*
- I. *If the distance from the ladder to the access point on the scaffolding exceeds 12 inches (305 mm) provide an additional landing that is capable of supporting a minimum of 1000 pounds (454 kg) and at least 24 inches*

(610 mm) wide and 24 inches (610 mm) long. Size and shape the landing so that the distance from the landing to the point where the scaffolding is accessed does not exceed 12 inches (305 mm). Firmly attach the landing to the ladder; however, do not use the ladder to support the landing.

- J. In addition to the scaffolding requirements above, comply with all Federal, State, and local laws, ordinances, regulations, orders, and decrees.
- K. Furnish all necessary traffic control to allow inspection during all phases of the project.

**514.10 Job Site Visual Standards.** Before starting abrasive blasting, establish job site visual standards by preparing a test section, subsequent test sections, and by using photographs of approved test sections. Use job site visual standards and SSPC-VIS 1-89 standard for blasting. The Contractor or fabricator shall prepare an approximately 20 to 30 square foot (2 to 3 m<sup>2</sup>) test section from a representative area on the first bridge to be painted. After the Engineer and the Contractor or fabricator agree the test area was blast cleaned according to Plan requirements, photograph the test section and check the steel surface for the proper profile. After the Engineer approves the test section and the job site visual standards are documented by photographs and replica tape, the Contractor or fabricator may start abrasive blasting. The quality control specialists and Engineer will use the job site visual standards (photographs) and the Plan specifications to determine acceptance of blast cleaning procedures, but in cases of dispute, the SSPC-VIS 1-89 standard shall govern. If the Contractor, Engineer, or fabricator believe the initial test section does not establish the proper visual standard for a different bridge another test section on the different bridge may be performed, in the opinion of any of the involved parties, a subsequent bridge is not indicative of the bridge on which the test section was performed, another test section may be requested.

**514.11 Surface Preparation.** This item consists of solvent cleaning, grinding flange edges, abrasive blasting, providing a wash facility for the Engineer, and containing, collecting, and disposing of abrasive blasting debris.

- A. **Solvent Cleaning (QCP #1).** Wash areas containing oil, grease, diesel fuel deposits, or other petroleum products (see SSPC-SP 1 for recommended practices). After cleaning with a solvent and before starting abrasive blasting, wash the areas with potable water as detailed below.

Use equipment capable of delivering the water at a nozzle pressure of at least 1000 psi (7 Mpa) and at a rate of not less than 4 gallons (15 L) per minute. The Contractor or fabricator shall provide the Engineer with equipment specifications that verify both delivery pressure and rate. Provide gauges on the equipment to verify the pressure during the

operation. Hold the nozzle a maximum of 12 inches (300 mm) from the surface being washed.

- B. **Grinding Flange Edges (QCP #2).** Before abrasive blasting, round all exposed bottom flange edges of longitudinal beams to a radius of  $1/8 \pm 1/16$  inch ( $3 \pm 1.5$  mm). This work has no weather and temperature restrictions.
- C. **Abrasive Blasting.** Do not abrasive blast areas that contain asphaltic, or diesel fuel deposits. Before abrasive blasting, completely remove all dirt, sand, bird droppings, and other debris from the scuppers, bulb angles, and pier and abutment seats.

Abrasive blast all steel to be painted according to SSPC-VIS 10 and as shown on the pictorial surface preparation standards for painting steel surfaces shown in SSPC-VIV 1-89. Maintain steel in a blast cleaned condition until it has received a prime coat of paint.

The Contractor may commercial blast clean the back side of end cross that are 3 inches (75 mm) or closer to backwalls according to SSPC-SP 6.

Cover and protect galvanized and metalized steel (including corrugated steel bridge flooring), adjacent concrete already or specified to be coat or sealed, and other surfaces not intended to be painted, from damage caused by blasting and painting operations. Repair adjacent coatings damaged during the blasting operation. Do not cover or protect deck backwalls and bottoms of decks not to be sealed.

For field blasting, use recyclable steel grit. For shop blasting, use an abrasive that produces an angular profile. All abrasives shall provide a profile from 1.5 to 3.5 mils (40 to 90  $\mu\text{m}$ ) as determined by replica tape according to ASTM D 4417, Method C. Clean the abrasive of paint, chips, rust, mill scale, and other foreign material after each use and before each reuse. Use equipment specifically designed for cleaning the abrasive.

Check each load of abrasives delivered to the job site or fabrication shop for oil contamination by adding a small sample of abrasives to tap water. Reject the abrasive if an oil film is detected on the water surface.

To ensure that the compressed air is not contaminated, the quality control specialists shall blow air from the nozzle for 30 seconds onto a white cloth or blotter held in a rigid frame. If the cloth or blotter retains oil or other contaminates, suspend abrasive blasting until retests verify the problem

*was corrected. Perform this test at the start of each shift and at 4-hour intervals.*

*The Contractor may simultaneously abrasive blast and paint the same bridge provided the abrasive blasting debris and dust does not contact freshly painted surfaces and does not contaminate paint during the curing period. For shop blasting, the fabricator may simultaneously abrasive blast and paint if the two operations are separated by distance or containment that prevents paint contamination.*

*For surface preparation of new structural steel in the fabricator's shop, the quality control specialist shall take replica tape readings as follows:*

- 1. For an automated blasting process, test the greater of 20 percent of the main members or one member per shift. These tests shall consist of taking five random readings per member.*
- 2. For a manual blasting process, test each main member. The test of a main member consists of taking five readings at random locations.*
- 3. For both an automated and manual blasting process, test 15 percent of all secondary members. The test of a secondary member consist of taking one random reading.*

*Remove abrasives and residue from all surfaces to be painted. Keep all structural steel that was blast cleaned in the field or the fabricator's shop dust free. Apply a prime coat to steel that was blast cleaned in the field within 12 hours of the beginning of the blasting operation. Apply a prime coat to structural steel that was blast cleaned in the fabricator's shop within 24 hours of the beginning of the abrasive operation. If a prime coat is not applied within the times stated above, reblast the steel before applying the prime coat. Remove all dust or abrasives from adjacent work and from the finish coat.*

*Provide the Engineer with a field wash facility with adequate supply of running potable water, soap, and towels for washing face and hands during the surface preparation operation. Properly contain, test, and dispose of the wastewater. Locate a wash facility at each bridge site and in an area that will not be contaminated by blasting debris.*

- D. Containment/Waste Disposal (QCP #4).** *Waste material generated by abrasive blasting operations in the field is a solid waste. Contain, collect, store, evaluate, and properly dispose of the solid waste. Comply with all Federal, State, and local environmental protection laws, regulations, and*

*ordinances including but not limited to air quality, waste containment, and waste removal. The Contractor is advised that various governmental bodies are involved with solid waste disposal and the Contractor is responsible for complying with laws enforced by the various governmental bodies.*

*To prevent contamination of the pavement or soil, park all equipment on ground covers free of cuts, tears, and holes.*

*Clean equipment of spent abrasives or debris before bringing equipment to the project, moving equipment from one bridge site to another, and removing equipment from the project. Store debris cleaned from equipment with the debris from the structure that generated the debris.*

*Erect an enclosure to completely surround (around, under, and over the top on truss type bridges) the blasting operations. The Contractor may use the ground as the bottom of the enclosure if the ground is completely covered with plastic or tarps.*

*Construct the enclosure of flexible materials such as tarpaulins or containment screens (specifically designed for blasting containments), or construct the enclosure of rigid materials such as plywood. Maintain all materials free from tears, cuts, and holes. Overlap all seams a minimum of 6 inches (150 mm) and fasten the seams together at 12 inch (300 mm) centers or in a manner that ensures a seal that does not allow openings between the screens in the containment. Extend the vertical sides of the enclosure completely up to the bottom of the deck on a steel beam bridge and use bulkheads between beams to enclose the blasting area.*

*The Contractor may use vacuum blasting instead of constructing a containment if the vacuum blasting equipment is manufactured and marketed for use without a containment and has controls that automatically shut down the blasting operation when the blast head brushes do not contact the surface being cleaned.*

*Collect all debris from blasting operations, equipment or filters, including that which fell to the ground. If practical, store debris at the bridge site and test and evaluate the debris for disposal. Otherwise, the Engineer and Contractor shall agree on an alternate storage location. Additionally, the Engineer and Contractor shall agree to the location of centralized cleaning stations for recyclable steel. Store debris in steel containers with lids that are locked at the end of each workday.*

*Obtain services of a testing laboratory to obtain directly from the project site an evaluation of a composite representative sample of the abrasive*

*blasting debris for each bridge site. The person taking the sample will be an employee of the testing laboratory.*

*Take the composite sample in the presence of the Engineer, comply with the requirements of U.S. EPA Publication SW 846 and take individual samples taken from all containers which are on the site at the time of the sampling. Blend individual samples of equal size together to comprise one complete sample. Take one individual sample from each drum and four randomly spaced individual samples from each container other than the drums.*

*Sample within the first week of production blasting at each bridge. Continue all blasting and painting operations on the bridge from which waste was generated only if sampling is done within the time allotted above.*

*Test composite samples for lead and chromium according to the U.S. EPA Publication SW 846. Provide the Chain of Custody records and test results to the City immediately after the test results are available. If blasting debris is hazardous, as defined below, provide the City with the names of the hauler and treatment facility. Perform all sampling and testing required by the hauler, treatment facility, or disposal facility.*

*The existing paint removed from bridges may contain lead or chromium. The Contractor is responsible for taking the proper safety precautions to ensure workers in this environment are properly protected (see bid proposal note entitled "Safety").*

- 1. **Hazardous Waste.** The blasting debris is hazardous if the concentration of either lead or chromium exceeds 5.0 milligrams per liter. Label the containers as "HAZARDOUS." Secure the storage location by surrounding the site with a 5 foot (1.5 m) high chain link fence fabric supported by traffic sign drive posts 10 feet (3 m) apart. Drive the traffic sign posts into the ground at least 2 feet (0.6 m) deep. Secure the fencing with padlocks at the end of each day. Post hazardous waste warning signs at obvious locations on the fenced enclosure.*

*The City will obtain a generator number assigned to the City. After the City obtains the generator number, arrange for the hauling, treating, and disposing of the hazardous waste. Use a firm licensed by U.S.EPA to haul and dispose of the hazardous waste. This firm is also responsible for providing the Uniform Hazardous Waste Manifest (EPA Form 8700-22A).*

*In every case, dispose of all hazardous waste within 60 days after it is generated.*

*If hazardous waste is not disposed of within 60 days, the City will consider the Contractor in breach of its contract and the City will take the following actions.*

- (a) Immediately suspend all abrasive blasting and painting of structural steel on the project until properly disposing of the hazardous waste.*
- (b) Cease all pay estimates.*
- (c) Forward a breach of contract notification to the Contractor's surety.*

*The Contractor is responsible for fines or liens assessed by any governmental agency that has jurisdiction over the disposal of this hazardous waste material.*

- (d) Decontaminate or dispose of all collection and containment equipment according to EPA guidelines.*

- 2. **Non Hazardous Solid Waste.** Haul and dispose of the waste that the City determines to be non-hazardous to a facility licensed to accept non-hazardous solid waste. Before disposing of any material, provide the Engineer with documentation that the disposal facility is licensed by the EPA to accept non-hazardous solid waste. Obtain from the disposal facility and provide the Engineer with a receipt that documents disposal of waste material at the approved landfill.*

***514.12 Washing Shop Primer (QCP #7).** Wash shop primed structural steel after it is erected and the concrete deck is placed and within 30 days of applying the intermediate coat.*

*Wash the steel with potable water. Use equipment capable of delivering the water at a nozzle pressure of at least 1000 psi (7 Mpa) and at a rate of not less than 4 gallons (15 L) per minute. The Contractor shall provide the Engineer with equipment specification that verify both the delivery pressure and rate. Provide gauges on the equipment to verify the pressure during operation. Hold the nozzle a maximum of 12 inches (300 mm) from the surface being washed. The surface is clean when clear rinse water runs off the structure. After rinsing the surface, inspect for remaining dirt and rewash dirty areas until clean.*

**514.13 Handling.** *Deliver all paint and thinner in original unopened containers with labels intact. The Engineer will accept containers with minor damage provided the container is not punctured. Thinner containers shall be a maximum of 5 gallons (19 L). Before use, provide the Engineer with shipping invoices for all painting materials used on the project.*

*Supply containers of paint and thinner with labels clearly marked by the manufacturer to show paint identification, component, color, lot number, date of manufacture, and information and warnings as may be required by Federal and State laws.*

*Store paint at the temperature recommended by the manufacturer and in a storage facility that prevents theft. Provide thermometers capable of monitoring the maximum high and low temperatures inside the storage facility.*

*Before opening paint or thinner containers, check the labels to ensure the proper container is opened and the paint has not been stored beyond its shelf life. Do not use paint that has been stored beyond its shelf life. Do not open containers of paint and thinner until required for use and then open the oldest paint of each kind first. Solvent used for cleaning equipment is exempt from the above requirements.*

*Do not use paint that has livered, gelled, or otherwise deteriorated during storage. The Contractor may use thixotropic materials that can be stirred to the normal consistency. Properly dispose of unused paint and paint containers.*

**514.14 Mixing and Thinning.** *Thoroughly mix all ingredients immediately before use with a high shear mixer (such as a Jiffy Mixer). Do not mix paint using paddle mixers, paint shakers, or an air stream bubbling under the paint surface. After mixing, carefully examine the paint for uniformity and to ensure that no unmixed pigments remain on the bottom of the container. Before use, strain the paint through strainers of a type to remove skins or undesirable matter and not remove pigment. Except for primer, mix paint as necessary during application to maintain a uniform composition. Continuously mix primer using an automated agitation system. Do not use hand-held mixers for primer paints.*

*Do not add thinner to the paint without the Engineer's approval, and only add thinner if necessary for proper application as recommended by the manufacturer printed instructions. In the Engineer's presence slowly add the amount of thinner recommended and supplied by the manufacturer to the paint during the mixing process. Do not mix other additives into the paint.*

*Add catalysts, curing agents, or hardeners that are in separate packages to the base paint only after thoroughly mixing the base paint. With constant agitation, slowly pour the proper volume of catalyst into the required volume of base. Do not pour off liquid that has separated from the pigment before mixing. Use the mixture within the pot*

life specified by the manufacturer and dispose of unused portions at the end of each working day.

#### **514.15 Coating Application**

- A. **General.** *Paint all structural steel, scuppers, expansion joints except to surface, steel railing, exposed steel piling, drain troughs, and other areas as shown on the plans. Paint galvanized or metalized surfaces if shown on the plans. Unless otherwise shown on the plans or specified below, apply paint by brush, spray or a combination of brush and spray methods. If brush and spray are not practical to paint places of difficult access, the Contractor may use daubers, small diameter rollers, or sheepskins.*

*Use daubers, small diameter rollers, or sheepskins to paint the following areas:*

1. *Where cross-frame angles are located within 2 inches (50 mm) of the bottom flange.*
2. *Where end cross-frames are within 6 inches (150 mm) of the backwall.*
3. *Where there is less than 6 inches (150 mm) between the bottom of the bottom flange and the beam seat.*

- B. **Application Approval.** *The Engineer may inspect the initial application of the prime, intermediate, and final coats. If the Engineer discovers defects, adjust the method of application to eliminate the defects then continue applying the coat.*

- C. **Additional Information Pertaining to Shop Applied Primer.** *Apply a prime coat to all structural steel surfaces including insides of holes, behind stiffener clips and contact surfaces of connection, and splice material that is to be fastened with bolts in the shop or field. Apply a mist coating from 0.5 to 1.5 mils (12.5 to 37.5  $\mu\text{m}$ ) on surfaces that are to be imbedded into concrete and on surfaces within 2 inches (50 mm) of field welds other than those attaching intermediate or end cross frames to beams or girders. Apply one coat of primer to pins, pin holes, and contact surfaces of bearing assemblies, except do not paint those containing self-lubricating bronze inserts. Once the prime coat is dry, apply erection marks using a thinned paint of a type and color that is completely concealed by and compatible with the second coat.*

*Do not handle or remove structural steel coated with inorganic zinc primers from the shop until the paint has cured as specified by the paint manufacturer's printed instructions.*

*Reduce the thickness of thick films of inorganic zinc primer by screening, sanding, or sweep blasting. If the primer paint cured longer than 24 hours, apply a re-coating of primer paint according to the paint manufacturer's printed instructions. If "mud-cracking" occurs, abrasive blast and reapply the primer to the affected area. If "checking" occurs, abrasive blast and reapply the primer or remove the "checking" by screening and evaluate the area by adhesion testing.*

- D. ***Surface Cleanliness.*** *All surfaces to be painted shall be free of dust, dirt, grease, oil, moisture, overspray, and other contaminants. If the surface is degraded or contaminated, restore the surface before applying the paint. In order to prevent or minimize degradation or contamination of cleaned surfaces in the field, the prime coat of paint shall be applied within 12 hours of the beginning of the abrasive blasting operation as required in surface preparation above, for steel which is cleaned and painted in the shop, the prime coat of paint shall be applied within 24 hours of the beginning of the blasting operation.*

*Schedule cleaning and painting when dust or other contaminants will not fall on wet, newly-painted surfaces. Protect surfaces that do not receive paint or have already been painted from the effects of cleaning and painting operations. Before applying the next coat, remove overspray and pigeon droppings with a stiff bristle brush, wire screen, or a water wash with sufficient pressure to remove overspray and pigeon droppings without damaging the paint. Before applying the next coat, remove all abrasives and residue from painted surfaces with a vacuum system equipped with a brush type cleaning tool. Remove all visible abrasives on the finish coat that came from the adjacent work.*

- E. ***Brush Application.*** *Apply the paint to produce a smooth coat. Work the paint into all crevices, corners, and around all bolt and rivet heads. Apply additional paint as necessary to produce the required coating thickness.*

- F. ***Spray Application (General).*** *Apply paint using spray application as follows:*

*Keep spray equipment clean so that dirt, dried paint, solvents, and other foreign materials are not deposited in the paint film. Remove solvent left in the equipment before using the equipment.*

*Apply paint in a uniform layer with overlapping at the edges of the spray pattern. Paint the border of the spray pattern first, followed by painting the interior of the spray pattern. Complete painting a spray pattern before moving to the next spray pattern area. Within a spray pattern area hold the gun perpendicular to the surface and at a distance that will ensure a wet layer of paint is deposited on the surface. Release the trigger of the gun at the end of each stroke. To ensure coverage, spray all bolts and rivet heads from at least two directions or apply the paint to bolts and rivet heads using a brush.*

*Each spray operator shall demonstrate to the Engineer or inspector the ability to apply the paint as specified before the operator sprays paint.*

*If mud cracking occurs, the affected area shall be cleaned to the bare metal in accordance with surface preparation above and repainted.*

*Fill all gaps and crevices 1/8 inch (3 mm) or less with primer.*

*Use spray equipment recommended by the manufacturer and suitable for use with the specified paint. Provide adequately sized traps or separators to remove oil and condensed water from the air. Periodically drain the traps during operations. To ensure that traps or separators are working properly, blow air from the spray gun for 30 seconds onto a white cloth or blotter held in a rigid frame. The Engineer will verify the test results by inspecting the white cloth or blotter. If the cloth or blotter retains oil, water, or other contaminants, suspend painting until retests verify the problem was corrected. Perform this test at the start of each shift and at 4 hour intervals. This is not required for an airless sprayer.*

*Do not use spray application unless the operation is totally enclosed as required for abrasive blasting, to prevent overspray damage to the ground, public and private property, vegetation, streams, lakes, and other surfaces not to be painted.*

- G. *Prime, Intermediate, and Finish Coat Application (QCP #5, #8, & #10).***  
*Apply paint as a continuous film of uniform thickness, free from all defects such as holidays, runs, and sags. Repaint all thin spots or areas missed before the next coat of paint is applied.*

*Ensure that each coat of paint is properly cured before applying the next coat. Comply with the manufacturer's written instructions for the time interval between coats and apply the next coat when an additional coat will not cause detrimental film irregularities, such as lifting, wrinkling, or loss of adhesion of the undercoat. Do not exceed the following time intervals. If the prime coat is organic zinc, the maximum time between the*

prime and the intermediate coats is 30 days. There is no maximum time between the prime and intermediate coats for an inorganic zinc primer. The maximum time interval between intermediate and finish coats is 13 days. These maximum recoat times include adverse weather days and the Engineer will not extend the time intervals. If the next coating is not applied within the times stated above, remove the coatings and reblast the steel according to SSPC-SP 10.

Stencil the completion date (month and year) of the finish coat and the letters of the applied paint system on the steel in 4-inch (100 mm) letters with black urethane paint. The appropriate letters for the paint systems are as follows:

<b>System Comprised of:</b>	<b>Letters</b>
<i>Inorganic zinc prime coat, epoxy intermediate coat, and urethane finish coat</i>	<i>IZEU</i>
<i>Organic zinc prime coat, epoxy intermediate coat, and urethane finish coat</i>	<i>OZEU</i>

Apply the date and paint system at four locations near the end of each outside beam on the outside web visible from the road or as directed by the Engineer.

- H. **Painting Wood.** *New wood shall be painted with a prime coat, a second coat, and a finish coat, all of 708.05 except where black paint is specified. Black paint shall conform to 708.11. Butt ends of timbers and all surfaces inaccessible after erection shall be well coated with white lead paste before erection.*

*Previously painted wood shall have all cracked or peeling paint, loose chalky paint, dirt and other foreign matter removed by wire brushing, scraping or other approved means immediately before repainting.*

**514.16 Removing Fins, Tears, or Slivers (QCP # 6).** *Use a grinder to remove all fins, tears, slivers or any other burred or sharp edges that become evident after applying the prime coat. Retexture ground surfaces to produce a profile from 1.5 to 3.5 mils (40 to 90 μm) and reprime ground surfaces before applying the intermediate coat.*

*The Contractor may begin removing fins, tears, and slivers after blasting and before priming.*

*Temperature and weather restrictions do not apply to removing fins, tears, and slivers, but restrictions do apply to applying the prime coat.*

**514.17 Caulking (QCP #9).** After the intermediate coat cures and before applying the finish coat, caulk gaps or crevices greater than 1/8 inch (3 mm).

**514.18 Dry Film Thickness (QCP #5, #8, & #10).** Determine prime coat thickness; prime and intermediate coat thickness; and prime, intermediate, and finish coat thickness using a Type 2 magnetic gage as follows:

Measure paint thickness at 5 separate, evenly spaced, spot measured locations over each 100 square foot (9 m<sup>2</sup>) of area. Locate the 5 spot measurements on flanges, webs, cross bracing, stiffeners, etc. At each spot location, take three gage thickness readings of either the substrate or the paint. Move the probe 1 to 3 inches (25 to 75 mm) for each new gage reading. Discard an unusually high or low gage reading that is not consistently repeated. The spot thickness measurement is the average of the three gage readings.

The average of 5 spot measurements for such 100 square foot (9 m<sup>2</sup>) area shall not be less than the specified thickness. No single spot measurement in and 100 square foot (9 m<sup>2</sup>) area shall be less than 80 percent of the specified minimum thickness nor greater than 150 percent of the maximum specified thickness when the organic zinc is applied and 120 percent of the maximum specified thickness when the inorganic zinc is applied. Any one of three readings which are averaged to produce each spot measurement, may under run or overrun by a greater amount. Take 5 spot measurements for each 100 square foot (9 m<sup>2</sup>) area as follows:

For all shop primed steel regardless of size, measure each 100 square foot (9 m<sup>2</sup>) area.

For structures not exceeding 300 square feet (27 m<sup>2</sup>) in area, measure each 100 square foot (9 m<sup>2</sup>) area.

For structures not exceeding 1000 square feet (90 m<sup>2</sup>) in area, randomly select and then measure three 100 square foot (9 m<sup>2</sup>) areas.

For structures exceeding 1000 square feet (90 m<sup>2</sup>) in area, measure the first 1000 square feet (90 m<sup>2</sup>) as stated in Section B and for each additional 1000 square feet (90 m<sup>2</sup>), or increment thereof, randomly select and then measure one 100 square foot (9 m<sup>2</sup>) area.

If the dry film thickness for any 100 square foot (9 m<sup>2</sup>) area (Sections B and C) is not in compliance with the requirements of paragraph 1 of this section, then measure each 100 square foot (9 m<sup>2</sup>) area.

Measure other areas or revise the number of spot measurements shown on the plans.

Each coat of paint shall have the following thickness measured above the peaks:

	<b>Min Spec. Thickness</b>	<b>Max. Spec. Thickness</b>	<b>Min. Spot Thickness</b>	<b>Max. Spot Thickness (Inorganic Zn)</b>	<b>Max. Spot Thickness (Organic Zn)</b>
<i>Prime</i>	3.0 mils (75 μm)	5.0 mils (125 μm)	2.4 mils (60 μm)	6.0 mils (150 μm)	7.5 mils (188 μm)
<i>Intermediate</i>	5.0 mils (125 μm)	7.0 mils (175 μm)	4.0 mils (100 μm)	10.5 mils (263 μm)	10.5 mils (263 μm)
<i>Sub Total</i>	8.0 mils (200 μm)	12.0 mils (300 μm)	6.4 mils (160 μm)	16.5 mils (413 μm)	18.0 mils (450 μm)
<i>Finish</i>	2.0 mils (50 μm)	4.0 mils (100 μm)	1.6 mils (40 μm)	6.0 mils (150 μm)	6.0 mils (150 μm)
<i>Total</i>	10.0 mils (200 μm)	16.0 mils (400 μm)	8.0 mils (200 μm)	22.5 mils (563 μm)	24.0 mils (600 μm)

Remove paint with a film thickness greater than the maximum specified thickness unless:

- A. The paint does not exhibit defects such as runs, sags, bubbles, or mud cracking, etc.
- B. The manufacturer provides a written statement that the excessive thickness is not detrimental.
- C. The City allows the paint to remain in place.

For any spot or average of 5 spots of a 100 square foot (9m<sup>2</sup>) area that exceeds the maximum spot thickness, either remove and replace the coating according to 514.19 or prove to the City that the excess thickness will not be detrimental to the coating system. In order to prove to the City that the excess thickness will not be detrimental to the coating system the Contractor may provide the City with the following information:

Certified test data that the excessive thickness will adequately bond to the steel when subjected to thermal expansion and contraction. The thermal expansion and contraction test shall take place over five cycles of temperature ranges from -20° F to 120° F (-29° C to 49° C). After the thermal contraction and expansion cycles have taken place, the tested system shall be subjected to pull off tests and the results compared to the results of the pull off tests which have been performed on a paint system with the proper thickness. In addition to the certified test results, it will also be necessary for the Contractor to provide the Engineer a written statement from the paint manufacturer stating that this excessive thickness is not detrimental.

*If the City does not approve the excessive coating thickness or the Contractor elects not to provide the required written statement from the paint manufacturer and the certified tests when required, the Contractor shall remove and replace the coating. The removal and replacement of the coating shall be done as specified in 514.19 Repair Procedures.*

**514.19 Repair Procedures.** *Remove paint and correct defects or damaged areas, including areas damaged by welding, and in areas that do not comply with the requirements of this specification. Correct defects and damaged areas using the same paint applied except the Engineer may approve using organic zinc to repair inorganic zinc in the field. Retexture the steel to a near white condition and a profile between 1.5 to 3.5 mils (40 to 90  $\mu\text{m}$ ). Measure the profile immediately before applying the prime coat to ensure the profile is not destroyed during the feathering procedure.*

*Feather existing paint to expose a minimum of 1/2 inch (13 mm) of each coat.*

*During the reapplication of the paint, apply paint as follows:*

*Apply the prime coat only to the surface of the bare steel and the existing prime coat exposed by feathering. Do not apply the prime coat to the adjacent intermediate coat.*

*Apply the intermediate coat only to the new prime coat and the existing intermediate coat exposed by feathering. Do not apply the intermediate coat to the adjacent finish coat.*

*Apply the finish coat only to the new intermediate coat and the existing finish coat that was feathered or lightly sanded. Do not apply the finish coat beyond areas that were feathered or lightly sanded.*

*At the perimeter of the repair area, apply the prime and intermediate coats using a brush. Apply the finish coat using either a brush or spray.*

*The Contractor may need several applications to obtain the proper thickness for each coat.*

*During the application of the prime coat, the paint shall be continuously mixed.*

*Perform all surface preparation and painting according to the specifications.*

*Instead of abrasive blasting, the Engineer may allow alternate methods of preparing the surface.*

*Blend repair areas with the adjacent coating and provide a finished surface in the patched areas that is smooth and has an even profile with the adjacent surface.*

*Submit in writing, the method of correcting areas with runs to the City for approval.*

**514.20 Method of Measurement.** *The City will measure Surface Preparation of Existing Structural Steel and Field Painting of Existing Structural Steel Prime Coat by the lump sum, or by the number of square feet (square meters). The City will measure Field Painting Structural Steel, Intermediate Coat and Field Painting Structural Steel, Finish Coat by the lump sum, by the number of square feet (square meters), or pounds (kilograms) of structural steel painted.*

*The City will determine the number of pounds (kilograms) of new structural steel painted by the accepted pay weight of the new structural steel.*

*For steel beam and steel girder bridges, the City will determine the surface area by taking a nominal measurement of the beams (i.e., 2 times the beam depth plus 3 times the flange width). In addition to this nominal measurement, the City will add a percentage to account for incidentals such as cross frames, bearing assemblies, stiffeners, expansion joints, scuppers, etc. Thus it is not necessary for the Inspector to field measure every detail of the bridge to verify quantities. If there is a quantity dispute, exact field measurements of all painted surfaces and/or calculations will govern over the above percentage to account for incidentals.*

*For extremely complex bridges, such as trusses, the City will pay for painting by the lump sum.*

*The City will measure Grinding Fins, Tears, Slivers on Existing Steel by the number of man-hours expended only by the workmen actually doing the grinding and will include the time when the workmen are performing grinding and repairing prime coat and not limited to only the actual grinding duration (i.e., the City will include all hours of the workmen assigned to grinding regardless of actual grinding time). The City will not measure grinding fins, tears, and slivers on new steel but will consider it incidental to the unit price for new steel.*

**514.21 Basis of Payment.** *The City will pay for accepted quantities at the contract prices as follows:*

<b><i>Item</i></b>	<b><i>Unit</i></b>	<b><i>Description</i></b>
514	<i>Square Foot (Square Meter) Lump Sum</i>	<i>Surface Preparation of Existing Structural Steel</i>
514	<i>Square Foot (Square Meter) Lump Sum</i>	<i>Field Painting of Existing Structural Steel, Prime Coat</i>
514	<i>Square Foot (Square Meter) Lump Sum, Pound, Kilogram</i>	<i>Field Painting Structural Steel, Intermediate Coat</i>
514	<i>Square Foot (Square Meter)</i>	<i>Fielding Painting Structural</i>

514	<i>Lump Sum, Pound, Kilogram Man Hour</i>	<i>Steel, Finish Coat Grinding Fins, Tears, Slivers on Existing Structural Steel</i>
-----	---	--

*The City may consider paint as eligible for payment for material on-hand as specified in 109.07; however, only paint that the Contractor can prove to the Engineer will be used during the construction season is eligible for payment. The Contractor shall provide the Engineer calculations indicating the total square feet (square meters) of steel to be painted during the construction season. The Contractor shall also provide calculations showing the total number of gallons (liters) required.*

*If the Contractor causes damage or injures public or private property, the City will not pay for restoring the property to its original condition.*

*The City will not pay for repairing adjacent coatings damaged during the blasting operations.*

*The City will not pay for removing and replacing an area of coating because a spot or maximum average thickness exceeds the maximum spot thickness.*

*The City will not pay for additional testing required by the hauler, treatment facility, or landfill.*

*The City will pay for caulking under Field Painting Structural Steel, Intermediate Coat.*