This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 630
PAINTING

630.01 DESCRIPTION.

This work consists of furnishing all paints and paint materials; preparing surfaces to be painted; applying, protecting, and drying paint coatings; and protecting all traffic, adjacent property, and the work itself against spatters or other damage due to painting operations.

The shop paint system for new structural steel shall consist of an inorganic zinc silicate primer and a compatible high-build, aliphatic polyurethane finish coat. After fabrication and before shipment, the primer and finish coat shall be applied to all surfaces except as specified.

The field applied system shall be an aluminum filled epoxy mastic primer and a compatible high-build, aliphatic polyurethane finish coat. This system is intended for rehabilitation painting of existing steel structures. It is also intended for coating field splices as well as touch-up of damaged areas of shop applied coats on new structural steel after erection.

630.02 MATERIALS.

A. **Inorganic Zinc Silicate Primer.** The inorganic zinc silicate primer shall be a 2-component self-curing type which, when mixed and applied by the manufacturer's instructions, cures without the use of a separate curing solution, and has the following properties:

1. **Composition:** Zinc dust shall meet ASTM D 520 Type I, modified to allow 0.1 percent retained on the No. 100 sieve. The vehicle component shall consist primarily of a partially hydrolyzed ethyl silicate in an appropriate solvent. The mixed paint shall have the following properties:

   a. Zinc portion shall be at least 72 percent by weight of the total solids of the dried coating.

   b. Total solids shall be at least 78 percent by weight.

   c. The color shall be a distinct contrast with the blast cleaned metal and the finish coat.

2. **Corrosion Resistance:** Test panels meeting ASTM D 609, having minimum dimensions of 2"x5"x1/8", shall be prepared by cleaning all surfaces

per SSPC SP-10 with a 1-3 mil profile. A 3 mil Dry Film Thickness (DFT) coating shall be applied and cured according to the manufacturer's recommendations. Individual test panels must pass the following tests:

a. **Fresh Water Resistance.** Panels shall be scribed down to base metal with an X having at least 2" legs and immersed in tap water at 75±5°F. The panels shall show no rusting, blistering, or softening after 30 days. Solution shall be replenished after 7 and 14 days.

b. **Salt Water Resistance.** Resistance shall be the same as 630.02 A.2.a except panels shall be immersed in 5 percent sodium chloride solution.

c. **Salt Fog Resistance.** Panels shall be scribed down to base metal with an X having at least 2" legs. Panels shall then be tested according to ASTM B 117. After 1,000 hours the panels shall show no loss of adhesion, rusting, blistering or softening.

B. **High-Build Aliphatic Polyurethane Finish Coat.** The high-build aliphatic polyurethane finish coat shall be a 2-component, weather resistant semigloss finish topcoat, compatible with previously applied coat, and shall have the following properties;

1. Solids by weight shall be minimum of 62 percent. Solids by volume shall be a minimum of 54 percent.

2. The coating shall not run or sag when applied at 10 mils Wet Film Thickness (WFT), unthinned. The coating must be sprayable to a uniform semigloss finish when thinned to the maximum level specified by the manufacturer.

3. The coating color shall be as specified.

C. **Aluminum Filled Epoxy Mastic Primer.** The aluminum filled epoxy mastic shall be a 2-component epoxy. The epoxy mastic must adhere to rusty steel and deteriorated coating systems. The epoxy mastic shall contain a rust inhibiting system which controls undercutting of the paint film.

1. **Composition.** The primary pigment shall be aluminum. Lead containing pigments shall not be present. The vehicle shall be of the epoxy-type and shall not contain coal tar. The curing agent shall allow trouble free application during normal humidity conditions (20% to 60% relative humidity).

   The epoxy mastic shall contain at least 70 percent solids by volume meeting ASTM D 1644. (Modified to a dry time of 72 hours at 100°F., rather than 3 hours at 105°C.)

2. **Flexibility.** A five mil (DFT) coating of the epoxy mastic shall be applied on a 1/8"x30"x4" steel panel sandblasted according to SSPC SP-5. The coating shall be cured for 2 weeks at 75°F. The coating shall not crack or lose adhesion after the panel is uniformly bent around an 8" diameter mandrel.

3. **Resistance.** The epoxy mastic shall meet or exceed the resistance tests when applied in the following manner: Steel panels, 2"x5"x1/8", meeting ASTM D 609, shall be sandblasted according to SSPC SP-5. The panels shall

be exposed to the weather for 30 days so uniform rusting occurs. Exposed to weather means stored outdoors at least 30 feet from walls, building or other obstruction to air or moisture movement. The panels shall be hand cleaned with a wire brush according to SSPC SP-2. The epoxy mastic shall be spray applied to the panels at 6 mils DFT in one coat. The coating shall be cured as recommended by the manufacturer.

a. **Fresh Water Resistance.** Panels shall be scribed down to base metal with an X having at least 2" legs and immersed in tap water at 75 ± 5°F. After 30 days the panel shall be unaffected except for discoloration. There shall be no blistering, softening, or visible rusting of the coating beyond 1/16" from the center of the scribe.

b. **Salt Water Resistance.** Resistance shall be the same as 630.02 C.3.a except panels shall be immersed in 5 percent sodium chloride solution. The solution shall be replenished with fresh solution after 7 and 14 days.

c. **Salt Fog Resistance.** Panels shall be scribed down to base metal with an X having at least 2" legs. Panels shall then be tested according to ASTM B 117. After 1,000 hours, the coating shall show no loss of bond, rusting, or blistering beyond 1/16" from the center of the scribed mark.

d. **Weathering Resistance.** Panels shall be tested according to ASTM G 23, Type D. Testing shall begin on the wet cycle. After 1,000 hours, the coating shall show no rusting, loss of adhesion, or blistering.

D. **Certification and Final Acceptance.** Before use of any paint system, the Department shall be furnished a certified test report from an independent testing laboratory. This certified test report shall show that the specific test results meet all quantitative requirements and resistance test requirements of these Specifications. The certified test report shall contain the exact ratio, by weight, of the pigment component to the vehicle component of the paint used for the tests, the lot tested, the manufacturer's name, brand name of paint, and date of manufacture. New certified test results shall be submitted any time the manufacturing process or the paint formulation is changed. New certified test results may be required when random sampling and testing of material offered for use indicates nonconformance to any of the requirements specified.

To obtain final acceptance of the paint system, a certification shall be furnished stating that the material used was the same as the material tested for manufacturer and brand name approval. The Department may sample and test any or all materials supplied.

E. **Packaging and Labeling.**

Two-component paint shall be packaged in 2-component containers or in 2 separate containers. The components shall be packaged and proportioned so that when the pigment is mixed with the vehicle, it yields 5 gallons of mixed paint.

Each container shall bear a label which clearly shows the name of the manufacturer, the brand name, and the lot number of the paint. The label on the vehicle container shall include complete instructions for use of this paint, shelf life of the

components, and pot life of the mixture. The container shall be coated to prevent attack by the paint components.

630.03 CONSTRUCTION REQUIREMENTS.

A. General.

The coatings shall be applied by the manufacturer's recommendations. A written copy of these recommendations shall be furnished to the Department. The recommendations shall include the mixing and thinning directions; the recommended spray nozzles and pressures; the minimum drying time; and the procedures for coating bolts, nuts, and washers.

Coatings shall be applied in a uniform, even coat and shall be worked into all corners and crevices. Coatings shall be applied with equipment meeting the manufacturer's application recommendations. On surfaces inaccessible to spray, the coatings may be applied with sheepskin daubers.

Surfaces with unsatisfactory coatings shall be reblasted, cleaned, and recoated at the Contractor's expense.

During fabrication, coating application, erection, and field repairs, scaffolding or lift platforms shall be provided to permit inspection of the steel.

B. Shop Painting Structural Steel.

1. Surface Preparation.

Surfaces to be coated shall be free of oil or grease prior to blast cleaning. Surfaces coated with oil or grease shall be solvent cleaned according to SSPC-SP1.

Surfaces to be coated shall be blast cleaned to a near white finish according to SSPC SP-10. Abrasives used for blast cleaning shall be either clean dry sand, steel shot, mineral grit, or manufactured grit and shall have a gradation that provides a uniform steel surface profile of 1 to 2.5 mils.

Fins, tears, slivers, and burred or sharp edges shall be removed by grinding and the area shall be reblasted to provide the profile specified before painting.

Blast residue shall be removed from steel surfaces with a commercial grade vacuum cleaner equipped with a brush-type cleaning tool, or by double blowing. Steel shall be kept dust free, dry, and primed within 24 hours after cleaning.

2. Mixing and Thinning Paint.

All coatings shall be thoroughly mixed so the pigment is completely in suspension and the consistency is uniform. The zinc primer shall be strained over a sieve having openings no larger than a No. 50 sieve and then continuously agitated until application is completed.

Thinning for proper application shall be accomplished by the manufacturer's recommendations.

3. **Coating Application.**

a. **Prime Coat.** All structural steel surfaces, including the shear connectors and the upper surface of the top flange shall be primed in the shop. The shop-applied prime coat shall be an inorganic zinc prime coat. Application shall meet SSPC PA-1 and shall be sprayed.

After cleaning the surfaces, the prime coat shall be applied. The DFT of the prime coat shall be 3 mils when measured according to SSPC-PA2.

Areas of deficient primer thickness shall be thoroughly cleaned with power washing equipment to remove all dirt. These deficient areas shall be wire brushed, vacuumed, and recoated.

Where excess coating thickness produces “mud cracking,” the coating shall be scraped back to the soundly bonded coating and the area recoated.

All primed surfaces shall be inspected for cleanliness and for the presence of loose zinc and zinc oxidation products (white oxides). When needed, the surface shall be cleaned by wiping, brushing, or flushing with fresh water.

b. **Finish Coat.** The shop-applied finish coat shall be a high-build aliphatic polyurethane finish coat. Application shall meet SSPC PA-1 and shall be sprayed. The DFT of the finish coat shall be 4 mils when measured according to SSPC-PA2.

The finish coat shall not be applied until the prime coat is approved. The minimum curing time between coats shall be as recommended by the manufacturer.

Splice plates and filler plates shall not be finish coated in the shop. Contact or faying surfaces of bolted field splices of the main members, shear connectors, and the upper surface of the top flanges shall be masked during the finish coat application.

To prevent top coat bubbling, a mist coat shall be required. The mist coat shall consist of a fast pass of the spray gun to seal the surface of the primer followed immediately by a full wet coat.

Where excessive coating thickness produces “mud cracking,” the coating shall be scraped back to soundly bonded coating and the area shall be recoated.

C. **Handling, Shipping, and Erecting.**

Steel material shall not be loaded for shipment until the shop coating has been approved. The steel shall not be damaged in the shop, during shipment, during erection, and during subsequent construction of the bridge. Overhang brackets shall be padded where they bear on the web. Deck formwork shall be mortar tight to prevent leakage onto the girders. The coating shall be protected from all chains, slings, hooks, and other apparatus used to lift or turn the coated steel. During ship-

ment, girders, diaphragms and other steel parts shall be padded and packed to prevent damage. The steel shall be stored off the ground on padded supports so they cannot fall on or touch one another. The steel shall not be shipped until the necessary equipment is available for handling and storing the steel. The proposed methods for handling and storing the steel shall be submitted at the preconstruction meeting.

Contact or faying surfaces of bolted field splices of main members including splice plates and filler plates, shall be covered until final assembly. Contamination from oil, grease, paint, etc., of these primed surfaces shall be removed by sandblasting to bare metal and recoated with shop primer. No other coating will be allowed on these surfaces. The intention is to provide clean, inorganically coated faying surfaces for field splices.

D. **Field Painting.**

1. **General.**

a. **Weather Conditions.** Paint shall only be applied when the air temperature is at or above 50 degrees F. and below 100 degrees F. Paint shall not be applied when the air is misty, dusty, or otherwise unsatisfactory for work. The surface temperature of the steel shall be above the dew point (exhibits no moisture condensation) before painting is permitted.

b. **Application.** Field painting shall not be accomplished until the formwork is removed.

Field painting shall be performed with an aluminum-filled epoxy-mastic primer and a finish coat of high-build aliphatic polyurethane. The DFT of the primer shall be 5 mils and the finish coat shall be 4 mils when measured according to SSPC-PA2.

Paint shall be applied during daylight hours by brushing or spraying. After application, the paint film shall be smooth and uniform without skips or areas of excessive paint. When spraying results in unsatisfactory surfaces, paint shall be applied by brushing. The previously-applied coat of paint shall be dry before the next coat is applied.

Only airless spray painting equipment shall be used. Paint shall be continually agitated during the spraying operation and applied in a fine, even spray. The operator shall manipulate the spray so the paint has a uniform thickness when dry. If necessary, the paint shall be immediately brushed out to secure uniform coverage and eliminate runs, wrinkling, blistering, and air holes. If adequate coverage cannot be obtained at rivets, bolt heads, nuts, corners, and edges, paint shall be applied to these areas by hand brushing before spraying.

c. **Protection.** All parts of the structure and adjacent property shall be protected from spatters of paint or paint materials. Canvas shields or other means may be required to protect traffic. Freshly painted surfaced shall be protected to prevent dust and dirt from contacting these surfaces.

Protective shields shall be provided so paint drift does not damage adjacent parts of the structure and adjacent property. Spray painting shall be

suspended whenever the application or drift is not being properly controlled.

d. **Responsibility for Paint Damage Claims.** The Contractor shall have a representative available at the job site to receive and promptly process paint damage claims. The Contractor, or representative, shall record the name and address of the claimant, date, and nature of damage; amount of monetary damages sought, date paid; and promptly report all claims to the Engineer.

2. **Field Painting New Structural Steel.**

After assembly, exposed surfaces of nuts, bolts, and washers shall be cleaned with a mineral spirit solvent followed by a hot water rinse. After these surfaces are thoroughly dry, they shall be given a coat of aluminum-filled epoxy-mastic prime coat, and coated with polyurethane finish coat.

Damaged finish coated areas shall be repaired by cleaning and applying the epoxy mastic primer before applying the finish coat.

Surfaces coated with inorganic zinc silicate primer shall be inspected for damage and cleanliness before finish coating. Damaged areas shall be repaired by priming with epoxy mastic. Necessary cleaning shall be done with hot water or steam. The finish coat shall not be applied until all cleaning and repairing has been inspected and accepted.

3. **Rehabilitation Painting.**

Surfaces to be coated shall be prepared by blast cleaning. The level of preparation shall meet SSPC SP-6, “Commercial Blast Cleaning.” Existing paint remaining along the edges of blast-cleaned areas shall be feathered and cleaned to assure a bond of new to old paint.

630.04 METHOD OF MEASUREMENT.

Measurement for painting shall be a Lump Sum item for furnishing and delivering all paint materials, preparing the surfaces and applying the primer and finish coat of paint.

If there is no bid item for Sandblasting and Painting, this work shall be incidental to the prices bid for Structural Steel.

630.05 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price as follows:

Pay Item	**Pay Unit**
Sandblasting and Painting	Lump Sum

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 638
STRUCTURAL PLATE CULVERTS

638.01 DESCRIPTION.

This item consists of furnishing, assembling, and backfilling structural plate pipe, elliptical structural plate pipe, pipe arches, or arches.

638.02 MATERIALS.

Material shall meet Section 830.02.

638.03 CONSTRUCTION REQUIREMENTS.

A. **Excavation.** Excavation shall meet Section 714.03 A.1 and as modified here.

When a pipe structure is erected in a trench, the width of the trench shall be sufficient to permit thorough tamping of the earth backfill.

B. **Bedding.** Bedding shall meet Section 714.03 A.2.

C. **Assembly and Installation.** Pipe shall be assembled by the manufacturer's assembly instructions. Care shall be exercised in the use of drift pins or pry bars to prevent chipping or injury to the galvanized coating.

D. **Backfill.** After assembling the pipe, the backfill shall be placed uniformly and equally on each side of the pipe in layers not to exceed 12 inches before compaction. Adequate earth cover shall be placed over the structure before heavy construction equipment is driven over it. Compaction of each layer of the backfill shall be equal to the compaction as described in Sections 714.03 A.6 and 714.03 A.7.

638.04 METHOD OF MEASUREMENT.

A. **Linear Basis.** When the linear unit quantity is shown on the bid schedule, the structural plate pipe, elliptical structural plate pipe, arches, or pipe arches will be measured in Linear Feet, installed in place, completed, and accepted. The number of Linear Feet will be measured as shown on the Plans for the particular item.

B. **Lump Sum Basis.** Each structural plate culvert shall be the type, size, gauge, and length designated and, for the purpose of measurement and payment, shall be considered as a unit installed in place, completed, and accepted.

638.05 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price as follows: