



# Illinois Department of Transportation

## Memorandum

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To: ALL BRIDGE DESIGNERS 19.6  
From: D. Carl Puzey   
Subject: Structure Coating Policy for New Steel Superstructures  
Date: August 1, 2019

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ALL BRIDGE DESIGNERS (ABD) Memorandum 19.6 details the latest policies regarding bridge coating systems. It gives direction to bridge planners and designers for all coating systems currently utilized by IDOT on new steel superstructures. Comparative costs of different types of coating systems, coating information and terminology, and required plan notes and details are provided. This memo supersedes structure coating policy for new steel structures previously issued with ABD Memorandum 10.1. The remainder of ABD Memorandum 10.1 addressing cleaning and painting of existing steel structures is addressed in ABD Memorandum 19.7.

Bridge coating systems are primarily used to increase the service life of structural steel. The coating may also be viewed as an aesthetic treatment. In order to provide a bridge coating system that is functional, durable, and aesthetically pleasing, a bridge coating strategy must be determined. IDOT currently supports four bridge coating strategies:

- Weathering Steel
- Painted Steel
- Hot-Dipped Galvanized Steel
- Metallized Steel

The weathering steel strategy requires painted or metallized beam ends. The painted steel strategy may utilize metallized beam ends. Galvanized and metallized steel may utilize a paint top coat for aesthetics.

The different strategies are explained below, with their advantages and disadvantages highlighted. The design considerations, required notes, pay items, plan details, and special provisions are then provided. This is followed by a flowchart (Attachment 1) to aid in the decision of a correct strategy, with a brief Q&A (Attachment 2) to explain the flowchart.

### **Planning Policy of Coating Strategies for New Steel Structures**

The coating strategy is typically chosen at the structure planning phase, and is indicated on the Type, Size and Location (TSL) as follows:

- If galvanized or metallized steel is chosen, this shall be stated on the TSL general plan and elevation sheet via a note (e.g., "All structural steel shall be galvanized." or "All structural steel shall be metallized.").

- If weathering steel is chosen, this is reflected on the TSL via the grade of steel (Grade 50W is shown).
- If nothing is shown on the TSL, painted steel is assumed to be the chosen strategy by default.

The decision of a coating strategy should be coordinated with District Studies and Plans Engineers, District Bridge Maintenance Engineers and/or District Paint Technicians, and will be reviewed by the Bureau of Bridges and Structures Bridge Planning Unit at the TSL review phase for State-owned structures. The coating strategy for Local Public Agency (LPA) structures shall be determined by the Owner, in consultation with the design engineer. The LPA may consult with the Bureau of Bridges and Structures.

A brief explanation of each of the four coating strategies is given below, followed by a summary of their relative costs, durability, and aesthetics.

#### 1) *Weathering Steel*

Weathering steel is a coating strategy wherein the steel relies on a dense metal oxide patina to resist corrosion. This coating system is effective when the steel can remain relatively dry and free of chlorides (i.e., salt). Locations where weathering steel cannot remain dry and free of chlorides, such as areas near deck joints, are coated with either paint or metallizing.

The most common use of weathering steel is in stream crossing applications, where it is not generally seen by the motoring public. However, weathering steel should not be used where there will be constant humidity due to the proximity of water. For stream crossings/crossings over running water, if the distance between the typical streamflow elevation and the bottom of the beams is less than 8 feet, weathering steel shall not be used. For crossings over lakes/stagnant bodies of water, if the distance between normal pool elevation and the bottom of the beams is less than 10 feet, weathering steel shall not be used. These 8 feet and 10 feet dimensions are taken from FHWA Technical Advisory 5140.22, which is available at <https://www.fhwa.dot.gov/bridge/t514022.cfm>

For bridges over waterways with significant boat traffic, some districts have opted to use weathering steel despite the aesthetic concerns. Painting of all areas of weathering steel within 10 feet of substructure units has been performed to limit staining. Other details such as drip plates may also limit staining of substructure units. These are viable options and may be utilized at the discretion of the district.

Cost: Weathering steel is the least expensive coating strategy, with initial per-pound costs that are around 90% of painted steel and 70% of galvanized or metallized steel. Comparatively, there is very little up-front cost for using weathering steel and recoating is not required. The additional cost of painting or metallizing beam ends is marginal when compared to the total cost of the structural steel.

Durability: Weathering steel is durable if it can remain dry and free of chlorides. Planners should note this is not always possible, and areas near deck joints and bridge fascias have been known to develop pack rust. Due to these concerns, some districts are not in favor of utilizing weathering steel.

Aesthetics: Weathering steel drips rust when wet, which is not considered to be aesthetically pleasing. Planners should account for this when choosing a coating strategy.

## 2) *Painted Steel*

Painted steel is a coating strategy wherein three coats of paint are applied to the steel. The first coat, or primer, consists of a zinc-rich paint that is intended to provide cathodic protection to the steel. The second coat, or intermediate coat, is intended to provide protection to the primer. The third coat, or topcoat, is an aesthetic treatment that also protects the intermediate coat from environmental elements and UV effects.

IDOT currently uses two paint systems for new steel. The systems are abbreviated by the material properties of their three coats:

- IZ/AC/AC- Inorganic Zinc-Rich Primer (IZ), Acrylic Intermediate Coat (AC), Acrylic Topcoat (AC)
- OZ/E/U- Organic Zinc-Rich Primer (OZ), Epoxy Intermediate Coat (E), Urethane Topcoat (U)

IZ/AC/AC is the preferred system for new painted structures. The Department has had over 30 years of experience with this primer. When compared to the OZ/E/U system, it provides better corrosion protection. The IZ primer is sensitive to imperfections in the steel and therefore the primer must be applied in the shop. The primer requires exposure to humidity to complete its curing, which requires the intermediate coat and topcoat to be applied in the field. However, compared to OZ/E/U, AC coats also require a higher ambient temperature (55 degrees Fahrenheit) to cure and may not be applicable in cold-weather work. Note that the use of heaters to help cure paint systems is common. Therefore, the outside ambient temperature may be considerably below 55 degrees and the paint system will still cure appropriately due to the heaters. However, the IZ/AC/AC system should not be used in extreme cold such as the middle of winter in northern Illinois, as the heaters may not be able to adequately warm the containment.

OZ/E/U utilizes a primer with a quicker recoat window and cures independently of the ambient humidity, which allows the entire system to be applied in the shop. This is advantageous when conditions require that steel be erected quickly (i.e., traffic control is a concern). OZ/E/U also has a lower curing temperature (35 degrees Fahrenheit) and may be utilized in colder conditions than the IZ/AC/AC system. The system is not preferred for new steel but may be chosen if traffic control or temperature requirements are a concern.

The Central Bureau of Materials maintains an approved list of paint products that are compliant with the above systems.

Recoating of painted steel, which is typically required every 25 years, can be very expensive, and negatively affects the life-cycle cost of the bridge. For this reason, painted steel also may be metallized at beam ends to increase the service life of the coating system at these locations. The additional cost of metallizing beam ends is marginal when compared to the total cost of the structural steel, and a topcoat may be provided over the metallizing for aesthetic purposes.

Painted steel is typically used in grade separation applications, where the motoring public is cognizant of the aesthetics of the structure.

Cost: Painted steel upfront costs are generally 10% higher than weathering steel, and 20% lower than galvanized or metallized steel. Life-cycle costs are substantially higher than any other system due to recoating requirements.

Durability: Painted steel requires recoating approximately every 25 years, sometimes sooner if located in poor environmental conditions. It should be anticipated that a painted steel bridge will be repainted twice over the course of its service life. It is seen as more durable than weathering steel but less durable than galvanized or metallized steel.

Aesthetics: Painted steel is considered aesthetically pleasing. IDOT currently allows four standard colors for painted steel. See the Painted Steel portion of the Design Policy portion of this memo.

### 3) *Galvanized Steel*

Galvanized steel is a coating strategy wherein the structural steel is dipped into a galvanizing kettle of zinc, which allows the zinc to form a metallurgical bond with the steel. This strategy provides the highest level of cathodic protection and is more adherent than paint or metallizing. It is the most resistant to corrosion, with a design life expected to be equal to the design life of the bridge. For this reason, it is the most desirable option.

There are multiple galvanizers available to hot-dip galvanize beams. Each of these galvanizers have kettles that vary in size. They also have different cranes with variable weight capacities available to lift the beam segments. In order to maximize the number of available galvanizers, beam segments shall follow the geometric requirements in *Table 1: Beam Segment Requirements for Hot-Dip Galvanizing*. A "beam segment" refers to a portion of a beam between a beam end and a splice, or the portion of the beam between two splices. The "preferred" column gives values which most hot-dip galvanizers can accommodate. The "maximum" column gives a value that should not be exceeded because it would be very difficult for the majority of hot-dip galvanizers to galvanize the beams. Note that the "width" must also include any curvature on curved beams.

In general, galvanizing is a viable option for structures with individual span lengths less than or equal to 120 feet and very little curvature. These structures tend to have shallow and comparatively lightweight sections that will meet the requirements in Table 1.

	Preferred	Maximum
Length	50 ft.	60 ft.
Width	4 ft.	9 ft.
Depth	6 ft.	12 ft.
Weight	10 k	20 k

*Table 1: Beam Segment Requirements for Hot-Dip Galvanizing*

To meet the requirements in the Table 1, segments may be required to be shortened to accommodate for curvature in highly curved structures. Shorter beam segments require additional splices to the structure to accommodate the galvanizing. This may not always be a viable option depending upon the structure configuration. For example, splices required to be erected over live rail traffic are discouraged, as are splices in regions of high moment. If splices in these locations are required, they will typically be assembled on the ground and multiple segments will be lifted into place simultaneously, which may complicate erection. Bridge planners should look at the geometry of the structure when determining if galvanized steel is an option. Excessively heavy beams, high curvature, deep girders, or longer required segments will often preclude the use of galvanized steel.

Because there is no need to recoat, galvanized steel is a preferred option where recoating is difficult, such as in high-traffic areas or over railroads.

Cost: Galvanized steel upfront costs are generally 40% higher than weathering steel, and 25% higher than painted steel. The upfront costs are generally slightly higher than metallized steel. The life-cycle costs of galvanized steel are reduced by the fact that recoating is not required.

Durability: Galvanized steel is considered the most durable bridge coating strategy. It has a design life that is anticipated to be equal to the life of the structure. Recoating is not required.

Aesthetics: Galvanized steel is a dull gray color that may appear to be patchy, especially in the first few years of the structure's life. It may not be considered aesthetically pleasing. The color also may change over time as the bridge ages. Galvanized steel fascia beams may be painted to improve aesthetics at an additional cost. Painting requirements are found in the Guide Bridge Special Provision "Hot-Dip Galvanizing for Structural Steel" (GBSP83), which references Section 506 of the Standard Specifications for Road and Bridge Construction regarding paint systems. The additional up-front cost of painting fascias of galvanized steel structures may be assumed to be 5% of the total steel cost. However, planners should note that aesthetic painting will likely require repainting in the future, increasing the life-cycle cost. More information on the painting of galvanized steel is given in the Design Policy portion of this memorandum.

#### 4) *Metallized Steel*

Metallized steel is a coating strategy wherein a metallic thermal spray is shop-applied to the structural steel. This spray is considered to have a similar adherence as paint, but is more resistant to thermal cycles than paint. Therefore, it is a more resistant bridge coating strategy than painted steel and weathering steel, but less resistant than galvanized steel.

Metallized steel does not have the design and detailing considerations required of galvanized steel. There are no maximum segment lengths, weights, or curvature requirements. It is available as an option for full bridge coating if galvanized steel is preferred but cannot be utilized due to geometric or weight constraints.

Cost: Metallized steel upfront costs are generally similar to galvanized steel for full structure coatings. For metallizing small areas near deck joints on weathering steel or painted steel projects, the overall cost of adding metallizing to these projects is small.

Durability: Metallized steel is a durable bridge coating strategy. It has a design life that is anticipated to be equal to 1.5 to 2 times that of painted steel. Metallized steel should be anticipated to be re-metallized once over the course of its service life.

Aesthetics: Metallized steel is a dull gray color that becomes increasingly darker as the structure ages, eventually becoming a charcoal gray. The color may not be consistent in tone across the structure. It may not be considered aesthetically pleasing. A clear coat may be added to seal the metallizing and limit further changes in color. Metallized steel fascias may be painted to improve aesthetics. These aesthetic options are more clearly explained in the Guide Bridge Special Provision "Metallizing of Structural Steel" (GBSP82). Similar to painting galvanized fascias, the additional cost of painting metallized fascias may be assumed to be 5% of the total structural steel cost. Also, similar to galvanized steel, planners should note that any aesthetic painting will likely require repainting in the future, increasing the life-cycle cost.

### **Design Policy of Coating Strategies for New Steel Structures**

Design policy for different coating strategies is given below. For each strategy, design considerations are stated, followed by required General Notes, plan details, and Special Provisions.

#### 1) *Weathering Steel*

##### Design Considerations

Weathering steel beams have an allowable fatigue stress range that corresponds with Fatigue Category B. This is less than the allowable fatigue stress range for painted steel beams, which utilize Fatigue Category A. See Section 6.6 of the AASHTO LRFD Bridge Design Specifications.

As per Table 6.4.1-1 of the AASHTO LRFD Bridge Design Specifications, Grade 50W weathering steel has Minimum Tensile Capacity ( $F_u$ ) of 70 ksi. This is important to note when designing connections.

Weathering steel with a yield strength of 36 ksi does not exist. Designers should note that any structure utilizing weathering steel will require a yield strength of 50 ksi or higher.

#### Required General Notes

The following General Notes shall be added for all projects with weathering steel:

*Fasteners shall be ASTM F 3125 Grade A325 Type 1, mechanically galvanized bolts in painted or metallized areas and ASTM F3125 Grade A325 Type 3 weathering steel bolts in unpainted areas.*

*All structural steel shall be AASHTO M270 Grade XXW (except expansion joints and bearings which shall be AASHTO M270 Grade XX).*

As per Articles 520.03 and 521.03 of the Standard Specifications for Road and Bridge Construction, exposed surfaces of metal bearings and metal bearing components shall be painted according to Article 506.09, with galvanizing used as an option. Therefore, there will not be a case where exposed weathering steel is used on a joint or bearing. The parenthetical statement in the note above excludes joints and bearings from the weathering steel requirement.

For bridges with weathering steel and integral or semi-integral abutments, ponding at the interface between the bottom flange and the abutment face has been known to occur. In these cases, it is useful to paint the end portions of the beams to avoid pack rust at these locations. For bridges with weathering steel and integral or semi-integral abutments, the following note shall be added to the General Notes:

*Structural steel shall be painted for a distance equal to the depth of the embedment into the concrete cap plus 18 inches. Painted areas shall be primed in the shop with a Department-approved zinc rich primer. Field painting will not be required.*

For bridges with weathering steel and deck joints, the portions of the structural steel near the joints shall be painted. Metallizing may be used at the option of the District.

For bridges utilizing painted beam ends, the IZ/AC/AC system is preferred unless traffic control or cold weather conditions are a concern, in which case the OZ/E/U system is used. The distance from the joints to be painted shall be the lesser of three times the beam depth or 10 feet. As per Article 506.08 of the Standard Specifications for Road and Bridge Construction, the color of the finish coat is Federal Color Standard 595a 20045. This is a color that has been designed to match the color of the weathering steel for aesthetic purposes.

For bridges with weathering steel and painted beam ends, the following note shall be added to the plans:

*All structural steel and exposed surfaces and bearings within a distance of (\*) ft. each way from the deck joints shall be painted using the (\*\*) paint system as specified in Section 506 of the Standard Specifications.*

\*Calculate the lesser of three times the beam depth or 10 feet and place this number in the General Note. Round up to a whole number of feet.

\*\*Place "Inorganic Zinc-Rich/Waterborne Acrylic" in the General Note when the IZ/AC/AC system is required. Place "Organic Zinc-Rich/Epoxy/Urethane" in the General Note when the OZ/E/U system is required.

Metallizing may be used at beam ends if desired. For bridges utilizing weathering steel and metallized beam ends, see the Metallized Steel portion of this memorandum.

#### Required Pay Items

Weathering steel bridges do not require any additional pay items to address the weathering steel.

#### Required Plan Details

There are no required plan details for weathering steel bridges. However, drip plates may be utilized on structures where staining of substructures is a concern, or structures with high profile grades where water may run for long distances along the bottom flange. Drip plates consist of clips that are epoxy-glued to the bottom flange, are sized to fit around the bottom flange, and are angled in a direction that promotes water to run off the flange. They typically are located near joints within the limits of the painted steel. For example, if 10 feet of beam ends are painted, the drip plates are placed 10 feet from the end of the beam. An example of a drip plate detail is shown in Figure 1.

#### Required Special Provisions

There are no required special provisions for weathering steel.

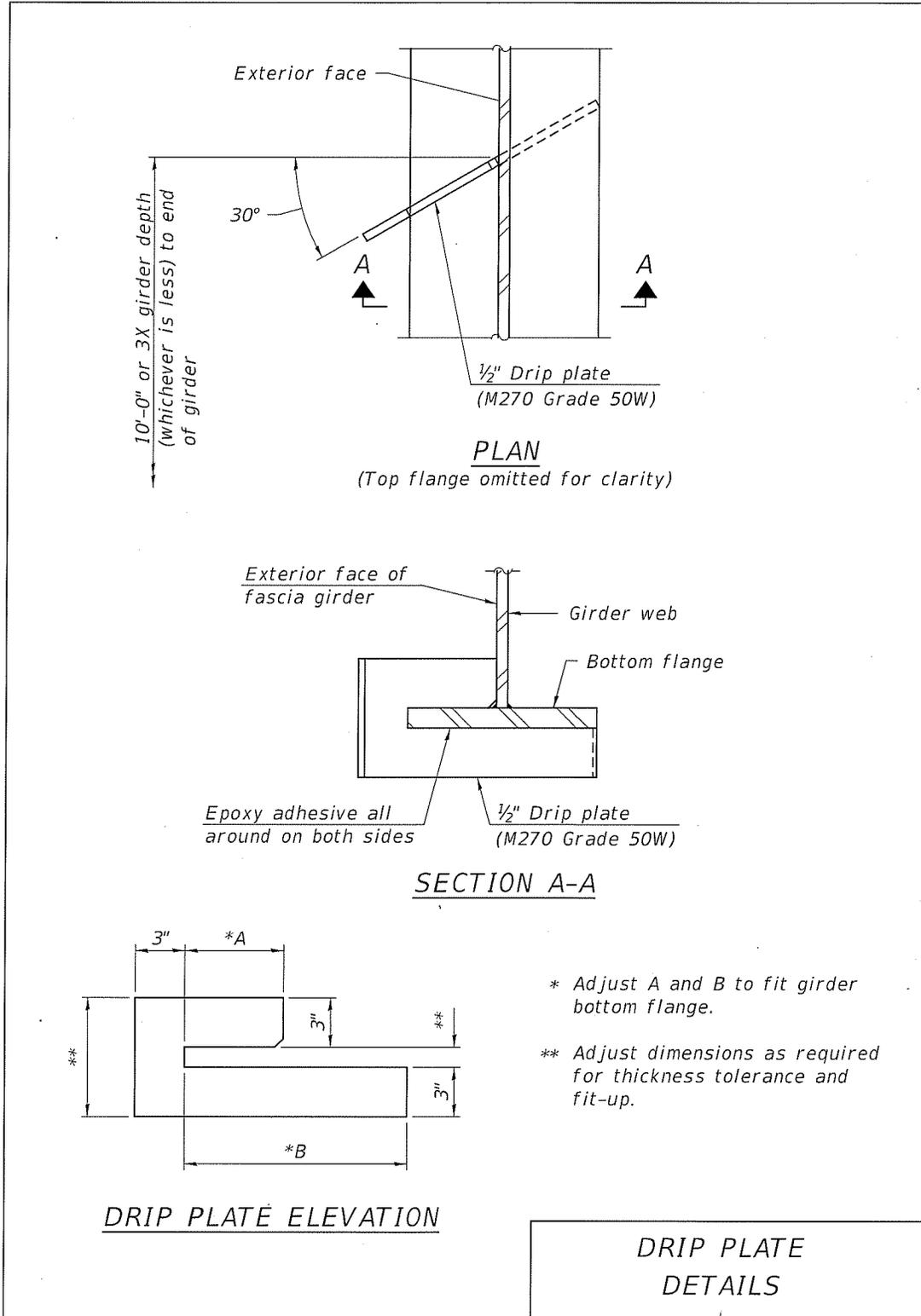


Figure 1

2) *Painted Steel*

Design Considerations

Painted steel beams have an allowable fatigue stress range that corresponds with Fatigue Category A. See Section 6.6 of the AASHTO LRFD Bridge Design Specifications.

The additional weight of paint is marginal (around 0.25 psf) and need not be accounted for in design.

Required General Notes

The following General Notes shall be added for all projects with painted steel:

*Fasteners shall be ASTM F 3125 Grade A325 Type 1, mechanically galvanized bolts in painted areas.*

For bridges with painted steel, where the full bridge is to be shop primed and field finished (IZ/AC/AC), the following note shall be added to the General Notes. Again, this is the preferred paint system unless traffic control or cold weather considerations are a concern.

*The Inorganic Zinc Rich Primer / Acrylic / Acrylic Paint System shall be used for shop and field painting of new structural steel except where otherwise noted. The color of the final finish coat for all interior steel surfaces shall be gray, Munsell No 5B 7/1. The color of the final finish coat for the exterior and bottom flange of the fascia beams shall be (\*\*).*

For bridges with painted steel, where the full bridge is to be shop painted only (OZ/E/U), the following note shall be added to the General Notes. As stated previously, this paint system is used when required by traffic control considerations (i.e., the lane closures required to field-paint are onerous) or cold weather construction considerations (i.e., it is known that the bridge will be constructed in the middle of winter in northern Illinois).

*The Organic Zinc Rich Primer/Epoxy/Urethane paint system shall be used for painting of new structural steel except where otherwise noted. The entire system shall be shop applied, with the exception that the exterior surfaces and bottom of the bottom flange of the fascia beams, masked off connection surfaces, and field installed fasteners, all of which shall be touched up and finish coated in the field. The color of the final finish coat for all interior steel surfaces shall be gray, Munsell No. 5B 7/1. The color of the final finish coat for the exterior and bottom flange of the fascia beams shall be (\*\*).*

For bridges with painted steel, where only a small amount of new steel is being added (e.g., diaphragm replacements), the new steel is typically only primed, and will be fully painted through a later contract. For these cases, the following note shall be added to the General Notes.

*All new structural steel shall be shop painted with an inorganic zinc rich primer per AASHTO M 300, Type 1.*

For bridges with painted steel, where additional beam lines are being added, the existing steel is typically repainted after the additional beam lines are added. When this occurs, the new beam lines and diaphragms are typically only primed in the shop. Then, after erection, all beams and diaphragms, existing and new, are blast cleaned and painted. For these cases, the following notes shall be added to the General Notes. Bridge designers should consult with district personnel, or the Owner for LPA structures, to establish the preferred color for a given structure.

*All new structural steel shall be shop painted with an inorganic zinc rich primer per AASHTO M 300, Type 1.*

*Cleaning and painting of the existing and new structural steel shall be as specified in the special provision for "Cleaning and Painting Existing Steel Structures". All existing and new steel shall be cleaned per Near White Blast Cleaning – SSPC-SP10. All existing and new steel shall be painted according to the requirements of Paint System 1 - OZ/E/U. The color of the final finish coat for all interior steel surfaces shall be Gray, Munsell No. 5B 7/1. The color of the final finish coat for the exterior and bottom flange of the fascia beams shall be (\*\*).*

*\*\*Colors for fascias:*

- Interstate Green, Munsell No. 7.5G 4/8
- Reddish Brown, Munsell No. 2.5YR 3/4
- Blue, Munsell No. 10B 3/6
- Gray, Munsell No. 5B 7/1

#### Required Pay Items

For painted steel structures where the structural steel is completely new (i.e., not bridge widening projects wherein the existing structure is being repainted), there are no additional required pay items.

For widening projects where the existing structural steel is to be repainted, the following pay item shall be added to the Contract plans:

- CLEANING AND PAINTING STEEL BRIDGE, at the designated location

For widening projects where the existing structural steel is to be repainted, at the request of the District/Owner, a two-year warranty may be added to the Contract in cases where the bridge is fully repainted. In this case, the following pay item shall be added to the plans:

- BRIDGE CLEANING AND PAINTING WARRANTY, at the designated location

For widening projects where the existing structural steel is to be repainted, one of the following two pay items shall be added for containing and disposing of the cleaning residues. Whether or not there is lead paint on the bridge will depend on when it was constructed. In general, structures prior to 1986 will

have lead paint on the structure. Determination of the presence of lead may be made by either checking the paint category in the Structure Information System (SIMS) or Pontis, or by checking the General Notes on the existing plans. Testing may be required if this information is not available.

- CONTAINMENT AND DISPOSAL OF LEAD PAINT CLEANING RESIDUES, at the designated location
- CONTAINMENT AND DISPOSAL OF NON-LEAD PAINT CLEANING RESIDUES, at the designated location

When these pay items are used, contracts with multiple structures shall have one pay item for each structure, even if the structures are dual structures and are technically at the same location.

#### Required Plan Details

For painted steel structures, there are no required plan details aside from the General Notes stated above.

#### Required Special Provisions

For new bridges with painted steel, there are no additional required special provisions for the painting of the steel.

For widening projects where the existing structural steel is repainted, the following Guide Bridge Special Provisions (GBSPs) shall be added to the Contract for the cleaning and painting of the structural steel:

- GBSP21: Cleaning and Painting Contact Surface Areas of Existing Steel Structures
- GBSP25: Cleaning and Painting Existing Steel Structures
- GBSP94: Warranty for Cleaning and Painting Steel Structures

For widening projects where the existing structural steel is repainted, one of the following two GBSPs shall be added for containing and disposing of the cleaning residues.

- GBSP26: Containment and Disposal of Lead Paint Cleaning Residues
- GBSP60: Containment and Disposal of Non-Lead Paint Cleaning Residues

### 3) *Galvanized Steel*

#### Design Considerations

To facilitate hot-dip galvanizing, beam segments have specific requirements that must be met. See the Galvanized Steel portion of the Planning Policy section of this memorandum for a table of these requirements. Because of

these requirements, additional splices may be required. Designers should note that splices in high-moment areas may become problematic both in the steel-only erected state and in the final state and should be avoided. Additionally, splices that are required to be erected over rail traffic should be avoided. On built-up members (i.e., plate girders) galvanizing thickness may vary from member to member depending upon the thickness of the members. To avoid large discrepancies of galvanizing thickness on a plate girder, designers should attempt to proportion members such that no member is more than three times the thickness of any other connected element. For example, if a ½" thick web is used on a plate girder, designers should attempt to limit flange thicknesses to 1½".

Contact with dissimilar metals is not recommended. The designer should ensure this does not occur in the plan details, including lighting and conduit details. Future attachments such as galvanized conduits mounted on non-galvanized beams require properly insulated connection details.

Galvanizing adds weight to the beams and girders that shall be accounted for in dead load calculations. Zinc has a unit weight of 426 pcf, and the maximum thickness of galvanizing may be assumed to be 20 mils. This 20 mil thickness is seen as a worst-case scenario and a conservative value to use in design. 20 mils of galvanizing adds an additional 0.71 psf of beam. While this seems like a marginal amount of weight, it can become substantial, depending upon the perimeter of the beam. For example, for a typical plate girder with a 48 inch deep web and 18 inch wide flanges, this is around 10 lb. / ft. additional weight.

Galvanizing may result in bolt relaxation. A 20% reduction in slip capacity shall be used when determining the number of bolts required for Service II loading.

#### Required General Notes

The following General Notes shall be added for all projects with galvanized steel:

*Fasteners shall be ASTM F 3125 Grade A325 Type 1. Fasteners shall be hot dip galvanized. See Special Provision for "Hot Dip Galvanizing for Structural Steel."*

*All new structural steel shall be galvanized. See Special Provision for "Hot Dip Galvanizing for Structural Steel".*

When fascias are to be painted for aesthetic purposes, the paint is shop-applied. The following note shall be added to the General Notes:

*The fascia and underside of the exterior beams and their associated splice plates shall be painted with the acrylic system. The color of the final finish coat of paint shall be (\*). See Special Provision for "Hot Dip Galvanizing for Structural Steel".*

*\*Colors for fascias:*

- Interstate Green, Munsell No. 7.5G 4/8
- Reddish Brown, Munsell No. 2.5YR 3/4
- Blue, Munsell No. 10B 3/6
- Gray, Munsell No. 5B 7/1

When steel plates for expansion joints are included in the contract, the following note shall be added to the General Notes:

*Expansion joint plates shall be shop painted with the inorganic zinc rich primer per AASHTO M300, Type 1.*

Required Pay Items

For galvanized steel structures, there are no additional pay items to address the galvanizing. As per GBSP83, the cost is included with the applicable pay items to be galvanized. Any additional aesthetic coatings are also included in the applicable pay items.

Required Plan Details

Plate girders are typically more susceptible than wide flange beams to warping during galvanizing. The following notes advise galvanizers to provide additional stiffeners at splice ends of plate girders when required. These notes may be located on the girder elevation details sheet or in the General Notes.

*Girders have bearing stiffeners and connection plates as required by design. Additional stiffeners may be added at the Contractor's expense as necessary to prevent distortion of the girders during galvanizing. The Contractor shall coordinate with the fabricator and the galvanizer to determine if additional stiffeners are necessary, and where these should be placed. Any proposed changes shall be submitted to the Engineer for approval prior to making any changes and documented on the shop drawings.*

*Temporary stiffener angles shall be bolted to each side of the splice ends of each girder segment to prevent distortion during galvanizing. Temporary stiffener angles shall bolt or fit tight against top and bottom flanges and include spacer tubes to minimize damage to galvanizing during removal. Cost included with Furnishing and Erecting Structural Steel.*

Required Special Provisions

For new bridges with galvanized steel, the following GBSP is required:

- GBSP83: Hot Dip Galvanizing for Structural Steel

4) *Metallized Steel*

Design Considerations

There are no additional design considerations for metallized steel.

The additional weight of metallizing is considered marginal and need not be accounted for in design.

Required General Notes

The following General Notes shall be added for all projects where the entirety of the bridge is metallized steel:

*All new structural steel shall be metallized. See Special Provision for "Metallizing of Structural Steel."*

*Fasteners shall be ASTM F 3125 Grade A325 Type 1, mechanically galvanized bolts in metallized areas.*

When only areas near deck joints are required to be metallized, such as weathering steel bridges with metallized beam ends, the following General Note shall be added. See Weathering Steel portion of this memorandum for determination of distance to be metallized.

*All structural steel girders, cross-frames, and exposed surfaces of bearings within a distance of (\*) ft. from the expansion joint shall be metallized. See special provision for "Metallizing of Structural Steel."*

When areas are required to be metallized and painted, the metallizing and painting is shop-applied. The following General Note shall be added:

*The metallized areas shall be painted with System 1. Exterior fascia and bottom of bottom flange areas shall be metallized and shop painted (System 3). See special provision for "Metallizing of Structural Steel." The color of the final finish coat of paint shall be (\*).*

*\*Colors for fascias:*

- Interstate Green, Munsell No. 7.5G 4/8
- Reddish Brown, Munsell No. 2.5YR 3/4
- Blue, Munsell No. 10B 3/6
- Gray, Munsell No. 5B 7/1
- Federal Color Standard 595a 20045 (weathering steel bridges only)

System 1 is a single clear aliphatic urethane coat that is shop applied. It is not considered to be aesthetic, which is why it is used on interior surfaces. System 3 is a three-coat Epoxy/Epoxy/Urethane system, which is similar to the OZ/E/U system used for shop-painting non-metallized steel.

#### Required Pay Items

For metallized steel structures, there are no additional pay items to address the metallizing. As per GBSP82, the cost is included with the applicable pay items to be metallized. Any additional aesthetic coatings are also included in the applicable pay items.

#### Required Plan Details

For metallized steel structures, there are no required plan details aside from the General Notes stated above.

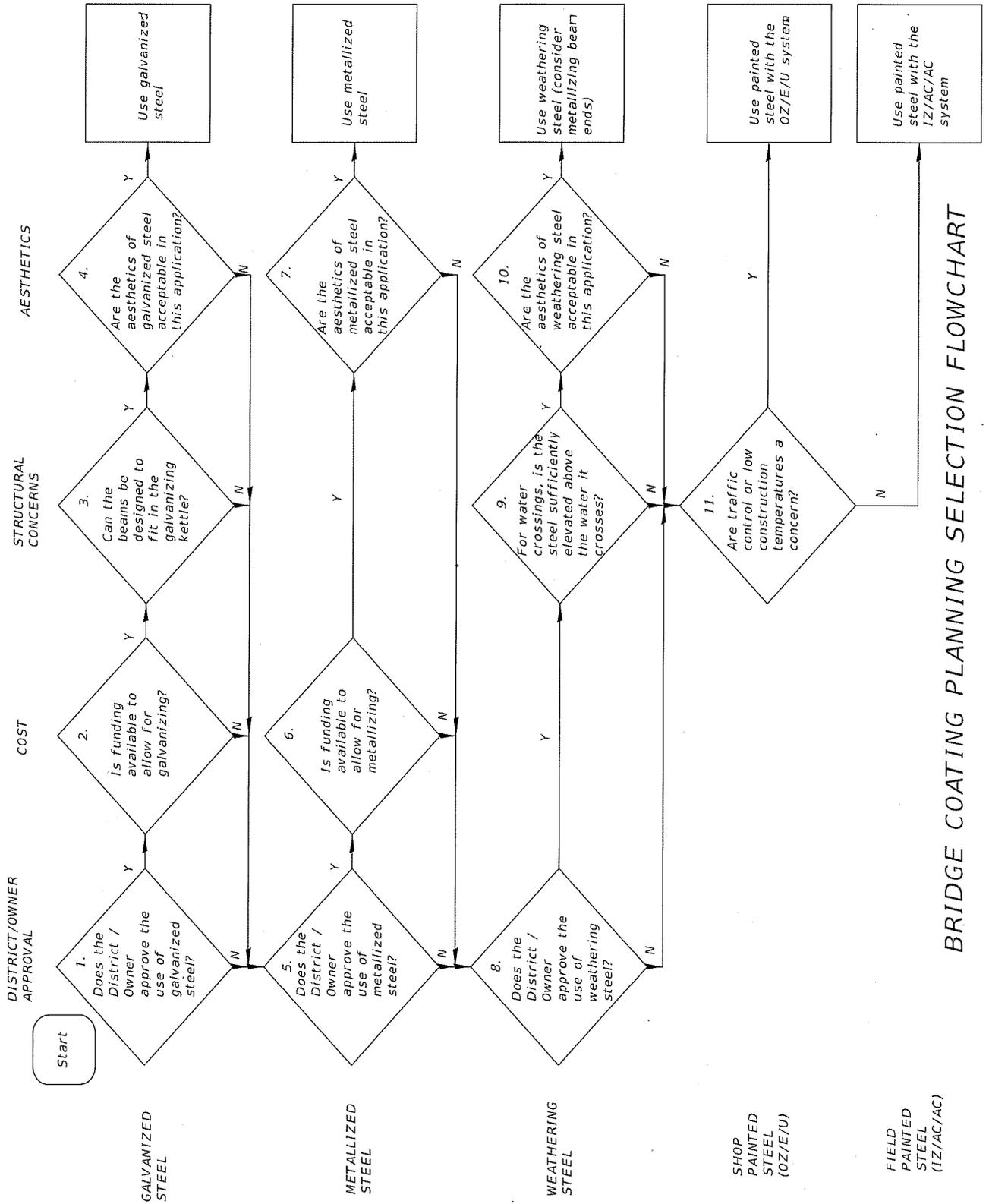
#### Required Special Provisions

For new bridges with metallized steel, the following GBSP is required:

- GBSP82: Metallizing of Structural Steel

#### **Implementation**

These policies shall be implemented on bridges with TSLs approved after September 1, 2019. If you have any questions, please contact Mark Shaffer of the Policy, Standards, and Final Plan Control Unit at (217) 785-2914.



BRIDGE COATING PLANNING SELECTION FLOWCHART

1. Does the District/Owner approve the use of galvanized steel?

Bridge planners should verify with District Studies and Plans Engineers and District Bridge Maintenance Engineers and/or District Paint Technicians, or Owner for LPA structures whether the district/owner has a preference for or against galvanized steel.

2. Is funding available to allow for galvanizing?

Galvanized steel costs around 40% more than weathering steel and 25% more than painted steel. For bridges with large amounts of steel, this is a substantial additional cost. Bridge planners should evaluate whether this additional cost is acceptable to the district/owner.

3. Can the beams be designed to fit in the galvanizing kettle?

In general, steel structures with individual span lengths less than or equal to 120 feet and very little curvature will meet the requirements below.

The following table gives beam segment requirements. This table is repeated from the Planning Policy portion of this memorandum.

	Preferred	Maximum
Length	50 ft.	60 ft.
Width	4 ft.	9 ft.
Depth	6 ft.	12 ft.
Weight	10 k	20 k

*Table 1: Beam Segment Requirements for Hot Dip Galvanizing*

Additional splices to be placed in high stress regions such as midspan or near piers and splices to be placed over live rail traffic are discouraged because they may complicate erection procedures.

4. Are the aesthetics of galvanized steel acceptable in this situation?

Bridge planners should inquire if the dull gray and potentially patchy color is aesthetically acceptable in the location of the bridge. If not, bridge planners should inquire if the district/owner is amenable to fascia painting over the galvanizing, knowing it that will incur an additional cost of around 5% of the steel cost and the fascias will eventually need to be repainted.

5. Does the District/Owner approve the use of metallized steel?

Bridge planners should verify with District Studies and Plans Engineers and District Bridge Maintenance Engineers and/or District Paint Technicians, or Owner for LPA structures, whether the district/Owner has a preference for or against metallized steel.

6. Is funding available to allow for metallizing?

Metallized steel costs around 40% more than weathering steel and 25% more than painted steel. For bridges with large amounts of steel, this is a substantial additional cost. Bridge planners should evaluate whether this additional cost is acceptable to the district/owner.

7. Are the aesthetics of metallized steel acceptable in this situation?

Bridge planners should inquire if the dull gray and potentially patchy color is aesthetically acceptable in the location of the bridge. If not, bridge planners should inquire if the district/owner is amenable to fascia painting over the metallizing, knowing that that will incur an additional cost of around 5% of the steel cost and the fascias will eventually need to be repainted.

8. Does the District/Owner approve the use of weathering steel?

Bridge planners should verify with District Studies and Plans Engineers and District Bridge Maintenance Engineers and/or District Paint Technicians, or Owner for LPA structures, whether the district/owner has a preference for or against weathering steel.

9. For water crossings, is the steel sufficiently elevated above the water it crosses?

Bridges with steel beams too close to constant bodies of water are not good candidates for weathering steel because the constant humidity will generate pack rust. Bridge planners should verify that the steel beams are at least 8 ft. above the average streamflow elevation for stream crossings/running water or 10 ft. above normal pool elevations of lakes/stagnant water they cross.

10. Are the aesthetics of weathering steel acceptable in this situation?

Weathering steel bridges tend to cause rust stains on adjacent substructure units and roadways. Bridge planners should verify that this is not an aesthetic concern prior to choosing weathering steel as a coating strategy. In general, weathering steel should not be used on structures at grade crossings or bridges over boat traffic. In the past, structures with weathering steel over boat traffic have been painted at substructure units to reduce the amount of staining at these locations. This is a viable option and may be used at the discretion of the district/owner.

11. Are traffic control or low construction temperatures a concern?

Bridge planners should choose field painting with the IZ/AC/AC system whenever feasible. Non-feasibility occurs when traffic control concerns limit the amount of time available to paint the bridge, or low erection temperatures (i.e., middle of winter in the northern portion of Illinois) will affect the curing of the paint system.