

Structures

The Contractor shall design, and construct all of the structures required to make the Project fully functional, in accordance with the Contract Requirements.

Standards

Location	Current Structure Number	New Structure Number	Proposed Action
Black Squirrel Creek NB	H-17-J	(H-17-DD)	Widen or Remove and Replace
Black Squirrel Creek SB	H-17-L	(H-17-DE)	Widen or Remove and Replace
Smith Creek NB	H-17-H	H-17-DF	Remove and Replace
Smith Creek SB	H-17-AL	H-17-DG	Remove and Replace
Monument Creek Branch NB	H-17-AG	H-17-DH	Remove and Replace
Monument Creek Branch SB	H-17-I	H-17-DI	Remove and Replace
Draw	H-17-M	H-17-DJ	Remove and Replace
Jackson Creek	H-17-AI	H-17-DK	Remove and Replace
Teachout Creek	H-17-BK	H-17-DL	Remove and Replace
I-25 NB over Northgate Blvd	H-17-BD		Widen
I-25 SB over Northgate Blvd	H-17-BC		Widen
Minor Concrete Box Culvert			Remove and Replace

The standards used for design and construction of the structures for this project shall be as specifically referenced in this section.

Standards referenced by this section include:

AASHTO LRFD Bridge Design Specifications, 6th Edition, 2012.

The Manual for Bridge Evaluation, 2010 2nd Edition, with 2011 Interims

AASHTO Standard Specifications for Structural Supports and Highway Signs, Luminaires, and Traffic Signals, 5th Edition, 2009, with 2010 and 2011 Interims

AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2011, 2nd Edition

Seismic design may be done using either the AASHTO Guide Specification for LRFD Seismic Bridge Design Specifications or the AASHTO LRFD Bridge Design Specifications, but shall be consistent and use one or the other for the design of all components of the bridge.

The 2011 Edition of the Standard Specifications for Road and Bridge Construction as published by the Colorado Department of Transportation and any documents referenced therein.

Structural Capacity Rating Requirements

The Structural Capacity Rating for the Bridge Superstructures, the Concrete Box Culverts, and the Concrete Rigid Frame this project shall be in accordance with the Bridge Rating Manual, CDOT Staff Bridge, effective date April 1st, 2011.

Structural Capacity Rating Submittals and CDOT Reviews

No construction of a Bridge Superstructure and Concrete Rigid Frame and no construction related to the Concrete Box Culverts, such as additional fill added on top of a Concrete Box Culvert or additional Concrete Box Culvert cells placed adjacent to existing cells shall be started until a Structural Capacity Rating package per the Bridge Rating Manual is submitted with safe load rating results for that design and structure, and the Rating package has been Approved by CDOT Staff Bridge. The rating submittal shall be based on the Deliverables in this section.

Software(s)

The software(s) for Structural Capacity Rating for the Bridge Superstructures, the Concrete Box Culverts (CBC), and the Concrete Rigid Frame (CRF) shall be per the Bridge Rating Manual.

Design Requirements

The Final Design Documents submittal of the bridge plans, See Section 3 – Quality Management shall be submitted to CDOT Staff Bridge on CDs. The requirements for the Final Design Documents submittal for the bridges, CBCs, CRFs, retaining walls, sign structures, and any other major structures shall be per Subsection 19.1, Minimum Project Requirements for Major Structures, Final Design Submittal.

Structure Concept Plan

If the Contractor replaces existing structures with a new bridge or CBC the Contractor shall submit a Structure Concept Plan (SCP) for Approval by CDOT.

If the Contractor decides to widen and rehabilitate a structure, the Contractor shall submit a Rehabilitation/Widening Structure Concept Plan (RWSCP) for Approval by CDOT.

Proceeding with any structure design, prior to Approval will be at the Contractor's risk. CDOT reserves five (5) Working Days review time for the SCP and the RWSCP.

The SCP shall include the following:

A. General Layout.

- (1) Bridge, CBC, CRF - Two page description of bridge type, superstructure type, and foundation, with one of the two pages a layout sheet showing Plan, Typical Section and Section.
- (2) Wall- Two page description of wall (if any) type and foundation with one of the two pages a layout sheet showing Location, Plan and Typical Wall Section.

The RWSCP shall include the following:

B. General Layout.

- (3) Bridge, CBC, CRF - Minimum two page description of rehabilitation/ widening/ extension concept including any new girders or superstructure widening required and description of these girders, any new substructure widening required and description of the substructure widening and new foundation elements required and a description of these. Description of how the new foundation elements will make the structure stable for the 500 yr scour event. Description of how the new abutments and piers will make the structure stable for the Vehicular Collision Force, CT, over Northgate Blvd. Description of how the new portions are compatible and behave structurally similar to and with the existing to-remain portions of the widened/rehabilitated structure. Description of all the repairs to be done, repair materials and methods. Minimum two layout sheets showing Plan, Typical Section and Section and any details necessary to fully show the rehabilitation/widening concepts.
- (4) Wall- Two page description of wall (if any) type and foundation with one of the two layout sheets showing Location, Plan and Typical Wall Section.

Additionally if the structure is creative or innovative or typically not used by CDOT the SCP and RWSCP shall include a description of the design, construction, and/or choice of structural type or rehabilitation concept that will benefit and/or enhance project schedule, hydraulic performance, minimized traffic impacts, and quality of the Project.

C. Description of each bridge type or rehabilitation/widening concept that is creative or innovative or not typically used by CDOT

- (1) A one -page description of type, materials, strategy for lateral loads, and design life considerations for each proposed new major structure, superstructure, substructure and/or foundation.
- (2) A list of the transportation authorities that have used the proposed bridge, superstructure, substructure and/or foundation type and/or rehabilitation/widening concept. Include actual projects and references.

D. Description of each wall type that is creative or innovative or not typically used by CDOT (one page)

- (1) A description of the methods of accommodating settlement and differential settlement.
 - (2) A description of the type of foundation for each type of wall (if any).
 - (3) The location of walls and identification of wall type (if any).
- E. Description of conceptual solutions for complex structural problems identified by the Contractor.

Materials

Concrete

Concrete shall be in accordance with the referenced Standards.

Prestressing Steel

Prestressing Steel shall be in accordance with the referenced Standards.

Post-Tensioning Steel Systems

Post Tensioning Steel Systems shall be in accordance with the referenced Standards.

Reinforcing Steel

Reinforcing Steel shall be in accordance with the referenced Standards.

Structural Steel

Structural Steel shall be in accordance with the referenced Standards.

Design Parameters

General

Design Parameters shall be in accordance with the referenced Standards and the requirements contained in this section.

All design calculations and plans shall be performed in English (Standard) units.

Structure or bridge design, bridge rating, and structural design check calculations shall have pages numbered and include a table of contents. All calculations shall identify which code is utilized and reference the appropriate section in the right hand column. References shall be included to computer programs in the calculations. Computer documentation shall include: name of program, vendor, version and release date; record of software output and verification of output with manual calculations or other recognized program; clear identification of input and output values and meaning; and check of input.

Loads and Forces

Load and Forces shall be in accordance with the referenced Standards and the requirements contained in this section.

1. Dead loads

Utilities (future and existing):	As appropriate
3" HMA (future and initial):	36 psf
Unit Weight Prestressed Concrete:	155 pcf
Unit Weight of Reinforced Concrete:	150 pcf
Unit Weight of Structural Steel	490 pcf

2. Thermal Forces

The following thermal coefficient and temperature ranges shall be used for designing the new and rehabilitated structures:

Thermal Coefficient:	0.000006/°F concrete, 0.0000065/°F steel
Design Temperatures:	45° rise; 60° drop

3. Load Rating

The Contractor shall load rate all highway bridges and bridge widenings in accordance with the AASHTO Manual for Bridge Evaluation, 2nd Edition, 2011, and the CDOT Bridge Rating Manual, last revised April 1st, 2011.

Geotechnical Data

See Section 10 – Geotechnical and Roadway Pavements for Geotechnical requirements. Geotechnical testing has been completed by the CDOT Materials and Geotechnical Branch for Structures H-17-J and H-17-L, for Structures H-17-AG, H-17-I, H-17-H, H-17-AL, H-17-M, H-17-AI, and H-17-BK. Request for Foundation Investigation will be requested to the CDOT Materials and Geotechnical Branch for Structures H-17-BD and H-17-BC. See Final Foundation Reports for these Structures in the Reference Documents.

Bridges or Culverts

Geometry

Bridge Geometry shall be in accordance with the referenced Standards and the requirements contained in this section.

See Section 13 - Roadway and Section 12 - Drainage for additional structure requirements.

Type – Concrete Box Culverts

Concrete Box Culverts on the Project shall be removed and replaced. The new CBC opening, wingwalls, headwalls, and length will be based on the hydraulics analysis and Ultimate configuration shown on the Reference Documents.

Type – Proposed Structures H-17-DD and H-17-DE Option (Black Squirrel Creek)

Structure Type shall be in accordance with the referenced Standards and the requirements contained in this section.

If existing Structures H-17-J and H-17-L are removed and replaced structure type will not be restricted to those typically used by CDOT. Other types and components may be used, but will be allowed only if they have been accepted for general use by other transportation authorities and the Contractor can demonstrate that the design of the bridge type and components will perform well under the Project's environmental conditions, including frequent freeze-thaw cycles and anti-icing chemicals.

Experimental bridge types, timber bridges, masonry bridges, all types of truss bridges and structural plate arches are not permitted.

Expansion devices in the deck are not allowed at Structures H-17-DD and H-17-DE.

The Contractor shall submit, to the CDOT Project Engineer for Approval, non-typical bridge types in the Structure Concept Plan.

The following structural requirements are to be met when new and innovative concepts or accelerated bridge construction (ABC) techniques are employed:

- A corrosion engineering consulting firm as approved by CDOT's Project Engineer with expertise in the prevention of corrosion for civil engineering structures shall be retained by the Contractor to review the integrity of the proposed connection details for a 75 year design life. The Contractor shall submit the results of this evaluation to the CDOT Project Engineer for CDOT's use in determining the acceptability of the proposed connection details.
- Weld plates can only be used as temporary supports during erection and shall not be placed in a pre-stressed load path or prevent elements from seating properly.
- Match casting shall be used to eliminate joint shifting in post-tensioned connections. Additionally, post-tensioning strands and bars shall be long enough to provide a meaningful amount of force after anchor set and long term losses have occurred.

Type – Widening and Rehabilitation of Structures H-17-J and H-17-L Option (Black Squirrel Creek)

Structures H-17-J and H-17-L shall be rehabilitated and widened per the requirements of this section.

Existing Structures H-17-J and H-17-L were built in 1954, under Colorado Department of Highways Project Number F.I. 002-2 (25) UNIT 2. They were widened in 1976 under Project Number I25-2(113). See Reference Documents for existing bridge plans for Structures H-17-J and H-17-L.

The existing width of Structures H-17-J and H-17-L is 45.25 ft edge of deck to edge of deck. The rehabilitated and widened structure shall be 63 ft edge of deck to edge of deck and 60 ft curb to curb.

The existing 45.25 ft wide bridge deck at Structures H-17-J and H-17-L is required to be removed and replaced with a new 63 ft wide bridge deck. The new bridge deck shall be made composite with the existing girders and any new girders. The bridge deck shall receive 3" of HMA and shall be protected with waterproofing (membrane).

The new bridge rail on the new bridge deck of Structures H-17-J and H-17-L shall be either Bridge Rail Type 10M or Bridge Rail Type 7.

Existing Structures H-17-J and H-17-L are 3 span CIC (concrete on rolled I beam continuous) bridges. There are asphaltic plug type joints in the deck at Abutment 1 and Abutment 4. Expansion devices in the deck are not allowed at Abutment 1 and Abutment 4 of the rehabilitated and widened structure. Approach slabs are required to be added and doweled to the new deck. If the roadway approach is concrete pavement the approach slabs added will require new strip seal type expansion devices at the end of the approach slabs. New U-type wingwalls will need to be added outside of the new approach slabs.

Structures H-17-J and H-17-L superstructures, as rehabilitated and widened, shall be rated per CDOT Bridge Rating Manual requirements, as if the rehabilitated and widened bridge were a new bridge.

The existing rolled steel girders and splices at Structures H-17-J and H-17-L are allowed to remain, but shall be inspected for adequacy, structurally analyzed for any deficiencies per current AASHTO specifications. Any deficiencies shall be remedied/strengthened. The strengthened girders shall be made composite with the new deck.

All loose rust and paint shall be removed from the exposed surfaces of the existing girders, diaphragms and splice plates.

The Contractor shall provide a Special Provision for welding shear studs to the girders to CDOT for Acceptance before any shear studs are welded to the girders.

The new paint system shall be applied to all exposed areas of girders, diaphragms and splice plates.

The paint and rust removal shall be per Revision of Section 202 Removal of Paint and Rust.

The new paint system shall be per Revision of Section 509 Paint Existing Structure
The new girder shall be painted steel girders and of similar depth as the existing.

The existing steel bearings at Structures H-17-J and H-17-L shall be removed and replaced with Type I or Type II Bearings, as appropriate.

New bearings, anchorages and substructure girder support widths at Structures H-17-J and H-17-L shall satisfy AASHTO seismic requirements.

The existing substructure at Structures H-17-J and H-17-L shall be analyzed and checked for capacity for new dead loads from widening and replacement of bridge deck and HMA overlay and for current live loads per CDOT Rating Manual. Any existing substructure capacity deficiencies due rehabilitation and widening dead load and current live load requirements, in addition to substructure and foundation loads due the 500 year scour event, shall be remedied. The rehabilitated widened bridge shall be made stable for the 500 year scour event. See also Reference Documents for CDOT Final Foundation Report.

If superstructure to substructure fixity/expansion conditions are altered by the rehabilitation and widening design, this change in fixity shall be accounted for in the design of the existing and modified substructure and/or foundation.

There are currently asphaltic plug type joints at the original and removed sliding plate expansion devices between the existing abutment front face of abutment parapet/back-wall and end of existing deck at Structures H-17-J and H-17-L. New expansion devices are not allowed in the deck at Structures H-17-J and H-17-L.

New approach slabs are required at the abutments at Structures H-17-J and H-17-L. The new bridge rail shall be mounted on top of the new approach slabs.

The existing abutments at Structures H-17-J and H-17-L shall be modified to U-type abutments with swept back cantilevered wing-walls, parallel to the roadway and outside of the new approach slab. A strip seal type expansion device is required whether there is concrete or HMA roadway approach pavement.

If the existing fill behind abutments at Structures H-17-J and H-17-L is excavated new backfill shall be mechanically stabilized backfill or flow-fill.

The existing pier seats/caps and abutment seats/caps at Structures H-17-J and H-17-L are in need of repair. All delaminated concrete at pier and abutment caps/seats shall be removed to sound concrete. Removed areas and existing reinforcing steel projecting into removed areas shall be prepared appropriately and patched. This work shall be done per Revision of Section 210 Rebuild Portions of Present Structure. See Structure Inspection Report in the Reference Documents.

Any cracks in concrete structural components at Structures H-17-J and H-17-L to remain, and not mentioned already as areas to be removed and replaced, that have a crack width greater than 1/32" in width shall be epoxy injected.

Type – Widening and Rehabilitation of Structures H-17-BD and H-17-BC Option (over Northgate Blvd.)

Structures H-17-BD (NB) and H-17-BC (SB) shall be rehabilitated and widened per the requirements of this section.

Existing Structures H-17-BD and H-17-BC were built in 1958, under Colorado Department of Highways Project Number I.N. 002-2 (40). See Reference Documents for existing bridge plans for Structures H-17-J and H-17-L.

The existing width of Structures H-17-BD and H-17-BC is 58 ft edge of deck to edge of deck. The rehabilitated and widened structure shall be 70 ft edge of deck to edge of deck, be widened 12 feet to the inside to accommodate the temporary configuration typical section, 3-12ft travel lanes, 4-ft inside shoulder, and a 10-ft outside shoulder.

The bridge deck shall receive 3” of HMA and shall be protected with waterproofing (membrane).

The new bridge rail on the new bridge deck of Structures H-17-BD and H-17-BC shall be either Bridge Rail Type 10M or Bridge Rail Type 7.

Existing Structures H-17-BD and H-17-BC are 2 span CPG (concrete prestressed girder (precast)) bridges. Expansion devices in the deck are not allowed at Abutment 1 and Abutment 3 of the rehabilitated and widened structure. Approach slabs are required to be added and doweled to the new deck. If the roadway approach is concrete pavement the approach slabs added will require new strip seal type expansion devices at the end of the approach slabs. New U-type wingwalls will need to be added outside of the new approach slabs.

Structures H-17-BD and H-17-BC superstructures, as rehabilitated and widened, shall be rated per CDOT Bridge Rating Manual requirements, as if the rehabilitated and widened bridge were a new bridge.

The existing prestressed concrete girders at Structures H-17-BD and H-17-BC are allowed to remain, but shall be inspected for adequacy, structurally analyzed for any deficiencies per current AASHTO specifications. Any deficiencies shall be remedied/strengthened. The strengthened girders shall be made composite with the new deck.

New bearings, anchorages and substructure girder support widths at Structures H-17-BD and H-17-BC shall satisfy AASHTO seismic requirements.

The existing substructure at Structures H-17-BD and H-17-BC shall be analyzed and checked for capacity for new dead loads from widening and replacement of bridge deck and HMA overlay and for current live loads per CDOT Rating Manual. Any existing substructure capacity deficiencies due rehabilitation and widening dead load and current live load requirements, in addition to substructure and foundation loads due the Vehicular Collision Force, CT, shall be remedied. The rehabilitated widened bridge shall be made stable for the Vehicular Collision Force, CT. See also Reference Documents for CDOT Final Foundation Report.

If superstructure to substructure fixity/expansion conditions are altered by the rehabilitation and widening design, this change in fixity shall be accounted for in the design of the existing and modified substructure and/or foundation.

New expansion devices are not allowed in the deck at Structures H-17-BD and H-17-BC.

New approach slabs are required at the abutments at Structures H-17-BD and H-17-BC. The new bridge rail shall be mounted on top of the new approach slabs.

The existing abutments at Structures H-17-BD and H-17-BC shall be modified to U-type abutments with swept back cantilevered wing-walls, parallel to the roadway and outside of the new approach slab. A strip seal type expansion device is required whether there is concrete or HMA roadway approach pavement.

If the existing fill behind abutments at Structures H-17-BD and H-17-BC is excavated new backfill shall be mechanically stabilized backfill or flow-fill.

The existing pier seats/caps and abutment seats/caps at Structures H-17-BD and H-17-BC are in need of repair. All delaminated concrete at pier and abutment caps/seats shall be removed to sound concrete. Removed areas and existing reinforcing steel projecting into removed areas shall be prepared appropriately and patched. This work shall be done per Revision of Section 210 Rebuild Portions of Present Structure. See Structure Inspection Report in the Reference Documents.

Any cracks in concrete structural components at Structures H-17-BD and H-17-BC to remain, and not mentioned already as areas to be removed and replaced, that have a crack width greater than 1/32" in width shall be epoxy injected.

Inspection Access

Inspection Access shall be in accordance with the referenced Standards.

Structure Components

Structure Components shall be in accordance with the referenced Standards and the requirements contained in this section.

Bridge Rails

Bridge Rail Type 10M or Bridge Rail Type 7 shall be used at new bridges or rehabilitated and widened bridges. Bridge Rail Type 10H shall be used at CBC headwalls

Approach Slabs

At Black Squirrel Creek, either the Contractor widens existing structures H-17-J (NB) and H-17-L (SB) or replaces them with a new bridge (not CBC), removal of existing approach slabs is required and new approach slabs with expansion joints at sleepers are required.

Decks

The Contractor shall provide a minimum concrete deck thickness of 8 inches.

Open or filled grating decks and orthotropic decks will not be permitted.

Concrete decks designed to the simplified “Ontario”, or any empirical methods, will not be permitted.

Precast transverse deck slabs shall be match cast and longitudinally post-tensioned.

Pre-tensioned precast concrete deck forms shall be temporarily supported on blocking with a 1:1 aspect ratio and a minimum dimension of 2”. The permanent bearing area at each end of each panel shall have a minimum width of 2” and minimum height of 1”.

Stay-in-place metal deck forms shall be used when the haunch height exceeds 6”. If stay-in-place metal deck forms are used, the superstructure, substructure, and foundation shall be designed for an extra 5 psf minimum dead load applied to the superstructure.

Permanent deck forms shall not be allowed for cast-in-place post-tensioned box girder or T-girder deck slabs, or for box culverts. In order for the cast-in-place portion of concrete placed on top of the top flange of a precast double tee or precast box girder to be considered composite with the precast top flange, the total laminated deck thickness shall be 8 inches minimum, the cast-in-place thickness shall be 4-3/4 inches minimum, and the top surface of the precast top flange shall be roughened.

Precast Double Tees or Precast Box Girders or longitudinal Precast Slabs without a cast-in-place deck placed on top will not be allowed. If any part of a deck resists tension the stress in the deck in this area shall not exceed 3-sqrt f’c. Minimum longitudinal steel in the top mat of cast in place decks shall be No. 4’s at 6 inch spacing spliced to the negative moment steel reinforcing.

Full-Depth Precast Transverse Deck Panels shall be designed and constructed to closely follow details as used CDOT Project BR 0061-073. See Reference Documents.

Girders

Girders shall be in accordance with the referenced standards.

Deck Joints

At Black Squirrel Creek, the bridges are short enough to eliminate the need for expansion joints. Expansion joints in the deck are not allowed.

At Air Force Academy Road 70, North Gate, replace existing expansion devices (Polymer Mortar End Dam and Silicone Joint Seal type) with strip seal type expansion devices (518 Bridge Expansion Device (0-4”)) at Pier 2 of each CPG bridge H-17-BD and H-17-BC. Existing Structures H-17-BC and H-17-BD: IN 002-2(40), 1958 Original; STA 0252-397, 2008 Overlay. The new strip seal type joints will require adding new concrete end dams. The removal of existing expansions devices and installation of new strip seal device will require the use of steel roadway plates during removal of existing and in installation of the new devices to maintain traffic. See Reference Documents for roadway plates.

Overlays

The Contractor shall provide a 3” HMA surface over waterproofing membrane to enhance bridge deck durability. This is applicable for bridge selections at Structure H-17-DD and at Structure H-17-DE. This is also applicable for the CRF top slab of Structure H-17-AI.

See Section 10 – Geotechnical and Roadway Pavements for type of HMA.

Superstructures

The Superstructure shall be in accordance with the referenced Standards.

Bearings

Bearings shall be in accordance with the referenced Standards.

Piers and Pier Caps

Piers and Pier Caps shall be in accordance with the referenced Standards.

Abutments

Structure backfill at abutments shall be per B-206-F1 or B-206-M1. The Contractor shall provide integral end diaphragm-type abutments for Structures H-17-DD and H-17-DE. MSE walls are not allowed in the flood plain. The length of cantilevered wingwalls and/or retaining walls from the end of the abutments of a U-type abutment shall be 4 feet longer than the point of intersection of the embankment slope, along outside face of cantilevered wingwalls or retaining walls, with the roadway finished grade.

Slope Protection

Slope Protection shall be in accordance with the referenced Standards.

Foundations

Foundations shall be in accordance with the referenced Standards.

Drainage

See Section 12 – Drainage for structure drainage requirements.

Utilities

Hanging of electrical or telephone conduits or utilities is not permitted under deck overhangs or on bridge rail.

Protection of utility conduits from the settlement of the abutment backfill shall be provided by the Contractor.

Utility placement on the bridge structure shall be approved by the CDOT Project Engineer.

The Contractor shall provide 3-inch conduit(s) in the bridges curb(s) for the required utility line(s) on the bridge structure.

Removal of Bridges or Structures and Removal of Portions of Present Structure

Removal of Bridges or Structures and Removal of Portions of Present Structure shall be in accordance with the referenced Standards and the requirements contained in this section.

The Contractor shall follow the requirements of the Section 7 – Utilities for the removal of the existing utilities on the existing structures.

Concrete deck and, any removed steel girders, any removed steel diaphragms, steel bridge railing, and bearings shall become the property of the Contractor and shall be removed from the site and shall not be reused in the new construction. Lead-based paint was found at structure Str H-17-J and H-17-L.

Retaining Walls

General

Retaining Walls shall be in accordance with the referenced Standards.

Geometry

Retaining Wall geometry shall be in accordance with the referenced Standards.

Type

Retaining Wall Type shall be in accordance with the referenced Standards.

Design Requirements

Retaining Wall design shall be in accordance with the referenced Standards.

Characteristics

Retaining Wall characteristics shall be in accordance with the referenced Standards.

Sign Structures

There are also 14 existing sign bridges or sign cantilevers in the stretch from Woodmen to Black Squirrel Creek. The locations of new sign structures are on the I-25 Roadway Plan, I-25 EA Conceptual Design prepared by Wilson & Company consultant for Project C 052-316, Const. # 12210, in 2003. Only the monotube type sign bridges or sign cantilevers may be reset, all other sign bridges and cantilevers must be replaced. The foundations for the reset structures must be certified by the Contractor, CDOT will accept the reset structures as is.

Design Reviews

Shop drawings shall be submitted to the CDOT Project Engineer for information only. The Contractor is solely responsible for shop drawing accuracy.

CDOT Bridge Rating Manual shall be used for the bridge rating package submittals.

Construction

General

Construction of all structures shall be in accordance with the referenced Standards.

Structure Backfill Requirements

Structure Backfill at abutments shall be either flow-fill or mechanically stabilized backfill per Staff Bridge Worksheet B-206-F1 or B-206-F2, or B-206-M1 or B-206-M2. The slope of the planned bottom of the mechanically stabilized backfill and the limits of structure excavation as shown in M-206-2, sheet 2 of 2, shall be 1V to 2H instead of the 1V to 1.5H as shown in M-206-2.

Deliverables

At a minimum, the Contractor shall submit the following to CDOT for review, Approval and/or Acceptance:

Deliverable	Acceptance or Approval	Schedule
Structure Concept Plans and Rehabilitation/Widening Concept Plans	Approval	As defined in Contract Schedules
Preliminary Structure Capacity Rating Submittals	Approval	Advanced Plans submittals (FOR)
Final Structure Capacity Rating Submittals	Approval	Final Plans submittals
Structure Capacity Rating Submittals revised to reflect any Field Revisions	Approval	Per Release For Construction (RFC)
Removal of Bridge Plans	Approval	Per RFC
Removal of Portions of Present Structure Plan Structures	Acceptance	Per RFC
Girder Erection Plan	Acceptance	Per RFC
Revision of Section 509 Welding of Shear Studs to Existing Girders	Acceptance	Per RFC

Project Special Provisions

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REVISION OF SECTION 202 REMOVAL OF BRIDGE

Section 202 of the Standard Specifications is hereby revised for this project as follows:

Subsection 202.01 shall include the following:

This work consists of removal of the existing bridges. Bridge removal shall consist of the removal of all superstructure and substructure elements, which includes piers, abutments, wingwalls, and any approach slabs and sleeper slabs, unless otherwise shown on the plans.

Subsection 202.02 shall include the following:

The removal of the existing bridge shall be performed in a safe manner.

When removal operations are located over a railroad or in proximity to any live water way , additional coordination with the railroad or other agency, (United States Army Corps of Engineers (USACE), US Fish and Wildlife Service, US Forest Service, etc.) shall be required.

At least one week prior to the Pre-Removal Conference, the Contractor shall approve, sign and submit a Bridge Removal Plan to the Engineer for record purposes only. The Bridge Removal Plan shall be stamped "Approved for Construction" and signed by the Contractor. The Bridge Removal Plan will not be approved by the Engineer. If falsework drawings are required they shall conform to and be submitted in accordance with subsection 601.11.

The Bridge Removal Plan shall provide complete details of the bridge removal process, including:

- (1) The removal sequence, including staging of removal operations. Sequence of operation shall include a detailed schedule that complies with the working hour limitations.
- (2) Equipment descriptions including size, number, type, capacity, and location of equipment during removal operations.
- (3) Shoring that exceeds 5 feet in height, all falsework and bracing.

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REVISION OF SECTION 202
REMOVAL OF BRIDGE

(4) Details, locations and types of protective coverings to be used. The protective covering shall prevent any materials, equipment or debris from falling onto the property below. When removal operations are located over or in proximity to any live waterway, railroad, or pedestrian/bicycle path, additional width of protective covering sufficient to protect these facilities shall be required. Detailed methods for protection of the existing roadway facilities, including measures to assure that people, property, utilities, and improvements will not be endangered.

(5) Detailed methods for protection of live waterways including minimization of turbidity and sedimentation, and protection of existing wetlands.

(6) Detailed methods for mitigation of fugitive dust resulting from the demolition.

(7) Details for dismantling, removing, loading, and hauling steel elements.

(8) Methods of Handling Traffic, including bicycles and pedestrians, in a safe and controlled manner.

A Pre-Removal Conference shall be held at least seven days prior to the beginning of removal of the bridge. The Engineer, the Contractor, the removal subcontractor, the Contractor's Engineer, and the Traffic Control Supervisor (TCS) shall attend the Pre-Removal Conference. The Bridge Removal Plan shall be finalized at this Conference.

The Contractor's Engineer shall sign and seal (1) and (3) listed above in the final Bridge Removal Plan. Calculations shall be adequate to demonstrate the stability of the structure remaining after the end of each stage of removal, before traffic is allowed to resume in its normal configuration.

The final Bridge Removal Plan shall be stamped "Approved for Construction" and signed by the Contractor. The Contractor shall submit a final Bridge Removal Plan to the Engineer prior to bridge removal for record purposes only. The Contractor shall not begin the removal process without the Engineer's written authorization.

Submittal of the final Bridge Removal Plan to the Engineer, and field inspection performed by the Engineer, will in no way relieve the Contractor and the Contractor's Engineer of full responsibility for the removal plan and procedures.

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**REVISION OF SECTION 202
REMOVAL OF BRIDGE**

Work within Railroad right-of-way shall be in accordance with Section 107. For bridge removal over railroads, including overhead wires, tunnels and underground facilities, approval of the bridge removal plans will be contingent upon the drawings being satisfactory to the railroad company involved.

When the bridge is removed in stages the Contractor's Engineer shall inspect and provide written approval of each phase of the removal prior to allowing vehicles or pedestrians on, below, or adjacent to the structure. The Contractor shall perform daily inspections of any partially removed bridge where there are vehicles or pedestrians on, below, or adjacent to the structure. The Contractor's Engineer shall provide an inspection form to the Engineer and the Contractor that lists the items the Contractor will document during the daily inspection of the partially removed structure. The Contractor shall provide the Engineer and the Contractor's Engineer with written documentation of these inspections with 24 hours of each inspection.

The Contractor shall have all necessary workers, materials, and equipment at the site prior to closing any lanes to traffic to accommodate bridge removal operations. While the lanes are closed to public traffic, work shall be pursued promptly and without interruption until the roadway is reopened to traffic.

Removal of hazardous material shall be in accordance with Section 250.

The Contractor shall take all steps to avoid contaminating state waters, in accordance with subsection 107.25.

Should an unplanned event occur or the bridge removal operation deviate from the submitted bridge removal plan, the bridge removal operations shall immediately cease after performing any work necessary to ensure worksite safety. The Contractor shall submit to the Engineer, the procedure or operation proposed by the Contractor's Engineer to correct or remedy the occurrence of this unplanned event or to revise the final Bridge Removal Plan. The Contractor shall submit his Engineer's report in writing, within 24 hours of the event, summarizing the details of the event and the procedure for correction.

Before removal of the protective covering, the Contractor shall clean the protective covering of all debris and fine material.

Bridge removal may be suspended by the Engineer for the following reasons:

(1) Final Bridge Removal Plan has not been submitted, or written authorization has not been provided by the Engineer to begin the removal.

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**REVISION OF SECTION 202
REMOVAL OF BRIDGE**

(2) The Contractor is not proceeding in accordance with the final Bridge Removal Plan, procedures, or sequence.

(3) Safety precautions are deemed to be inadequate.

(4) Existing neighboring facilities are damaged as a result of bridge removal.

Suspension of bridge removal operations shall in no way relieve the Contractor of his responsibility under the terms of the Contract. Bridge removal operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension, as approved in writing by the Engineer.

The Contractor shall notify all emergency response agencies of the proposed removal work and any detours 24 hours in advance of work. This shall include the Colorado State Patrol, local Police Department, local Fire Department, all local ambulance services, and the Sheriff's Department, as appropriate.

All required traffic control devices, night time flagging stations, barricades and VMS signs shall be in place, with detours in operation, prior to the beginning of removal operations each day. Night work shall conform to the requirements of the MUTCD, Parts 1, 5, and 6.

Prior to reopening the roadway to public traffic, all debris, protective pads, materials, and devices shall be removed and the roadways swept clean.

Explosives shall not be used for removal work without the written approval of the Engineer.

Existing structures, facilities, adjacent properties, and surrounding roadways shall not be damaged by the removal operations. Damage that does occur shall be repaired immediately at the Contractor's expense.

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**REVISION OF SECTION 202
REMOVAL OF PORTIONS OF PRESENT STRUCTURE**

Section 202 of the Standard Specifications is hereby revised for this project as follows:

Subsection 202.01 shall include the following:

This work consists of removal of portions of the present structures.

Subsection 202.02 shall include the following:

The removal of portions of present shall be performed in a safe manner.

When removal operations are located over a railroad or in proximity to any live water way, additional coordination with the railroad or other agency, (United States Army Corps of Engineers (USACE), US Fish and Wildlife Service, US Forest Service, etc.) shall be required.

The Contractor shall submit a Removal of Portions of Present Structure Plan, the Removal Plan, to the Engineer, for record purposes only, at least 20 working days prior to the proposed start of removal operations. This Removal Plan shall detail procedures, sequences, and all features required to perform the removal in a safe and controlled manner. The Removal Plan shall be stamped "Approved for Construction" and signed by the Contractor. The Removal Plan will not be approved by the Engineer. If falsework drawings are required they shall conform to and be submitted in accordance with subsection 601.11.

The Removal Plan shall provide complete details of the bridge removal process, including:

- (1) The removal sequence, including staging of removal operations. Sequence of operation shall include a detailed schedule that complies with the working hour limitations.
- (2) Equipment descriptions including size, number, type, capacity, and location of equipment during removal operations.
- (3) Shoring that exceeds 5 feet in height, all falsework and bracing.
- (4) Details, locations and types of protective coverings to be used. The protective covering shall prevent any materials, equipment or debris from falling onto the property below. When removal operations are located over or in proximity to any live waterway, railroad, or pedestrian/bicycle path, additional width of protective covering sufficient to protect these facilities shall be required. Detailed methods for protection of the existing roadway facilities, including measures to assure that people, property, utilities, and improvements will not be endangered.
- (5) Detailed methods for protection of live waterways including minimization of turbidity and sedimentation, and protection of existing wetlands.

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**REVISION OF SECTION 202
REMOVAL OF PORTIONS OF PRESENT STRUCTURE**

- (6) Detailed methods for mitigation of fugitive dust resulting from the demolition.
- (7) Details for dismantling, removing, loading, and hauling steel elements.
- (8) Methods of Handling Traffic, including bicycles and pedestrians, in a safe and controlled manner.

A Pre-Removal Conference shall be held at least seven days prior to the beginning of removal of the Removal of Portions of Present Structure. The Engineer, the Contractor, the removal subcontractor, the Contractor's Engineer, and the Traffic Control Supervisor (TCS) shall attend the Pre-Removal Conference. The Removal Plan shall be finalized at this Conference.

The Contractor's Engineer shall sign and seal (1) and (3) listed above in the final Removal Plan. Calculations shall be adequate to demonstrate the stability of the structure remaining after the end of each stage of removal, before traffic is allowed to resume in its normal configuration.

The final Removal Plan shall be stamped "Approved for Construction" and signed by the Contractor. The Contractor shall submit a final Removal Plan to the Engineer prior to bridge removal for record purposes only. The Contractor shall not begin the removal process without the Engineer's written authorization.

Submittal of the final Removal Plan to the Engineer, and field inspection performed by the Engineer, will in no way relieve the Contractor and the Contractor's Engineer of full responsibility for the removal plan and procedures.

Work within Railroad right-of-way shall be in accordance with Section 107. For removal of portions of present structure over railroads, including overhead wires, tunnels and underground facilities, approval of the removal plans will be contingent upon the drawings being satisfactory to the railroad company involved.

When the bridge is removed in stages the Contractor's Engineer shall inspect and provide written approval of each phase of the removal prior to allowing vehicles or pedestrians on, below, or adjacent to the structure. The Contractor shall perform daily inspections of any partially removed bridge where there are vehicles or pedestrians on, below, or adjacent to the structure. The Contractor's Engineer shall provide an inspection form to the Engineer and the Contractor that lists the items the Contractor will document during the daily inspection of the partially removed structure. The Contractor shall provide the Engineer and the Contractor's Engineer with written documentation of these inspections with 24 hours of each inspection. The Contractor's Engineer shall certify in writing that the falsework, bracing, and shoring conform to the details of the final Removal Plan. A copy of the certification shall be submitted to the Engineer.

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**REVISION OF SECTION 202
REMOVAL OF PORTIONS OF PRESENT STRUCTURE**

The Contractor's Engineer shall inspect the Removal of Portions of Present Structure site and report in writing on a daily basis the progress of the operation and the status of the remaining structure. A copy of this daily report shall be available at the site of the work at all times, and a copy of the previous day's inspection report shall be submitted to the Engineer daily.

The Contractor shall have all necessary workers, materials, and equipment at the site prior to closing any lanes to traffic to accommodate bridge removal operations. While the lanes are closed to public traffic, work shall be pursued promptly and without interruption until the roadway is reopened to traffic.

Removal of hazardous material shall be in accordance with Section 250.

The Contractor shall take all steps to avoid contaminating state waters, in accordance with subsection 107.25.

Should an unplanned event occur or the bridge removal operation deviate from the submitted bridge removal plan, the bridge removal operations shall immediately cease after performing any work necessary to ensure worksite safety. The Contractor shall submit to the Engineer, the procedure or operation proposed by the Contractor's Engineer to correct or remedy the occurrence of this unplanned event or to revise the final Removal Plan. The Contractor shall submit his Engineer's report in writing, within 24 hours of the event, summarizing the details of the event and the procedure for correction.

Before removal of the protective covering, the Contractor shall clean the protective covering of all debris and fine material.

Removal of Portions of Present Structures may be suspended by the Engineer for the following reasons:

- (1) Final Removal Plan has not been submitted, or written authorization has not been provided by the Engineer to begin the removal.
- (2) The Contractor is not proceeding in accordance with the final Bridge Removal Plan, procedures, or sequence.
- (3) The Contractor's Engineer is not on site to conduct inspection for the written approval of the work.
- (4) Safety precautions are deemed to be inadequate.
- (5) Existing neighboring facilities are damaged as a result of bridge removal.

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**REVISION OF SECTION 202
REMOVAL OF PORTIONS OF PRESENT STRUCTURE**

Suspension of bridge removal operations shall in no way relieve the Contractor of his responsibility under the terms of the Contract. Removal of Portions of Present Structure L-24-F operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension, as approved in writing by the Engineer.

The Contractor shall notify all emergency response agencies of the proposed removal work and any detours 24 hours in advance of work. This shall include the Colorado State Patrol, local Police Department, local Fire Department, all local ambulance services, and the Sheriff's Department, as appropriate.

All required traffic control devices, night time flagging stations, barricades and VMS signs shall be in place, with detours in operation, prior to the beginning of removal operations each day. Night work shall conform to the requirements of the MUTCD, Parts 1, 5, and 6.

Prior to reopening the roadway to public traffic, all debris, protective pads, materials, and devices shall be removed and the roadways swept clean.

Explosives shall not be used for removal work without the written approval of the Engineer.

Removal of Portions of Present Structures shall include the bridge deck, portions of the substructure, which includes the piers, the abutments and wingwalls as applicable, the bridge rail, and any approach slabs and sleeper slabs for bridges, and portions of the top slab, the bottom slab, the CBC exterior and interior walls, the headwalls, the wingwalls, and the aprons for concrete box culverts.

All materials removed from the existing structure shall become the property of the Contractor and shall be properly disposed of offsite at the Contractor's expense.

Existing structures, facilities, and surrounding roadways shall not be damaged by the removal operations. Damage that does occur shall be repaired immediately at the Contractor's expense.

**REVISION OF SECTION 202
REMOVAL OF PAINT AND RUST**

Subsection 202.01 shall include the following:

This work consists of the removal of paint and rust from existing structures H-17-J (NB) and H-17-L (SB).

Subsection 202.02 shall include the following:

Removal of Paint from Structure. Paint and loose rust shall be removed from existing structures H-17-J (NB) and H-17-L (SB).

- (a) Paint Removal Methods. The Contractor shall use a paint and rust removal method as Approved by CDOT, or a combination thereof, as contained in the Industrial Lead Paint Removal Handbook, Steel Structures Painting Council (SSPC) 2009, to achieve, as a minimum, an SSPC SP11 “Power Tool Cleaning with Vacuum Blasting” finish. Removal and disposal of paint and rust shall be per Section 250 Environmental, Health and Safety Management.
- (b) Method Statement. The Contractor shall submit a method statement detailing removal methods and methods for capturing and disposing of all collected waste material.
- (c) Construction Performance. Before any work is started the Contractor shall clean an approximately ten square foot area on the structure to demonstrate an SSPC-SP11 finish to the Engineer. An ASTM D3359-09, Standard Test Methods for Measuring Adhesion by Tape Test, shall be performed on the existing paint system that is to remain. Test Method A shall be used and the adhesion of the remaining existing paint system to the steel substrate will be considered good if there is no peeling or removal, or there is trace peeling or removal along incisions or at their intersections.

No welding, except as called for in the plans or in this section, shall be done on the existing bridge structure and no holes shall be drilled in the existing bridge structure.

**REVISION OF SECTION 206
STRUCTURE BACKFILL**

Section 206 of the Standard Specifications is hereby revised for this project as follows:

Delete subsection 206.02, and replace with the following:

206.02 General. All structure backfill, bed course material, and filter material will be accepted in place.

- (a) *Structure Backfill.* Class 1 and Class 2 structure backfill shall be composed of non-organic mineral aggregates and soil from excavations, borrow pits, or other sources. Material shall conform to the requirements of subsection 703.08. Class of material shall be as specified in the Contract or as designated.

Structure backfill (flow-fill) meeting the following requirements shall be used to backfill bridge abutments and culverts. The Contractor may substitute structure backfill (flow-fill) for structure backfill (class 1) or structure backfill (class 2) in other backfill areas of the project.

Ingredients	Lbs./Cu.Yd
Cement	50
Coarse Aggregate (AASHTO No. 57 or 67)	1700
Fine Aggregate (AASHTO M 6)	1845
Water	325 (or as needed)

The amount of water shall be such that the structure backfill (flow-fill) flows into place properly without excessive segregation. Approximately 39 gallons of water per cubic yard of structure backfill (flow-fill) is normally needed.

The Contractor may substitute 30 pounds per cubic yard of cement and 30 pounds per cubic yard of fly ash for 50 pounds per cubic yard of cement or may substitute 60 pounds per cubic yard of cement and 60 pounds per cubic yard of fly ash for 100 pounds per cubic yard of cement.

Recycled broken glass (glass cullet) is acceptable as part or all of the aggregate. Aggregate including glass must conform to the required gradations. All containers used to produce the cullet shall be empty prior to processing. Chemical, pharmaceutical, insecticide, pesticide, or other glass containers containing or having contained toxic or hazardous substances shall not be allowed and shall be grounds for rejecting the glass cullet. The maximum debris level in the cullet shall be 10 percent. Debris is defined as any deleterious material which impacts the performance of the flowfill including all non-glass constituents.

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**REVISION OF SECTION 206
STRUCTURE BACKFILL**

- (b) *Bed Course Material.* Material shall conform to the requirements of subsection 703.07. Upon approval, aggregate base course conforming to the requirements of subsection 703.03 may be used in lieu of bed course material.
- (c) *Filter Material.* Class A, Class B, and Class C filter material shall conform to the requirements of subsection 703.09. Class of material shall be as specified or designated.

Delete paragraphs 13 and 14 of subsection 206.03 and replace with the following:

The maximum layer thickness for structure backfill (flow-fill) shall be 3 feet. The structure backfill (flow-fill) shall be consolidated with suitable mechanical vibrators operating within the flow-fill.

Vibrators shall be of a type and design approved by the Engineer. They shall be capable of frequencies of at least 10,000 vibrations per minute, in air. The vibration at any point shall be of sufficient duration to accomplish consolidation, but shall not be prolonged to the point where segregation occurs.

Subsection 206.07 shall include the following:

Structure excavation and structure backfill required for all culverts and extensions will not be measured and paid for separately, but shall be included in the work.

**REVISION OF SECTION 210
REBUILD PORTIONS OF PRESENT STRUCTURE**

Section 210 of the Standard specifications is hereby revised for this project as follows

DESCRIPTION

This work shall consist of chipping concrete to a minimum depth of 1/8 inch, sandblasting and applying a gel mortar to the damaged area and bring the structure to its original shape.

MATERIALS

The material, to be approved by the Engineer, shall be a cementitious, 2-component, fast-setting mortar that is formulated for application by trowel and is especially designed for repair of overhead surfaces.

CONSTRUCTION REQUIREMENTS

Removal and rebuild operations shall be conducted so that there will be minimum interference to traffic below the structures.

The affected areas shall be chipped to a minimum depth of 1/8 inch into existing concrete, all loose concrete will be removed, the area shall be sandblasted and the surface preparation shall be as the product literature describes.

The material shall not be installed in the work prior to the Engineer's approval.

Two copies of the product literature containing pertinent materials and installation of the product supplied on this project shall be furnished to the Engineer at least two weeks prior to the products' installation.

Any damage to portions to remain in place by the Contractor in performing the work described above shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

**REVISION OF SECTION 513
BRIDGE DRAIN**

Section 513 is hereby added to the Standard Specifications for this project as follows:

DESCRIPTION

513.01 This work shall consist of furnishing and placing bridge drains in accordance with the details shown on the plans and the specifications.

MATERIALS

513.02 Pipe for bridge drains shall meet the requirements of ASTM A53 and shall be standard weight.

Down spout pipe shall be hot dipped galvanized after fabrication. Galvanizing shall meet the requirements of AASHTO M111.

Metal used in the manufacture of castings shall meet the requirements of ASTM A48 Class 35B.

CONSTRUCTION REQUIREMENTS

513.03 Bridge drains shall be placed and secured at the locations shown on the plans prior to placement of concrete.

Prior to fabrication of this item, two sets of working drawings which comply with the requirements of Section 105 shall be submitted to the Engineer for information only. The working drawings will not be approved or returned.

**REVISION OF SECTION 509 AND 708
PAINT EXISTING STRUCTURE**

Section 509 and 708 of the Standard Specifications are hereby revised for this project as follows:

Subsection 509.01 shall include the following:

This work consists of painting the steel portions of the structure as indicated in the technical requirements, including designated areas of the girders, all of the diaphragms, and any remaining portions of the bearings.

Delete subsection 509.29(b) and replace with the following:

- (b) Surface Preparation. The surface shall be prepared in accordance with Revision of Section 202 Removal and Disposal of Paint. In addition all adhering dirt, grease, and foreign material shall be removed from the structural steel, in the areas to be painted, by a water based biodegradable non-toxic, non-corrosive, non-caustic, degreaser/cleaner.

Subsection 708.03 shall include the following:

- (c) Three-coat Polyurethane System. The primer shall be an approved moisture cure, rust inhibitive urethane penetrating primer containing micaceous iron oxide (2.0 lbs./gal. minimum). The intermediate coat shall be a single component moisture cure urethane containing micaceous iron oxide (3.0 lbs./gal. minimum). The top coat shall be a single component moisture cure urethane containing micaceous iron oxide (4.0 lbs./gal. minimum). The supplied paint system shall not exceed 2.8 lbs./gal. V.O.C.

Structural Steel Bridge Paint shall conform to subsection 708.03(c), Three-coat Polyurethane System. The paint color shall be as determined by the Engineer.

All areas where paint and loose rust has been removed, leaving tight rust, and given a surface preparation of SSPC SP11 , “Power Tool Cleaning with Vacuum Blasting”, as a minimum, shall be given a field coat of primer as described in 708.03(c). This entails spot priming areas where loose paint and rust was removed. The paint system shall be applied and allowed to cure according to manufacturer's recommendations. Each coat shall be allowed to cure before application of a subsequent coat for a minimum of 4 hours.

All structural steel shall be given an intermediate coat and top coat as described in 708.03(c).

The thickness of the primer coat shall be a minimum 2.0 Mills DFT. The thickness of the intermediate coat shall be a minimum 3.0 Mills DFT. The thickness of the top coat shall be a minimum 2.0 Mills DFT.