

**TABLE OF CONTENTS**

**DIVISION “SB”**

<b><u>SECTION</u></b>	<b><u>PAGE</u></b>
SB-1 BRIDGE PLANS .....	1
SB-2 (1717) AIR, LAND AND WATER POLLUTION.....	1
SB-3 (2104) REMOVAL OF ASBESTOS AND REGULATED WASTE (BRIDGE).....	1
SB-4 (2401) CONCRETE BRIDGE CONSTRUCTION .....	2
SB-5 (2402) STEEL BRIDGE CONSTRUCTION .....	21
SB-6 (2404) CONCRETE WEARING COURSE FOR BRIDGES .....	28
SB-7 (2405) PRESTRESSED CONCRETE BEAMS .....	31
SB-8 (2411) PRECAST ARCHITECTURAL PANELS .....	33
SB-9 (2442) REMOVAL OF EXISTING BRIDGES .....	46
SB-10 (2451) STRUCTURE EXCAVATIONS AND BACKFILLS.....	50
SB-11 (2452) STEEL SHEET PILING (TEMPORARY) .....	50
SB-12 (2452) PILING.....	51
SB-13 (2471) STRUCTURAL METALS.....	54
SB-14 (2545) CONDUIT SYSTEMS .....	56
SB-15 (3372) STEEL PILING.....	57
SB-16 (3385) ANCHOR RODS .....	57
SB-17 (3391) FASTENERS .....	57
SB-18 (3741) ELASTOMERIC BEARING PADS .....	58

**SPECIAL PROVISIONS**  
**DIVISION 'SB'**  
**SPECIAL REQUIREMENTS**

**SB-1**            **BRIDGE PLANS**

Limited plans of the existing structure are on the County's website.

**SB-2**            **(1717) AIR, LAND AND WATER POLLUTION**

The provisions of 1717 are supplemented as follows:

The Contractor's attention is hereby directed to MPCA Rule 7011.0150 as it relates to sandblasting and/or concrete removal operations  
(<http://www.pca.state.mn.us/index.cfm>).

Unless otherwise provided in these special provisions, construction, demolition and/or removal operations conducted over or in the vicinity of public waters shall be so controlled as to prevent materials from falling into the water. Any materials which do fall into the water, or onto areas where there is a likelihood that they will be picked up by rising water levels, shall be retrieved and stored in areas where such likelihood does not exist.

**SB-3**            **(2104) REMOVAL OF ASBESTOS AND REGULATED WASTE**  
**(BRIDGE)**

This work shall consist of the removal and disposal of any regulated waste found on existing bridges or from the utilities located on the bridge, in accordance with the applicable Mn/DOT Standard Specifications and the following:

SB-3.1            If during the course of removal or renovation of utility or bridge, additional asbestos materials or regulated wastes, other than that noted in the Assessment Summary are encountered, the Contractor shall notify the County Project Engineer who shall suspend work and the Contractor shall furnish a documented inspection and evaluation by a Mn/DOT approved certified MDH contractor prior to the resumption of work. The work, as outlined in this paragraph, will be paid for as Extra Work.

SB-3.2            All asbestos and/or regulated waste shall be disposed of in accordance with Mn/DOT's manual. Only those listed in this manual as pre-approved for asbestos and/or regulated waste will be allowed to work on this Project. The Contractor's shall use Mn/DOT approved companies for testing, waste transport and disposal as provided and described in Mn/DOT's manual "*Asbestos and Regulated Waste Manual For Structure Demolition Or Relocations for Construction Projects*" available on the following website:  
<http://www.dot.state.mn.us/environment/regulated-materials/index.html>. Contact Mark Vogel, Mn/DOT Office of Environmental Services, 651-366-3630 with any questions regarding the manual.

SB-3.3            All material shall be removed, identified, and disposed of in accordance with Section S-1701 (LAWS TO BE OBSERVED (BRIDGE)) of these Special Provisions. The Contractor will not receive permission to begin the regulated

waste removals, with the exception of material needed for hazardous and regulated waste assessment or testing, until the Engineer has copies of all required notices.

SB-3.4 The Contractor will not be allowed to proceed with the demolition or renovation of bridges until the Engineer has received copies of all required notifications as indicated in Section S-1701 (LAWS TO BE OBSERVED (BRIDGE)) of these Special Provisions.

SB-3.5 The Contractor shall be responsible to notify any utility owners at least three (3) days prior to the removal of any regulated waste which may affect the utility allowing the utility owner time to have a representative on site.

SB-3.6 See the attached "Asbestos and Regulated Waste Assessment Summary" for information on whether or not asbestos or regulated waste was detected in the bridge(s) to be removed or renovated.

The assessment summary included with the Plan or Special Provisions are intended for informational purposes. Quantity, type and analysis of any asbestos or regulated waste containing material are estimates intended as a general guide.

SB-3.7 No measurement will be made of any portion of the asbestos or regulated waste material removal, but the complete removal thereof as specified shall be construed to be included in the single lump sum for which payment is made under Item 2104.601 (Remove Regulated Waste Material (Bridge)).

**SB-4 (2401) CONCRETE BRIDGE CONSTRUCTION**

The provisions of Mn/DOT 2401 are modified and/or supplemented with the following:

Delete the first sentence of the first paragraph of 2401.3G:

Cure newly placed concrete by providing protection against rapid loss of moisture, freezing temperatures, high temperatures, abrupt temperature changes, and vibration exceeding a normal or reasonable limit as described in the Bridge Construction Manual chapter .362, shock waves, and prematurely applied loads.

Add the following to the end of the second paragraph of 2401.3G:

All sections not included in superstructures.....45

SB-4.1 Concrete Aggregate for Bridges

The provisions of 2401.2A shall apply except as modified herein:

Delete the second paragraph of 2401.2A and substitute the following therefor:

Class A or Class C coarse aggregate, as defined in 3137.2B, shall be used in all concrete for bridge superstructures, except that coarse aggregate requirements for precast concrete members fabricated under 2405 shall be as specified in 2461.2D.

SB-4.2 Placement of Concrete in High Abutments

To reduce the effects of shrinkage in abutment concrete, there shall be a 72 hour delay between concrete pours of adjacent sections that have vertical construction joints.

SB-4.3 Joint Filler and Sealing

The provisions of 2401.3J1 are supplemented as follows:

Prior to installation of sealing materials, concrete curing shall be completed. A minimum of 7 days drying is required prior to application of sealers. Sawcut joints shall be sandblasted, blown clean, and the concrete surfaces shall be dry at the time sealer is installed.

Preformed joint shall be as detailed in the Plans and in conformance with the following requirements.

1. Bituminous felt shall comply with AASHTO M33, modified to the extent that the load required to compress the test specimen to 50 percent of its thickness before test shall be not more than 8274 kPa (**1200 psi**).
2. Cork shall comply with Mn/DOT 3702 and AASHTO M153 Type II.
3. Polystyrene shall comply with the following:

Type	Minimum Compressive Strength (5 percent deflection)	Characteristics
A	207 kPa ( <b>30 psi</b> )	Closed Cell Expanded Polystyrene
B	69 kPa ( <b>10 psi</b> )	Molded Polystyrene

Testing for compressive strength of polystyrene shall be in accordance with ASTM D 1621. The Contractor shall, if requested by the Engineer, furnish evidence that the material meets these requirements.

The quantity of preformed cork joint filler material given in the Plans is for the Contractor's convenience only. Any additional joint filler required shall be furnished by the Contractor with no additional compensation.

SB-4.4 Architectural Surface Treatment Types 1 and 3

A. Description of Work

This work consists of constructing simulated natural (split) cut stone masonry textured surfaces on all areas so designated on the plans for Bridge \_27B81\_. The work shall be performed in accordance with the applicable provisions of Mn/DOT 2401, the Plans and the following:

SB-4.5 Architectural Surface Treatment Type 1 - Abutment Face, Fascia Panels (both sides) and Wing Walls

A random cut stone pattern resembling stone masonry shall be applied to the surface areas of the abutment faces, fascia panels and wing walls in the areas so designated on the plans. The maximum depth of the simulated stone shall be 3/4 inch and shall have alternating courses of approximately 7-1/2" high and 6" high with random length stones. The stone surface shall be a low relief split-faced finish.

The random horizontal stone pattern shall be similar to Milestones, Incorporated, Pattern MS-4005.

#### Architectural Surface Treatment Type 3 – Lower, Sloped Abutment Wall

A low relief split-faced stone pattern (identical to the texture of Architectural Surface Treatment Type 1) shall be applied to the surface areas of the abutment face walls as identified in the Plans. The horizontal course pattern can be achieved through the use of rustication strips (refer to Plans). The course height shall align with the course height of the stone used for Architectural Surface Treatment Type 2.

#### A. Formed Textured Surfaces

When simulated cut stone is designated, concrete surfaces shall be formed using a form lining system made of high-strength urethane elastomer materials capable of withstanding anticipated concrete pour pressures without leakage or causing physical defects. Form liners shall attach easily to forms and be removable without causing concrete surface damage. The liners shall be designed to form surfaces conforming to the design intent including the shape, lines and dimensions described herein and in the plans. Match pattern features at form liner joints to minimize visible pattern repeats and make the formed concrete surface appear uniform and continuous without visible seams and form marks. When joints are unavoidable, make joints along main features of the pattern.

Form liners shall produce the textured effect of a highly realistic, random low relief split-face masonry surface. Simulated stone surfaces having a smooth, slick or shiny surface will be rejected. Maximum pattern relief shall be 3/4 inch. Form liner molds shall be cast from natural split-face stones to provide a realistic natural stone pattern. Individual stones shall be formed with crisp, sharp edges and a rough (split), natural relief to the shape and dimensions described herein and shown on approved shop drawings.

Subject to compliance with requirements, provide form liner materials from the following manufacturers:

1. Custom Rock International, Inc.
2. Milestones, Inc.
3. Other approved manufacturers

Form ties shall be made of non-corrosive materials when the portion permanently embedded in the concrete is less than 1-1/2 inches from the finished surface.

Form release agents shall be fully compatible with the form liner material and the special surface finish to be applied to the textured surfaces.

B. Submittals

Within 60 calendar days of execution and approval of the Contract, the Contractor shall submit the following to the Engineer for approval:

1. Product data including manufacturer's technical information and use instructions for form liner placement and release.
2. Actual samples of form ties that will be permanently embedded in the concrete.
3. Qualification data for firms and person specified below under Quality Assurance to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, and names of architects, engineers and owners, plus any other pertinent information.
4. Shop drawings indicating form liner layout and termination details. Indicate backup, rustication, reveal, and chamfer strip locations. Include jointing, form tie location, pattern placement, pattern match details, and end, edge and other special conditions. Indicate tolerances and procedure of installation and separation.

C. Quality Assurance

1. Manufacturer's Qualifications: The form liner manufacturer must have five years minimum experience making liners used to create formed concrete surfaces matching natural stone shapes and textures.
2. Installer Qualifications: The form liner installer shall have had a minimum of five consecutive years of experience in textured formed concrete construction.
3. Test Panel Mock-ups and Test Panels (Cut Stone Patterns Only): Construct test panel mock-ups of textured formed surfaces of the approved Architectural Concrete Texture for quality control comparison of surface texture and pattern characteristics between the approved sample mock-up and the actual work as it is installed. The test panel mock-ups shall be constructed using urethane foam to produce a surface that simulates that produced when casting concrete. The test panel mock-ups may also be used as a finished surface for mock-ups of the Architectural Color System as specified under Section SB-\_\_\_ of these special provisions. The test panel mock-ups shall be a minimum of 3 inches thick, 5 feet

wide and 4 feet high. They must be light weight and easily moved or transported by one person.

Upon approval of the test panel mock-up, concrete test panels shall also be constructed. At a minimum, the concrete test panels shall be the same size as the test panel mock-ups. Materials used in the construction of the concrete test panels shall comply with the applicable requirements of 2401 for formwork and concrete. Concrete mix for the concrete test panels shall be Mix No. 3Y43. The form liners used for the concrete test panels shall produce the same pattern that is intended for use on the structures. Cast unreinforced panels vertically simulating as many phases of the actual construction as possible. Additional concrete test panels will be required if results of the initial test panel do not meet the requirements of these special provisions.

Following completion of the structure, remove and dispose of the test panels in accordance with 2104.3C3.

Test panels shall be considered incidental to the work and no direct compensation will be made therefore.

D. Construction Requirements

Surface Preparation: All conventionally formed concrete surfaces to receive fractured rib texture shall be water blasted to break the surface film and to remove all laitance detrimental to the finish coating system performance. Sandblasting will not be allowed for cleaning concrete surfaces, as it will reduce the architectural concrete texture specified in this Special Provision. Pressure washing with water at a pressure of **3000 psi** at a rate of **3 to 4 gallons** per minute using a fan nozzle held perpendicular to the surface at a distance of **one to two feet** shall be used.

Match pattern features at form liner joints to make the formed concrete surface appear uniform and continuous without grout leakage at the joints. When concrete vertical construction joints are required, place form liner joints in the valley of the grooves, or as approved by the Engineer. Following removal of forms, finish minor defects to blend with the balance of the pattern surface texture. Filling of "bug holes" or other similar deformities in the texture surface that are 1/2 inch or less in diameter or depth is not required. No visible vertical and horizontal seams or conspicuous form marks created by butt-joining form liners will be allowed. Where it is not possible to locate a vertical groove at a construction joint, the concrete surface shall be finished to reduce visibility of the construction joints.

Strip formwork in accordance with the form liner manufacturer's recommendations to avoid concrete surface deterioration or weakness planes in the substrate. Finish form tie holes in accordance with 2401.3F2a using approved patching materials.

Clean and repair surfaces of form liners to be re-used. Split, frayed, delaminated or otherwise damaged form liner material will not be acceptable for exposed surfaces. Form liners shall be cleaned and free of concrete buildup prior to each pour. Do not use "patched" forms for exposed concrete surfaces unless acceptable to the Engineer.

E. Method of Measurement

Measurement for Architectural Surface Treatments Type 1 and 3 will be made by area in square yard of the finished surface constructed to the limits shown and noted in the Plans.

F. Basis of Payment

Architectural Concrete Texture: Payment for Item 2411.604, "ARCH SURFACE TREATMENT TYPE 1" and Item 2411.604 "ARCH SURFACE TREATMENT TYPE 3" will be made at the Contract price per square yard and shall be compensation in full for all costs of constructing the textured surfaces on the abutments, wing walls, and fascia panels as described above, including the test panel mock-ups, concrete test panels, and the additional concrete required to achieve the specified treatment relief.

SB-4.6 Architectural Surface Treatment Type 2

This work shall consist of furnishing and installing Limestone stone masonry, at the locations indicated by Architectural Surface Treatment Type 2 in the plans, in accordance with the applicable provisions of Mn/DOT 2401, 2461 and the following:

A. Submittals

A. ***Prior to shipping stone, the Contractor shall submit compliance certificates, product data, shop drawings, stone samples and qualification data to the Engineer for approval.***

1. product data indicating manufacturer's technical information, label analysis,
2. application instructions and color samples for mortar products. Mortar color will be selected by the Engineer from manufacturer's standards.
3. drawings showing stone cutting and setting details, indicating sizes, dimensions,
4. sections and profiles of stones; arrangement and provisions for jointing, supporting, anchoring and bonding stonework; and details showing relationship with, attachment to and reception of related work. No stone shall be processed until shop drawings have been approved.

Samples of veneer stone of adequate size 12 inch x 12 inch minimum showing the full range of color and pattern variations to be expected with each finish specified. Mark each type of stone and finish clearly.

5. Qualification data indicating compliance with specifications. Include list of completed projects with project name and location and architect/engineer/owner of record.

B. Quality Assurance

Installer shall be experienced and have successfully completed stone masonry installation similar in material, design and extent to that required by this project.

Contractor shall obtain veneer stone and setting materials from a single source with sufficient resources to provide products and materials of consistent quality in appearance and physical properties without delaying progress of the work.

- C. ***Contractor shall demonstrate his workmanship by constructing a mock-up panel using approved products, materials, methods and workmanship, including, but not limited to, stonework, mortar mix, anchor ties and cleaners. The panel shall also be used for verification of selections made for color and finish and to establish standard of quality for completed work. It is the Contractor's option to use the bottom two courses on the North Abutment as the mock-up. If it is deemed unsatisfactory, the Contractor shall remove and replace all stone until it is satisfactory.***

The minimum size of concrete test panel shall be 6 feet wide x 4 feet high.

It shall be constructed on any concrete backup system approved by the Engineer. All unsatisfactory panels shall be removed and replaced with a satisfactory panel. The Contractor shall dispose of the test panel in accordance with Mn/DOT 2104.3C3 upon completion of the project.

Furnishing and installing the test panel shall be considered an incidental expense

for which no direct compensation will be made.

D. Materials

Veneer Stone shall be Lannon Limestone. Stone shall be durable, sound, free from cracks, and furnished from deep ledge formations protected from the action of frost while in the ledge, conforming to accepted range of color, pattern and texture as approved by the Engineer and the following:

Color: Stone shall be Pewter colored.

Texture: Stone shall be furnished as indicated on the plans with exposed surfaces being hand-pitched rock-faced surfaces.

Size: Veneer depth varies. Refer to the plans.

Pattern: Stone shall be laid in patterns as indicated on the plans.

Stone shall be accurately cut to shape and dimensions, with jointing as shown on approved shop drawings. Exposed faces shall be cut true with beds and joints dressed straight and square, unless otherwise shown. Corners shall be pre-fabricated as indicated on the plans.

Materials used as ingredients in mortar shall conform to the requirements for the ASTM designations listed:

- Portland Cement (C-150 Type 1)
- Masonry Cement (C-91)
- Quicklime (C-5)
- Hydrated lime (C-207 Type S)
- Aggregates (C-144)
- Water (Clean and potable)
- Color (Lime proof, color-fast mineral pigments)

Comply with ASTM C270 proportion specification for type of mortar required. Use

Type S mortar for stone masonry having a minimum compressive strength of 2,500 psi at 28 days.

Mortar shall be mixed in a batch mixer for not less than five minutes, and shall be mixed long enough for thorough intimate mixing of all ingredients. If color is added, it shall be added in a consistent manner to provide final uniformity.

No mortar shall be re-tempered after initial set has taken place.

Grout may consist of mortar with sufficient water added to provide a pourable consistency or may consist of a 1:2:3 cement, sand and pea-gravel mix.

Anchors and fasteners for stone shall be made of non-corrosive materials or corrosion-resistant materials in compliance with local building code requirements. Aluminum will not be permitted. Unless otherwise recommended by stone fabricator/installer, adjustable unit ties shall be attached to the cast-in-place concrete backup. The anchor system shall consist of dovetail slots and triangular wire tie anchors. All components of the system shall be hot dipped galvanized (ASTM A153, 1.5 oz./sq. ft.) (not mill galvanized) or stainless steel (sheet, ASTM A580 Type 304 or wire, ASTM A167 Type 304). The slot material shall be no less than 22 ga., the clip shall be no less than 12 ga., and the wire tie shall be no less

than 3/16" diameter. All anchors and fasteners shall be approved by the Engineer.

Cleaner for stone shall be any commercial, neutral liquid type formulated for the purpose intended recommended by the stone quarry /fabricator and approved by the Engineer.

E. Construction Requirements

1. The stone masonry construction of the finished work shall achieve the same final effect as demonstrated on the approved test panel.
2. Contractor shall verify that conditions are satisfactory for the installation of the masonry. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Deliver, store, protect and handle stone products in accordance with fabricator recommendations to prevent staining and breakage due to improper handling.
3. Masonry work shall not be constructed when temperature of outside air is below 40°F unless suitable means are provided to heat the stone materials and protect the completed work from freezing. When the outside air is below 40°F stone materials shall be heated to at least 40°F, and an air temperature above 40°F shall be maintained on both sides of the work for at least 48 hours.
4. Stone veneer anchors shall be attached to the cast-in-place concrete backup, installed vertically, and spaced 24 inches center to center, with ties extending from dovetail channel into the mortar joints of the stone. Ties shall be spaced a maximum of 24 inches apart both vertically and horizontally
5. Veneer stone shall be laid in pattern approved by the Engineer with veining, jointing and other work affecting appearance consistent throughout for each type of installation required. Lay stones with all bedding planes horizontal in a workmanlike manner, true to line, with corners plumb and true and with each course breaking joints with the course below, well keyed, secured and bonded together.
6. Not less than 1/2 inch of cement mortar shall be provided between veneer stone and the backup system. All joints and the space behind the stone between the backing and stone shall be filled solidly with mortar and the grout joints raked smooth and flat to a 1/4 inch depth to provide a tight waterproof joint.
7. Expansion joints shall be adequate to allow for thermal and structural differential movement. Expansion joints shall be constructed using asphalt-saturated organic roofing felt complying with ASTM D226, Type 1 (No. 15 Asphalt Felt), compressible foam backer and tinted one-part, low modulus polyurethane sealant

compatible with sealing compound. Sealant color shall match the mortar color.

8. Keep stone work as clean as possible as work progresses. Upon completion, clean stone thoroughly with soap and water and fiber brushes. Repair all defective mortar joints to the satisfaction of the Engineer.

F. Measurement and Payment

Measurement will be made by the plan quantity of planimetric area of stone masonry veneer constructed as specified. Payment will be made under Item 2411.604 "ARCH SURFACE TREATMENT TYPE 2" at the Contract bid price per square yard, which shall be compensation in full for all costs incidental thereto, including masonry work and stone mockup sample(s) required.

SB-4.7 Architectural Surface Finish (Single Color)

A. Description of Work

This work consists of applying an architectural surface finish to all exposed concrete surfaces of the Architectural Surface Treatment Type 3 Bridge No. 27B81. The work shall be performed in accordance with the applicable provisions of Mn/DOT 2401, the Plans, and the following:

Architectural Surface Finish (Single Color)

Architectural Surface Finish (Single Color) shall be applied to the lower sloped abutment wall, so designated in the Plans to receive Architectural Surface Finish (Single Color).

Architectural Surface Finish (Single Color) shall be a single color stain. The color shall match Federal Standard 595C, Color No. 36424 adjusted by field testing as required to match to the color of the Special Surface Finish.

B. Surface Color

The surface coloring for the Architectural Surface Finish described above shall be performed using approved stains or paint systems applied in a manner consistent with the aesthetic design requirements of the Project.

For Architectural Surface Finish (Single Color), the color shall be provided by a two-coat stain application. The application of the base coat shall follow ordinary concrete finish operations and be by air or airless sprayer. Allow to thoroughly dry before applying topcoat. The topcoat shall be applied in a uniform manner, moving in one direction, 5.5 to 6.5 mils wet film thickness equivalent to 1.5 to 2.0 mils dry film thickness. Use sufficient material to provide color uniformity, but avoid buildups and runs.

C. Stain Materials

Stain shall be a 100 percent acrylic; water-repellant, semi-opaque, tinted emulsion sealer designed for concrete and masonry surfaces. Acceptable products shall allow moisture and vapor transmission, be formulated for exterior application with resistance to freeze/thaw, moisture, alkali, acid and mildew, mold or fungus, discoloration or degradation and meet the following requirements:

1. Physical or performance properties:
  - \$ Volume Solids 29-31 percent (Calculated Lab Value)
  - \$ Weight Solids 44-46 percent (Calculated Lab Value)
  - \$ Viscosity 65-85 KU (Calculated Lab Value)
  - \$ Accelerated Weathering 1,000 Hours Minimum (ASTM G-26)
2. Color pigments for tinted products shall be derived from synthetic mineral oxides.
3. Subject to compliance with requirements, provide colored concrete finishing products from one of the following manufacturers:
  - The Sherwin-Williams Company
  - Tamms Industries
  - Chem-Rex
  - Other approved sources

To the greatest practical extent, all concrete finishing products shall be obtained from a single source.

All materials shall be furnished, prepared, applied, cured and stored according to the product manufacturer's directions and as specified herein. Special attention shall be given to the recommended temperature range for application.

D. Submittals by Contractor

Within 60 calendar days of execution and approval of the Contract, the Contractor shall submit the following to the Engineer for approval:

1. Product data including manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
2. Laboratory test reports showing that materials proposed for use meet physical or performance property requirements.
3. 1 foot X 1foot square samples of the Color System on the textured surface pattern. Final color selections will be based upon comparison to the Federal Standard 595C Color Chip in the color specified above.

E. Surface Preparation

Following removal of forms, all exposed textured concrete surfaces shall receive an ordinary surface finish in accordance with Mn/DOT 2401.3F2a prior to the surface preparation described below. Minor defects shall be finished to blend with the balance of the textured surfaces. On heavily textured surfaces (i.e. ashlar stone, cut stone, fractured granite, etc.) only minor defects greater than 1/2" in diameter shall be finished to blend with the balance of the textured surface. The Contractor shall make every effort to match the surface texture of patched surfaces with the surrounding textured surface. Visible vertical or horizontal seams or conspicuous form marks shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

All formed concrete surfaces to receive Architectural Surface Finish (single color) shall be water-blasted to break the surface film and to remove all laitance detrimental to the color system performance. Sandblasting will not be allowed for cleaning concrete surfaces, as it will reduce the architectural surface treatment texture. Pressure washing with water at a pressure of 3000 pounds per square inch at a rate of 3 to 4 gallons per minute using a fan nozzle held perpendicular to the surface at a distance of 12 inches to 24 inches shall be used.

F. Application

The concrete to which the architectural surface finish is to be applied must be a minimum of 28 days old. All surfaces that are to receive an architectural surface finish shall be thoroughly flushed with clean water not more than 24 hours before commencing with the finishing.

The finish color effect for the bridges and structures involves an application of a two coats of stain, uniformly applied over the entire textured surface. The color application shall meet the requirements of the product manufacturer for both thickness and coverage. Stain products used to complete the work shall not be diluted with water or other solvents in any way.

G. Basis of Payment

Payment for Architecture Surface Finish (Single Color) shall be made under Item No. 2411.618, "ARCH SURFACE FINISH (SINGLE COLOR), at the Contract bid price per square foot, which shall be compensation in full for all costs incidental thereto.

SB-4.8 Architectural Surface Finish (Multi-color)

A. Description of Work

This work consists of applying an architectural surface finish to all exposed concrete surfaces of the Architectural Surface Treatment Type 1. The work shall be performed in accordance with the applicable provisions of Mn/DOT 2401, the Plans, and the following:

Architectural Surface Finish (Multi-color): Architectural Surface Finish (Multi-color) shall be applied to the areas designated in the plans to receive Architectural

Architectural Surface Finish (Multi-color): shall be a multi-colored application using approved stains. Architectural Surface Finish shall also include an anti-graffiti coating applied to the stained surface as specified in SB-5.9.

B. Surface Color

The surface coloring for the Architectural Surface Finish described above shall be performed using approved stains or paint systems applied in a manner consistent with the aesthetic design requirements of the Project.

For Architectural Surface Finish (Multi-color), the color shall be provided by a two colored stain application. The desired finish color effect shall be achieved through the application of a base coat of stain matching Federal Standard Color 595C, Color No. 33578. After application of base coat spray a diluted wash coat over the surface followed immediately by wiping the surface. The intent of this coat is to reduce the brightness of the base coat and create a natural stone appearance. Use Federal Standard Color 595C, Color No. 30099 for this wash coat.

Color samples will be developed by the Contractor using the test panel mock-ups described in SB-4.4 and the color information contained herein. Colors shall be derived from real rock samples of the natural stone provided by the Contractor. These color samples shall remain the property of the Department.

C. Stain Materials

Stain shall be a 100 percent acrylic; water-repellant, semi-opaque, tinted emulsion sealer designed for concrete and masonry surfaces. Acceptable products shall allow moisture and vapor transmission, be formulated for exterior application with resistance to freeze/thaw, moisture, alkali, acid and mildew, mold or fungus, discoloration or degradation and meet the following requirements:

1. Physical or performance properties:
  - § Volume Solids 29-31 percent (Calculated Lab Value)
  - § Weight Solids 44-46 percent (Calculated Lab Value)
  - § Viscosity 65-85 KU (Calculated Lab Value)
  - § Accelerated Weathering 1,000 Hours Minimum (ASTM G-26)
2. Color pigments for tinted products shall be derived from synthetic mineral oxides.

3. Subject to compliance with requirements, provide colored concrete finishing products from one of the following manufacturers:
  - § The Sherwin-Williams Company
  - § Tamms Industries
  - § TK Products
  - § Chem-Rex
  - § Other approved sources

To the greatest practical extent, all concrete finishing products shall be obtained from a single source.

All materials shall be furnished, prepared, applied, cured and stored according to the product manufacturer's directions and as specified herein. Special attention shall be given to the recommended temperature range for application.

D. Submittals by Contractor

Within 60 calendar days of execution and approval of the Contract, the Contractor shall submit the following to the Engineer for approval:

Product data including manufacturer's technical information, label analysis, and application instructions for each material proposed for use.

1. Laboratory test reports showing that materials proposed for use meet physical or performance property requirements.
2. 1 foot x 1 foot square samples of the Architectural Surface Finish (Multi-color) to be used on architectural surface treatment type 1. Final color selections will be based upon completion of the test panel specified below.
3. Proof that the applicator has had five years experience finishing simulated stone masonry textured concrete. Include list of completed projects with project name and location and architect/engineer/owner of record.

E. Quality Assurance

The Contractor shall finish the test panel mock-up for Architectural Surface Treatment Type 1 fabricated under Section SB-4.4 to satisfy the criteria specified herein.

1. Approved mock-up panels will be used for quality control comparison of color characteristics between the approved mock-up panels and the actual work as it is completed. The Contractor and/or his agents shall be responsible for maintaining these panels at individual work sites while the work is in progress for this purpose.

2. The Contractor shall demonstrate his workmanship by completely finishing the architectural surface treatment concrete test panels, described in SB-4.4, using approved concrete stain products, materials, methods and workmanship and the specified surface preparation method. Test panels shall be considered incidental to the work and no direct compensation will be made therefore.

F. Surface Preparation

Following removal of forms, all exposed textured concrete surfaces shall receive an ordinary surface finish in accordance with Mn/DOT 2401.3F2a prior to the surface preparation described below. Minor defects shall be finished to blend with the balance of the textured surfaces. On heavily textured surfaces (i.e. ashlar stone, cut stone, fractured granite, etc.) only minor defects greater than 1/2" in diameter shall be finished to blend with the balance of the textured surface. The Contractor shall make every effort to match the surface texture of patched surfaces with the surrounding textured surface. Visible vertical or horizontal seams or conspicuous form marks shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

All formed concrete surfaces to receive Architectural Surface Finish (Multi-color) shall be water-blasted to break the surface film and to remove all laitance detrimental to the color system performance. Sandblasting will not be allowed for cleaning concrete surfaces, as it will reduce the architectural concrete texture. Pressure washing with water at a pressure of 3000 lbs. per Square Inch at a rate of 3 to 4 gallons per minute using a fan nozzle held perpendicular to the surface at a distance of 12 inches to 24 inches shall be used.

G. Application

The concrete to which the architectural surface finish is to be applied must be a minimum of 28 days old. All surfaces that are to receive a architectural surface finish shall be thoroughly flushed with clean water not more than 24 hours before commencing with the finishing.

The finish color effect for the bridges and structures involves an application of a base coat, uniformly applied over the entire simulated stone textured surface (both individual stones and joints between stones). Subsequent coats are applied by placing one color over another or by intermixing several colors of stain to achieve the characteristics of the approved sample panel. The base color application shall meet the requirements of the product manufacturer for both thickness and coverage. All stain products used to tint and highlight the work shall not be diluted with water or other solvents in any way.

H. Method of Measurement

Measurement for the Architectural Surface Finish (Multi-color) applied to the architectural surface treatment type 1 will be by area based on the Plan dimensions of the finished colored plane surface area in square feet.

I. Basis of Payment

Architectural Surface Finish (Multi-color):

Payment for Item No. 2411.618, "ARCH SURFACE FINISH, (Multi-color)", shall be at the Contract price per square foot and shall be compensation in full for all costs of furnishing and applying finishing materials to the areas of Architectural Surface Treatment Type 1.

Application of the architectural surface finish to the test panels for quality assurance purposes shall be considered incidental and no direct compensation will be made therefore.

SB-4.9

Finish of Concrete Surfaces

Cure concrete for a minimum of 28 days or as recommended by the manufacturer prior to applying special surface finish (SSF) or acrylic paint. Thoroughly flush all surfaces that are to receive SSF with clean water not more than 24 hours before commencing with the SSF finishing.

A. Special Surface Finish

The provisions of 2401.3F2c apply except as modified herein:

Apply Special Surface Finish on the exposed concrete surfaces as designated below for Bridge No. 27B81.

Abutment and wing wall pilasters

All exposed faces of the concrete parapets or barriers

Wing wall portions that are not receiving architectural concrete treatment

Edge of bridge deck

Underside of deck overhang to exterior face of fascia panel

Portions of abutment face that are not receiving architectural concrete treatment

Portions of precast fascia panel that are not receiving architectural concrete treatment

Provide a finish color for all Special Surface Finish matching Federal Standard 595 C No. 36424. Provide paint free of toxic metals and toxic pigments.

Provide a test area, 1 meter x 1 meter (**3 foot x 3 foot**), for final color selection and have the Engineer approve the test area after the color has been added to it.

Add the following sentence after the fourth sentence in the second paragraph of 2401.3F2c:

Furnish only one approved system of mortar, bonding agent, water, and 100% acrylic paint (meeting MnDOT 3584) from the "Approved/Qualified Product Lists of Special Surface Finish" (<http://www.dot.state.mn.us/products/index.html>) to produce the color(s) specified in this special provision.

B. Finishing Roadway Faces and Tops of Barrier Railing

1. Finish conventionally formed roadway faces, tops of barrier railings (and medians), as per 2401.3F2d and the following:
  - a) Plan and execute concrete placement, form removal, and finishing operations so that the surface finishing can be started immediately after forms are removed. Remove the roadway face forms as soon as the concrete can retain its molded shape. In no case shall the elapsed time between concrete placement and initial surface finishing exceed 24 hours.
  - b) After completion of the curing period, paint the roadway faces and tops of the barrier railings with an approved acrylic paint conforming to 3584. The color of the acrylic paint shall conform to Federal Std. No. 595 C, No. 36424. Apply the paint at a rate of 7.4 m<sup>2</sup> per L (**300 ft<sup>2</sup> per gallon**). Commence or suspend the painting operation when the air and surface temperature meet or exceed the manufacturer's recommendations.
2. Finish slip-formed roadway faces and tops of barrier railings (and median), in accordance with the following:
  - a) Lightly broom the railing surface immediately after passage of the slipformer.
  - b) Coat the roadway face and top of the barrier railing as described above for the conventionally formed railing.

C. Basis of Payment

Finishing of concrete surfaces, except as otherwise provided in these special provisions, special surface finish, application of topcoat, and painting are considered an incidental expense to the respective concrete mixes for this construction, and no additional compensation will be made for this work.

SB-4.10 Anti-Graffiti Coating

A. Description of Work

This work consists of applying an anti-graffiti coating to all areas of Bridge 27B81 as designated herein and in the plans. The following concrete surfaces shall receive Anti-Graffiti Coating:

Front face of abutments (face of stem, sloped wall, stone faces, fascia panel seat, bridge seat, and pedestals)

Abutment wing walls

Abutment and wing wall pilasters

Concrete parapet/barriers

All faces, except the top, of the precast fascia panels

Edge of bridge deck

Underside of deck overhang

The work shall be performed in accordance with the Plans and the following:

B. Materials

**Anti-Graffiti Coatings**

Anti-graffiti coatings shall be a clear, multi-component, multi-coat system designed as a permanent, non-destructive coating system for exterior architectural aesthetics. Product shall be compatible with any surface sealer and/or special surface finish that may have been previously applied to the concrete surfaces. It shall be non-yellowing, non-chalking and UV-resistant, available in a flat or matte finish and shall not require re-application after graffiti removal. Coating shall not contain paraffin (wax) or elastomeric silicones. Acceptable products shall demonstrate protection from graffiti defacement, chemical staining, ghosting, shadowing and normal environmental effects without yellowing, color change, increased dirt pick-up or damage to the coating or substrate for a minimum ten-year period.

Acceptable anti-graffiti coating products are as follows:

- Invisi Shield as manufactured by Sherwin Williams
- Permaclean as manufactured by TK Products
- Graffiti Guard as manufactured by Tex-Cote
- Other products submitted for approval by the Mn/DOT Office of Materials – Analytical Lab

Graffiti removal agents shall be non-toxic, non-flammable, biodegradable and have a pH of 7 - 8.5. After graffiti removal, no evidence of graffiti shall be present. The product(s) shall not cause a change in the appearance to the treated surface, including shadowing, ghosting or staining of the coating or substrate.

C. Submittals

Submittals may be made at any time prior to being incorporated in the work. Allow sufficient time so that construction will not be delayed as a result of the time required to approve the submittals, including time for re-

submittal as necessary. An extension of time will not be authorized because of failure to transmit submittals sufficiently in advance of the work.

The Contractor shall submit the following items to the Engineer:

- a) Manufacturer ' s product data sheets indicating technical information, label analysis and application instructions for each material proposed.
- b) For the purpose of future maintenance, a list of manufacturer-approved products for cleaning of the surface of the anti-graffiti coating product(s) used on the Project
- c) Certified test reports indicating compliance with requirements.
- d) A one-quart sample of each anti-graffiti coating product and a compatible graffiti removal agent for verification purposes.
- e) Applicator qualifications demonstrating experience in coating applications. Include a list of recently completed graffiti-resistant coating projects. Supply name and location of project, name and telephone number of owner, and a description of products used, substrates, applicable local environmental regulations and application procedures.

D. Quality Assurance

All products applied under this Project shall be supplied by the same manufacturer. Coating and removal products shall demonstrate a history of successful use on transportation, commercial or industrial projects.

The approved coating manufacturer shall conduct a training seminar for the purpose of training applicators on anti-graffiti product technology, substrates and application methods. Applicator trainers shall be approved by and shall be in good standing with the manufacturer.

E. Application

The substrate shall be prepared and the anti-graffiti coating product(s) shall be applied in accordance with the manufacturer's directions.

Prior to full application of the anti-graffiti coating to the designated surfaces, the applicator shall apply the anti-graffiti coating to a small inconspicuous area on the bridge wing wall to confirm compatibility, coverage and possible color change. Any problems or damage to the concrete substate as a direct result of the anti-graffiti products or surface preparation methods, shall be corrected to the satisfaction of the Engineer and at the Contractor's expense.

F. Method of Measurement

Measurement for the Anti-graffiti Coating applied to the natural concrete surfaces will be by area based on the Plan dimensions of the finished plane surface area in square feet.

G. Basis of Payment

Anti-graffiti Coating

Payment for Item No. 2411.618, "ANTI-GRAFFITI COATING", shall be at the Contract price per square foot and shall be compensation in full for all costs of furnishing and applying finishing materials to the areas designated in the plans.

Application of the anti-graffiti coating to the test area for quality assurance purposes shall be considered incidental and no direct compensation will be made therefore.

**SB-5**

**(2402) STEEL BRIDGE CONSTRUCTION**

This work shall be performed in accordance with the provisions of Mn/DOT 2402 except as modified below:

Delete the first paragraph of 2402.3D and substitute the following:

At least six weeks before starting construction of the structural steel erection falsework, the Contractor shall supply the Engineer with three copies of the detailed Plans and Specifications and two copies of the associated calculations of the proposed system for constructing the falsework. Design of the falsework shall be in accordance with AASHTO "Guide Design Specifications for Bridge Temporary Works". The Plans and Specifications shall be prepared by an Engineer, thoroughly checked by a second Engineer for completeness and accuracy, and certified by one of the aforementioned professional Engineers licensed in the State of Minnesota. The documents shall include sufficient details so that construction of the proposed system can be completed solely by reference to the Plans and Specifications. The design criteria shall be shown on the first sheet of the Plans.

Delete the first paragraph of 2402.3F and substitute the following:

Structural steel members shall be erected in a manner that will provide safety to the workers, inspectors, and the public, at all times, as well as reasonable assurance against damage to the steel members. Prior to placement of diaphragms, the primary members, such as beams and girders, shall be temporarily anchored, braced, and stabilized as they are erected so as to preclude sliding, tipping, buckling, or other movement that may otherwise occur.

If active vehicular or railroad traffic will be permitted to travel beneath beams prior to complete erection of all the beams and diaphragms in a span, the Contractor shall submit an erection plan prepared by an engineer, thoroughly checked by a second engineer for completeness and accuracy, and certified by one of the aforementioned professional engineers licensed in the State of Minnesota

which details all temporary works necessary to brace and stabilize beams. Struts, bracing, tie cables, and other devices used for temporary restraint shall be of a size and strength that will ensure their adequacy. Plans shall specify the required bolt tension and number of bolts to be installed in permanent diaphragm connections and in other bracing necessary to stabilize the beams. The Contractor shall arrange the work schedule so that at least two adjacent girders will be erected (including diaphragms and bolts fully tightened) and braced in any one span before operations are suspended for the day.

The last sentence of 2402.3F, paragraph (3), is hereby modified to read as follows:

Connections for primary members, diaphragms, and other secondary members shall have a sufficient number of holes filled with erection pins and bolts so that the plates are drawn into full contact and so that the holes are properly matched prior to placing the permanent connectors.

#### SB-5.1

##### Metal Railing

This work shall consist of furnishing, coating, and installing metal railing, including all anchorages and fittings, in accordance with the applicable provisions of 2402, 2433, 2471, 2478, the Plans and the following. The contractor is responsible for communicating all applicable specifications, special provisions and requirements to all subcontractors.

##### A. Engineer

Engineer, as used herein, when relating to shop fabrication and coatings, shall mean the Departments Bridge Construction and Maintenance Engineer.

##### B. Materials

All materials shall be in accordance with the Plan details. If not specified, all steel shall comply with 3306, except that pipe and pipe sleeves shall comply with 3362. Threaded rods, bolts, nuts, and washers shall meet 3391 and shall be galvanized in accordance with 3392 or electroplated in accordance with ASTM B 633, Type III, SC 4.

##### C. Anchorages

Except when part of a proprietary anchorage assembly, threaded rods and bolts shall meet the requirements of 3385 and 3391, respectively.

Adhesive or cast-in-place type anchors shall be used unless otherwise specified in the plans.

If the Contractor chooses adhesive anchors, the Contractor shall submit, for approval by the Engineer, the following chemical adhesive supplier's product literature or calculations to establish embedment depth. This information will demonstrate compliance with the specification:

- Name of supplier
- Full product name (as given in supplier's literature)
- Embedment depth as determined from supplier's literature

Anchorage for fastening rail posts shall have an ultimate pull out strength, as specified in the Plan, and shall be installed in sound concrete to a depth equal to at least six times the rod or bolt diameter. Bolt heads and/or nuts shall be in contact with the adjacent surface and shall be torqued to approximately 108 Nm (**80 foot pounds**) unless a different torque is recommended by the manufacturer. Adhesive anchorages shall consist of a continuously threaded rod secured by an adhesive or mortar.

Laboratory tests, that include static load tests for ultimate pullout strengths, shall be performed on anchorage systems that are subject to tensile loads. The tests, in accordance with ASTM E 488, shall be performed and certified by an independent testing laboratory. The Contractor shall furnish the Engineer with the test reports and the specification sheets that are prescribed by ASTM E 488.

The Contractor shall demonstrate the anchorage system for drilled-in anchorage systems at the first site of field installation prior to actual use in the Project for each Project element where drilled-in anchorage systems are used. The demonstration shall include installation and a static tension test in the presence of the Engineer, in accordance with test procedures prescribed in ASTM E 488. No portion of the testing device shall bear on the concrete surface within a distance equal to the anchorage embedment depth. Three anchorages shall be tested to not less than 1/2 the required minimum ultimate pull out strength or the value given in Table 1, whichever is less. Failure of an anchorage test will require a modification of installation procedures or use of a different anchorage system.

In addition to the three tests stated above, the Engineer will require that each bridge element where drilled-in anchorage systems are used have an additional 2% (not less than 1 test) of the remaining anchorages tested at a later date. The Engineer will determine the locations of the additional anchors. If a failure occurs while testing the additional 2%, more testing will be required at the rate of an additional 1% per each failure at the Contractor's expense. Compensation for costs of testing is included in the payment for anchorage type reinforcement bars.

Location	Bolt or Rod Diameter Inches	Minimum Embedment Depth Inches	Ultimate Pull-out Strength Pounds
Ornamental Metal Railing	5/8"	6"	21,600
Ornamental Metal Railing Type 1 Special	3/4"	5"	11,300

**TABLE 1**  
**ANCHOR ROD PROOF LOADS, KN (kips)**  
**TYPE OF ROD, FROM SPEC. 3385**

DIA., mm (inches)	TYPE A	TYPE B	TYPE C	TYPE D
16 (5/8")	33.0 (7.4)	39.5 (8.9)	70.0 (15.8)	34.0 (7.6)

Installation of anchorages shall be in accordance with the manufacturer's recommendations and as specified in the Plan.

Any voids occurring between the top of the anchorages and the concrete in which it is embedded shall be filled with caulk approved by the Engineer.

**D. Fabrication and Inspection Requirements**

All metal railing shall be fabricated in accordance with 2471 and the Plan. The welding code shall be AWS D1.1-Structural Welding Code-Steel. Welding Procedure Specifications (WPSs) shall be submitted to the Engineer, for approval, prior to the start of fabrication.

Prior to fabrication the Contractor shall submit a Quality Control Plan (QCP) and fabrication drawings that are acceptable to the Engineer. Any work started prior to receiving approved drawings WPSs, and a QCP, shall be subject to 1512. The Contractor shall also give the Engineer at least 5 working days notice prior to beginning work so that Quality Assurance (QA) inspection may be provided.

All metal railing will be inspected by the Engineer. The purpose of the inspection(s) is to establish compliance with the Contract Documents. The shop inspection(s) is not intended to supplement or replace the Contractor's own Quality Control (QC). The Contractor is ultimately responsible for the correction of errors and faulty workmanship or for the replacement of nonconforming materials.

All parts of the fabrication are to be visually inspected and the inspections are to be documented by the Contractor's QC personnel. Any Nondestructive Testing required by the Contract Documents shall be performed and documented by an ASNT-TC-1A Level II qualified inspector.

Parts found to be in nonconformance shall be documented by using a Nonconformance Report form (NCR). The NCR shall describe in detail the fabrication error and the proposed repair procedure(s) in accordance with the QCP. Repair(s) performed shall be subject to the written approval of the Engineer.

E. Coating Requirements

All railing material shall be galvanized in accordance with 3394 after fabrication and painted (Duplex Coated) using the applicable provisions of 2478. The primer coat shall not be used on galvanized surfaces. The color of the finish coat for bridge railings shall be Black and have a semi-gloss finish. The Pipe Railing for the stairway and the Ornamental Metal Railing Type Special 1 along the trail under the bridge shall match Benjamin Moore Bronzitone 6060 low lustre color, a sample of which shall be provided to the Engineer for review and approval.

Pre-Galvanized Procedure(s):

1. Calibrate dry film thickness gages in accordance with SSPC-PA 2-Measurement of Dry Coating Thickness with Magnetic Gauges.
2. Prepare all fabricated material surfaces by abrasive blast cleaning to a minimum of SSPC-SP 6/NACE No. 3-Commercial Blast Cleaning, prior to galvanizing.
3. Purchase Order(s) shall inform the galvanizer as to which specific items are going to be duplex coated so that they may comply with any additional cleaning required to meet the "Post Galvanizing Procedures", and, as necessary, meet the visual requirements of aesthetic, ornamental products. The galvanizer shall also be informed which materials, to be galvanized, are reactive (e.g. 3309, etc.).

Galvanizing Procedure(s):

1. All metal railing to be galvanized will be processed utilizing a "dry" kettle. The metal railing shall be prefluxed prior to the galvanizing bath using an aqueous tank of zinc chloride/ammonium chloride. The use of a "top flux" blanket on the molten zinc bath will not be permitted.
2. Air cool the metal railing to ambient temperature before handling for shipment and/or storage. Do not quench the metal railing or apply any post-galvanizing treatments.
3. Lumps, projections, globules, or heavy deposits of zinc, which will interfere with the "intended use of the product", will not be permitted. Damage to the galvanized zinc coating resulting in uncoated "black" and/or bare areas, blisters, flux deposits, and dross inclusions will also be considered unacceptable. Galvanized material that does not meet the requirements of 3394, shall be repaired in accordance with the methods described in ASTM A780. Required repair(s) may be subject to written approval of the Engineer. "Intended use of the product" shall be defined as surface conditions that, when painted, will produce acceptable aesthetic and/or visual qualities.
4. Galvanized metal railing shall be stored in a manner that will prevent the formation of "white-rust" or wet storage painting. "White rust" or staining of the galvanizing is not acceptable. A written repair procedure shall be

subject to the approval of the Engineer. All repairs shall be performed at no expense to the owner.

5. The galvanizer shall provide the Engineer with all galvanizing process-related Quality Control documents prior to shipment of the galvanized product. These documents shall include the following: coating material certifications, visual examinations, and coating thickness examinations.
6. The galvanized metal railing shall have a straightness tolerance of 3 mm in 3000 mm (**1/8 inch in 10 ft**), prior to any subsequent paint applications. Any galvanized metal railing not meeting this tolerance shall be straightened.
7. It is the galvanizer's responsibility to provide the Engineer with advanced notification of at least 5 working days of intent to ship so that the Engineer can perform a Quality Assurance audit.

Post Galvanizing Surface Preparation:

1. Preparation of galvanized surfaces for painting shall be in accordance with ASTM D6386.

Paint Application:

1. Surface cleaning shall be by the solvent cleaning method and surface preparation shall be performed by sweep blasting.
2. All sweep blasted galvanized railing shall be coated with the subsequent coat(s) within the time frame defined in ASTM D 6386, Sect. 5.4.1, or within the same 8-hour shift, maintaining manufacturer defined control and environmental conditions. The Contractors QC personnel shall document that all parameters were followed.
3. All coating material shall be applied in accordance with the contract documents and the manufacturer's Product Data Sheet (PDS) and application guides for the material and system specified.
4. Coating material(s) shall meet the requirements of 3520. The color of the intermediate coat shall present a distinct contrast from other applied coatings.
5. QC Inspections of all coated products shall be accomplished by an observer with normal color vision, in a "well lighted" area, during each coating phase and prior to final acceptance.

"Well-lighted" shall be defined as a minimum of 50 foot candles of artificial light or natural daylight. A light meter with readings in foot candles shall be used to verify the adequacy of the lighting.

Handling and Shipping of Coated Metal Railing:

All completed, fabricated, and coated metal railing shall be protected during handling, and shipping, to prevent any damage to the coating(s). Coated metal

railing shall not be moved or handled until the coating has cured, but in no case sooner than recommended by the coating manufacturer.

Metal railing may be padded to protect it from direct contact with wood, steel, or other packaging materials that could scratch, mar or otherwise damage the final coated railing finish. Softeners may be used in conjunction with high-density foam or other acceptable packaging materials at all points of contact.

Storage of Coated Metal Railings:

All completed coated metal railing shall be stored in accordance with 1606 and the following:

1. All railing shall be clearly tagged/piece marked by the fabricator prior to final storage. Identification markings shall include, as a minimum: individual piece marks, bridge and/or project number(s), fabricator and applicator job numbers. All marking(s) shall not be visible to the public when the railing is in its installed position. The method of identification shall be included in the fabricators QCP.
2. It is the Contractors responsibility to provide the Engineer with advance notification of at least 5 working days of intent to ship, so that the Engineer can perform a QA audit prior to shipping.

F. Construction Requirements

The steel posts shall be adjusted to obtain the grade and alignment as shown in the Plans by one of the following methods:

1. The steel posts shall be shimmed with steel shims or washers to the proper grade and alignment, not to exceed 6 mm (**1/4 inch**) of shim height. Before attaching the nuts, coat the surface between the base plate and concrete rail with an approved silicone caulk. Tighten the anchor rod nuts (as per section "C"-Anchorages) and neatly smooth the caulk around the perimeter of the railpost base plate.
2. The anchor rods shall have leveling nuts threaded on them and turned down to the base of the anchor rods. The rails shall be installed and the steel posts set to the proper grade and alignment by adjusting the leveling nuts. Install the top nuts and tighten them firmly to the base plate. The space between the base plate and the concrete shall be filled and neatly finished with grout that is approved by the Engineer.

Ground all metal railings. Install all electrical grounding in accordance with the applicable provisions of Mn/DOT specification 2557 and the National Electrical Code. Clamp or braze the ground wires to the grounding device, then practicably route and attach to the nearest rail by clamping, brazing, or any other approved means that will provide a permanent positive

connection. If rail has non-continuous sections, use a #6 AWG solid copper wire to connect adjacent railing panels.

If the bridge does not include exposed electrical equipment, then ground the rails at points directly below or adjacent to the railing at all abutment corners. The grounding system will consist of a #6 AWG solid copper wire connected to the railing which in turn is connected to a copper coated steel rod having a nominal diameter of 15 mm (**5/8 inch**) or more and a minimum length of 2.4 m (**8 feet**) installed to an elevation approximately flush with the ground surface.

If the bridge includes exposed electrical equipment, such as roadway lighting, traffic signals, variable message signs, surveillance cameras, or ramp metering, then bond the railing grounding system to the exposed electrical equipment grounding system. Refer to the electrical plans and electrical special provisions for details regarding bonding multiple electrical grounding systems.

G. Repairs of Coated Steel Railings:

Any damaged coated surfaces, identified through either Quality Control or Quality Assurance inspections as being unacceptable, either after the application of the paint or after shipping and handling, shall be subject to the provisions of 1512.

H. Basis of Payment

Payment for Item No. 2402.583 "ORNAMENTAL METAL RAILING", 2402.583 "ORNAMENTAL METAL RAILING TYPE SPECIAL 1", and 2402.585 "PIPE RAILING" will be made at the contract price per foot and shall be compensation in full for all costs of fabrication, (galvanizing), surface preparation, painting, delivery, and installation, as described above. Failure to comply with any of these requirements will result in rejection of the material and/or reduction in payments.

SB-5.2 Drainage System Bridge Deck

The item Drainage System Bridge Deck shall include all material, labor, and equipment required to provide and install the drainage system bridge deck as shown on the plans.

No measurement will be made for the materials required to provide the drainage system for the bridge deck. All work performed as specified above will be considered to be included in a single lump sum for which payment is made under Item No. 2402.601, "DRAINAGE SYSTEM BRIDGE DECK".

**SB-6 (2404) CONCRETE WEARING COURSE FOR BRIDGES**

The provisions of Mn/DOT 2404 are modified and/or supplemented with the following:

SB-6.1 Concrete Wearing Course 3U17A

The provisions of 2404 shall apply except as modified herein.

Add the following to 2404.3A:

Special precautions shall be taken to control and abate the dust generated by the blasting operation in accordance with MPCA Rule 7011.0150 <https://www.revisor.leg.state.mn.us/rules/?id=7011.0150>. The Contractor shall submit his/her proposed plan for dust abatement at least 14 days before the start of this work. This abatement plan shall include, but not necessarily be limited to, the following operations and procedures:

- A. The bridges and approach slabs shall be thoroughly swept prior to blasting. A power sweeper shall use the least amount of water necessary to minimize the dust from the sweeping operation.
- B. The blast wheel or blasting nozzle or nozzles shall be enclosed in a housing or directed into a housing. The housing shall have a negative air emission control system that draws the confined air and dust into an adequate filter collection system. The capacity of the exhaust system shall be sufficient to readily relieve the pressure generated within the housing by the blasting equipment. The filter collection system shall be cleaned, as necessary, to assure proper filtration. The sides and corners of the housing shall be flexible at the bottom to the extent that the bottom of the housing shall be in contact with the deck surface during all blasting operations.
- C. The housing and/or filter collection system shall be constructed, maintained, and operated so that avoidable dust emissions are eliminated.
- D. After blasting, the prepared surface shall be thoroughly hand swept or swept with a "Pickup" type power sweeper equipped with adequate dust storage capacity. All minor debris remaining after the sweeping operation shall be completely removed by air blasting. The air supply system shall be so constructed that a suitable oil trap is placed in the air supply line between the storage tank and the nozzle.

Measurement will be made by the area, in square meters (**feet**), based on the bridge roadway dimensions between gutter lines and from end of (slab) (approach) to end of (slab) (approach).

Payment for performing this work, as described above, will be made under Item No. 2404.618 "BLASTING (SPECIAL)", at the Contract price per square foot.

SB-6.2 Texture Planing of Bridge Slabs

Delete the 16<sup>th</sup> paragraph of 2404.3A and substitute the following:

After completion of work required to meet surface tolerance, texture the roadway surface in a longitudinal direction by planing the hardened concrete using a diamond saw-blade grinder. The entire surface area of the roadway except the

area within 500 mm (**20 inches**) of the curb shall be planed to a uniform texture. The surface shall have a finished texture with the width of the grooves between 2.5 mm (**1/10 inch**) and 3.3 mm (**1/8 inch**) at a distance of between 2.0 mm (**5/64 inch**) and 3.0 mm (**1/8 inch**) apart. The grooves shall not be less than 0.8 mm (**1/32 inch**) or more than 3.0 mm (**1/8 inch**) in depth. The actual textured surface in any selected 0.5 meter (**1.5 feet**) by 30 meter (**100 foot**) longitudinal strip shall not be less than 98% of the surface area.

During planing operations, joints must be adequately protected against damage and special care shall be taken to avoid damage to expansion devices. Planing shall be done in a manner that will provide a smooth riding surface at expansion joints and at the ends of the concrete wearing course. After completion of the planing, the permissible surface deviation will be 3 mm (**1/8 inch**) in 3 meters (**10 feet**) measured with a straightedge laid longitudinally and 3 mm (**1/8 inch**) in 1 meter (**3 feet**) measured transversely at right angles to the centerline of roadway.

All slurry material shall become property of the Contractor and must be disposed of as per Mn/DOT 2104.3C3, as approved by the Engineer, and as described in this special provision.

All concrete residue and water (slurry) resulting from concrete bridge deck texture planning operations must be continuously vacuumed from the surface, captured, and containerized for further handling or processing. The slurry must not be permitted to flow across lanes occupied by traffic, flow into drainage facilities or discharge anywhere within the highway Right of Way. The Contractor must submit a slurry disposal or reuse plan at the preconstruction conference for approval by the Engineer.

The method to manage the slurry may require separation of the solids from the liquids. This separation may be achieved mechanically by centrifuging or passively by allowing settlement of the fines to occur in a temporary impermeable lines containment area. If a temporary containment area is used within the highway Right of Way, a Site Plan as per 1717 will be required for the Engineer's approval. The minimum Site Plan shall include methods for storm water protection at the temporary containment area, a description of the proposed separation method, and the process for final removal and restoration of the disturbed containment area. For any method used to separate the liquid from the solids, the Contractor shall identify the name and location of the POTW (publicly owned treatment works facility) that the liquids will be deposited in, or how the processed water will be reused by the Contractor.

As part of the slurry disposal or reuse plan, the Contractor must be able to provide, upon request, documentation that identifies the name and location of the MPCA permitted lined mixed municipal solid waste (MMSW) or industrial landfill that the solids will be deposited in, or identifies any alternative methods of disposal or reuse that meet environmental requirements of regulated industrial waste.

The Contractor shall hold County harmless for any fines or sanctions caused by the Contractor's actions or inactions regarding compliance with concrete slurry management and disposal. All materials and labor for installation of storm water protection practices, maintenance, control, removal and disposal for the management of concrete slurry is incidental to the bridge deck texture planning operation.

Planned areas not meeting requirements may, at the Engineer's option, be replaced, re-planned or left as is and accepted for payment subject to a price reduction of \$2.70 per square meter (**25 cents per square foot**) but, in all cases, positive surface drainage shall be provided.

Measurement will be made to the nearest square foot of concrete area planed and textured based on surface area. Payment will be made under Item 2401.618 "BRIDGE DECK PLANING", at the Contract bid price per square foot, which shall be compensation in full for all costs relative to the specified texture planing.

**SB-7**

**(2405) PRESTRESSED CONCRETE BEAMS**

The provisions of Mn/DOT 2405 are modified and/or supplemented with the following:

Delete the first paragraph of 2405.3M and substitute the following:

Prestressed concrete beams shall be erected in a manner that will provide safety to the workers, inspectors, and the public, at all times, as well as reasonable assurance against damage to the prestressed members. Prior to the placement of diaphragms, the prestressed beams shall be temporarily anchored, braced, and stabilized as they are erected so as to preclude sliding, tipping, buckling, or other movement that may otherwise occur. If active vehicular or railroad traffic will be permitted to travel beneath beams prior to complete erection of all the beams and diaphragms in a span, the Contractor shall submit an erection plan prepared by an engineer, thoroughly checked by a second engineer for completeness and accuracy, and certified by one of the aforementioned professional engineers licensed in the State of Minnesota which details all temporary works necessary to brace and stabilize beams. Struts, bracing, tie cables, and other devices used for temporary restraint shall be of a size and strength that will ensure their adequacy. The Contractor shall arrange the work schedule so that each beam will be connected to an adjacent beam and at least two adjacent girders will be erected (including diaphragms and bolts fully tightened) and braced and stabilized in any one span before operations are suspended for the day.

Add the following immediately before the last paragraph of 2405.3M:

Threaded rods used to attach prestressed concrete beams to cast-in-place concrete diaphragms shall either be galvanized per Mn/DOT specification 3392 or electroplated in accordance with ASTM B633, service condition SC4.

**SB-7.1**

**Prestressed Concrete Fabricator Certification**

The Fabricator's quality control office shall maintain documentation containing the data required by the specifications and the State of Minnesota Materials

Engineer. This documentation shall contain test data and measurements taken at times and locations approved by the Engineer, assuring that monitoring, by personnel not directly involved in production, is sufficient to ensure compliance with approved procedures.

If the Engineer's review of fabrication work discloses that approved procedures are not being followed, the Fabricator shall immediately correct the procedure.

The Engineer will determine what additional testing work must be done by the Fabricator or, if necessary, what part of the work must be repaired or replaced if fabrication work is not properly monitored and documented by the Fabricator.

Any and all costs of required additional monitoring and testing shall be at the expense of the Contractor with no additional compensation.

#### SB-7.2 Steel Intermediate Diaphragms

In lieu of providing the steel intermediate diaphragm shown in detail B403 of the plans, the Contractor may substitute a bent plate diaphragm. The bent plate diaphragm shall be made of 8 mm (**5/16"**) thickness plate bent as shown in detail B402 of Mn/DOT Bridge Details Manual. The minimum depth for diaphragm shall be dimension "C" shown in B403; minimum flange width shall be 125 mm (**5"**).

#### SB-7.3 Prestress Transfer

The Fabricator of prestressed concrete beams shall closely monitor the ends of the beams during the strand release process. The following sequence of releasing the individual prestressing strands will be required if cracks occur in the ends of the beams during the fabricator's releasing sequence.

Delete the first sentence of the second paragraph of 2405.3H.

Add the following to 2405.3H:

Prestress transfer shall be conducted in a sequential and alternating manner symmetrical to the vertical axis of the beam in order to minimize the lateral eccentricity of the prestress forces and diminish cracking of the concrete. The sequence of individual prestressing strand release shall be in accordance with the following criteria unless different criteria are approved by the Engineer.

- 1) Beginning with the *straight* strands closest to the vertical axis of the beam and in the second row from the bottom of the beam, release the strands each side of center. Move two columns away from this column in the same row and release the strand on each side of the center. Then proceed to the outermost strands in this row and release the strand on each side of the center. Repeat the sequence for the third and subsequent rows from the bottom upward until approximately one-fourth of the straight strands have been released.
- 2) Release approximately one-half (+/- one strand) of the *draped* strands alternating about the vertical axis, starting from the bottom.
- 3) Release the hold-down anchors for the draped strands.

- 4) Release the remainder of the *draped* strands alternating about the vertical axis.
- 5) Release the remainder of the *straight* strands beginning with the strand in the bottom row nearest the vertical axis. The strands are released alternating each side of the center. Release all the strands in that column moving upward. Proceed two columns away from this column and release the strands bottom to top alternating each side of the center. Next, move to the outer most column and release strands bottom to top continuing to alternate each side of the center. The remainder of the strands shall be released bottom to top starting with the inner most column alternating each side of the center.

Once release has started, all strands of that beam shall be released in the sequence described above even if cracking is noticed near the end of the beam. The Engineer shall be notified immediately of any cracking and no other beams with the same strand pattern may be fabricated until the Engineer has approved a revised release sequence.

## **SB-8**

### **(2411) PRECAST ARCHITECTURAL PANELS**

This work shall consist of the fabrication, delivery and erection of the precast fascia panels as shown in the Plans. This work shall be performed in accordance with the Plans, the applicable provisions of Mn/DOT 2401 and 2405, and the following:

This work includes:

1. All work included under the precast fascia panel described in section 8.1 below.
2. All work included under the post tensioning system described in section 8.2 below.
3. Delivering the precast fascia panels to the site.
4. Placing the precast fascia panels in place.
5. Furnishing and installing the grout to fix the precast fascia panels into the north abutment pilaster as shown on the Plans.
6. Furnishing and installing the 3" polystyrene to lock the precast fascia panels into the south abutment pilaster as shown on the Plans.

#### **SB-8.1**

##### **Precast Fascia Panels**

The work includes providing all materials, equipment and labor required to fabricate the precast fascia panels as shown on the plans. This includes, but is not limited to the materials listed below. In addition, the work includes submittals and storing and handling the panels as describe in sections A and B below.

1. Structural Concrete (3W46)
2. Architectural Surface Treatment Type 1

3. Epoxy coated reinforcement bars
4. Epoxy coated welded wire fabric

A. Submittals

Contractor shall submit a comprehensive engineering design for panel handling and connection points necessary for handling, which is signed and sealed by a professional engineer responsible for its preparation and registered in the state of Minnesota. Design shall include panel handling during all stages of construction. These stages are when the panels are four individual panels, when the two "panel 2" (as referred to on the Plans) are tensioned together, and when all four panels are tensioned together. Design shall also include necessary reinforcement in the panels to resist handling, transportation and erection stresses. All connection points, or lifting points, shall be located at the top of the panels so as to not affect the architectural treatment.

B. Product Storage, Delivery and Handling

5. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, staining, and to prevent cracking, distortion, warping or other physical damage.
6. Store units, unless otherwise specified, with dunnage across full width of each bearing point.
7. Place stored units so identification marks are clearly visible, and units can be inspected.
8. Deliver all structural precast concrete units in such quantities and at such times to assure compliance with the schedule and proper setting sequence to ensure continuity of installation.
9. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
10. Place dunnage of even thickness between each unit.
11. Lift and support units only at designated points shown on the Shop Drawings.
12. Panels must be cast a minimum of 28 days prior to post tensioning and installation in the field.

SB-8.2 Post Tensioning System

A. Description of Work

This work shall consist of prestressing the precast fascia panels by the post-tensioning method.

This work includes:

1. Design calculations and working drawings.

2. Furnishing and installing the ducts and prestressing bars, including centering devices for the tendons and appurtenant items necessary for the particular system to be used.
3. Furnishing and installing the anchorage system
4. In-place friction testing, if necessary.
5. Post-tensioning the system.
6. Grouting the ducts and anchorage blockouts upon completion of the stressing operations.
7. Protection of anchorages, clean-up, and other work necessary for installation of the system.

#### Working Drawings

##### A. General:

Working drawings of the proposed prestressed concrete members shall be submitted in accordance with the requirements of 1502 and these special provisions.

The Contractor shall prepare composite drawings in plan, elevation and section which show to scale the relative positions of all items that are to be embedded in the concrete, the concrete cover, and the embedment depth for the portions of the structure that are to be temporarily or permanently prestressed. Such embedded items include the prestressing ducts, vents, anchorage reinforcement and hardware, and reinforcing steel strand. Such drawings shall be adequate to ensure that there will be no conflict between the planned positions of any embedded items, and that concrete cover will be adequate. If, during the preparation of such drawings, conflicts are discovered, the Contractor shall revise the working drawings for one or more of the embedded items, or proposed changes in the dimensions of the work as necessary to eliminate the conflicts or provide proper cover. Any such revisions shall be approved by the Engineer before work on an affected item is started.

The drawings shall show the method and procedure of jacking and the type, size, and properties of the bars and the anchorage assemblies. Details in addition to those shown on the contract plans shall be included for any additional reinforcing steel required to resist the concrete bursting stresses in the vicinity of the anchorage assemblies. The force or stress diagram shall be shown on the drawings. The sizes, shapes, and dimensions shall be shown for the ducts. Vent locations and details of the vents shall also be included on the drawings.

The drawings shall include complete details of the method, materials, and equipment proposed for use in the prestressing operations. Such details shall outline the method and sequence of jacking, show complete details of the prestressing steel, anchoring devices, type of enclosures, block-outs,

and show all other data pertaining to the post-tensioning system or operations.

Complete details shall be submitted for grouting prestressing tendons including the materials and proportions for grout, details of equipment for mixing and placing grout and methods of mixing and placing grout.

The Contractor will not be required to duplicate in the working drawings any aspect of the system that is fully detailed in the plans.

### Materials

#### A. Prestress Anchorages

All prestressing steel shall be secured at the ends by means of permanent type anchoring device. Prestress anchorages shall develop at least 95 percent of the guaranteed ultimate tensile strength of the prestressing steel.

Prestress anchorage devices shall effectively distribute prestressing loads to the concrete and shall conform to the following requirements.

- a. The bearing stress in the concrete created by the anchorage plates shall not exceed the values per AASHTO Standard Specifications for Highway Bridges, 17<sup>th</sup> Edition.
- b. Bending stresses in the plates or assemblies induced by the pull of the prestressing steel shall not exceed the yield point of the material in the anchorage plate when 95 percent of the ultimate strength of the tendon is applied. Nor shall it cause visual distortion of the anchor plate as determined by the Engineer.

#### B. Ducts

##### 1. General

All duct material shall be sufficiently rigid to withstand loads imposed during placing of concrete and internal pressure during grouting while maintaining its shape, remaining in proper alignment and remaining watertight.

The duct system, including splices and joints shall effectively prevent entrance of cement paste or water into the system and shall effectively contain pressurized grout during grouting of the tendon. The duct system shall also be capable of withstanding water pressure during flushing of a duct in the event the grouting operation is aborted.

The interior diameter of ducts for the bar shall be at least ½ inch greater than the nominal diameter of the bar.

C. Specific Material Properties

Type B - Corrugated Metal

Corrugated metal duct shall be fabricated with either welded or interlocked seams and shall be bent without crimping or flattening. Sections of duct shall be connected with heat shrink sleeves having uni-directional circumferential shrinkage shall be manufactured specifically for the size of the duct being coupled consisting of an irradiated and cross linked high density polyethylene backing for external applications and linear-density polyethylene for internal applications. Adhesive must bond to steel and polyolefin plastic materials.

Ensure the heat shrink sleeves have an adhesive layer that will withstand 150° F operating temperature and meet the requirements of the following table:

Property	Test Method	Minimum Requirements	
		Internal Application	External Application
Minimum Fully Recovered Thickness		92 mils	111 mils
Peel Strength	ASTM D 1000	29 pli	46 pli
Softening Point	ASTM E 28	162°F	216°F
Lap Shear	DIN 30 672M	87 psi	58 psi
Tensile Strength	ASTM D 638	2,900 psi	3,480 psi
Hardness	ASTM D 2240	46 Shore D	52 Shore D
Water Absorption	ASTM D 570	Less than 0.05%	Less than 0.05%
Color		Yellow	Black
Shrinkage		33%	23%

***Install heat shrink sleeves using procedures and methods in accordance with the manufacturer's recommendations.***

Duct and metal connectors shall be fabricated from galvanized sheet steel meeting the requirements of ASTM 525, Coating Designation G90. Areas of zinc coating damaged by welding or in fabricating interlocked seams shall be repaired by painting with a zinc dust-zinc oxide paint conforming to Federal Specifications TT-P-640 or MIL-P-21035.

Joints between sections of duct shall have no sharp edges within contact of the prestressing steel.

D. Grout and Grout Storage

- a. Use only pre-packaged grouts that meet the specifications of the table below. Select the post-tensioning grout for use by the proper application either repair or horizontal. Pre-packaged grout shall be mixed with potable water. Maintain grout fluidity in strict compliance with the grout manufacturer's recommendations and test with a flow cone.
- b. Store grout in a location that is both dry and convenient to the work. Storage in the open must be on a raised platform and with adequate waterproof covering to protect the material. On site storage of grout is limited to a maximum period of one month.
- c. All grouting operations shall comply with the requirements of SB-8.2.3.

Grout Properties

Grout shall have been used on a Mn/DOT segmental bridge project within the last three years or meet the requirements below. (A few Mn/DOT segmental bridge projects that have been constructed within the last three years are Interstate 35W over the Mississippi River, Crosstown project, or Interstate 494 over the Mississippi River. SikaGrout 300PT was used for 35W over the Mississippi River.)

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature **65-78°F** and conditions. Conduct all grout tests with grout mixed to produce the minimum time of efflux. Establish the water content to produce the minimum and maximum time of efflux.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Property	Test Value	Test Method
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density – Laboratory	Report maximum and minimum obtained test value lb/ft <sup>3</sup> (kg/l)	ASTM C 185
Wet Density – Field	Report maximum and minimum obtained test	ASTM C 138

	value lb/ft <sup>3</sup> (kg/l)	
Compressive Strength 28 day (Average of 3 cubes)	≥ 7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Time of Efflux***		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	Or Min. 9 Sec. Max. 20 Sec.	ASTM C 939***
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	Or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940
Permeability @ 28 days	Max. 2500 coulombs At 30 V for 6 hours	ASTM C 1202

\*Use ASTM C117 procedure modified to use a #50 sieve. Determine the percent passing the #50 sieve after washing the sieve.

\*\*Modify ASTM C1090 to include verification at both 24 hours and 28 days.

\*\*\*Adjustments to flow rates will be achieved by strict compliance with the manufacturer's recommendations. The time of efflux is the time to fill a one liter container placed directly under the flow cone.

\*\*\*\*Modify the ASTM C939 test by filling the cone to the top instead of to the standard level.

#### E. Prestressing Steel

Bar: Unless otherwise noted on the plans, uncoated Grade 150, high strength, threaded bar meeting the requirements of ASTM A 722, Type II.

#### F. Inlets, Outlets, Valves and Plugs

1. Provide permanent grout inlets, outlets, and threaded plugs made of ASTM A 240 Type 316 stainless steel, nylon or polyolefin materials. For products made from nylon, the cell class of the nylon according to ASTM D5989 shall be of S-PA0141 (weather resistant), S-PA0231 or S-PA0401 (ultimate strength not less than 10,000 psi with UV stabilizer added). Products made from polyolefin shall contain antioxidant(s) with a minimum Oxidation

Induction Time (OIT) according to ASTM D 3895 of not less than 20 minutes. Test the remolded finished polyolefin material for stress crack resistance using ASTM F 2136 at an applied stress of 348 psi. resulting in a minimum failure time of 3 hours.

2. All inlets and outlets will be equipped with pressure rated mechanical shut-off valves or plugs. Inlets, outlets, valves and plugs will be rated for a minimum pressure rating of 150 psi. Use inlets and outlets with a minimum inside diameter of 3/8 inch for single bar tendons.
3. Provide dual mechanical shutoff valves when performing vertical grouting.
4. Temporary items, not part of the permanent structure, shall be specifically designated on the PT System drawings and may be made of any suitable material.

G. Permanent Grout caps

1. Use permanent grout caps made from fiber reinforced polymer or ASTM A 240 Type 316L stainless steel. The resins used in the fiber reinforced polymer shall be either nylon, Acrylonitrile Butadiene Styrene (ABS) or polyester. For products made from nylon, the cell class of the nylon according to ASTM D5989 shall be S-PA0141 (weather resistant), S-PA0231 or S-PA0401 (ultimate strength not less than 10,000 psi with UV stabilizer added). For products made from nylon a cell class of S-PA0141 (weathering resistant) is required.

Construction Requirements

A. Protection of Prestressing Steel

Prestressing steel shall be protected against physical damage at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time will be rejected.

The prestressing steel shall be stored in a manner which will prevent the packing material from becoming saturated with water and will allow a free flow of air around the packages.

At the time the prestressing steel is installed in the tendons, it shall be free from loose rust, loose mill scale, dirt, paint, oil, grease or other deleterious material. Removal of tightly adhering rust or mill scale will not be required. Prestressing steel which has experienced rusting to the extent that it exhibits pits visible to the naked eye shall not be used in the work.

If the period of time between installation of prestressing steel and grouting of the tendon will exceed 10 calendar days, the prestressing steel shall be protected from corrosion during the entire period it is in place but ungrouted as provided below.

When the plans provide for prestressing steel to be installed in one unit with a length of prestressing steel left projecting to be threaded into another unit during erection, all of the prestressing shall be protected from corrosion from immediately after it is installed in the first unit until the tendon is grouted in the second unit as provided below.

When corrosion protection of in-place prestressing steel is required, a corrosion inhibitor which prevents rust or other results of corrosion shall be applied directly to the prestressing steel. The corrosion inhibitor shall have no deleterious effect on the prestressing steel or grout or bonding of the prestressing steel to the grout. The inhibitor shall be water soluble. The corrosion inhibitor, the amount and time of initial application, and the frequency of reapplication shall be subject to the Engineer's approval.

B. Installation of Ducts

Ducts shall be securely tied in position, carefully inspected and repaired before placing of the concrete is started. Care shall be exercised during placement of the concrete to avoid displacing or damaging the ducts. Internal ducts shall be supported at intervals of not more than **4 feet**. Any additional mild reinforcing required to support post-tensioning ducts shall be supplied by the contractor with no additional compensation. The tolerance on the location of the tendons shall be plus or minus **¼ inch** at any point. After installation in the forms, the ends of ducts shall at all times be sealed to prevent entry of water and debris.

All ducts or anchorage assemblies for permanent post-tensioning shall be provided with vent pipes or other suitable connections at each end and at each side of couplers for the injection of grout after post-tensioning. Vents shall be **½ inch** minimum diameter standard pipe or suitable plastic pipe. All connections to ducts shall be made with metallic or plastic structural fasteners. Waterproof tape shall be used at all connections including vent and grouting pipes. Plastic components, if selected and approved, shall not react with the concrete or enhance corrosion of the post-tensioning steel, and shall be free of water soluble chlorides. The vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents. Ends of steel vents shall be removed at least **one inch** below the concrete surface after the grout has set. Vents shall be properly grouted over with an epoxy grout. Ends of plastic vents shall be removed to the surface of the concrete after the grout has set.

All grout injection and vent pipes shall be fitted with positive mechanical shut-off valves. Vents and injection pipes shall be filled with valves, caps or other devices capable of withstanding the pumping pressures.

C. Post-Tensioning Operations

1. Stress in Tendons

The post-tensioning forces shown are theoretical and do not include losses in the system or thermal affects.

All post-tensioning shall be tensioned by means of hydraulic jacks so that the force of the prestressing steel shall not be less than the value shown on the approved working drawings. The maximum temporary tensile stress (jacking stress) in prestressing steel shall not exceed 81 percent of the guaranteed ultimate tensile strength (GUTS) of the prestressing steel. The prestressing steel shall be anchored in a way that will result in the ultimate retention of forces not less than those shown on the approved working drawings, but in no case shall the stress, after anchor set, exceed 70 percent of the guaranteed ultimate tensile strength of the prestressing steel at the anchorage nor 75% at the end of the anchorage seating zone.

When friction must be reduced, water soluble oil or graphite with no corrosive agents may be used as a lubricant subject to the approval of the Engineer. Lubricants shall be flushed from the duct as soon as possible after stressing is completed by use of water pressure. These ducts shall be flushed again just prior to the grouting operations. Each time the ducts are flushed, they shall be immediately blown dry with oil-free air.

2. Stressing Jacks

Each jack used to stress tendons shall be equipped with a pressure gauge having an accurate reading dial at least **6 inch** in diameter for determining the jack pressure. Prior to use for stressing on the project, each jack and its gauge shall be calibrated as a unit by a testing laboratory approved by the Engineer.

Calibration shall be done with the cylinder extension approximately in the position that it will be when applying the final jacking force and with the jacking assembly in an identical configuration to that which will be used at the job site (i.e. same length hydraulic lines). Certified calibration calculations and a calibration chart, both in English units of measure, shall be furnished to the Engineer for each jack.

3. Stressing of Tendons

Post-tensioning forces shall not be applied until the concrete has attained the specified compressive strength as evidenced by tests on representative samples of the concrete. These samples shall be stored under the same conditions as the concrete in order to accurately represent the curing condition of the concrete in place.

Prestressing steel shall be cut by an abrasive saw within  $\frac{3}{4}$ " to **1½ inch** away from the anchoring device. Flame cutting of prestressing steel is not allowed, except for pretensioned prestressing steel.

D. Grouting Operations

- a. Grouting Operations Plan: Submit a grouting operations plan for approval at least six weeks in advance of any scheduled grouting operations. Written approval of the grouting operations plan by the Engineer is required before any grouting of the permanent structure takes place.

At a minimum, the plan will address and provide procedures for the following items:

1. Type, quantity, and brand of materials used in grouting including all certifications required;
2. Type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts;
3. General grouting procedure;
4. Duct pressure test and repair procedures;
5. Method to be used to control the rate of flow within ducts;
6. Theoretical grout volume calculations;
7. Mixing and pumping procedures;
8. Direction of grouting;
9. Sequence of use of the inlets and outlet pipes;
10. Procedures for handling blockages;
11. Procedures for possible post grouting repair.

Before grouting operations begin, a pre-grouting conference of the Contractor, grouting crew and the Engineer will be conducted. At the meeting the grouting operation plan, required testing, corrective procedures and any other relevant issues will be discussed.

Grout Inlets and Outlets: Ensure the connections from the grout pump hose to inlets are free of dirt and are air-tight. Inspect valves to be sure that they can be opened and closed properly.

Supplies: Before grouting operations start, provide an adequate supply of water and compressed air for clearing and testing the ducts, mixing and pumping the grout. Where water is not supplied through the public water supply system, a water storage tank of sufficient capacity must be provided.

Equipment:

General: Provide grouting equipment consisting of measuring devices for water, a high-speed shear colloidal mixer, a storage hopper (holding reservoir) and a pump with all the necessary connecting hoses, valves, and pressure gauge. Provide pumping equipment with sufficient capacity to ensure that the post-tensioning ducts to be grouted can be filled and vented without interruption at the required rate of injection.

1. Provide an air compressor and hoses with sufficient output to perform the required functions.

Mixer, Storage Hopper: Provide a high speed shear colloidal mixer capable of continuous mechanical mixing producing a homogeneous and stable grout free of lumps and undispersed cement. The colloidal grout machinery will have a charging tank for blending and a holding tank. The blending tank must be equipped with a high shear colloidal mixer. The holding tank must be kept agitated and at least partially full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct. Add water during the initial mixing by use of a flow meter or calibrated water reservoir with a measuring accuracy equal to one percent of the total water volume.

Grout Pumping Equipment: Provide pumping equipment capable of continuous operation which will include a system for circulating the grout when actual grouting is not in progress. The equipment will be capable of maintaining pressure on completely grouted ducts and will be fitted with a valve that can be closed off without loss of pressure in the duct. Grout pumps will be positive displacement type, will provide a continuous flow of grout and will be able to maintain a discharge pressure of at least 145 psi. Pumps will be constructed to have seals adequate to prevent oil, air or other foreign substances entering the grout and to prevent loss of grout or water. The capacity will be such that an optimal rate of grouting can be achieved. A pressure gauge having a full scale reading of no more than 300 psi will be placed at the duct inlet. If long hoses (in excess of 100 ft) are used, place two gauges, one at the pump and one at the inlet. The diameter and rated pressure capacity of the grout hoses must be compatible with the pump output.

E. Grouting:

1. Temperature Considerations: Maximum grout temperature must not exceed 90°F at the grout inlet. Use chilled water and/or pre-cooling of the bagged material to maintain mixed grout temperature below the maximum allowed temperature. Grouting

operations are prohibited when the ambient temperature is below 40°F or is 40°F and falling.

2. **Mixing and Pumping:** Mix the grout with a metered amount of water. The materials will be mixed to produce a homogeneous grout. Continuously agitate the grout until grouting is complete.
3. **Grout Operations:** Open all grout outlets before starting the grouting operation. Grout tendons in accordance with the Grouting Operations Plan.

Unless approved otherwise by the Engineer, pump grout at a rate of 16 feet to 50 feet of duct per minute. Conduct normal grouting operations at a pressure range of 10 psi to 50 psi measured at the grout inlet. Do not exceed the maximum pumping pressure of 145 psi at the grout inlet.

Use grout pumping methods which will ensure complete filling of the ducts and complete encasement of the steel. Grout must flow from the first and subsequent outlets until any residual water or entrapped air has been removed prior to closing the outlet.

Pump grout through the duct and continuously discharge it at the anchorage and grout cap outlets until all free water and air are discharged and the consistency of the grout is equivalent to that of the grout being pumped into the inlet. Close the anchorage outlet and discharge a minimum of 2 gallons of grout from the grout cap into a clean receptacle. Close the grout cap outlet.

4. **Construction Traffic and Operations Causing Vibrations:** During grouting and for a period of 4 hours upon completion of grouting, eliminate vibrations from sources such as moving vehicles on the partially completed superstructure as well as jackhammers, compressors, generators, pile driving operations and soil compaction operations that are operating within 300 feet down-station and 300 feet up-station of the ends of the span in which grouting is taking place.
5. **Post-Grouting Operations and Inspection:** Do not remove or open inlets and outlets until the grout has cured for 24 to 48 hours. Perform inspections within one hour after the removal of the inlet/outlet. After the grout has cured, remove all outlets located at anchorages and high points along the tendon to facilitate inspection. Perform inspections in the presence of the Engineer using endoscopes or probes. Within four hours of completion of the inspections, fill all duct and anchorage voids using the volumetric measuring vacuum grouting process.

Seal and repair all anchorage and inlet/outlet voids that are produced by drilling for inspection purposes as. Remove the

inlet/outlet to a minimum depth of 2 inches . Use an injection tube to extend to the bottom of the drilled holes for backfilling with epoxy.

#### Protection of Prestress Anchorages

As soon as possible but not to exceed 14 days after tensioning and grouting is completed, exposed end anchorages, strands, other metal accessories and concrete in and around blockout shall be cleaned by sandblasting or equal of rust, misplaced mortar, grout, and other such materials. The surfaces of concrete against which concrete encasement over anchorage assemblies is to be placed shall be abrasive blast cleaned and aggregate exposed. Immediately following the cleaning operations, the entire surface of the anchorage recess (all metal and concrete) shall be thoroughly dried and permanent grout caps shall be placed on each anchor head. A heavy unbroken coating of "wet-to-dry" epoxy bonding compound, per AASHTO M235, Class II, shall then be applied to all surfaces against which concrete or grout will be cast.

When blockouts are used, the following shall apply: Epoxy coated mesh shall be placed across the anchor head block out and tied to the in-place reinforcement with plastic coated wire ties. A Mn/DOT approved high strength and low shrinkage grout shall then be placed over the anchor heads. After the grout has cured, an approved epoxy paint (which does not delaminate) shall be placed over the concrete block out. The entire block out plus at least 1 foot above and below the blockout shall be covered as approved by the Engineer. This epoxy paint shall be applied in a manner and thickness as recommended by the manufacturer.

#### SB-8.3 Payment

No measurement will be made of the materials required to provide the precast fascia panels as specified above. All work performed as specified above will be considered to be included in a single lump sum for which payment is made under Item No. 2411.601, "PRECAST ARCHITECTURAL PANELS".

#### **SB-9 (2442) REMOVAL OF EXISTING BRIDGES**

The provisions of Mn/DOT Specification 2442 shall apply except as supplemented herein.

#### SB-9.1 Disposal of materials by the Contractor shall be in accordance with 1506, 2104.3C, 2442, Mn/DOT "Asbestos and Regulated Waste Manual for Structure Demolition or Relocations for Construction Projects" and the following: The Contractor shall furnish written information to the Engineer as to disposal of steel bridge beams and other steel bridge components coated with lead paint. This information shall include method of stabilization and disposal; name, address, and telephone number of disposal site; certification that Contractor has notified disposal site of presence of lead paint; acknowledgment by Contractor of OSHA requirements relating to lead; and certification that Contractor is familiar with proper handling and disposal of materials with lead-based paint systems. All lead paint that has been identified as peeling must be stabilized by coating with a paint

or similar material that will prevent the peeling paint from flaking during demolition, or must be scraped. This must all be completed as per the Mn/DOT “Asbestos and Regulated Waste Manual for Structure Demolition or Relocations for Construction Projects”. The form supplied in this special provision shall consist of the signature of the authorized Superintendent verifying that the information is correct.

SB-9.2      **MIGRATORY BIRD PROTECTION**

Bidders are advised that bridge sites such as those in this Contract are usually attractive places for swallows and phoebes to build nests and raise their young.

Bidder’s attention is directed to the fact that swallows are protected by the Federal Migratory Bird Treaty Act 50 CFR 21, and the knowing destruction of swallows or their active nests is a felony punishable by a fine and/or jail term. Cliff swallows and barn swallows often build their nests on bridges that are over or near water.

The first priority for this Project is for the Contractor to take measures to prevent birds from building new nests before May 15 and until such time as the bridge construction activities are completed, or no longer threaten the nests. Birds should also be prevented from using old nests from the previous season. Old nests can be removed. An active nest is a nest with eggs or chicks. An unfinished nest is not considered active unless eggs have been laid. Acceptable measures include hosing or knocking down any unfinished or inactive nest as it is being built. To prevent nesting, cover the undersides and nesting surfaces of the bridge with tamps, fabric or netting to prevent nesting. No permit is required as long as this activity is done prior to May 15 or the active nesting period.

If it is impossible to remove nests prior to May 15, the Contractor must obtain the required depredation permits and deal with the swallows on the bridge in a manner that is acceptable to the U.S. Fish and Wildlife Service (USFWS) and the Minnesota Department of Natural Resources (DNR). Depredation permits from the USFWS are required for the destruction of migratory bird nest on bridges during the nesting season (May 15 to September 1). The DNR also has permit authority over protected wildlife. USDA Animal Damage Control is also involved. The contact persons for obtaining the depredation permits are as follows:

Marilyn Balancer	Blair Joselyn
U.S. Fish & Wildlife	Research Unit Supervisor
Migratory Bird Office	Dept. of Natural Resources
Federal Building, One Federal Drive	Lafayette Road
Fort Snelling, MN 55111-4056	St. Paul, MN 55101
Phone: 651-725-3313	Phone: 651-296-3344
Fax: 651-725-3509	

USDA - APHIS  
ADC  
316 North Roberts Street  
St. Paul, MN 55105  
Phone: 651-290-3156

The Contractor should allow a minimum of 21 days for processing the permit request.

All permits issued by the USFWS contain the requirement that any young swallows and eggs removed from the bridges must be turned over to a licensed rehabilitator for care and subsequent release. The rehabilitator must be contacted prior to the removal of any active nests to make sure that their services will be available. Contact the Department of Natural Resources' Central Office for federal licensed rehabilitators.

#### Summary

1. Bridge work may be performed outside of the nesting season, i.e., before May 15th or after September 1st. No permit is required for this activity unless active nests are involved.
2. The portions of the bridge providing nesting sites (undersides, overhangs, and ledges) may be covered with tarps, fabric or netting to prevent the birds from nesting. Other acceptable options are to diaper the underside of the bridge or hang filter reinforced with wire mesh from the side of the bridge to a foot below the water line. No permit is required for this activity. These measures should be implemented before May 15.
3. Old nests from the previous year and unfinished nests (Not Active = No eggs or chicks present) can also be removed by hosing or knocking the nests down. No permit is required for this activity as long as it is done before May 15.
4. Bridge work may be begun on August 15th in the hope that all or most of the birds will have completed nesting for the season. The risk with this approach is that some late nesters may still be present. If birds are still present, they must be turned over to a licensed rehabilitator. This activity requires a permit whenever there are active nests.

All costs of getting the necessary permit, rehabilitators, screening, properly disposing of swallow nests and/or swallows and eggs from the bridge, and all other work associated with removal of swallow nests shall be considered incidental to bridge construction.

**NOTE:** The network of rehabilitators was originally established to take in limited numbers of orphaned or abandoned animals from a local area. The network, as it is set up at the present, is neither able nor willing to commit to handling large numbers of birds on a statewide basis. Before deciding to employ the services of a rehabilitator, the rehabilitator should be contacted to make sure that their services will be available and that they have federal permits.

## Notification Form on Disposal of Bridge Steel

The Contractor is required to provide certain information on disposal of bridge steel which has been painted with lead-based paint. By signing this document, the Contractor certifies that information supplied by the Contractor is correct and that the Contractor is familiar with proper handling and disposal of materials with lead-based paint. This information must be furnished to the Project Engineer a minimum of 30 days prior to removal of the bridge steel from the project site. Any change in method or location of disposal would require resubmittal and a 30 day notice.

County Project No. \_\_\_\_\_ Bridge No. \_\_\_\_\_

Description of Bridge Steel \_\_\_\_\_

Paint System is Mn/DOT Spec. \_\_\_\_\_ , \_\_\_\_\_  
(Primer) (Top Coat)

Project Engineer: \_\_\_\_\_

Contractor/Subcontractor: \_\_\_\_\_  
(Name, mailing address, telephone no.)

I \_\_\_\_\_ certify that the following information is correct:  
(print name of authorized representative)

The above bridge steel will be disposed of by the following method(s): \_\_\_\_\_  
(list name,

address and telephone no. of recipient, estimated delivery date, and intended use.)

I also certify that \_\_\_\_\_ is familiar with  
(Contractor/Subcontractor name)  
the requirements in OSHA 29 CFR 1926.62 relating to lead, precautions to be taken when working with lead, and proper handling and disposal of materials with lead-based paint systems and that  
\_\_\_\_\_ has been notified of the presence of lead-based paint.  
(name of recipient)

\_\_\_\_\_  
(signature)

\_\_\_\_\_  
(date)

Received by Project Engineer/Inspector: \_\_\_\_\_  
(date) (signature)

cc: Project File  
Office of Environmental Services

**SB-10**      **(2451) STRUCTURE EXCAVATIONS AND BACKFILLS**

The provisions of Mn/DOT 2451 are modified and/or supplemented with the following:

**SB-10.1**      Structure Excavation

The item Structure Excavation shall include all excavation, sheeting and shoring and/or other protection, preparation of foundation, and placing of backfill necessary for construction of Bridge No. 27B81, which is not specifically included in the grading portion of the Contract. It shall also include the disposal of surplus material and site dewatering.

Exact groundwater elevation is unknown. At the time that Geotechnical borings were collected, the measured or estimated groundwater elevation in the borings varied between 838.0 and 842.0

Care shall be exercised during excavation operations around the existing arch bridge. The maximum unbalanced excavation depth on either side of the existing arch shall be 3 feet. The contractor may exceed this depth if they provide calculations from a professional engineer licensed in the state of Minnesota demonstrating adequate structural capacity in the arch.

No measurement will be made of the excavated or backfill material. All work performed as specified above will be considered to be included in a single lump sum for which payment is made under Item No. 2401.601, "STRUCTURE EXCAVATION". No direct payment will be made for dewatering.

For purposes of partial payments, the portion of the lump sum Structure Excavation at each substructure unit will be defined as follows:

Bridge 27B81 Each Abutment 50%

**SB-11**      **(2452) STEEL SHEET PILING (TEMPORARY)**

This work shall consist of furnishing, driving and removing steel sheet piling in accordance with Mn/DOT 2452, at the locations in the Plans, and the following:

The Contractor shall design, furnish, place, and remove temporary steel sheet piling when required in the Contract or by the Engineer. Contractor shall determine required locations, lengths and heights for the temporary steel sheet piling based on the removal plan and elevation shown in the Plans. The steel sheet piling shall not be placed further north than shown in the Plans. The Contractor may furnish used sheet piling if it is in a condition acceptable to the Project Engineer.

At locations where the difference in ground elevation on the two sides of the sheet piling is greater than 15 feet, the Contractor shall submit plans for the sheet piling that have been prepared and certified by a Registered Professional Engineer in the State of Minnesota. The design criteria shall be shown on the submitted plans.

At least six weeks before starting construction of the sheet piling, the Contractor shall supply the Engineer with three copies of the detailed plans and two copies of

the associated calculations. Lateral support systems shall be required when retaining fills are greater than 20 feet in height unless the Contractor's engineer can satisfactorily document they are not required.

Payment will be made under Item No. 2452.601, "STEEL SHEET PILING (TEMPORARY)", at the Contract bid lump sum price, which shall be compensation in full for all costs of designing, furnishing, placing, and removing acceptable piling.

**SB-12**      **(2452) PILING**

The provisions of Mn/DOT 2452 are modified and/or supplemented with the following:

Delete the second paragraph of 2452.3H and substitute the following:

Pile welders shall be qualified using AWS D1.1 standards or current Mn/DOT welding certification.

**SB-12.1**      **Equipment for Driving**

Delete the first and second paragraph of 2452.3C1 and substitute the following:

All pile driving equipment to be furnished by the Contractor shall be subject to approval by the Engineer. Approval is based on the satisfactory results of a wave equation analysis.

At least 30 calendar days prior to the start of pile driving operations, the Contractor shall submit the following:

1.      A completed pile and driving equipment data form for each hammer proposed for the project. The form may be downloaded from the following website:  
<http://www.pile.com/pdi/users/grlweap/equipdatafrm-en.pdf>
2.      A wave equation analysis in accordance with GRL WEAP or similar program for each pile type and hammer. A hard copy of the results of the analysis, including a WEAP bearing graph, shall be submitted to the Engineer.

For the pile driving equipment to be acceptable, the required number of hammer blows indicated by the wave equation at 155% of the pile factored design load as shown in the Plans shall be between 30 and 180 blows per foot.

The pile stresses indicated by the wave equation shall be reviewed to determine that the piles can be driven as described in 2452.3D without failure. If stress levels are such that damage to the piling is considered to be likely, adjustments shall be made to the pile driving system or to the strength of the pile until satisfactory results are obtained. Substantial refusal is defined in subsequent paragraphs.

All costs associated with providing the wave equation analysis and submittals as described above shall be an incidental expense to the test piles and no additional compensation will be made for this work.

SB-12.2 Penetration and Bearing

Delete 2452.3E and substitute the following:

A. General

The nominal pile bearing resistances shown in the Plans were calculated using design loadings and indicate the factored loads that the piles are required to support. The nominal resistance determined using the dynamic methods, defined under Determination of Nominal Bearing Resistances, is the basis for establishing the minimum criteria for pile acceptance in which the driving resistance is not less than the resistance specified in the Plans. It may be necessary to drive the foundation piles beyond the specified resistance until the required penetration as shown in the Plan is reached, or until the piles have been driven to a penetration as determined by the engineer based on the test pile results.

Since the purpose of a test pile is to provide information for authorizing the length of the foundation piles, it shall be driven full length unless substantial refusal (as defined below) is encountered at a lesser penetration. If the test pile has been driven full length and 115% of the nominal resistance required for the foundation piles has not been attained the Engineer may order the test pile be driven further as per 2452.3D2 and 2452.4A. If pile redriving is specified in the Plan, the penetrations and time delays shall be in accordance with 2452.3D7 and/or these special provisions.

Substantial refusal, as referenced in 2452.3D, shall be considered to have been attained when the penetration rate is equal to 0.05 inches per blow.

B. Determination of Nominal Bearing Resistance

The required nominal resistance shown in the Plans is based on a field control method as noted. The driven pile nominal resistance shall be determined in accordance with the following provisions using the appropriate corresponding field control method indicated in the Plans. Unless otherwise specified, if more than one field control method is shown, the method used shall be determined in accordance with the following:

- When the "Pile Analysis" pay item is included for a bridge, the Pile Driving Analyzer (PDA) shall be required for the field control.
- When the "Pile Analysis" pay item is not included for a bridge, the field control method shall be at the Contractor's option. The cost of the PDA shall be incidental to the cost of Piling Driven.

B1. Mn/DOT Nominal Resistance Pile Driving Formula Used as Field Control Method

The nominal pile bearing resistance shall be determined by dynamic formula as follows:

All types of piling driven with power-driven hammers.

$$R_n(\text{metric}) = \frac{867E}{S+5} \times \frac{W + (CxM)}{W + M} \quad R_n(\text{english}) = \frac{10.5E}{S+0.2} \times \frac{W + (CxM)}{W + M}$$

WHERE:

$R_n$  = Nominal Pile Bearing Resistance in Newtons (**pounds**).

W = Mass of the striking part of the hammer in kilograms (**pounds**).

H = Height of fall in millimeters (**feet**).

S = Average penetration in millimeters (**inches**) per blow for the last 10 or 20 blows, except in cases where the pile may be damaged by this number of blows.

M = Total mass of pile plus mass of the driving cap in kilograms (**pounds**).

C = 0.1 for Timber, Concrete and shell type piles, 0.2 for Steel H piling

\* The following definition is for Metric units. See English units below:

E = WHx0.00981 for single acting power-driven hammers. It is equal to the joules or newton-meters (joule = newton-meter) of energy per blow for each full stroke of either single acting or double acting hammers as given by the manufacturer's rating for the speed at which the hammer operates.

\*The following definition is for English units:

E = WH for single acting power-driven hammers. It is equal to the foot pounds of energy per blow for each full stroke of either single acting or double acting hammers as given by the manufacturer's rating for the speed at which the hammer operates.

NOTES:

When provisions are not made available for field determination of the energy output on a power-driven hammer, such as measurement of the drop for single-acting hammers, or such as pressure gauges or determination of energy on the basis of the frequency of the blows (cycles per minute) for double-acting hammers, the manufacturer's rated energy shall be reduced by 25 percent. This reduction is not intended to apply when determining the required hammer size. Double-acting hammers, for the purpose of these requirements, will include all hammers for which a power source is utilized for acceleration of the down-stroke of the ram. The dynamic formula specified herein-before are applicable only when:

- (a) The hammer has a free fall.
- (b) The head of the pile is free from broomed or crushed fibre.
- (c) The penetration of the pile is at a reasonably uniform rate.
- (d) There is not noticeable bounce after the blow. When there is a noticeable bounce, twice the bounce height shall be deducted from H to determine the value of H in the formula.

B2. Pile Driving Analyzer (PDA) Used as Field Control Method

The nominal pile bearing resistance shall be determined using the pile driving analyzer and the Case Pile Wave Analysis Program (CAPWAP) in accordance with the following section, Dynamic Monitoring of Pile Driving. The WEAP bearing graph listed below under deliverables shall be used to determine the bearing resistances that are recorded on the pile driving report (attach a copy of the bearing graph to the report). For informational and comparison purposes, the bearing resistances shall also be computed using the Mn/DOT formula and recorded on the report.

SB-12.3 Pile Tip Protection

This work consists of furnishing pile tip protection for steel H-piles in accordance with the following:

- A. The Contractor shall:
  - 1. Provide an approved H-pile tip protector from the "Approved/Qualified Product List for Bridge Products, "H-pile Tip Protection" (<http://www.dot.state.mn.us/products>). For products not on the Department's prequalified list, provide information as required on the web site.
  - 2. Attach cast steel points to the piles in accordance with the manufacturer's recommendations.
- B. Payment for pile tip protection will be by the number of authorized piles, including test piles, with their tips protected.
- C. Payment will be made under Item 2452.602 "PILE TIP PROTECTION 12 INCH" for all HP 12x53 piles and 2452.602 "PILE TIP PROTECTION 14 INCH" for all HP 14x117, at the Contract price per each. Payment will be compensation in full for all costs of furnishing and attaching tips to the piles.

SB-12.4 Substitution for Steel H-Piling Prohibited

Substitution of thick wall pipe for steel H-Piling will not be permitted on this project.

**SB-13 (2471) STRUCTURAL METALS**

The provisions of Mn/DOT 2471 are modified and/or supplemented with the following:

Delete the fourth paragraph of 2471.3A2 and substitute the following:

The Contractor/Fabricator performing coating application must demonstrate qualification by obtaining the AISC Sophisticated Paint Endorsement (SPE), the SSPS QP Certification, or a Quality Control Plan (QCP) that is acceptable to the Engineer.

Add the following to the end of the second paragraph of 2471.3C:

The Engineer will audit suppliers with approved QCP's on a biannual or annual basis or as deemed necessary by the Engineer to determine if the QCP is being implemented. The Department will invoke its Corrective Action Process if the audit indicates non-conformance. Corrective action, up to and including the supplier hiring a third party Quality Control Inspector, may be required as a disciplinary step, at no cost to the Department. A copy of the Departments Corrective Action Process is available from the Engineer.

Add the following to 2471.3E1 as the first paragraph:

Steel plates and splice plates for major structural components shall be cut and fabricated so that the primary direction of rolling is parallel to the direction of the main tensile or compressive stresses.

Add the following to 2471.3F:

#### F1b Web-to-Flange Welds

For the purpose of this specification, a repair is defined as any area of the welded product not in compliance with the current edition of AASHTO AWS D1.5 Bridge Welding Code. Limit each individual web-to-flange weld repairs to 2 percent of the weld length and grinding web-to-flange weld repairs to 5 percent of the weld length. Exceeding these limits will result in revocation of the Welding Procedure Specification (WPS) used to perform the initial production welding.

Add the following as 2471.3G1:

#### G1 Fracture Critical Welder Qualifications

Fracture Critical Welder Qualifications shall be in accordance with AASHTO/AWS D1.5-Bridge Welding Code. Annual requalification shall be based upon acceptable radiographic test results of either a production groove weld or test plate. If a welder is requalified by test, a WPS written in accordance with the requirements of D1.5, shall be used and the test plate shall be as shown in Figure 5.24. The WPS shall be included in the Fabricators QCP.

Add the following to 2471.3N1:

Work that is not performed in accordance with the suppliers approved QCP shall be subject to rejection in accordance with 1512.

**SB-14**      **(2545) CONDUIT SYSTEMS**

Each Conduit System shall be furnished and installed in accordance with the Plans, approved erection drawing, the applicable requirements of 2545, 2550, 2565 and the following:

All conduit runs shall be straight and true and all offsets and bends shall be uniform and symmetrical. The Contractor shall adjust the elevations of the conduit assembly, for its full length, to approximately the same gradient as the finished roadway, and s/he shall furnish and install in the approaches such suitable spacers and framing as may be necessary to maintain the correct grade and alignment.

Ferrous components of fittings shall be hot dip galvanized. All fittings shall be carefully installed according to the manufacturer's recommendations and at the locations shown in the Plans. At time of installation, adjacent conduit sections to be coupled by fittings shall be in true alignment.

Fabrication and inspection of structural metals used for each Conduit System shall be in accordance with the applicable requirements of 2471.

The ends of conduits shall be identified as lighting, signals, telephone, telegraph, power, etc. by the use of embossed metallic tags or other equally durable identification.

Non-metallic conduit and fittings shall conform to the requirements of the NEMA Standards Publication No. TC 14, entitled "Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings."

Three sets of erection drawings of each Conduit System shall be furnished to the Engineer for preliminary review. Two sets will be forwarded to the Bridge Construction and Maintenance Engineer for review and one set will be returned to the Contractor showing any necessary corrections.

The drawings shall be to a scale of not less than 1/4" = 1'-0" and shall show the locations of the diaphragms and inserts, a conduit placement scheme, and detailed views of the placement of the sleeves through the parapets, end webs, and diaphragms. The locations of the sleeves shall be defined from established reference points or lines and elevations, such as working points or centerlines and bridge seat elevations. The locations and manufacturer of expansion fittings shall be shown in the drawings.

Concrete inserts for hanger assemblies shall be spaced in such a manner that the assemblies will not interfere with conduit couplings. Hanger spacing shall not exceed 10 feet. Conduit shall be installed in 10 foot lengths where practicable.

Each expansion/deflection fitting shall be an approved watertight unit which can accommodate 3/4 inch of linear expansion or contraction of conduit, 3/4 inch of parallel misalignment of adjacent conduit sections, and up to 30° of angular misalignment of the axes of adjacent conduit sections. To prevent damage to internal bonding jumper, fittings should not be twisted during installation.

The Contractor shall seal any remaining conduit opening with an approved sealant after the conduit is in place.

All flush mounted junction boxes shall be stainless steel and be installed with a neoprene gasket. Junction boxes not installed under a luminaire must be furnished with a stainless steel cover plate and eight vandal free stainless steel screws. Each conduit entrance shall be threaded to provide five full threads.

Each junction box conduit entrance shall include an insulating bushing of the appropriate size.

**SB-15**      **(3372) STEEL PILING**

The provisions of 3372.2 shall apply except as modified below:

The first paragraph of 3372.2 is hereby deleted and the following substituted therefore:

Steel H-piles shall be bearing sections of the size and mass per unit of length specified in the Plans and shall conform to ASTM A572M/A572, Grade 345 (50) for carbon steel shapes of structural quality.

**SB-16**      **(3385) ANCHOR RODS**

The provisions of 3385 shall apply except as modified below:

Add the following to 3385.2:

Anchorage supplied under this specification must be pre approved by the Mn/DOT Laboratory and the certification from the Mn/DOT Laboratory must not be more than one year old. The Contractor must furnish the Engineer a copy of the Mn/DOT approval letter for the source, size and grade of anchorages specified in the plans and also a certification stating that anchor bolts of the size and grade specified were manufactured and tested in accordance with ASTM F 1554 (e.g. heat analysis and heat number, tensile tests, zinc coating weight and thickness, etc.).

**SB-17**      **(3391) FASTENERS**

SB-17.1      Delete the contents of 3391.2B and substitute the following:

Field and shop bolts for steel bridges shall meet ASTM A325, Type 3 bolts. The bolts shall project through the nut not less than 3 mm (**1/8"**) nor more than 10 mm (**3/8"**). Field and shop nuts for steel bridges shall meet ASTM A563/A563M, Grade C3 or DH3 nuts and field and shop washers for steel bridges shall meet ASTM F436/F436M, Type 3 washers.

For all other bridges and structures the bolts shall meet ASTM A325, Type 1 (for painted and/or galvanized applications) or Type 3 (for unpainted weathering steel applications). The bolts shall project through the nut not less than 3 mm (**1/8"**) nor more than 10 mm (**3/8"**). The nuts shall meet ASTM A563/A563M and the washers shall meet ASTM F436/F436M.

ASTM A325 bolts may only be retightened once after having been previously fully tightened.

At the time of installation of fasteners, all nuts, regardless of their specified finish, shall be lubricated with a lubricant of contrasting color as per ASTM A 563 Supplementary requirements S1, S2, and S3.

SB-17.2 Delete the first two sentences of 3391.2E and add the following:

Stainless steel bolts are to meet the requirements of ASTM F 593, Condition CW1, Type 304, 316, or 316L, with a minimum yield strength of 415 MPa (**60,000 psi**), an ultimate tensile strength of 660 MPa (**95,000 psi**), and a minimum elongation of 20 percent in 50 mm (**2 inches**). The nuts are to meet the requirements of ASTM F 594, Condition CW1, Type 304, 316, or 316L.

**SB-18** **(3741) ELASTOMERIC BEARING PADS**

The provisions of 3741 shall apply except as modified below:

Replace the first sentence in 3741.2A with the following:

The elastomeric portion of the bearing pads shall be in accordance with AASHTO M251-04 with a specified Shore A scale hardness of  $60 \pm 5$  durometers. The elastomer compounds shall be classified as of low-temperature Grade 4 as specified by the grade requirements of Table 14.7.5.2-2, "Low temperature Zones and Minimum Grade of Elastomer", of the *AASHTO LRFD Bridge Design Specifications*.

Delete all of 3741.2B1 except for the last paragraph.