S.P. 6212-62037 (T.H. 36 = 118)
February 5, 2013

INDEX TO DIVISION SB
DIVISION SB

Section No.	Item	Page No.
SB-1	Bridge Plans	1-SB
SB-2	Scope of Project	1-SB
SB-3	(1706) Employee Health and Welfare	2-SB
SB-4	Construction Operations Adjacent to Roadways	3-SB
SB-5	(1717) Air, Land and Water Pollution	4-SB
SB-6	(2104) Removal of Asbestos and Regulated Waste (Bridge)	4-SB
SB-7	(2401) Concrete Bridge Construction	6-SB
SB-8	(2405) Prestressed Concrete Beams	42-SB
SB-9	(2442) Removal of Existing Bridges	55-SB
SB-10	(2451) Structure Excavations and Backfills	56-SB
SB-11	Steel Sheet Piling (Permanent)	57-SB
SB-12	(2452) Piling	59-SB
SB-13	(2471) Structural Metals	74-SB
SB-14	(2472) Metal Reinforcement	75-SB
SB-15	(2511) Riprap – Geotextile Filter Type IV (Modified)	81-SB
SB-16	(3308) General Requirements for Structural Steel	82-SB
SB-17	(3385) Anchor Rods	82-SB
SB-18	(3391) Fasteners	82-SB
SB-19	(3741) Elastomeric Bearing Pads	83-SB

BRIDGE PLANS

The plans for this Project, consisting of the sheets tabulated below, were approved by the State Bridge Engineer.

BRIDGE NO.	TOTAL SHEETS	SHEET NO.	DATE OF APPROVAL
62037	68	1-68	02/01/2013

I hereby certify that the Special Provisions for bridge construction (Division SB) contained in this Proposal were prepared by me or under my direct supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Angel M Staples

(Angel M. Staples)

Date: 2/5/13 Lic. No. 41656

SB-1 BRIDGE PLANS

Plans of existing structures are available at the Minnesota Department of Transportation, Bridge Office, 3485 Hadley Ave N, Oakdale, MN, 55128, for review and inspection by bidders; electronic copies are also available for viewing, printing and downloading on the MnDOT Consumer Access EDMS (Electronic Document Management System) at http://dotapp7.dot.state.mn.us/cyberdocs_guest/. However, the state neither warrants nor represents that existing structures conform exactly to the details shown in those plans.

SB-2 SCOPE OF PROJECT

SB-2.1 Description of Work

Bridge No. 62037 utilizes precast concrete abutment elements, precast pier elements, and precast inverted T-beams to facilitate the development of Accelerated Bridge Construction (ABC) in the State of Minnesota.

The precast concrete abutment elements and precast pier cap elements are placed on the precast pre-stressed concrete piles. These elements, some with architectural surface finish patterns, shall be placed at the design elevations with strictly limited tolerance. The piles shall be located and driven within the defined tolerances so these precast abutment elements and pier elements can be placed within the design locations. The construction staging will require concrete closure pours between precast elements from two construction stages with matching architectural surface finish.

SB-2.2 Coordination

Bidders are advised that significant coordination and cooperation will be required between the Contractor, Subcontractors, MnDOT and other associated parties during the execution of this Project. In addition to typical project coordination, the Contractor will be required to coordinate his/her activities closely with the work of the precast concrete abutment and pier manufacturer, the precast inverted T-beam manufacturer, MnDOT and other situations that may arise during the course of the Project. It is a project requirement, and in the best interest of the Contractor, that the precast elements shall be ready before beginning pile driving for the bridge construction. The required curing time for these precast members will be critical for this bridge construction. A Quality Management Plan shall be submitted for the Engineer's review prior to the start of construction as specified in Division S of the special provisions. A CPM schedule for the entire bridge construction shall be submitted for Engineer's review prior to the start of bridge construction as specified in Division S of the special provisions.

SB-2.3 Special Provisions

Detailed special provisions for the construction of components of Bridge No. 62037 are contained in the remainder of Division SB of this Proposal.

SB-2.4 Submittals

As part of the contract, the Contractor is required to provide several submittals. It is the Contractor's responsibility to provide all submittals required in the contract documents (plans, specifications, special provisions). The following is a list of bridge related submittals and is not all inclusive:

A.	Plan to provide OSHA required safety equipment	(SB-3)
B.	Plan & specifications for sheeting & shoring if required	(SB-4)
C.	Contractor Concrete Mix Design – 3Y33HP	(SB-7.10)
D.	Precast piles	(SB-11)
E.	Precast concrete inverted T-beam shop drawings	(SB-8)
F.	Precast concrete abutment and pier element shop drawings	(SB-8.8)
G.	Precast concrete abutment and pier element erection plan	(SB-8.8)
H.	Test data and certified test results	(SB-8.8)
I.	Repair procedures	(SB-8.10)

Submittals identified in items F through I shall be submitted as a combined "Fabrication, Assembly and Installation Plan".

The dates for submittals shall be outlined in the CPM scheduling submittal at the beginning of the bridge construction.

SB-3 (1706) EMPLOYEE HEALTH AND WELFARE

The provisions of MnDOT 1706 are supplemented as follows:

The Contractor shall submit a plan, at the preconstruction conference, for providing all OSHA required safety equipment (safety nets, static lines, false decks, etc.) for all work areas whose working surface is 1.8 meters (**6 feet**) or more above the ground, water, or other surfaces. Submittal of this plan will in no way relieve the Contractor of his/her responsibility for providing a safe working area.

All safety equipment, in accordance with the Contractor's plan, must be inplace and operable in adequate time to allow MnDOT personnel to perform their required inspection duties at the appropriate time. No concrete shall be placed in any areas affected by such required inspection until the inspection has been completed.

The installation of safety lines, safety nets, or other systems whose purpose is to reduce the hazards of bridge work may require the attachment of anchorage devices to beams, girders, diaphragms, bracing or other components of the structure. Clamp type anchorage systems which do not require modification of structural members may be used provided they do not interfere with proper execution of the work; however, if the Contractor desires to use an anchorage system which requires modification of structural members, s/he shall request approval, in writing, for plan modification as provided in MnDOT Specifications. Requests to install systems which require field welding or drilling of primary stress carrying members of a bridge will not be approved. The Contractor shall indicate any portions of anchorage devices which will remain permanently in the structure.

On both ends of each pier cap extending 1.8 meters (**6 feet**) or more above the ground, the Contractor shall install an insert or other suitable anchorage to which safety lines can be attached. Any portion of said device extending outside the finished lines of the pier cap shall be removed unless otherwise approved by the Engineer. Any void or cavity resulting from the installation or removal of this device shall be repaired or sealed to prevent the ponding or entry of water as directed by the Engineer.

Approved anchorage systems shall be furnished, installed, and removed at no increased cost to the State for materials, fabrication, erection, or removal of the bridge component or anchorage system.

SB-4 CONSTRUCTION OPERATIONS ADJACENT TO ROADWAYS

This work shall be performed in accordance with the provisions of MnDOT 1404, 1502, and 1707 except as modified below:

The Contractor shall, when necessary to adequately prevent undermining of the existing roadbed and protect traffic, sheet and shore the roadway side and end of each footing excavation having a traveled roadway adjacent thereto. The sheeting and shoring shall remain in place until the excavated area has been properly backfilled.

At least six weeks before starting construction of the bridge, supply the Engineer with five copies of the detailed Plans and Specifications and two copies of the associated calculations of the proposed system for constructing an installation adjacent to traveled roadways. Design the protective installations 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. Include in the documents sufficient details so that construction of the proposed system, be it staged or not staged, can be completed solely by reference to the Plans and Specifications. No work will be permitted adjacent to traveled roadways until these plans have been approved by the Engineer.

Shoring design shall meet all conditions of the secured permits and shall not restrict the flow of water beyond the extent authorized by the secured permits.

SB-5 (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-6 (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 MnDOT Standard Specifications and the following:

SB-6.1 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 MnDOT Project Engineer who shall suspend work and the Contractor shall furnish a documented inspection and evaluation by a MnDOT 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-6.2 All asbestos and/or regulated waste shall be disposed of in accordance with MnDOT'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 MnDOT approved companies for testing, waste transport and disposal as provided and described in MnDOT'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, MnDOT Office of Environmental Services, 651-366-3630 with any questions regarding the manual.

SB-6.3 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-6.4 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.

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-6.5 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-6.6 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)).

The scope of the assessment did not investigate the timber piles for the inplace Bridge No. 5715 which need to be removed as a part of this contract. The Contractor shall assume the timber piles contain regulated waste. Compensation for the proper treatment and disposal of the timber piles is included in this pay item.

SB-7 (2401) CONCRETE BRIDGE CONSTRUCTION

The provisions of MnDOT 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, 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

If concrete is cast by means of a pumping operation, the Contractor shall maintain a standby pump or crane capable of delivering an uninterrupted flow of concrete in case of a pump breakdown.

SB-7.1 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-7.2 Temporary Structural Shoring for Staged Construction

Delete paragraphs 2, 3 and 4 of 2401.3B2 and substitute the following:

At least six weeks before starting construction of the stage, removal, 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 new superstructure while shoring as required to maintain the staged traffic on the inplace superstructure. 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.

As a minimum, falsework plans shall contain the following:

(1) The size of all load-supporting members and all transverse and longitudinal bracing. Connection details for load-supporting members must be included. For box girder structures, the drawings must show the falsework members supporting sloping exterior girders, deck overhangs and any attached construction walkways.

(2) All design-controlling dimensions must be shown, including beam length and spacing; post location and spacing; overall height of falsework bents; vertical distance between connectors in diagonal bracing; and similar dimensions that are critical to the design.

(3) The location and method by which the falsework will be adjusted to final grade must be shown.

(4) Unless a concrete placing schedule is specified in the Contract, the falsework plans must include a superstructure placing diagram showing the proposed concrete placing sequence and/or the direction of pour, whichever one is applicable, and the location of all construction joints. (For relatively simple structures, this requirement may be satisfied by a note on the plans.)

Add the following to 2401.3B4:

The Contractor will not be permitted to begin stage 1 removals for the superstructure until (1) Plans and Specifications meeting the above requirements have been provided to the Engineer; (2) the engineer who has certified plans and specifications for the falsework has inspected the falsework after erection; and (3) the engineer inspecting the as-constructed falsework certifies in writing that all details are approved.

Basis of Payment

Payment for Item No. 2452.601, "TEMPORARY STRUCTURAL SHORING", will be made at the Contract price per lump sum for all shoring on this project.

SB-7.3 Slipforming of Bridge Railing Prohibited

Slipforming of Type F barrier railing is not permitted on this project on Bridge No. 62037.

SB-7.4 Joint Filler and Sealing

Supplement MnDOT 2401.3J1 provisions as follows:

Complete concrete curing prior to installation of sealing materials. A minimum of 7 days drying is required prior to application of sealers. At the time sealer is installed, sawcut joints must be sandblasted, blown clean, and the concrete surfaces dry.

Construct preformed joint(s) as detailed in the plans and in conformance with the following requirements.

1. Bituminous felt must 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 be not more than 1200 psi (8274 kPa).

2. Cork must comply with MnDOT 3702 and AASHTO M153 Type II.

3. Polystyrene must comply with the following:

Type	Minimum Compressive Strength (5 percent deflection)	Characteristics
A (High Density)	30 psi (207 kPa)	Closed Cell Expanded Polystyrene
B (Low Density)	10 psi (69 kPa)	Molded Polystyrene

Test for compressive strength of polystyrene in accordance with ASTM D 1621. Furnish evidence that the material meets these requirements, if requested by the Engineer.

The quantity of preformed cork joint filler material given in the plans is for convenience only. Furnish any additional joint filler required at no additional compensation.

SB-7.5 Architectural Concrete Texture (Ashlar Stone)

A. Description of Work

This work consists of constructing simulat natural (split) stone masonry textured surfaces on all areas so designated on the plans for Bridge 62037. The work shall be performed in accordance with the applicable provisions of MnDOT 2401, the Plans and the following:

Architectural Concrete Texture (Ashlar Stone)

Architectural Concrete Texture (Ashlar Stone) shall be a random ashlar stone pattern resembling stone masonry applied to the surface areas of the bridge abutment and wing walls so designated on the plans. The maximum relief of the simulated stone shall be 1 inch in depth and shall range in size from the largest stone being 30 inches and the smallest stone being 3 inches.

The ashlar pattern shall match the appearance and characteristics which result when using Customrock International, Inc., Pattern No. 12005 (Bearpath Coursed Stone). The pattern shall match the pattern used in the construction of the Arcade Street Bridge over the channel between Spoon Lake and Lake Gervais located just north of the new TH 36 Bridge.

B. Formed Textured Surfaces

When simulated ashlar 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 ashlar stone masonry surface. Simulated stones should exhibit the rough, natural (split) finish of real limestone laid in place with hand tooled mortar joints. Simulated stone surfaces having a smooth, slick or shiny surface will be rejected. Acceptable form liners shall provide a maximum pattern relief of 2 inches. 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. Scott System
4. 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.

C. 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.

D. 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 (Ashlar Patterns Only): Construct test panel mock-ups of textured formed surfaces of the approved Architectural Surface Treatment 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 or other suitable lightweight material 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 Surface Finish (Multi-color) as specified under Section SB-7.8 of these special provisions. The test panel mock-ups shall be a minimum of 3 inches thick, 4 feet wide, and 3 feet high. They must be lightweight 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 un-reinforced 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.

E. Construction Requirements

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.

Surface Preparation: All conventionally formed concrete surfaces receiving architectural concrete 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.

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.

F. Method of Measurement

Measurement for Architectural Concrete Texture (Ashlar Stone) will be made by area in square feet of the finished surface constructed to the limits shown and noted in the Plans.

G. Basis of Payment

Architectural Concrete Texture (Ashlar Stone)

Payment for **Item 2411.618, "ARCH CONC TEXTURE (Ashlar Stone)"**, shall be made at the Contract price per square foot and shall be compensation in full for all costs of constructing the textured surfaces including the test panel mock-ups, concrete test panels, and the additional concrete required to achieve the specified treatment relief.

SB-7.6 (2411.604) Architectural Concrete Texture (Sandblast)

A. Description of the Work

This work shall consist of applying a sandblast texture to all areas so designated in the plans for Bridge 62037. All four sides of each concrete pile shall be sandblasted from the bottom of the pier cap to minimum of 1'-0" below the normal pool water elevation. The work shall be performed in accordance with the applicable provisions of MnDOT 2401, the Plans, and the following:

B. Textured Surfaces

The textured concrete surfaces shall be formed by applying a medium sandblast sufficient to generally expose and reveal the coarse aggregate to a maximum projection of a fourth of the diameter of the aggregate or a reveal of 1/4 inch. The finished surface should be rugged and uneven.

C. Submittals

1. At least 30 days prior to the forming of the concrete piles, the contractor shall construct a concrete test panel 2 feet X 2 feet in size. Concrete mix for the concrete test panel(s) shall be the same as that specified for the concrete piles. Cast the unreinforced test panel simulating the casting of the concrete piles. Apply the sandblast finish to the level specified above and to the satisfaction of the Engineer. 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

1. Sandblasting of the specified areas shall commence within 24 – 72 hours after forms are stripped form the barrier/parapet. All blasting shall be done at the same concrete age for uniformity of appearance. The material used for sandblasting shall be silica sand unless another material is approved by the Engineer. The same type and grade of the abrasive shall remain the same throughout the entire project. The same blasting material must be used for both the test panel and the work done on the bridge.

2. Upon completion of the sandblasting, the surface shall be power washed to remove any loose material and dust.

3. After power washing the sandblasted surfaces, apply a clear penetrating silane water repellant sealer containing a 40 percent solution of alkyl silane formulated for application to concrete and masonry surfaces. Follow all manufacturer's recommendations regarding preparation of the substrate and application of the material.

4. Follow all state and local pollution control regulations during application, cleaning, and sealing of the specified areas.

E. Method of Measurement

Measurement for Architectural Concrete Texture (Sandblast) will be made by area in square meters of the textured surface based on the plan dimensions.

F. Basis of Payment

Payment for item **2411.604 "Architectural Concrete Texture (Sandblast)"** will be made at the contract price per square foot and shall be compensation in full for all costs of constructing the textured surfaces on the exposes concrete piles of Bridge 62037 as described above, including the concrete test panel, the cleaning of the textured surface, and the application of the silane water repellent sealer.

SB-7.7 Finish of Concrete Surfaces

Cure concrete for a minimum of 28 days (preferred) 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 two (2) coats of SSF on the exposed concrete surfaces as designated below for Bridge No. 62037.

1. Exterior (non-traffic) surfaces of barriers
2. Wing walls (smooth surfaces)
3. Copings
4. Edges of slabs
5. Exposed Fascia of Inverted "T" Beams
6. Deck Overhangs
7. Bottom(soffit) of Bridge Superstructure
8. Abutments (smooth surfaces)
9. Pier cap

Provide a finish color for all SSF matching Federal Standard 595C, Color No. 33522. Provide paint free of toxic metals and toxic pigments.

Apply a top coat of 100% acrylic paint (MnDOT Spec. 3584) in the color specified.

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 median barriers), 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 (and median barrier) with two (2) coats of an approved acrylic paint conforming to 3584. The color of the acrylic paint shall conform to Federal Standard 595C, Color No. 33522. Apply the paint at a rate of 7.4 m^2 per L (**300 ft^2 per gallon**). Commence or suspend the painting operation when the air and surface temperature meet or exceed the manufacturer's recommendations.

2. Finish slipformed 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-7.8 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 Concrete Texture (Ashlar Stone). The work shall be performed in accordance with the applicable provisions of MnDOT 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 Surface Finish (Multi-color).

Architectural Surface Finish (Multi-color) shall be a multi-colored application using approved stains. Simulated stone formed concrete surfaces shall be stained in the full color range of stain treatment applied to the existing Arcade Street Bridge over the channel between Spoon Lake and Lake Gervais located just north of the new TH 36 Bridge. Architectural Surface Finish shall also include an anti-graffiti coating applied to the stained surface as specified in SB-7.9.

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 multi-colored stain application emulating the full color range of the simulated stone referenced above, including subtle color variations, mineral oxidation and staining. The desired finish color effect shall be achieved through the application of a base coat and then either applying one color over another or intermixing several colors of stain. Highlight coloration shall be by hand staining or other suitable antiquing methods. A minimum of five stain colors will be required.

Grout pattern joints shall have the appearance of natural mortared joints.

Cork joints shown in the Plans shall be finished to visually continue the stonework pattern across the joint uninterrupted. A sample of the colored cork for approval shall be included in the concrete test panel described in SB-7.5D.

Color samples will be developed by the Contractor using the test panel mock-ups described in SB-7.5D and the color information contained herein. 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
TK Products
Chem-Rex
Tamms Industries
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 1 foot square samples of the Architectural Surface Finish (Multi-color) to be used on the stone textured surface patterns. Final color selections will be based upon completion of the test panel specified below.

4. 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

1. The Contractor shall finish the test panel mock-up for Architectural Concrete Texture fabricated under Section SB-7.5D to satisfy the criteria specified herein.

2. 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.

3. The Contractor shall demonstrate his workmanship by completely finishing the architectural surface treatment concrete test panels, described in SB-7.5D, 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 MnDOT 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 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 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 inter-mixing 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 concrete texture (stone pattern) 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 Concrete Texture (Stone Pattern).

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-7.9 Anti-Graffiti Coating

A. Description of Work

This work consists of applying an anti-graffiti coating to all areas of Bridge 62037 which receive Architectural Surface Finish (Multi-color), smooth concrete surfaces on the abutments and wing walls, and the sandblasted surfaces of the exposed concrete piles. 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, matte or semi-gloss 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
- I Permaclean as manufactured by TK Products
- I Graffiti Guard as manufactured by Tex-Cote
- I Other products submitted for approval by the MnDOT 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) Test panel in accordance with the requirements of SB-7.5D.

f) 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

Anti-graffiti coating shall be applied after all components of the Architectural Surface Finish have been applied to the areas of architectural concrete texture.

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 the test panel containing Architectural Concrete Texture and Architectural Surface Finish (Multi-color) as described in SB-7.5D to confirm compatibility, coverage and possible color change. Any problems or damage to the color system 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 architectural concrete texture will be by area based on the Plan dimensions of the finished colored 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 of Architectural Concrete Texture and other smooth or sandblasted surfaces designated above.

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

SB-7.10 Contractor Concrete Mix Design – 3Y33HP

For Bridge No. 62037, the Contractor shall design a 3Y33HP concrete mixture that will minimize cracking. The work shall be performed in accordance with the requirements of MnDOT 2461 and the following:

The Contractor shall be responsible for determining the appropriate concrete mix design proportions based on a volume of 1.000 cubic yard and testing the mixes in accordance with the requirements. All submittals shall be sealed by a register Professional Engineer.

Any MnDOT approved admixture including water reducers, super-plasticizers, retarders, accelerators, and any Viscosity Modifying Admixture (VMA) or a combination thereof may be used at the discretion of the Contractor. The approved list is on file in the MnDOT Concrete Unit or can be found at the following web site: **www.dot.state.mn.us/products**

The Contractor shall obtain a written statement from the manufacturer of the admixtures verifying the compatibility of the combination of materials and the sequence in which they are combined. The manufacturer will further designate a technical representative from the concrete supplier or his company to be in charge of the dispensing of the admixture products. The technical representative shall act in an advisory capacity and shall report to the Contractor any operations or procedures which are considered by the representative as being detrimental to the integrity of the placement. The manufacturer's technical representative will be present during the concrete placement unless the Engineer waives his presence.

If any adjustments are made on site they shall be done with the addition of admixtures originally incorporated into the mix. No water will be allowed to be added on site, except that required to dilute the admixture for mixing (less than 1 gallon). The load shall be mixed a minimum of 50 revolutions after an addition of the admixture.

A. Specific requirements for **3Y33HP** concrete:

1. Cement complying with ASTM C 150 Type I or I/II or ASTM C595 blended cement currently on the MNDOT approved list shall be used. Up to a total of 30 percent replacement by mass (weight) with fly ash conforming to ASTM C618, ground granulated blast furnace slag conforming to ASTM C 989, and/or Silica Fume conforming to ASTM C 1240 may be used. Replacement with Silica Fume shall not exceed 5 percent of the total cementitious material.

2. The Contractor shall designate a 3" slump range. The slump shall be kept consistent during the entire placement. If a spread range is specified a Visual Stability Index (VSI) of 1 or less is required according to ASTM C1610.

3. The coarse aggregate shall be class A, B, or C. MnDOT 3137.2D2(h) is hereby deleted and the following is inserted: The maximum absorption of class B aggregate shall be 1.10%. If the Contractor selects to use coarse aggregate from sources identified by MnDOT as quartzite or gneiss and the aggregate does not comply with the 0.04 percent expansion limits of ASTM C-1293, the other cementitious material shall be:

(a) 30% of an approved fly ash meeting the following requirements:

MnDOT 3115 is modified such that fly ash used as cementitious material in the concrete mixture shall have a minimum $Si0_2$ + Fe_2O_3 +Al_2O_3 of 66.0% on a dry weight basis. In addition, it shall have a minimum $Si0_2$ content of 38.0%.

-or-

(b) 35% of an approved ground granulated blast furnace slag.

4. The Contractor shall use any good standard practice to develop a job mix formula and gradation working range by using procedures such as but not limited to 8-18, 8-20 gradation control, Shilstone process, FHWA 0.45 power chart or any other performance related gradation control to produce a workable and pumpable concrete mixture meeting all the requirements of this contract.

5. The mix shall meet the following aggregate Alkali Silica Reactivity (ASR) requirements:

If the sand and cement combination have previously been tested, those results will determine what mitigation may be necessary, otherwise the higher expansion result of the two cement and sand combinations shall determine what mitigation may be necessary. A list of previously tested sand sources is available at: www.dot.state.mn.us/materials/concrete.html.

Tests shall be performed according to ASTM C-1260 MnDOT Modified on the designated fine aggregate tested with: (1) Holcim, St. Genevieve, Type I/II portland cement **or** (2) Lafarge, Davenport, Type I/II portland cement. If the fine aggregate contains “buckshot” or “pearock” as determined by the Concrete Engineer use the standard ASTM C-1260 test procedure.

If the proposed fine aggregate expansion results are:

(a) ≤ 0.150 % The fine aggregate is acceptable with or without a mitigator in the concrete mix.

(b) 0.151 % - 0.250 % The fine aggregate shall be mitigated with 35% ground granulated blast furnace slag or a minimum of 20% fly ash.

(c) 0.251 % - 0.300 % The fine aggregate shall be mitigated with 35% ground granulated blast furnace slag or 30% fly ash meeting MnDOT 3115 modified with a minimum $Si0_2$ + Fe_2O_3 +Al_2O_3 of 66.0% on a dry weight basis and a minimum $Si0_2$ content of 38.0%.

(d) > 0.300 % The fine aggregate is rejected.

MnDOT reserves the right to reject the fine aggregate if mortar bar specimens exhibit an indication of external or internal distress not represented by the expansion results. The Concrete Engineer shall make the final acceptance of the aggregate.

6. The mixture shall be designed and produced at a water/cementitious ratio of not greater than 0.45.

7. The air content shall be 6.5 percent plus 2.0 percent or minus 1.5 percent at the point of placement.

8. The shrinkage of the concrete when performed in accordance with ASTM C157 shall not be greater than 0.040 percent at 28 days.

9. The concrete shall obtain a rapid chloride permeability of not more than 2500 Coulombs at 28 days and not more than 1500 Coulombs at 56 days. The 28 day results are for preliminary approval only. Final acceptance will be based on the 56 day results.

10. The deck will obtain an anticipated strength of 4300psi at 28 days when measured in accordance with ASTM C31. The maturity method according to ASTM C1074 may be considered for subsequent strength determination.

B. Mix design submittals

The Contractor shall submit the following to the Engineer and MnDOT for review prior to the beginning of laboratory tests for the mix designs.

1. A completed Contractor mix design form using the MnDOT Contractor Mix Design Submittal package available from the MnDOT Concrete Engineering website. Any changes or adjustments to the material or mix design require a new Contractor mix design submittal. For mix design calculations, MnDOT Concrete Unit will provide specific gravity and absorption data.

2. A Job Mix Formula (JMF) containing proportions of materials and individual gradations of each material, plus a composite gradation.

   The JMF submittal shall include working ranges based on the composite gradation of the above sieves. The working range limits of the composite gradation are based on a moving average of 4-tests (N=4). The working ranges are:

Sieve Size	Working Range
4.75 mm [**# 4**] sieve or greater	+/- 5 %
2.36 mm [**# 8**] to 600 µm [**# 30**] sieve	+/- 4 %
300 µm [**# 50**] sieve	+/- 3 %
150 µm [**# 100**] sieve	+/- 2 %

   The Contractor shall produce a mixture of uniform composition conforming to the approved JMF. If, during production, the Contractor determines from the moving average results of QC aggregate gradation tests that aggregate adjustments to the JMF working range gradation requirements are necessary, adjustments may be made within the limits of the table below without a new mix design providing all other requirements are met to the satisfaction of the Engineer. A JMF adjustment constitutes beginning a new lot and restarting the gradation moving average.

Allowable JMF Adjustments

Sieve Size	Allowable Adjustment
4.75 mm [**# 4**] sieve or greater	± 5 %
2.36 mm [**# 8**] to 600 µm [**# 30**] sieve	± 4 %
300 µm [**# 50**] sieve	± 3 %
150 µm [**# 100**] sieve	± 2 %

Individual proportions of aggregate may be adjusted up to 5 % by weight from the original mix design provided all other requirements are met to the satisfaction of the Engineer. Adjustments should be documented on the JMF adjustment worksheet and signed by the Contractor and the Agency's representatives. The Contractor may continue pouring, provided that the changes are documented and submitted to the Concrete Engineer. Approval of further adjustments to the JMF without a new mix design is at the discretion of the Concrete Engineer.

Compliance is determined based on the Contractor's test results as verified by department testing.

The Department's samples for gradation control acceptance are based on one lot representing the concrete bridge deck slab placement. Each sublot shall represent approximately 150 cubic yards. One complete gradation test of both coarse and fine aggregate is required per sublot. For bridge deck quantities of less than 150 cubic yards the sublot requirement shall be waived and only one complete gradation test is required per bridge.

3. The dosage and types of admixtures proposed for use and their purpose.

C. Laboratory testing requirements and submittals:

To determine the characteristics of the Contractor proposed mix design, the Contractor will be required to prepare test batches and do laboratory testing. The following tests shall be conducted at an AMRL certified laboratory using the exact materials proposed in the mix design:

Lab testing requirements:

1. Slump and air content.
2. Compressive strength at 1, 3, 7, 28, 56 days (sets of 3).
3. Hardened air content (ASTM C457) at a minimum of 7 days.
4. Rapid chloride permeability (ASTM C1202) at 28 days and 56 days (2 specimens for 28 day test and 2 test specimens for 56 day test (Take 2 specimens from each batch of a 2 batch mix).
5. ASR Expansion results.
6. Concrete shrinkage (ASTM C 157) at 28 days.

The Contractor is required to contact the MnDOT Concrete Engineering Unit a minimum of 2-days prior to any mixing so that a MnDOT representative can observe the process. This same 2-day notification is required prior to any physical testing on hardened concrete samples. Additionally, any hardened concrete test specimens must be retained for a minimum of 90 days and be made available for MnDOT to examine.

All testing for plastic concrete shall be performed after admixtures have been added to the concrete mixture.

After completion of the laboratory testing specified herein and, at least, 15 working days prior to the full scale test pour, the following material shall be submitted to MnDOT for review and approval:

1. Laboratory reports of the design mixes, including the following:

   (a) Exact batch weights and properties of all ingredients used and all aggregate gradations.
   (b) Slump and air content (at <5 minutes, 15 minutes, and 30 minutes after the completion of mixing).
   (c) Cylinder identification, including mix designation.
   (d) Date and time of cylinder preparation.
   (e) Date and time cylinder specimen was tested.
   (f) Compressive strength of each cylinder specimen at 1, 3, 7, 28, and 56 day (sets of 3).
   (g) A graphic plot of age, from 0 to 56 days, vs. strength for each mix design.

Standard Cylinder Testing: A minimum of 15 test cylinders, 4 inches x 8 inches, shall be made of each proposed mix. A set of 3 cylinders shall be broken at 1, 3, 7, 28, and 56 days. Cylinders shall be made in accordance with AASHTO T126 and tested in accordance with AASHTO T22.

The mix design used in the permanent work shall be of the same materials, same supplier, and same supplier's manufacturing plant, and proportions as were used in the approved test mix. Strength requirements specified for each mix shall also be applicable to the cylinder tests taken during the production work.

D. Trial placement

A minimum of two weeks prior to the actual pour, a separate trial placement utilizing a minimum of two 10 cubic yard loads shall be successfully completed prior to placement of the bridge deck slab concrete. The trial placements may be incorporated into the bridge footings, abutments or end diaphragms. Trial placements need not be incorporated into the completed project, and may be part of a residential /commercial construction in the immediate vicinity of the project, but must be mixed and transported using the same methods that will be used to construct the bridge deck. Final approval of the mixture is based on satisfactory field placement and performance. The Contractor shall verify strength results by casting and testing strength specimens. The number of test specimens (sets of 3) required shall be mutually agreed upon be the Engineer and Contractor.

Payment for design of the concrete mixes shall be considered as incidental to the concrete furnished and placed, and no direct compensation will be made therefore.

E. Structural slab curing

A structural slab placement and curing plan for each bridge shall be submitted to the Engineer for approval at least 2 weeks prior to placement. The Contractor's plan shall include detailed information regarding the anticipated concrete delivery rates, estimated start and finish time, and material, labor and equipment that will be used to place, finish and to cure the deck segment in accordance with specifications, including placement of wet burlap and soaker hose or other system to maintain the deck in a moist condition during the curing period. Information supplied shall also include the number of "work" bridges that will be used, and the number of people responsible for the various tasks. The plan must also discuss bulkheading methods and materials that will be used if it is determined that proposed concrete placement rates cannot be maintained.

A pre-placement meeting shall be held 4 weeks prior to the structural slab placement to review the information and details provided in the placement and curing plan. The meeting shall be attended by the Contractor, Engineer, and if required by the Engineer, the concrete supplier and/or concrete pump supplier.

The Contractor is fully responsible for curing methods. The Contractor shall comply with one of the following curing methods unless other methods are approved by the Engineer.

Deck Slab Curing

After completion of the carpet dragging for bridge deck slab and after free water has disappeared from the surface, the Contractor shall apply a membrane curing compound meeting the requirements of MnDOT specification 3754, section B (Requirements for Concrete Pavement Membrane Curing Compound). The curing compound shall be applied with approved power-operated spray equipment. The Contractor shall place the membrane cure material homogeneously to provide a uniform solid white opaque coverage on all exposed concrete surfaces (equal to a white sheet of paper). The membrane cure shall be placed within 30 minutes of concrete placement unless otherwise directed by the Engineer. Failure to comply with this provision will result in a price reduction for the concrete item involved in accordance with MnDOT Spec. 1503. The curing compound is not a substitute for the cure specified below, but is required for moisture retention until the conventional wet curing material can be placed. Conventional wet curing shall be applied as soon as the concrete can be walked on with insignificant damage. The deck slab surface shall be kept continuously wet with clean fresh water for an initial curing period of at least 7 days. The Contractor must provide adequate personnel to ensure that the deck surface is maintained in a wet condition on weekends and/or holidays.

F. Crack sealing

2401.3J2 is modified as followed:

Any cracks that develop in the deck surface shall be sealed with an approved methylmethacrylate or epoxy sealant just prior to opening the bridge to traffic. Sand shall be broadcast on the surface after flood coat sealant application. All work required to seal cracks prior to opening the bridge to traffic shall be included in the payment for 3Y33HP deck concrete.

SB-7.11 Texture Planing of Bridge Slabs

Delete the 3rd paragraph of 2401.3F3b(3) and substitute the following:

Special care shall be taken in finishing roadway surfaces in the vicinity of expansion devices and other locations where breaks in continuity occur to ensure a smooth riding surface.

After the concrete has been consolidated, screeded, floated, and carpet dragged, curing shall be applied as soon as possible.

Upon completion of curing, a surface smoothness check will be made on the roadway surface. The final surface shall meet the tolerance requirements of 2401.3F3b(3). Surface areas not meeting the specified tolerances shall be corrected by removal and replacement or by grinding the high spots to the extent directed by the Engineer prior to beginning surface texturing operations. Nonconforming areas that are not satisfactorily corrected shall be subject to 1503 and 1512.

After completion of work required to meet surface tolerance, the Contractor shall texture the roadway surface in a longitudinal direction by planing the hardened concrete by diamond saw-blade grinding. 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 MnDOT 2104.3C3, as approved by the Engineer, and as described in this special provision.

All concrete residue and water (slurry) resulting from concrete texture planning 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 lined 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 MnDOT 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.

Planed areas not meeting requirements may, at the Engineer's option, be replaced, re-planed 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 meter of concrete area planed and textured based on surface area. Payment will be made under Item 2401.604 "BRIDGE DECK PLANING", at the Contract bid price per square meter, which shall be compensation in full for all costs relative to the specified texture planing.

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-7.12 Curing Bridge Slab

Delete the 13th paragraph of 2401.3G and substitute the following:

Bridge slab shall have conventional wet curing applied immediately following the finishing machine or air screed. The conventional wet curing shall consist of **pre-wetted** burlap covered with white plastic sheeting. The burlap shall cover 100% of the deck area with no visible openings, the only exception being that area of the deck, which will be located beneath the permanent barrier. The wet curing shall be placed **no later than 30 minutes** after the finishing machine has completed final strike-off of the concrete surface. If, at any time, the Contractor fails to place the wet curing within the 30 minute time period, and to the satisfaction of the Engineer, the Contractor will be assessed **a non-compliance charge of $500.00 for every 5 minute period or any portion thereof**, which the Engineer determines that the Contractor has not complied. The non-compliance charge, set forth above, may be assessed more than once. The slab surface shall be kept continuously wet for an initial curing period of at least 7 days. The Contractor must provide adequate personnel to ensure the burlap is maintained in a wet condition on weekends and/or holidays. **In order to comply with the wet curing requirement a work bridge following the finish machine may be required, and an additional center rail may be required on wide bridges.**

A slab placement and curing plan for each bridge shall be submitted to the Engineer for approval at least 2 weeks prior to placement. The Contractor's plan shall include detailed information regarding the anticipated concrete delivery rates, estimated start and finish time, and material, labor and equipment that will be used to place, finish and to cure the deck segment in accordance with specifications, including placement of wet burlap, and soaker hose or other system to maintain the deck in a moist condition during the curing period. Information supplied shall also include the number of "work" bridges that will be used, and the number of people responsible for the various tasks. The plan should also discuss bulkheading methods and materials that will be used if it is determined that proposed concrete placement rates cannot be maintained.

A pre-placement meeting shall be held 2-4 days prior to the slab placement to review the information and details provided in the placement and curing plan. The meeting shall be attended by the Contractor, Engineer, and if required by the Engineer, the concrete supplier and/or concrete pump supplier.

SB-7.13 Metal Railing Posts & Brackets

This work shall consists of furnishing, coating, and installing metal railing posts and brackets, including all anchorages and fittings, in accordance with the applicable provisions of 2402, 2433, 2471, 2478, the Plans and the following. The Prime contractor is responsible for communicating all applicable specifications, special provisions, standards, 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, provide threaded rods and bolts shall meet the requirements of 3385 and 3391, respectively.

C1. Drilled in Anchorages

Drilled in anchorages may be used in the following location: concrete pedestrian path beneath the bridge in front of the east abutment.

There is no MnDOT approved product list for adhesive anchorages having an ultimate pull-out tension greater than 5000 lbs. [22 kN]. Every adhesive system will need to be accepted by the Engineer in conjunction with the Regional Bridge Construction Engineer. To accomplish this, furnish independent laboratory test data certifying that static load tests for ultimate pull-out strengths were performed and are acceptable, as specified. Provide independent lab test data in accordance with ASTM E 488.

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

Anchorages 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 minimum embedment depth of 5 inches as shown in the plan. Bolt heads and/or nuts shall be in contact with the adjacent surface and shall be torqued to

- 1/2 inch diameter = 30 foot pounds [41 Nm]
- 5/8 inch diameter = 60 foot pounds [81 Nm]
- 3/4 inch diameter and larger = 80 foot pounds [108 Nm]

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. 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 ½ 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 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 mm (**inches**)	Minimum Embedment Depth mm (**inches**)	Ultimate Pull-out Strength kN (**pounds**)
Rail Post	5/8 inch	5 inches	8000 pounds

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**
13 (**1/2"**)	21.0 (**4.75**)	25.0 (**5.7**)	45.0 (**10.1**)	22.0 (**4.9**)
16 (**5/8"**)	33.0 (**7.4**)	39.5 (**8.9**)	70.0 (**15.8**)	34.0 (**7.6**)
19 (**3/4"**)	47.0 (**10.6**)	56.0 (**12.6**)	101.0 (**22.8**)	49.0 (**11.0**)
22 (**7/8"**)	65.0 (**14.5**)	77.0 (**17.4**)	138.0 (**31.0**)	67.0 (**15.0**)
25 (**1"**)	85.0 (**19.0**)	100.0 (**22.6**)	180.0 (**40.5**)	86.0 (**19.5**)

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

Fabricator shall supply QA/QC documentation verifying that all fabricated railing components are within the necessary tolerances for proper fit up and installation of the railing, including measurements between railing base plates that indicate that the as fabricated base plate hole locations are within 1/8 inch of the specified plan dimensions, based on the plan specified rail post spacing.

All metal railing posts 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 posts 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 post and bracket 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 shall match Federal Standard 595 C No. 27038 (Black) and have a semi-gloss finish.

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 posts 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 posts 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. Prepare of the galvanized surfaces for painting in accordance with SSPC SP16 and 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 posts shall be protected during handling, and shipping, to prevent any damage to the coating(s). Coated metal railing posts shall not be moved or handled until the coating has cured, but in no case sooner than recommended by the coating manufacturer.

Metal railing posts 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 Posts:

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

1. All railing posts 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 post 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 wood 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.

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. Method of Measurement

Measurement will be by length in m (**feet**) based on Plan dimensions between the outside ends of metal railings~~.~~

I. Basis of Payment

Payment for Item No.2511.603 “PEDESTRIAN RAILING TYPE SPECIAL" 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 payment.

SB-8 (2405) PRESTRESSED CONCRETE BEAMS

The provisions of MnDOT 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 MnDOT specification 3392 or electroplated in accordance with ASTM B633, service condition SC4.

SB-8.1 Prestressed Concrete Fabricator Certification

The Fabricator's quality control office shall maintain documentation containing the data required by the specifications and the State 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-8.2 Special Requirements for Prestressed Inverted T-Beams

A. Surface Requirements

The upper surfaces of the inverted T-beams shall have a roughened surface for bonding to the cast-in-place portion of the deck. The roughened surface must have an amplitude of at least ¼". The method used to obtain the ¼" amplitude roughness must be reliable. Subsequent failure of obtaining the ¼" roughness on the actual inverted T-beams will be grounds for rejection of the beams.

B. Age Requirements

Prior to pouring the cast-in-place bridge deck onto the inverted T-beams, a minimum of 14 days of aging shall be required for the inverted T-beams starting from the date that the beams are initially cast. The date that each beam is cast shall be recorded and clearly marked on the prestressed concrete beam.

C. Shop Drawings

Shop drawings for the prestressed inverted T-beams will be required. Separate shop drawings for each beam type shall be furnished to the Engineer for approval. The Contractor shall allow a review period of 21 calendar days by the Department prior to fabrication of the inverted T-beams. Shop drawings shall be per the design plans, and any changes or deviations will require the Engineer's approval.

The shop drawings shall include all information necessary to completely fabricate the beams, and, as a minimum, shall include beam length, cross-section with dimensions, end-of-beam details, strand size and location, initial prestressing jacking force, initial and final concrete strengths, reinforcement bar size and spacing, projected length of bars extending out of the section, and required number and size of handling devices. All handling devices shall be located within 2'-0" from the ends of the beams.

D. Inspection by MnDOT

Only beams bearing a mark indicating that they were examined by a MnDOT inspector and approved for shipment shall be delivered to the Project site.

E. Method of Measurement

Measurement of Inverted T-beams will be made by the linear foot for the summation of beam lengths measured out-to-out of beam along the centerline of beams.

F. Basis of Payment

Payment for Item No. 2405.603, "PRESTRESSED BEAM INV-T 18" TYPE _", for invert T-beams will be made at the Contract price per linear foot for each type, and shall be compensation in full for all costs of materials, shop drawings, fabrication, construction of the test section specimen for the roughened surface, transportation and erection of the beams in their final position, as described above.

SB-8.3 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.

Beginning with the bottom row of strands, proceed to the outermost strands in this row and release one strand each side of center. Move up one row, to the outermost strands in this row and release one strand each side of center. Move to the top row at the top of the beam, to the outermost strands and release one strand each side of center. Move to the second row from the top of the beam to the outermost strands and release one strand each side of center. Proceed to the bottom row of strands at the bottom of the beam, 3 columns from the vertical axis, and release one strand each side of center. Move up one row in the same column and release one strand each side of center. Then proceed to the innermost strands in the bottom row and release one strand each side of center. Move up one row and release the same strands. Proceed to the innermost strands in the top row at the top of the beam and release one strand each side of center. Proceed to the bottom row, 1 column in from the outmost strands and release one strand each side of center. Move up one row and release the same strands. Proceed to the bottom row, 2 columns out from the vertical axis of the beam and release one strand each side of center. Move up one row and release the same strands.

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-8.4 Anchorages

Each anchorage shall be furnished and installed in accordance with the applicable requirements of 2433 and the following:

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

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

Threaded rods, bolts, nuts, and washers not encased in concrete after project completion shall be galvanized in accordance with 3392 or be electroplated in accordance with ASTM B 633, Type III, SC 4. As an alternate to galvanizing or electroplating, threaded rods, bolts, nuts, and washers which are part of a proprietary anchorage may be fabricated from stainless steel in accordance with 3391.

The Contractor shall submit, for approval by the Engineer, the following anchorage 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

If anchorages are installed vertically and are not encased in concrete after project completion, any voids occurring between the top of the anchorages and the concrete in which it is embedded shall be filled with approved caulk.

Payment will be made as 2433.516 "ANCHORAGES TYPE REINF. BARS (STAINLESS STEEL)", at the contract price per each, which shall include all costs of furnishing, testing, and installing the anchorages.

SB-8.5 Grouted Anchorages

This work consists of placing grouted reinforcement bar anchorages at the interface of the top of precast abutment corners and the bottom of the cast-in-place corner pilaster concrete and also at the interface of the top of the precast piles and the cast-in-place pile pocket on the abutments and piers.

A. Construction Requirements

Each anchorage shall consist of drilling and grouting a reinforcement bar into the inplace concrete. Holes in prestressed elements shall be located a minimum of 1 ½ hole diameters from the center of any prestressing strand. The holes for the anchorages shall be drilled to the diameter and depth given in the Plans. Grout shall be a type formulated for this usage and approved by the Engineer.

B. Method of Measurement

Measurement will be by the single unit for each acceptable anchorage installed. Anchorages installed that are not shown in the Plans or ordered by the Engineer will not be measured for payment.

C. Basis of Payment

Payment for Item 2433.602 "GROUTED REINFORCEMENT BARS", at the Contract price per each shall be compensation in full for all costs of furnishing, placing, and grouting the reinforcement bars complete inplace.

SB-8.6 Precast Concrete Abutment and Pier Elements

Description of Work

This work consists of furnishing, erecting, grouting, and installing precast concrete elements for abutments and pier caps including all necessary materials, equipment, and closure pours to complete the work as shown in the Plan.

In order to meet the required curing time, all precast elements shall be fabricated before the starting of pile driving for the “Accelerated Bridge Construction” (ABC) required schedule for this project. Contractor shall plan the production of the precast concrete element for abutments and piers with the precast element supplier(s) to meet the ABC schedule for this project.

SB-8.7 Materials

A. The concrete for the precast elements shall be MnDOT mix 3Y43.

B. Use structural non-shrink grout for through holes, keyway, and any blockouts shown on the Plan. The Contractor shall submit test results of the grout mixture verifying compliance with the following requirements:

1. Product Composition
   - 1.1 Neat Grouts: The product shall be composed of all fine particles and have a consistency of a powder.
   - 1.2 Extended Grouts: A 3/8 inch pea gravel aggregate extension may be used in conjunction with a neat grout. The aggregate composite shall not exceed 50% by weight.
   - 1.3 Neat and extended grouts must comply with the specifications set forth in Section 2 through Section 6 of SB-8.7B.
2. Compressive Strength
   - 2.1 The product shall meet the following time-based criteria for compressive strength based on ASTM C 109:
     - 1 day: Minimum 4000 psi
     - 7 day: Minimum 5000 psi
   - 2.2 If a 7 day compressive strength is not available for a product, the following criteria shall be used:
     - 28 day: Minimum 6000 psi

3. Splitting Tensile Strength
   3.1 The product shall meet the following time-based criteria for splitting tensile strength based on ASTM C 496:
   - 1 day: Minimum 200 psi
   - 7 day: Minimum 400 psi

   3.2 If a 7 day splitting tensile strength is not available for a product, the following criteria shall be used:
   - 28 day: Minimum 600 psi

   3.3 If no splitting tensile strength information is available for a product, the following criteria shall be used:
   - 1 day compressive strength divided by 15 must be greater than 300 psi
   - 7 day compressive strength divided by 15 must be greater than 400 psi
   - 28 day compressive strength divided by 15 must be greater than 500 psi (in lieu of 7 day strength)

4. Shrinkage
   4.1 The product shall meet the following criteria for shrinkage based on either ASTM C 157 or ASTM C 596. Neat grouts shall be evaluated with 1 in. square cross section prisms and extended grouts shall be evaluated with 3 in. square cross section prisms. The criteria shall remain the same regardless of test prism size.
   - 28 day: Maximum 0.04% (400 microstrain)

5. Mixing Procedure
   5.1 If an aggregate extension is used, the aggregate shall be added to the initial water content before any powder is added.
   5.2 The powder shall be added to the specified minimum water content. An additional water amount shall be supplied after approximately 80% of the product has been added to the initial water. This additional water amount may be specified by the manufacturer or may be taken as the difference between the specified maximum water content and the specified minimum water content. The specified maximum water content for a specific product shall not be exceeded. No water shall be added to the product once placement has commenced.

6. Flow
   6.1 The product shall be tested on site according to SB-8.7.B.6.2, after mixing and immediately before pouring the product.
   6.2 The product shall be tested on a standard flow table specified by ASTM C 230. The testing procedure shall follow ASTM C 1437 with the following modifications:
   - The average diameter of the product shall be measured after the mold is lifted to determine the product's flow under its own self weight.
   - The table shall then be dropped 10 times in 15 seconds.
   - The average diameter of the product shall be measured after 10 drops.

- If either the self weight or 10 drops causes the product's diameter to exceed the diameter of the table, then that measurement shall be recorded as the diameter of the table.

6.3 The product shall meet the following criteria for flow based on the procedure in 9.2:
- Minimum average diameter from self weight flow: 7 in.
- Minimum average diameter after 10 drops: 9 in.

7. Recognized Grout **Products**
- Set 45® Hot Weather Grout
- Five Star® Highway Patch
- Set 45® Hot Weather Grout extended with pea gravel

SB-8.8 Submittals

A. Submit the following to the Engineer for review and in accordance with the requirements of 1502 and these special provisions:

1. Shop Drawings:
   a. Submit five sets, 11 x 17 inch sheets with a 1½ inch blank margin on the left-hand edge.
   b. Place the Project designation data in the lower right-hand corner of each sheet.
   c. Prepare shop drawings and supporting calculations certified by a Professional Engineer licensed in Minnesota.
   d. Design, show and locate all lifting inserts, hardware or devices, and vertical adjustment hardware on the shop drawings for the Engineer's review. Design lifting hardware according to the provisions of Chapter 5 of the PCI Design Handbook.
   e. Provide ID for all precast elements to be stamped on elements.
   f. Contractor shall identify the location of the precast plant or yard and stamp on the precast elements.
   g. Do not order materials or begin work until review of the shop drawings is complete.
   h. Do not deviate from the shop drawings unless authorized in writing. Contractor is responsible for costs incurred due to faulty detailing or fabrication.
   i. The Engineer reserves the right to review these drawings for up to 7 calendar days. This right applies each time the drawings are submitted or re-submitted.

2. Erection Plans:
   a. Submit five sets, 11 x 17 inch sheets with a 1½ inch blank margin on the left-hand edge.
   b. Place the Project designation data in the lower right-hand corner of each sheet.
   c. Prepare drawings and supporting calculations certified by a Professional Engineer licensed in Minnesota.
   d. Check that all handling and erection stresses, deflections and bracing conform to Chapter 5 of the PCI Design Handbook.
   e. Include the following at a minimum on the installation plans:
      1) Minimum clearances of reinforcing to precast element edges, and to the face of through holes.
      2) Locations and details of lifting devices including supporting calculations. Design all lifting devices based on the no cracking criteria in Chapter 5 of the PCI Design Handbook. Use a device that will have a 3"min. top cover and a 1 inch min. bottom cover after installation. Galvanize the device after fabrication per MnDOT Spec. 3392 or 3394.
      3) Type and amount of any additional reinforcing required.
      4) Calculations showing that tensile stresses in all elements do not exceed the modulus of rupture during the handling, fabrication, shipping, and erection of the element.
      5) Minimum concrete compressive strength attained prior to handling the precast concrete elements.
      6) Load distribution.
      7) Cables and lifting equipment.
      8) Details of vertical adjusting system and hardware. Galvanize per MnDOT 3392 or 3394.
      f. Include details showing the erection and installation of the proposed precast elements in accordance with the Plan.
      g. Submit Erection Plan drawings and calculations including the following minimum information:
         1) Crane and pick locations
         2) Crane charts
         3) Element erection sequence
         4) Vertical adjustment method for distributing the precast element load to supporting piles as per the Plan, achieving grade elevation and meeting specified dimension/location tolerances.

h. Submit to the Engineer for review a proposed method for forming through holes, forming vertical element joints and installing grout and SCC, sequences, and equipment for grouting placement operations. Submit a back-up procedure in the event leaks occur during grout installation. Obtain approval prior to placing grout.

i. Submit a method of forming joints between precast elements to watertight.

j. The Engineer reserves the right to review these drawings for up to 14 calendar days. This right applies each time the drawings are submitted or re-submitted.

B. Submit for Materials.

1. Supply test data for concrete element including slump, air content and unit weight for fresh concrete and compressive strengths after 7, 14, and 28 days for the hardened concrete.

2. Supply certified test results from an independent accredited test laboratory for the structural non-shrink grout.

SB-8.9 Precast Concrete Element Fabricator Certification

The Contractor shall fabricate the precast element in a precast/prestressed concrete fabrication plant that has been granted certification by the Precast/Prestressed Concrete Institute, or by an organization approved by the Materials Engineer.

If contractor chooses to fabricate precast concrete elements without using certified precast plant, Contractor shall submit completely detailed precasting methods and procedures to ensure the precision of dimensions and locations of all rebars, inserts and accessories per the Plan, and the QA/QC plan for the Engineer's review. The fabrication site for the precast concrete elements shall have been granted plant pre-approval for acceptance of precast concrete products by the Material Engineer of MnDOT.

The Fabricator's quality control office shall maintain documentation containing the data required by the specifications and the State 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-8.10 Quality Assurance

A. Permanently mark each precast unit with element ID number, date of casting and supplier identification. Stamp markings in fresh concrete.

B. Prevent cracking or damage during handling and storage of precast units.

C. Defects and Breakage of Prestressed and Nonstressed Elements:

1. Elements that sustain damage or surface defects during fabrication, handling, storage, hauling, or erection are subject to review and rejection.
2. Write and submit proposed repair procedures and obtain approval from the Engineer before performing repairs.
3. Repair work must reestablish the element's structural integrity, durability, and aesthetics to the satisfaction of the Engineer.
4. Determine the cause of any damage and take corrective action.
5. Failure to take corrective action leading to similar repetitive damage is cause for rejection of the damaged elements.
6. Element with cracks that extend to the nearest reinforcement plane and fine surface cracks that do not extend to the nearest reinforcement plane but are numerous or extensive are subject to review and rejection.
7. Element with full depth cracking or breakage greater than nine inches in length is cause for rejection.
8. Cracks wider than 0.02 inches shall be repaired.

D. Construct elements and panels to tolerances shown in the Plan.

SB-8.11 Shipping and Handling

Precast concrete elements for abutments and pier caps shall be installed and transported 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 precast concrete elements. The precast concrete elements shall be temporarily anchored, braced, and stabilized as they are transported and erected so as to preclude sliding, tipping, buckling, or other movement that may otherwise occur. Struts, bracing, tie cables, and other devices used for temporary restraint shall be of a size and strength that will ensure their adequacy.

SB-8.12 Construction

A. Do not place concrete in the forms until the Engineer, or Engineer's representative, has inspected the placement of all materials in the precast elements.

B. Finish the precast concrete elements as shown in the Plan. The tolerance for the through hole spacing shall be within ±3/16". The overall size of through holes shall be within ±1/4" of the plan dimensions. All inserts shall be located within 1" of the location as shown in Plan.

1. Wet cure elements and panels by covering all exposed surfaces with wet burlap, cotton mats, or both, and plastic sheets.

C. Do not strip the forms before the precast elements have obtained a minimum compressive strength of 3500 psi.

SB-8.13 Installing Precast Concrete Elements

A. Install precast concrete elements per the Plan and approved Erection Plans.

B. Support the erected precast concrete elements from shifting or dropping throughout the installation of grout and concrete closure pours. The supports for the precast concrete elements are detailed per the Plan or approved working drawings.

SB-8.14 Preparation and Installation of Non-Shrink Grout and Closure Pours

A. Form around holes and voids between precast elements for grouting as shown in the approved Erection Plan.

B. Clean and remove all debris from the through holes, blockouts, voids and shear keyways prior to placement of the structural non-shrink grout.

C. Keep bonding surfaces free from laitance, dirt, dust, paint, grease, oil, rust, or any contaminant other than water.

D. Mix and place grout product following manufacturer's and supplier's recommendations for preparation and installation.

E. Place structural non-shrink grout in the locations as per the Plan and approved Erection Plans in a continuous operation within a precast element after all precast concrete elements are prepared for grout.

F. Voids are not allowed in the grout.

G. Do not apply superimposed dead loads or live loads to the precast concrete elements until the structural non-shrink grout has reached a strength referenced in SB-12.1, closure pour concrete has reached a strength of 3500 psi based on the 7-day strength test form concrete cylinders.

H. Cure structural non-shrink grout per manufacturer's recommendation.

1. Contact the manufacturer's representative for advice on how to reduce heat such as wet curing or adding retarding admixture if the heat of hydration is excessive.

I. Finish grout flush or a maximum of ⅛ inch above element top surface.

1. Grout the through holes to the top of the holes. Fill with grout in the annular void between the pile and the through hole wall carefully so there shall be no trapped air and void in the grout.
2. Grout the keyways and void per the Plan and approved Erection Plans.
3. No additional compensation will be made for any corrections to the finish of grouting the through holes, keyways and voids.

J. Place required structural concrete closure pours in the locations as per the Plan and approved Erection Plans in a continuous operation for precast substructures. The closure pours shall fill all gaps and voids between precast elements without gaps or cracks.

SB-8.15 Basis of Payment

- Payment for Item No. 2405.602, "PRECAST PIER ELEMENT", will be made at the Contract price per each for each precast pier cap element.
- Payment for Item No. 2405.602, "PRECAST ABUTMENT ELEMENT", will be made at the Contract price per each for each precast abutment element.

All payment for these items will be compensation in full for all costs of manufacturing, transporting, grout installation, erecting the precast concrete elements in their final position with any required temporary bracing, and closure pours, as shown in the Plan. All payment for these items shall also include accessories, mock-up panels, labor, materials, equipment and temporary supports to install abutments and piers to the completion of the work.

SB-9 (2442) REMOVAL OF EXISTING BRIDGES

Apply the provisions of MnDOT 2442 except as supplemented below.

Dispose of materials in accordance with MnDOT 1506, 2104.3C, 2442, MnDOT "Asbestos and Regulated Waste Manual for Structure Demolition or Relocations for Construction Projects" and the following:

Furnish written information to the Engineer as to disposal of steel bridge beams and other steel bridge components coated with lead paint. 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. Stabilize all lead paint that has been identified as peeling by coating with an approved product, as listed on the MnDOT Approved Products website www.dot.state.mn.us/products under "Lead Paint Encasement Product". Prevent the peeling paint from flaking off during demolition, or scrape and contain the peeling paint. If the painting option is used apply 16 mils of the product. Applying more than 16 mils of the product on a bridge over any water will require that the bridge have a diaper apron be attached under the bridge to contain the drips. Complete all work as per the MnDOT Asbestos and Regulated Waste Manual for Structure Demolition or Relocations for Construction Projects. The form supplied in this special provision must include the signature of the authorized Superintendent verifying that the information is correct.

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.

MnDOT Project No. _____ Bridge No._____

Description of Bridge Steel _____

Paint System is MnDOT 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 MnDOT 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, and disposal of surplus material necessary for construction of Bridge No. 62037, which is not specifically included in the grading portion of the Contract. At the abutment, excavate material necessary to construct to finished grade as shown in the "Finished Grading Section" on MnDOT Standard 5-297.233 and 5-297.234.

No measurement for payment will be made for approach surcharge material or select granular modified abutment approach treatment material as part of the structure excavation pay item. Refer to the grading portion of the contract for measurement and payment of these items.

No measurement will be made of the excavated or backfill material that is included in the structure excavation pay item. 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".

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

Bridge 62037	North Abutment Stage 1	25%
	South Abutment Stage 1	25%
	North Abutment Stage 2	25%
	South Abutment Stage 2	25%

SB-10.2 Foundation Preparation

Each item of work Foundation Preparation shall consist of furnishing all material for and performing all work involved in the preparation of the foundation for the piers on Bridge No. 62037. Contractor must design and submit a foundation preparation plan for review and approval by the Engineer prior to beginning pier construction operations. Unless otherwise provided by separate Contract item, item shall include, but not be limited to temporary work to access pier locations, earth excavation and all other work such as temporary complete closure of channel, channel diversion, coffer dam construction, concrete seals, pumping, removal of the cofferdam and other temporary works, backfilling the excavation, and disposal of surplus excavated materials as may be necessary. As requested by the Contractor, partial payment for Foundation Preparation items may be made based on the Engineer's estimate of percent of work complete.

Piling will be paid for separately.

All costs for the work specified above for each of the piers will be paid for separately as Item No. 2401.601 "FOUNDATION PREPARATION", at the contract lump sum price per each pier.

SB-11 STEEL SHEET PILING (Permanent)

The following consists of furnishing and installing a permanent steel sheet piling wall in accordance with MnDOT 2452 and 3373, to the limits and tolerances shown on the plans and according to the following:

Furnish and install permanent steel sheet piling when required in the Contract or by the Engineer.

A. Materials to be supplied:

1. Furnish new interlocking, hot-rolled steel sheet pile material with a minimum yield strength of 50 ksi (345 MPa) unless otherwise specified, conforming to MnDOT spec 3373. Identifiable markings are required on the sheeting material. Sheeting cannot be used if physical defects such as kinks or buckles that would cause the pile to fail during driving are present.

Furnish a copy of the published sheet pile section properties for verification purposes. Provide a sheet pile section for each wall section with an "effective section modulus" equal to or greater than that specified on the plan. (Effective Section Modulus is computed by taking the effects of corrosion loss allowances). Use the corrosion rate in accordance with Article 11.10.6.4.2 of the AASHTO LRFD Bridge Design Specifications. Verification is required of the Engineer prior to use. If unauthorized sheeting is installed it will be removed at the Contractor's expense.

Supply to the Engineer a copy of the certified Material Test Report (MTR) attesting to the physical and chemical properties of the steel sheet piling in accordance with MnDOT Spec 3373, prior to installing the sheeting.

Note: The selection of the sheet pile section does not relieve the Contractor of the responsibility to satisfy all details including minimum clearances, cover, embedment, reinforcement, shear stud locations, interlocking, and field cutting. Any modifications of the plans to accommodate the Contractor’s selection will be paid for by the Contractor and subject to the approval of the Engineer.

2. Supply structural steel shapes and plates meeting MnDOT spec 3306 and galvanized per MnDOT spec 3394.

3. Provide select granular backfill meeting the requirements of MnDOT spec 3149.2B2.

B. Prior to and during construction:

1. Verify locations of all underground utilities and existing storm sewer systems and other known obstructions before driving any sheet piling. Any disturbance or damage to existing structures, utilities or other property, caused by the Contractor's operation, shall be repaired by the Contractor in a manner satisfactory to the Engineer at no additional cost to the Department.

2. Determine the appropriate equipment necessary to drive the sheeting to the tip elevation(s) specified on the plans. Drive sheeting to the interim depth shown on the plans and field drill weep holes in order to avoid excavation and unbalanced lateral loading on the sheeting. During construction, the maximum excavation limit below final groundline is shown on the Plans. Drive the sheet piling, as a minimum, to the tip elevation(s) specified, prior to commencing any related construction. If unable to reach the minimum tip elevation, the adequacy of the sheet piling design will require re-evaluation by the Department prior to allowing construction adjacent to the sheet piling in question. Drive sheet piling in such increments of penetration as may be found necessary to prevent distortion, twisting out of position or pulling apart at the interlocks. Have the Engineer approve the methods used to cut off piles or drill holes in the pile before starting the cutting or drilling.

3. Compact the select granular borrow to 100% of the relative standard proctor density.

C. Method of Measurement

Measurement will be made by the total area of permanent sheeting in square feet of steel sheet piling that is necessary for the intended permanent use. Measurement will only be made for locations designated in the Contract or by the Engineer.

D. Basis of Payment

Payment for Item No. 2452.618 “STEEL SHEET PILING (PERMANENT)" will be made at the Contract price per sq. ft. and shall be compensation in full for all costs of furnishing and installing the complete steel sheet piling wall system as described in the plan and as described above. This also includes, but is not limited to, additional items such as cutting the permanent piling to a desired elevation below the finished grade, drilling holes for the drainage system, shear studs, surveying for additional utilities , any additional structural steel details and select granular backfill behind the wall, and anything incidental to it. See plans for additional details on wall accessories. All additional items shall be incidental to the sheet pile wall.

SB-12 (2452) PILING

The provisions of MnDOT 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 MnDOT welding certification.

Delete the first sentence of the second paragraph of 2452.3D7 and substitute the following:

Piles designated by the Engineer to be redriven shall have a required minimum time delay of 24 hours between the initial driving and redriving. If the redrive at 24 hours fails to achieve bearing, the Engineer may require an additional redrive after a minimum 48-hour wait time after the first redrive.

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.

Pile Hammers

a. General

All equipment is subject to satisfactory field performance. Use a variable energy hammer to drive concrete piles. Hammers will be rated based on the theoretical energy of the ram at impact. Supply driving equipment which provides the required resistance at a blow count ranging from 2.5 blows per inch (30 blows per foot) to 15 blows per inch (180 blows per foot) at the end of initial drive, unless approved otherwise by the Engineer after satisfactory field trial. When the Engineer determines the stroke height or bounce chamber pressure readings do not adequately determine the energy of the hammer, provide and maintain a device to measure the velocity of the ram at impact. Determine the actual hammer energy in the field so that it is consistent with the hammer energy used for each bearing capacity determination. When requested, furnish to the Engineer all technical specifications and operating instructions related to hammer equipment.

b. Diesel Hammers

Variable energy diesel hammers shall have at least three fuel settings that will produce reduced strokes. Operate and maintain diesel hammers within the manufacturer's specified ranges. Determine the rated energy of diesel hammers using measured ram stroke length multiplied by the weight of the ram for open end hammers and by methods recommended by the manufacturer for closed end hammers. Provide the Engineer with a chart from the hammer manufacturer equating stroke and blows per minute for the open-end diesel hammer to be used. Also provide and maintain in working order for the Engineer's use an approved device to automatically determine and display ram stroke for open-end diesel hammers. Equip closed-end (double acting) diesel hammers with a bounce chamber pressure gauge, in good working order, mounted near ground level so the Engineer can easily read. Also, provide the Engineer with a chart, calibrated to actual hammer performance within 30 days prior to initial use, equating bounce chamber pressure to either equivalent energy or stroke for the closed-end diesel hammer to be used.

c. Hydraulic Hammers

Variable energy hydraulic hammers shall have at least three hydraulic control settings that provide for predictable stroke control. The shortest stroke shall be a maximum of 2 feet for the driving of concrete piles. The remaining strokes shall include full stroke and approximately halfway between minimum and maximum stroke. Determine the hammer energy according to the manufacturer's recommendations. When pressure measuring equipment is required to determine hammer energy, calibrate the pressure gauges before use.

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 (herein referred to as "WEAP analysis"). A hard copy of the results of the analysis, including a WEAP bearing graph, shall be submitted to the Engineer.

   (a) The WEAP analysis shall evaluate the suitability of the proposed driving system (including the hammer, capblock and pile cushions) as well as to estimate the driving resistance, in blows per 12 inches or blows per inch, to achieve the pile bearing requirements and to evaluate pile driving stresses.

   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. For prestressed concrete piles compression and tensile limits are given below. 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.

   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. Wave Equation Analysis shall indicate the hammer is capable of driving to twice the pile factored design load without overstressing the piling in compression or tension and without reaching practical refusal (20 blows per inch). Ensure that the hammer provided also meets the requirements described previously under "Pile hammers: General".

   (b) Required Equipment For Driving: Hammer approval is solely based on satisfactory field trial including dynamic load test results and Wave Equation Analysis. Supply a hammer system that meets the requirements described in the specifications based on the above analysis. Obtain approval from the Engineer for the pile driving system based on satisfactory field performance.

In the event piles require different hammer sizes, the Contractor may elect to drive with more than one size hammer or with a variable energy hammer, provided the hammer is properly sized and cushioned, will not damage the pile, and will develop the required resistance.

(c) Maximum Allowed Pile Stresses:

(1) General: The maximum allowed driving stresses for concrete piles are given below. In the event Wave Equation analyses show that the hammer will overstress the pile, modify the driving system or method of operation as required to prevent overstressing the pile. In such cases provide additional cushioning or make other appropriate agreed upon changes. For penetration of weak soils by concrete piles, use thick cushions and/or reduced stroke to control tension stresses during driving.

(2) Concrete Piles: Use the wave equation to evaluate the proposed pile cushioning. Use the following equations to determine the maximum allowed pile stresses as predicted by the wave equation, and measured during driving when driving prestressed concrete piling:

$s_{apc} = 0.7\, f'_c - 0.75\, f_{pe}$	Maximum allowed compression stress
$s_{apt} = 6.5\, (f'_c)^{0.5} + 1.05\, f_{pe}$	For piles less than 50 ft long
$s_{apt} = 3.25\, (f'_c)^{0.5} + 1.05\, f_{pe}$	For piles greater than 50 ft long and longer
$s_{apt} = 500$	Within 20 ft of a mechanical splice

where:

s_{apc} = maximum allowed compression stress, psi
s_{apt} = maximum allowed pile tensile stress, psi
f'c= specified minimum compression strength of the concrete, psi
f_{pe}= effective prestress (after all losses) at the time of driving, psi, taken as 0.8 times the initial prestress force (f_{pe}=0 for dowel spliced piles)

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.

Delete 2452.3C2 and substitute the following:

Pile Cushion: Provide a pile cushion that is adequate to protect the pile from being overstressed in compression and tension during driving. Use a pile cushion sized so that it will fully fill the lateral dimensions of the pile helmet minus one inch but does not cover any void or hole extending through the top of the pile. Determine the thickness based upon the hammer-pile-soil system. For driving concrete piles, use a pile cushion made from pine plywood or oak lumber. Alternative materials may be used with the approval of the Engineer. Obtain the Engineer's approval for all pile cushions. Do not use materials previously soaked, saturated or treated with oil. Maintain pile cushions in good condition and change when charred, splintered, excessively compressed, or otherwise deteriorated to the point it will not protect the pile against overstressing in tension and/or compression. Protect cushions from the weather, and keep them dry. Do not soak the cushions in any liquid. Replace the pile cushion, if during the driving of any pile, the cushion is either compressed more than one-half the original thickness or begins to burn. Provide a new cushion for each pile unless approved otherwise by the Engineer after satisfactory field trial.

Reuse pile cushions in good condition to perform all set-checks and redrives. Use the same cushion to perform pile redrives as was used during the initial driving, unless this cushion is unacceptable due to deterioration, in which case use a similar cushion.

Pile Helmet: Provide a pile helmet suitable for the type and size of piling being driven. Use a pile helmet deep enough to adequately contain the required thickness of pile cushion and to assist in maintaining pile-hammer alignment. Use a pile helmet that fits loosely over the pile head and is at least 1 inch larger than the pile dimensions. Use a pile helmet designed so that it will not restrain the pile from rotating.

Delete 2452.3C3 and substitute the following:

Leads: Provide pile leads constructed in a manner which offers freedom of movement to the hammer and that have the strength and rigidity to hold the hammer and pile in the correct position and alignment during driving.

Templates and Ground Elevations: Provide a fixed template, adequate to maintain the pile in proper position and alignment during driving with swinging leads or with semi-fixed leads. Where practical, place the template so that the pile can be driven to cut-off elevation before removing the template. Ensure that templates do not restrict the vertical movement of the pile.

Supply a stable reference close to the pile, which is satisfactory in the opinion of the Engineer, for determination of the pile penetration. At the time of driving piles, furnish the Engineer with elevations of the original ground and template at each pile or pile group location. Note the highest and lowest elevation at each required location and the ground elevation at all piles.

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.

In the event that the Contractor has driven the pile to approximately 18 inches above cut-off without reaching the required resistance, the Engineer may require the Contractor to interrupt driving up to 24 hours prior to performing a redrive. This hold point is to avoid the potential for unnecessary splices. Provide an engineer’s level or other suitable equipment for elevation determinations to determine accurate pile penetration during the redrive. In the event the results of the initial redrive is not satisfactory, the Engineer may direct one additional redrive after 48 hours minimum from the first redrive. The Engineer may accept the pile as driven when a redrive shows that the Contractor has achieved the minimum required pile bearing and has met all other requirements of this Section.

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 <u>not</u> 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. MnDOT Nominal Resistance Pile Driving Formula Used as Field Control Method

Prestressed concrete piles shall not use the MnDOT Nominal resistance Formula. For other piles, the nominal pile bearing resistance shall be determined by dynamic formula as follows:

All types of piling driven with power-driven hammers.

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

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. Dynamic load tests on prestressed concrete piles shall use an embedded data collector or an externally mounted instrument system and signal matching analyses to determine pile capacity. Notify the Engineer two working days prior to placement of piles within the template and at least one working day prior to driving piles. Do not drive piles without the presence of the Engineer. If the mounted instrument system fails to communicate properly with the receiving system, allow the Engineer sufficient time to mobilize back-up equipment for performing dynamic load testing.

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 of piles other than prestressed concrete piles shall also be computed using the MnDOT formula and recorded on the report.

B3. Piling Supporting Concrete Retaining Walls

The nominal pile bearing resistances shown on MnDOT Standard Concrete Retaining Wall Sheets (MnDOT Standard Figures 5-297.620 through 5-297.632 dated May 31, 2006) were calculated using the Allowable Stress Design (ASD) Method, Not the LRFD method. If dynamic formulas are used to determine pile resistance for concrete retaining walls in the field, follow MnDOT specification 2452.3E as detailed in the 2005 Standard Specifications for Construction in lieu of 2452.3E-A and 2452.3E-B1 shown above. Do not use the formulas shown above to compute pile capacities for concrete retaining walls. For retaining wall plan sheets dated later than May 31, 2006 the inspector must confirm which dynamic formula to use.

SB-12.3 Dynamic Monitoring of Pile Driving

A. Description of Work

The Contractor shall provide all equipment and personnel necessary to perform dynamic pile testing of driven piles using a Pile Driving Analyzer (PDA). The work shall be performed in accordance with the requirements of ASTM 4945. The dynamic pile testing shall be performed on the initial driving and redriving of the test piles as directed by the Engineer. Testing may also be required on additional piles as designated by the Engineer.

B. Pile Preparation and Wave Matching

The Contractor shall prepare each pile to be tested by attaching instrumentation to the piles except that for testing on initial driving of steel shell piles, the Contractor shall attach the instrumentation after the pile has been placed in the leads. Prestressed concrete test piles shall use an externally mounted instrument system and signal matching analysis unless approved by the Engineer. The Contractor shall perform wave matching of the PDA data using the Case Pile Wave Analysis Program (CAPWAP). This work shall be performed by an engineer experienced in dynamic testing and CAPWAP analysis. The program shall be run on all piles dynamically tested, or as directed by the Engineer.

C. Wave Equation Analysis

Following the wave matching, the Contractor shall use the GRLWEAP program and CAPWAP data to produce a refined Wave Equation Analysis Program (WEAP) bearing graph and inspector's chart to be used as the basis for pile acceptance. The bearing graph shall be used to determine the foundation pile's nominal bearing resistance that is to be recorded on the pile driving report. The wave matching analysis and wave equation analysis shall be performed in a timely manner.

D. Deliverables

The Contractor shall provide the following items to the Engineer within the specified time intervals described herein:

1. Results from each dynamic test performed with the PDA and checked with the CAPWAP program. The results shall be in the form of a hard copy of columnar data produced with the PDAPLOT program. The data shall consist of blow counts, stresses in the pile, pile capacities, hammer energies and hammer strokes for each one foot (0.25 meter) depth increment. The results shall be provided in a timely manner. In addition, the Contractor shall provide expert advice regarding the analysis of the PDA and CAPWAP data.

2. A WEAP bearing graph and inspection chart showing blow count-versus-pile resistance and stroke-versus-blow count that will be used for determining the nominal bearing resistance of the foundation piles. The graph/charts shall be developed based on the results of the PDA and CAPWAP data. Both the maximum force and maximum transferred energy calculated by WEAP shall match within 10% of those calculated by the CAPWAP. The bearing graphs shall be delivered to the Engineer within two days after completion of driving the test piles at any single substructure unit. These graphs/charts shall also be documented in the appropriate reports listed below.

3. A brief report for the piles at each substructure tested including a summary of the PDA and CAPWAP results. In addition, the Contractor shall supply one or more 3.5 inch diskettes or CD containing all data for the piles tested for that substructure. The data shall be in the form of X01 (PDA file) and Q00 (PDAPLOT file) files and shall be properly labeled. These reports shall be sent to the Engineer no later than three working days after dynamic pile tests have been completed at any given substructure unit.

4. A PDA summary report which summarizes the findings from the PDA and the associated CAPWAP computer program and the developed GRLWEAP bearing graphs. This report shall be sent to the Engineer no later than one week following the completion of the dynamic pile tests, addressed separately.

E. Method of Measurement

When the Pile Driving Analyzer field control method is required by the contract, measurement will be by the number of piles on which the pile driving analysis is performed. Initial analysis and redrive analysis on an individual pile shall be counted as one pile analysis. The Department reserves the right to increase or decrease the number of piles which are required to be dynamically monitored.

When the Pile Driving Analyzer field control method is not required by the contract but is chosen at the Contractor's option, no measurement will be made of the analyses performed and all costs associated with the dynamic testing will be at the Contractor's expense.

F. Basis of Payment

Payment for Item No. 2452.602 "PILE ANALYSIS" will be made at the Contract price per each and shall be compensation in full for all of the Contractor's expenses associated with the dynamic testing of a pile during initial driving and redriving. This includes, but is not limited to, additional time needed in driving operations, labor, consultants and equipment necessary for performing all of the work described above, including all incidentals thereto. This includes the payment for the dynamic testing of the redrive but all other work associated with the redrive itself will be paid for under the "Pile Redriving" pay item per each.

No unit price adjustment will be made in the event of increased or decreased Contract quantities for Pile Analysis.

SB-12.4 Prestressed Concrete Piling.

Description:

Provide prestressed concrete piles that are manufactured, cured, and driven in accordance with the requirements of the Contract Documents. Provide piles full length without splices to the length shown in the plans.

Manufacture: Fabricate piles in accordance with MnDOT 2405. When Embedded Data Collectors (EDCs) will be used for dynamic load testing, supply and installation is subject to the Engineers approval. Ensure the EDCs are installed by personnel approved by the manufacturer.

Storage and Handling:

A. Time of Driving Piles: Drive prestressed concrete piles at any time after the concrete has been cured in accordance with MnDOT 2405 (as modified by the Special Provisions) and the concrete compressive strength is equal to or greater than the specified 28 day compressive strength.

B. Storage: Support piles on adequate dunnage both in the prestress yard and at the job site in accordance with the locations shown in the Standard Indexes to minimize undue bending stresses or creating a sweep or camber in the pile.

C. Handling: Handle and store piles in the manner necessary to eliminate the danger of fracture by impact or of undue bending stresses in handling or transporting the piles from the forms and into the leads. In general, lift concrete piles by means of a suitable bridge or slings attached to the pile at the locations shown in the Standard Indexes. Construct slings used to handle piles of a fabric material or braided wire rope constructed of six or more wire ropes which will not mar the corners or the surface finish of the piles. Do not use chains to handle piles. During transport, support concrete piles at the lifting locations shown in the Standard Indexes or fully support them throughout 80% or more of their length. In handling piles for use in salty or brackish water, exercise special care to avoid damaging the surface and corners of the pile. If an alternate transportation support arrangement is desired, submit calculations, signed and sealed by the Specialty Engineer, for approval by the Engineer prior to transporting the pile. Calculations must show that the pile can be transported without exceeding the bending moments calculated using the support locations shown in the Plans.

D. Cracked Piles: The Engineer will reject any pile that becomes cracked in handling to the point that a transverse or longitudinal crack extends through the pile, shows failure of the concrete as indicated by spalling of concrete on the main body of the pile adjacent to the crack, or which in the opinion of the Engineer will not withstand driving stresses. The Engineer will not reject any pile for the occasional minor surface hairline cracking caused by shrinkage or tensile stress in the concrete from handling.

Do not drive piling with irreparable damage, which is defined as any cracks that extend through the pile cross-sectional area that are, or will be, below ground or water level at the end of driving. Such cracks are normally evidenced by emitting concrete dust during their opening and closing with each hammer blow. Remove and replace broken piles or piles cracked to the extent described above at no expense to the Department. The Engineer will accept cracks less than 0.005 inches which do not extend through the pile. Using approved methods, cut off and splice or build-up to cut-off elevation piles with cracks greater than 0.005 inches at the pile head or above ground or water level, and piles with cracks above ground or water level which extend through the cross-sectional area of the pile. The Engineer, at his discretion, may require correction of pile damage or pile cracks by cutting down the concrete to the plane of sound concrete below the crack and rebuilding it to cut-off elevation, or the Engineer may reject the pile. Extract and replace rejected piles that cannot be repaired, at no expense to the Department. Take appropriate steps to prevent the occurrence of cracking, whether due to handling or driving. When cracking occurs during driving, take immediate steps to prevent additional cracking by using thicker cushions or reducing the ram stroke length. Revise handling and transporting equipment and procedures as necessary to prevent cracking during handling and transportation.

E. Preparation for Transportation: Cut any strands protruding beyond the ends of the pile flush with the surface of the concrete using an abrasive cutting blade before transporting the piles from the casting yard. Cut and patch the metal lifting devices in accordance with the following:

(1) Provide corrosion protection for embedded metal lifting devices that would remain exposed after construction. After lifting operations using recessed metal lifting devices are complete, backfill block-outs with a non-sagging gel type epoxy for a minimum distance of 2 inches beyond the perimeter of the metal device as measured parallel to the exposed concrete surface. If the block-out extends less than 2 inches beyond the perimeter of the metal device, extend the epoxy compound beyond the block-out along the concrete surface. If Type 304 or 316 stainless steel lifting devices are used, non-shrink grout may be used to backfill the block-out within its limits. After lifting operations using flush or protruding metal lifting devices are complete, cut the lifting devices back to a minimum depth of 1 inch below the concrete surface and patch with a nonsag gel-type epoxy compound. For all square prestressed piling cut and patch lifting devices before transporting from the casting yard..

F. Method of Driving: Unless otherwise directed, drive piles by a hammer or by means of a combination of water jets and hammer when jetting is allowed. When using jets in combination with a hammer, withdraw the jets and drive the pile by the hammer alone to secure final penetration and to rigidly fix the tip end of the pile. Keep jets in place if they are being used to continuously eliminate the soil resistance in the scour zone.

Extensions and Build-ups Used to Increase Production Lengths:

A. General: Where splices and build-ups for concrete piles are necessary, construct such splices and build-ups in accordance with the Contract Plans. When splicing a prestressed precast section onto the original pile, and after driving, the length of spliced section below cut-off elevation is 4 feet or less, remove the pile concrete to the cut-off elevation and leave the dowels in place to be incorporated into the cap as directed by the Engineer. The Contractor may cut the length of dowels which becomes exposed to a length of 48 inches from the plane of pile-splice. These requirements are not applicable to specially designed piling. Make splices for special pile designs as shown in the Plans. Submit to the Engineer for approval details of any proposed cast splice section.

Apply to any build-ups or extensions the same surface treatment or sealant applied to the prestressed piles.

When electing to use dowel splices, assist the Engineer in performing a dynamic load test on each dowel spliced pile to verify the splicing integrity at the end of driving. Replace any damaged pile splices as outline under "Replacing Piles". Provide the Engineer 48 hours advance notification prior to driving piles with epoxy-bonded dowel splices. Mechanical pile splices shall be capable of developing the following capacities in the pile section unless shown otherwise in the Plans and capable of being installed without damage to the pile or splice:

a) Compressive strength = (Pile Cross sectional area) x (28 day concrete strength)
b) Tensile Strength = (Pile Cross sectional area) x 900 psi

Pile Size (inches) 16" square and required 175 ft-kips Bending Strength (kip-feet)

Pile Cut-offs: After the completion of driving, cut piles off which extend above the cut-off elevation with an abrasive saw. Make the cut the depth necessary to cleanly cut through the prestressed strands. Take ownership and dispose of cut-off sections not used elsewhere as allowed by this Section. Any steel reinforcement and prestressing steel that cut shall be cleaned of any oil, liquids, dirt or other deleterious substances and painted with an approved epoxy-based product in a manner that is approved by the Engineer.

Replacing Piles: In the event a pile is broken or otherwise damaged by the Contractor to the extent that the damage is irreparable, in the opinion of the Engineer, the Contractor shall extract and replace the pile at no additional expense to the Department. In the event that a pile is mislocated by the Contractor, the Contractor shall extract and replace the pile at no expense to the Department. In the event that a pile is driven below cut-off without obtaining the required bearing, and the Engineer elects to have the pile pulled and a longer pile substituted, it will be paid for as Unforeseeable Work. In the event a pile is damaged or mislocated, and the damage or mislocation is determined to be the Department's responsibility, the Engineer may elect to have the pile extracted, and it will be paid for as Unforeseeable Work. If the extracted pile is undamaged and driven elsewhere the pile will be paid for at 30% of the Contract unit price for Piling. When the Department determines that it is responsible for damaged or mislocated pile, and a replacement pile is required, compensation will be made under the item for piling, for both the original pile and replacement pile.

The Contractor may substitute a longer pile in lieu of splicing and building-up a pile. In this event, the Contractor will be paid for the original authorized length of the pile, plus any additional length furnished by the Contractor up to the authorized length of the build-up, as piling. The Contractor will be paid 30 feet of piling as full compensation for extracting the original pile.

SB-12.5 Pile Authorization

Add the following to 2452.3A:

The length of the foundation piles for each substructure unit will not be authorized until the test pile for that unit and the test pile for at least one immediately adjacent unit have been driven.

SB-13 (2471) STRUCTURAL METALS

The provisions of MnDOT 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 (2472) METAL REINFORCEMENT

The provisions of MnDOT 2472 are modified and/or supplemented with the following:

SB-14.1 Stainless Steel Reinforcement Bars (Bridge No. 62037)

Furnish and place stainless steel reinforcement bars in the concrete approach panel, abutments and piers. Stainless steel reinforcement bars are marked with the suffix "S" in the bridge plans. (Example: A1604S.)

A. Materials

The requirements of MnDOT 2472.2 are modified to include the following:

Grade and Type: The material shall conform to ASTM A 955 and to one of the following Unified Numbering System (UNS) designations: S24000, S24100, S32205, S32304, S20910, S30400, S31603, S31803, or S31653.

Supply Grade 60 bars, all of the same UNS designation.

Evaluation of Corrosion Resistance: Prior to fabrication, supply test results from an independent testing agency certifying that stainless steel reinforcement from the selected UNS designation meets the requirements of Annex A1 of ASTM A955. Corrosion performance for the selected UNS designation shall be redemonstrated if the processing method is significantly altered. Removal of mill scale or pickling processes used for stainless steel reinforcement supplied under this contract shall be the same as those used to prepare the samples tested per Annex A1 of ASTM A955.

Chemical composition of the material shall conform to that specified in ASTM A 276, Table 1, Chemical Requirements, for the given UNS designation.

Heat Treatment: Bars may be furnished in one of the heat treatment conditions listed in ASTM A 955, and as needed to meet the requirements of this specification.

Finish: Supply bars that are free of dirt, mill scale, oil and debris by pickling to a bright or uniform light finish. Fabricate and bend bars using equipment that has been thoroughly cleaned or otherwise modified to prohibit contamination of the stainless steel from fragments of carbon steel or other contaminants. Bars displaying rust/oxidation, questionable blemishes, or lack of a bright or uniform pickled surface are subject to rejection.

Bending and Cutting: Bend bars in accordance with MnDOT 2472 and ASTM A 955. Use fabrication equipment and tools that will not contaminate the stainless steel with black iron particles. To prevent such contamination, equipment and tools used for fabrication, including bending and cutting, shall be solely used for working with stainless steel. Do not use carbon steel tools, chains, slings, etc. when fabricating or handling stainless steel reinforcement bars.

Manufacturers/Suppliers: The following manufacturers/suppliers are capable of providing material meeting this specification. Other suitable manufacturers/suppliers may also exist. Ensure that all materials supplied meet the Contract requirements.

SUPPLIERS:	CONTACT	PHONE NO.
Altec Steel, Inc. 5515 Meadow Crest Drive Dallas, TX 75229	Ross Paulson	425-823-1913
American Arminox 1230 Avenue of the Americas 7th Floor New York, NY 10020	Jean-Pierre Belmont	646-283-3837
Contractors Materials Co. 10320 S. Medallion Drive Cincinnati, OH 45241	David Friedman	513-719-0112
Dunkirk Specialty Steel 88 Howard Ave Dunkirk, NY 14048	Gary Zaffalon	800-916-9133 716-366-1000 Ext 323
North American Stainless 6870 Highway 42 East Ghent, KY 41045	Jason Sharp	800-499-7833 Ext 6360
Salit Specialty Rebar 3235 Lockport Road Niagara Falls, NY 14305	Kevin Cornell	877-299-1700 716-299-1990
Talley Metals P.O. Box 2498 Hartsville, SC 29551	Melba Deese	800-334-8324 Ext 712-2356

Control of Material: All reinforcement bars or bar bundles delivered to the project site shall be clearly identified with tags bearing the identification symbols used in the Plans. The tags shall also include the UNS designation, heat treat condition, heat number, grade (corresponding to minimum yield strength level), and sufficient identification to track each bar bundle to the appropriate Mill Test Report.

In accordance with MnDOT 1603.2, supply samples to the MnDOT Materials Laboratory for testing. Supply one three foot long sample per heat, per bar size. Each sample shall include one complete set of bar markings. Each sample shall be individually tagged with the same information listed above per "Control of Material" and shall include a copy of the associated Mill Test Report. If material is from a coil, the test specimen shall be straightened by the supplier.

Provide Mill Test Reports (MTR) for the Project that:

1. Are from the supplying mill verifying that the stainless reinforcement provided has been sampled and tested and the test results meet ASTM A 955, ASTM A 276, Table 1 and the Contract requirements;

2. Include a copy of the chemical analysis of the steel provided, with the UNS designation, the heat lot identification, and the source of the metal if obtained as ingots from another mill;

3. Include a copy of tensile strength, yield strength and elongation tests per ASTM A 955 on each of the sizes (diameter in millimeters) of stainless steel reinforcement provided;

4. Permit positive determination that the reinforcement provided is that which the test results cover;

5. Include a statement certifying that the materials meet MnDOT 1601 regarding material being melted and manufactured in the United States; and

6. Certify that the bars have been pickled to a bright or uniform light finish.

B. Construction

Conform to the construction methods in MnDOT 2401 and 2472 except as modified below:

Ship, handle, store, and place the stainless steel reinforcement bars according to the applicable provisions with the following additions and exceptions:

1. Prior to shipping, ensure that all chains and steel bands will not come into direct contact with the stainless steel reinforcement bars. Place wood or other soft materials (i.e., thick cardboard) under the tie-downs. Alternatively, use nylon or polypropylene straps to secure the stainless steel reinforcement bars.

2. When bundles of reinforcement steel and stainless steel reinforcement bars must be shipped one on top of the other, load the stainless steel reinforcement bars on top. Use wooden spacers to separate the two materials.

3. Outside storage of stainless steel reinforcement bars is acceptable. Cover the stainless steel reinforcement bars with tarpaulins.

4. Store stainless steel reinforcement bars off the ground or shop floor on wooden supports.

5. Do not use carbon steel tools, chains, slings, etc. when fabricating or handling stainless steel reinforcement bars. Only use nylon or polypropylene slings. Protect stainless steel from contamination during construction operations including any cutting, grinding, or welding above or in the vicinity of stainless steel.

6. Place all stainless steel reinforcement on bar chairs that are solid plastic, stainless steel, or epoxy coated steel. Fabricate stainless steel metal chairs and continuous metal stainless steel supports from stainless steel conforming to the same requirements and UNS designations as stainless steel bar reinforcement as listed in section A, “Materials”. Use stainless steel chairs with plastic-coated feet above steel beams.

Use one of the listed tie wires to tie stainless steel reinforcement:

- 16 gauge or heavier plastic or nylon coated soft iron wire; or
- Fabricated from stainless steel conforming to the same requirements as stainless steel bar reinforcement as listed in section A, “Materials”, dead soft annealed, annealed at size. The tie wire does not need to be of the same UNS designation as the bar reinforcement.

Do not tie stainless steel reinforcing to, or allow contact with uncoated reinforcement, bare metal forming hardware, or to galvanized attachments or galvanized conduits. Direct contact with these materials is *not* acceptable. When stainless steel reinforcing or dowels must be near uncoated steel reinforcing, bare metal forming hardware or galvanized metals, maintain a minimum 1-inch (25 mm) clearance between the two metals. Where insufficient space exists to maintain this minimum, sleeve the bars with a continuous 1/8-inch (3 mm) minimum thickness polyethylene or nylon tube extending at least 1 inch (25 mm) in each direction past the point of closest contact between the two dissimilar bars and bind them with nylon or polypropylene cable ties. Stainless steel reinforcing bars are allowed to be in direct contact with undamaged epoxy coated reinforcing bars. Stainless steel reinforcing is permitted to contact or be tied to shear studs on steel girders.

Uncoated fasteners (such as used for static safety lines on beams), anchors, lifting loops, etc., that extend from the top flange of prestressed beams into the bridge deck shall be completely removed or cut off flush with the top flange of the beam prior to casting the deck.

Splices: Splices shall generally be of the lap type. Stainless steel mechanical splices may be used in certain situations, subject to the approval of the Engineer.

If it is necessary to increase the number of bar laps from those indicated in the Plans, provide copies of plan sheets to the Engineer showing the revised reinforcement layout with length and location of laps. The Engineer must approve the location of new lap splices prior to fabrication. New lap splices must be at least as long as those shown in the plans. No additional compensation or changes in the reinforcement bar quantities will be made for such splices.

Provide mechanical splices for stainless steel reinforcement made of stainless steel conforming to one of the UNS designations listed in section A, “Materials”, above.

Notification: Notify the Engineer and the MnDOT Bridge Construction Unit at (651) 366-4564, a minimum of 2 weeks prior to placing the stainless steel reinforcement.

Approval: Stainless steel reinforcement placed in any member must be inspected and approved by the Engineer before placing concrete. Concrete placed in violation of this specification may be rejected and removal required.

C. Method of Measurement

Measurement of the stainless steel reinforcement will be by weight in pounds (kg) based on Table 5.2.2.1 of the MnDOT LRFD Bridge Design Manual, regardless of the actual unit weight of the material supplied.

D. Basis of Payment

Payment for Item No. 2401.541 "REINFORCEMENT BARS (STAINLESS STEEL)" will be made at the Contract price per pound (kg) and shall be compensation in full for all costs of furnishing and installing the stainless steel reinforcement with all component materials as described above, including fabricating and shipping.

SB-15 (2511) RIPRAP – Geotextile Filter Type IV (Modified)

The provisions of MnDOT 2511 are modified and/or supplemented with the following:

SB-15.1 Adhere to 2511.2 and 3733 material requirements except as modified below:

Modify 3733.2A as follows:

Delete the first sentence of the first paragraph and replace with the following: Use non-woven needle punched fabric for geotextile.

Modify 3733.2B as follows:

Delete the first sentence of section and replace with the following:

Geotextile property requirements are the same as shown in Table 3733-1 except as modified below:

Table 3733-1 (Modified):

Geotextile Property	Test Method (ASTM) Units	Type *(A)* IV
B1 Grab Tensile Strength minimum, each principal direction	D4632 kN **(pounds)**	 1.45 **(315)**

SB-15.2 Delete the second paragraph of 2511.3A and replace with the following:

Place riprap on a filter material, to the thickness and extent specified in the plans.

Delete the last paragraph of 2511.3B2 and replace with the following:

Place Geotextile Filter as shown in the Plans.

SB-15.3 Measurement will be made to the nearest square meter **(square yard)** of area on the basis of actual surface dimensions as staked, with no allowance for overlaps or seams.

SB-15.4 Payment will be made under Item 2511.515 "GEOTEXTILE FILTER TYPE IV (MOD)" at the Contract bid price per square meter **(square yard)**, which shall be payment in full for all costs involved, including the geotextile filter, labor and equipment.

SB-16 (3308) GENERAL REQUIREMENTS FOR STRUCTURAL STEEL

Delete the first sentence of 3308.2D and substitute the following:

Impact test Structural Steel furnished for use in major structural components as defined in 2471.3A1, and/or identified by the contract.

SB-17 (3385) ANCHOR RODS

The provisions of 3385 shall apply except as modified below:

Add the following to 3385.2:

Anchorages supplied under this specification must be pre approved by the MnDOT Laboratory and the certification from the MnDOT Laboratory must not be more than one year old. The Contractor must furnish the Engineer a copy of the MnDOT 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-18 (3391) FASTENERS

Delete the contents of 3391.2B and substitute the following:

Provide field and shop bolts for steel bridges meeting the requirements of ASTM A325, Type 3 bolts. Provide bolts that project through the nut not less than ⅛ in (**3 mm**) nor more than ⅜ in (**10 mm**). Provide field and shop nuts for steel bridges that meet ASTM A 563/A 563M, Grade C3 or DH3 nuts and shop washers for steel bridges that meet ASTM F436/F 436M, Type 3 washers.

Provide bolts, nut, and washers that will be completely installed before application of the prime coat, in the uncoated "Black" condition. The bolts are to receive the same paint coatings as the structural steel. Provide mechanically galvanized fasteners that are to be field installed after the application of the prime coat, in accordance with ASTM B 695, Class 50, Type 1.

For all other bridges and structures, provide bolts that meet ASTM A 325, Type 1 (for painted and/or galvanized applications) or Type 3 (for unpainted weathering steel applications). Provide bolts that project through the nut no less than ⅛ in (**3 mm**) or more than ⅜ in (**10 mm**). Provide nuts that meet ASTM A 563/A 563M and washers that meet ASTM F 436/F 436M.

Bolts meeting ASTM A 325 may only be retightened once.

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

SB-18.1 Delete the first two sentences of 3391.2E and add the following:

Provide stainless steel bolts made of material meeting the requirements of ASTM F 593, for Condition CW1, Type 304, Type 316, or Type 316L. Provide finished bolts with the following characteristics:

(1) A yield strength of at least 60,000 psi [**415 MPa**],
(2) An ultimate tensile strength of 95,000 psi [**660 MPa**], and
(3) A minimum elongation of 20 percent in 2 in [**50 mm**].

Provide stainless steel nuts made of material meeting the requirements of ASTM F 594, Condition CW1, Type 304, 316, or 316L.

SB-19 (3741) ELASTOMERIC BEARING PADS

Apply the provisions of 3741 except as modified below:

Replace the first sentence in 3741.2A with the following:

Provide elastomer for bearing pads meeting the requirements of AASHTO M 251 with durometer hardness of 60 ±5 on the Shore “A” scale. Provide elastomer compounds classified as low-temperature Grade 4 meeting the grade requirements of AASHTO *LRFD Bridge Design Specifications*, Table 14.7.5.2-1, “Low temperature Zones and Minimum Grade of Elastomer.”

Delete all of 3741.2B1 except for the last paragraph.