ALERT: this PROPOSAL is written for the 2020 Spec Book. Items highlighted in GREEN are new.

The headers for each boilerplate were left in for teaching moments.

S.P. 2762-27138
Revised for 2023 Class

INDEX TO DIVISION SB

DIVISION 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
27138	29	00 – 29	2023

New or revised sheets were approved as listed below:

BRIDGE NO.	SHEET NO.	DATE OF APPROVAL

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.

Bridge Engineer
(Bridge Engineer)

S.P. 2762-27138
Revised for 2023 Class

Date:_____2023~~2~~_____ Lic. No._007___

SB2020-1502.0

Use on all bridge construction projects.

CREATED 4/28/2017
REVISED 3/20/2021 (1)

SB-1 (1502) PLANS AND WORKING DRAWINGS

The provisions of 1502, "Plans and Working Drawings," are supplemented as follows:

The Department will provide revised bridge drawings, bridge specifications, or provide bridge engineering analysis for the Contractor's means and methods if:

1. Deemed necessary by the Department, in its sole discretion, to rectify materials or workmanship not meeting specifications, or

2. Requested by the Contractor in writing.

The Department may, at its option, perform the work with its own staff, or by engaging a consultant pre-qualified by the Department to perform such work. If the Department is unable to perform the work, the Department may require the Contractor to have the work performed by a consultant acceptable to the Department.

If the Department, or a consultant engaged by the Department, performs further bridge engineering studies, bridge redesign, or provides additional bridge engineering analysis, the Contractor will reimburse the costs incurred by the Department. For work performed by the Department, the Department will charge the Contractor for the work at actual hourly rates of pay (including an overtime premium when applicable) and customary additives and overhead. For work performed by a consultant, the Department will charge the Contractor the amount invoiced by the consultant. The Department will prepare a Change Order for reimbursement, and will deduct the costs from any payment(s) due the Contractor.

When such work is performed by the Department or its consultant, the work will be considered a review for the Department's own purposes and will not be considered work commissioned by the Contractor. This clause will not constitute a special relationship between the Department and the Contractor, nor will the Contractor be a third-party beneficiary of the Department's contract with its consultant.

SB2020-1706.0

Use on ALL BRIDGES.

CREATED 12/4/1994
REVISED 3/20/2021 (3)

SB-2 (1706) EMPLOYEE HEALTH AND WELFARE

The provisions of 1706, "Employee Health and Welfare," are supplemented as follows:

All safety equipment, in accordance with applicable safety and health codes and regulations, must be in place and operable in adequate time to allow Department personnel to perform their required inspection duties at the appropriate time. Don't place concrete in any areas affected by such required inspection until the inspection has been completed.

The installation of guardrail systems, safety nets, horizontal or vertical lifelines, personal fall arrest systems, or scaffolding 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; if using an anchorage system which requires modification of structural members, request approval, in writing, for plan modifications 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 6 feet or more above the ground, the Contractor shall install an insert or other suitable anchorage to which a horizontal lifeline can be attached. Remove any portion of said device extending outside the finished lines of the pier cap unless otherwise approved by the Engineer. The Contractor shall repair or seal any void or cavity resulting from the installation or removal of this device to prevent the ponding or entry of water as directed by the Engineer.

The Contractor shall furnish, install and remove approved anchorage systems at no increased cost to the state for materials, fabrication, erection, or removal of the bridge component or anchorage system.

SB2020-1707.0

Use as required for projects adjacent to roadways which are open to traffic during construction operations.

CREATED 8/3/1994
REVISED 113/320/2021 (32)

SB-3 CONSTRUCTION OPERATIONS ADJACENT TO ROADWAYS

The Contractor shall perform work in accordance with 1502, "Plans and Working Drawings," and 1707, "Public Convenience and Safety," 2563, "~~Temporary~~ Traffic Management," located in the S Division section of this contract provisions, except as modified below:

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 Contractor shall leave sheeting and shoring in place until the excavated area has been properly backfilled.

SB2020-1717.0

Use on all projects.

CREATED 8/3/1994
REVISED 3/20/2021 (6)

SB-4 (1717) AIR, LAND, AND WATER POLLUTION

The provisions of 1717, "Air, Land, and Water Pollution," are supplemented as follows:

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

SB2020-2105.0

See designer notes below.

CREATED 11/2/1994
REVISED 2/24/2016 (3)

SB-5 BRIDGE ABUTMENT CONSTRUCTION

Do not start construction of each abutment until at least 72 hours after the approach fill at that abutment has been constructed to the full height and cross section.

SB2020-2401.0

Use on all projects.

CREATED 8/3/1994

REVISED ~~6/6/2018~~2/22/2022 (1~~5~~)

SB-6 (2401) CONCRETE BRIDGE CONSTRUCTION

The provisions of 2401, "Concrete Bridge Construction," are supplemented as follows:

SB-6.1 Bridge Slab Inclusion of Fibers

Insert the following sentence as the first sentence in 2401.2K.6.b:

K.6.b Fiber Reinforcement

For bridge slabs, furnish one of the materials listed on the *Approved/Qualified Product List* for Concrete, "Non-metallic Fibers (Bridge Applications)". Provide fibers at a dosage as prescribed on the *Approved/Qualified Product List* per the manufacturer. Incorporate the fibers into the mix design in accordance with the applicable requirements of 2401, "Concrete Bridge Construction," and 2461, "Structural Concrete".

SB2020-2401.3 F 2

Use when a SSF surface finish is required.

CREATED 12/14/2016

REVISED ~~3/20/2021~~12/12/2021 (~~5~~)

SB-6.~~2~~1 Special Surface Finish of Concrete Surfaces

To preserve and enhance the state's environmental, scenic, historic and cultural values and in response to the National Environmental Policy Act of 1969 (NEPA) the *Cost Participation and Maintenance Responsibilities with Local Units of Government Manual* dictates that the Aesthetic level of bridge(s) 27138 is level B impact.

1. Exposed Concrete Surfaces receiving a textured surface finish

Spray apply a **textured** SSF II (see APL) on the exposed concrete surfaces as designated below for Bridge No.(s). 27138. Apply the SSF II coating at a rate as defined on the Approved Products List (APL) in a uniform texture and color appearance. Back-roll the spray applied coating, if required by the Engineer.

- Edges of slab;
- Bottom of overhangs;
- Copings;
- Wingwalls;
- Abutments;
- Piers/pier caps

Provide a finish color for all SSF II matching AMS-STD-595A Color No. 30372 (MnDOT gray). Provide paint free of toxic metals and toxic pigments. Provide a "matte" finish for all colors.

2. Finishing Roadway Faces, Tops, and Outside surface of concrete barriers and parapets

Spray apply a **smooth** SSF II (see APL) on the exposed concrete surfaces as designated for Bridge No.(s). 27138. Apply the SSF II coating at a rate as defined on the APL in a uniform texture and color appearance. Back-roll the spray applied coating, if required by the Engineer.

a. Finish conventionally formed roadway faces, tops, and outside surfaces of barriers as per 2401.3F.2.d, "Curb, Sidewalk, and Median Finish," and the following:

(1) 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 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 12 hours.

(2) After completion of the proper curing period, begin SSF II application. Provide a finish color for all SSF II matching AMS-STD-595A Color No. 30372 (MnDOT gray). Provide a "matte" finish for all colors.

b. Finish slipformed barriers, in accordance with the following:

(1) Lightly broom in a vertical texture on the barrier surface immediately after inserting the plastic control joint strips and passage of the slipformer.

(2) Coat the surfaces of the barrier as described in paragraph 2. "**Finishing Roadway Faces, Tops, and Outside surface of concrete barriers and parapets**," above in this special provision. Back-roll the spray applied coating, if required by the Engineer.

3. Finishing Precast Concrete Girders

Spray apply a **smooth** SSF II (see APL) on the exposed concrete surfaces as designated below for Bridge No.(s). 27138. Apply the SSF II coating at a rate as defined on the APL in a uniform texture and color appearance. Back-roll the spray applied coating, if required by the Engineer.

- Outside face of fascia girders;
- Bottom of bottom flange of fascia girders;
- All faces of all girders; and
- Bottom of bottom flange of all girders.

Provide a finish color for matching AMS-STD-595A Color No. 30372 (MnDOT gray). Provide a "matte" finish for all colors.

SB-6.3~~2~~ Architectural Concrete Texture

This work consists of furnishing, placing and subsequent removal of form liners and the concrete forming system required to provide Architectural Concrete Texture on the areas designated on the plans.

The provisions of 2401, "Concrete Bridge Construction," are supplemented with the following:

A. Surface Texture

Concrete Texture Type 1: Symonds Formliner P/C 30498 or approved equal.

Concrete Texture Type 2: Dayton Superior No. 13617, Fitzgerald No. 14323, Karlson Forming Specialties Straight Fluted Rib or approved equal.

Concrete Texture Type 3: Fitzgerald No. 14301, Dayton Superior No. 601, Karlson Forming Specialties Styrene Plastic or approved equal.

Concrete Texture Type 4: as shown in the plans.

Form liner material may be ABS, Elastomeric, Expanded Polystyrene or approved equal. The material to be used shall be subject to approval or rejection by the Engineer on the basis of capability to provide concrete surfaces in texture, finished dimensions and finished appearance and form liner requirements herein described.

B. Installation

Ensure the form liners are capable of withstanding anticipated concrete pour pressures without leakage causing physical or visual defects. Provide form liners that are capable of being removed without causing concrete surface deterioration or weakness planes in the substrate. Provide form release agents, form stripping methods and patching materials that are compatible with special surface finish to be applied.

C. Construction Requirements

If form ties are used which result in a portion of the tie permanently embedded in the concrete, the portion left embedded shall be non-corrosive. Place form tie holes in the valley of the rustication groove. The ties shall be so designed that all material in the device to a depth of at least one inch [25 mm] back of the concrete face (bottom of rustication groove) can be disengaged and removed without spalling or damaging the concrete. Submit the type of form ties to the Engineer for approval prior to use in this work. The Engineer will determine which type of form tie will be used in conjunction with each architectural surface treatment.

D. Method of Measurement

Measurement of Architectural Concrete Texture will be based on the final accepted square foot measure of concrete surfaces formed with the approved form liner.

E. Basis of Payment

Payment for Item No. 2411.618 "Architectural Concrete Texture Type 1" at the Contract price per square feet, shall be compensation in full for all work described above.

Payment for Item No. 2411.618 "Architectural Concrete Texture Type 2" at the Contract price per square feet, shall be compensation in full for all work described above.

Payment for Item No. 2411.618 "Architectural Concrete Texture Type 3" at the Contract price per square feet, shall be compensation in full for all work described above.

Payment for Item No. 2411.618 "Architectural Concrete Texture Type 4" at the Contract price per square feet, shall be compensation in full for all work described above.

SB2020-2401.3 F 5

Use with bridges having skews 20 degrees or greater, when there is a vertical curve, but only when recommended by the Regional Bridge Engineer.

CREATED 8/3/1994
REVISED 6/6/2018 (3)

SB-6.43 Bridge Slab

Operate the finishing machine for Bridge No. 27138 so that the longitudinal axis of the machine is generally parallel to the centerline of bearings of the substructure units.

SB2020-2401.3 G 3

Use with high abutments that have vertical construction joints detailed in the plan.

CREATED 8/3/1994
REVISED 6/6/2018 (2)

SB-6.54 Placement of Concrete in High Abutments

Delay adjacent concrete pours of abutments with vertical construction joints by 72 hours to reduce the effects of shrinkage.

SB2020-2401.3 G 5

Use on all jobs.

CREATED 2/22/2022
REVISED 2/22/2022

SB-6.6 Protection Against Cold Weather

Delete the 5th paragraph of 2401.3G.5, "Protection Against Cold Weather," and substitute the following:

Provide insulated forms, insulation, or heating and housing facilities to maintain a concrete surface and projecting reinforcing temperature of between 60°F and 120°F during the curing period. The Engineer may allow the concrete surface temperature of between 50°F and 120°F for concrete with strengths equal to or greater than 75 percent of the required compressive strength but not less than 4,000 psi.

SB2020-2401.3 G 6b

Use for all bridge deck pours.

CREATED 2/22/2022
REVISED 2/22/2022

SB-6.8 Bridge Slab Curing Method

Delete the entire contents of 2401.3G.6.b, "Curing Method," and substitute the following:

G.6.b Curing Method

The Contractor is fully responsible for curing methods. Cure the concrete Bridge deck in accordance with Table 2401.3-4, unless other methods are approved by the Engineer in writing.

Table 2401.3-4
Required Curing Method Based on Final Bridge Deck Surface

Bridge Deck Type	Final Bridge Deck Surface	Required Curing Method ‖
Bridge Structural Slab curing (3YHPC-S) (3YLCHPC-S) (3Y42-S)	Low Slump Wearing Course	Conventional wet curing after carpet drag
Bridge Deck Slab curing (3YHPC-M) (3YLCHPC-M) (3Y42-M)	Epoxy Chip Seal Wearing Course or Premixed Polymer Wearing Course	Conventional wet curing after carpet drag
	Bridge Deck Planing	Conventional wet curing after carpet drag
	Tined Texturing*	Conventional wet curing after tine texturing. AMS curing compound after wet cure period
	Finished Sidewalk or Trail Portion of Deck (without separate pour above)*	Conventional wet curing after applying transverse broom finish AMS curing compound after wet cure period
* Prevent marring of broomed finish or tined textured surface by careful placement of wet curing. ‖ Apply conventional wet curing to Bridge Slab following the concrete finishing.		

Use conventional wet curing consisting of pre-wetted burlap covered per 3751, "Burlap Curing Blankets," with 6 mil (minimum) white plastic sheeting per 3756, "Plastic Curing Blankets," and in accordance with the following:

(1) Place the burlap to cover 100 percent of the deck area without visible openings

(2) Place the wet curing within 30 minutes after initial strike-off, as defined in 2401.3F.3.c(4), "Strike-Off of Bridge Slab (Applies to both Bridge Deck Slab and Bridge Structural Slab)," of the concrete surface (failure to place the wet curing within 30 minutes will

constitute a Department monetary deduction as specified in 2401.5A.2, "Concrete Curing and Protection")

(3) Keep the slab surface continuously wet for an initial curing period of at least 7 Calendar Days

(4) Use a Work Bridge to follow the finish machine

(5) Provide an additional center rail on wide Bridges, if necessary

After 96 hours, the Engineer may allow some modification of the requirement for continuous curing without interruption for the purpose of tying barrier reinforcement bars. Restrict the interrupted area to within 2 feet of the barrier. Protect the concrete from freezing or excessive drying during the interruption period. Resume curing at the earliest opportunity, and cure until completion of the curing period.

Where marring of the broomed finish or tined texturing surface finish of Bridge Deck Slabs is a concern, the Engineer may authorize curing as follows:

(1) Apply a membrane curing compound meeting the requirements of 3754, "Poly-Alpha Methyl Styrene (AMS) Membrane Curing Compound," using an approved power-operated sprayer in accordance with 2401.3G.2.a, "Membrane Curing Method"

(2) Provide a uniform, solid white, opaque coverage of membrane cure Material on exposed concrete surfaces (equal to a white sheet of typing paper). This may require use of a Work Bridge to access the center portion of the deck

(3) Place the membrane cure within 30 minutes after initial strike-off, as defined in 2401.3F.3.c(4), "Strike-Off of Bridge Slab (Applies to both Bridge Deck Slab and Bridge Structural Slab)," of the concrete placement (failure to place the curing compound within 30 minutes will constitute a Department monetary deduction as specified in 2401.5A.2, "Concrete Curing and Protection," unless otherwise directed by the Engineer)

(4) Provide curing compound for moisture retention until the placement of conventional wet curing

(5) Apply conventional wet curing as soon as walking on the concrete will not produce imprints deeper than 1/16 inch

(6) Keep the deck slab surface continuously wet for an initial curing period of at least 7 Calendar Days

~~(3)~~(7) The Engineer will not allow placement of membrane curing compound on any concrete surface that will receive future placement of additional concrete or wearing course on that surface

SB2020-2401.3 H 1

Slipforming is typically allowed, but, sometimes it is prohibited.

CREATED 11/25/1997
REVISED 3/20/2021 (5)

SB-6.96 Slipforming of Bridge Barrier

The provisions of 2401.3H.1, "Reinforcement Bars," are supplemented as follows:

Add the following to 2401.3H.1:

For slipform construction, tie 100% of the reinforcement bar intersections in the barrier.

SB2020-2404.0

Use on all jobs that will receive a low slump concrete wearing course.

CREATED 10/3/1988
REVISED 3/20/2021 (10)

SB-7 (2404) CONCRETE WEARING COURSE FOR BRIDGES

The provisions of 2404, "Concrete Wearing Course for Bridges," are supplemented with the following:

SB2020-2404.1

Use on all jobs that will receive a low slump concrete wearing course.

CREATED 4/4/1997
REVISED 6/15/2022 (8)

SB-7.1 Concrete Wearing Course 3U17A Width Limitation

Delete the first paragraph of 2404.3D, "Concrete Placement and Texturing," and substitute the following:

Place and finish concrete at a linear rate, measured parallel to the centerline of the Bridge, of at least 40 feet per hour under normal working conditions. Do not place concrete wearing course placement widths greater than 28 feet.

SB2020-2404.3

Use when texture planing is required on the low slump wearing course.
Use in the Metro District for speeds over 40 mph. For speeds ≤ 40 mph, consult the Metro Region Construction Engineer.

CREATED 7/24/2001

SB-7.21 Texture Planing of Bridge Wearing Course Surface

Delete the 6th and 7th paragraphs of 2404.3D, "Concrete Placement and Texturing," and substitute the following:

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

Upon completion of curing and a minimum of 72 hours prior to performing texture planing, remove all equipment and material from the bridge slab and approach panel surface and sweep the surface clean of debris. The Engineer will check surface smoothness of the roadway surface in accordance with 2401.3F.3.c(8), "Surface Smoothness Check". The final surface must meet the tolerance requirements of 2401.3F.3.c(5), "Final Finish Texture". Correct surface areas not meeting the specified tolerances by removal and replacement or by grinding using a surface diamond grinding device consisting of multiple diamond blades on the high spots to the extent directed by the Engineer prior to beginning surface texturing operations. Nonconforming areas that are not satisfactorily corrected are subject to 1503, "Conformity with Contract Documents," and 1512, "Unacceptable and Unauthorized Work".

Notify the Engineer at least 24 hours before beginning texture planing. Do not begin texture planing until the Engineer agrees that work required to meet surface tolerance has been completed. Mark the lane lines and crown in the deck and discuss with the texture planing operator prior to beginning the work.

Texture the roadway surface in a longitudinal direction by planing the hardened concrete with diamond sawblades. Plane the entire surface area of the roadway, except the area within 20 inches of the curb, or gutter to a uniform texture. Ensure the surface has a finished texture with groove width between $^{1}/_{10}$ inch and $^{1}/_{8}$ inch at between $^{5}/_{64}$ inch and $^{1}/_{8}$ inch apart. Make the grooves no less than $^{1}/_{32}$ inch or more than $^{1}/_{8}$ inch in depth. Ensure the actual textured surface in any selected 1.5 feet by 100 ft longitudinal strip is no less than 95% of the surface area. The Engineer will not include areas directly adjacent to expansion joints if it has been agreed that texture planing of those areas will result in damage to the expansion joint device or plow finger straps.

Perform planing in a manner that will provide a smooth riding surface at expansion joints and at the ends. After completion of the planing, the permissible surface deviation will be $^{1}/_{8}$ inch in 10 ft measured with a straightedge laid longitudinally and $^{1}/_{8}$ inch in 3 ft measured transversely at right angles to the centerline of roadway. **In all areas of the exposed deck, the Contractor will be required to provide positive drainage (including the 20 inches of unplaned gutter).** A small walk-behind grinder may be required to remove high spots along the gutter.

Perform the slurry management per (1717) AIR, LAND, AND WATER POLLUTION (CONCRETE GRINDING) of the "S" section of this contract.

A. Method of Measurement

The Engineer will observe the planing and any damage, including coating damage, to the expansion joint devices, plow finger straps, and deck drains will be corrected or will be removed and replaced as unacceptable work, as directed by the Engineer. If the Engineer does not direct either repair or replace of the unacceptable

work, the Contractor may leave the work in-place and the Engineer will adjust the contract unit price of the affected items by 50 percent. Install modular expansion joint devices after texture planing.

Measurement will be made to the nearest square foot of concrete area planed and textured based on surface area. Areas not texture planed will be deducted from the plan quantity unless the surface in any selected 1.5 feet by 100 ft longitudinal strip is at least 95% textured.

The Engineer will measure the surface of the finished concrete and all planed areas not meeting the requirements may, at the Engineer's option, be re-planed, be replaced as unacceptable work, or left as is and accepted for payment subject to a price reduction of 50 cents per sq ft but, in all cases, provide positive surface drainage.

B. Basis of Payment

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.

SB2020-2405.0

Use on all Prestressed Beam Jobs.

CREATED 11/17/1988
REVISED 3/20/2021 (11)

SB-8 (2405) PRESTRESSED CONCRETE BEAMS

The provisions of 2405, "Prestressed Concrete Beams," are supplemented with the following:

A. Construction Requirements

The provisions of 2405.3F, "Tensioning," are modified with the following:

Delete the contents of 2405.3F.2, "General Procedures," and replace with:

Conduct the tensioning procedure so that it is possible to compare the indicated force in the strands based on gauge pressures and the indicated force based on the corresponding elongation of the strands at any time during the tensioning operation. If the two indicated forces, corrected for friction loss, differ by no greater than 5 percent, stress the strands so the lower of the two indicated forces equals the required tension in the strand. Do not tension any strands to an indicated force greater than 80 percent of its specified minimum breaking strength at any time. If the indicated forces differ by greater than 5 percent, stop tensioning operations. Determine the source of the discrepancy and correct it before resuming tensioning operations.

When the tensioning operation includes more than two girders with all deflection points included, demonstrate proper tension at both ends. When tensioning more than four girders with all deflection points included, measure and ensure proper elongation on the interior girders that are more than one girder from an end.

Do not tension prestressing strands in a bundled position with direct contact between adjacent strands. Maintain a clear space of at least ¼ inch between adjacent strands during tensioning. Depress tensioned strands into a bundled position after the completion of tensioning.

Record the gauge pressures, indicated forces, and elongations, and submit the record to the Materials Engineer.

The Contractor may tension strands as a group if the strands in the group are from the same manufacturer and the strands receive the same initial tension. When tensioning, consider initial strand tension no greater than 150 lbs. per strand to be zero tension. If the contract requires an initial tension greater than 150 lbs. per strand, use a dynamometer to measure the tension. Add the elongation due to the initial tension to the final elongation measurement.

Tension the deflected strands so that final tension is uniform in all parts of the strand. Provide freely turning rollers to reduce frictional forces at the deflection points.

Correct tension and elongation measurements for losses due to slippage of grips or anchorages, and friction to ensure the prestress force shown on the plans is met.

When tensioning strands, make temperature corrections using the temperature of the strand at stressing and 95°F for the temperature when concrete bonds to the strand for the tensioning correction. If a temperature differential in the strands at the time of tensioning and 95°F exceeds 14°F, consider the change in the final elongation measurements to obtain the required prestress force at the time of casting. Base the change in elongation due to temperature on 1/8 inch per 100 feet of strand length for each 15°F variation in temperature. Tension prestressing strands when the ambient air temperature and prestressing strand temperature are greater than 32°F and will not fall below 32°F at any point.

SB2020-2405.2

Use on all Prestressed Beam Jobs with "I" shaped beams.

CREATED 1/18/2013
REVISED 11/1/2019 (15)

SB-8.1 Beam Camber and Deflection

Add the following 2405.3J.1, "Beam Camber and Deflection," after the last paragraph of 2405.3J, "Marking, Handling, Storage, and Transportation,":

J.1 Beam Camber and Deflection

The Erection Camber dimension shown in the Plans is the computed beam camber at midspan based on a time lapse of 30 to 180 calendar days after release of the prestressing strands. This camber may vary by + 1 inch and is intended to advise the Contractor as to the expected camber at the time of deck forming. A positive (+) dimension indicates upward camber.

To help control camber, schedule fabrication of prestressed concrete beams between 30 and 180 calendar days prior to slab placement on the erected beams. For projects where the slab is placed; a) before the

beams are 30 calendar days old, or b) after the beams are 180 calendar days old, the Contractor is responsible for controlling the beam camber and all associated costs, including but not limited to:

- bridge and roadway slab materials,
- form adjustments required to maintain specified steel reinforcing bar clearances and deck profiles,
- beam seat adjustments,
- application of load to the beams, and
- any additional expenses in connection with accommodating insufficient or excess beam camber.

Record the date and camber of each beam at the following times:

1. Initial – Just prior to removal of the beam from the casting bed; and
2. During Storage – At a frequency not to exceed 60 calendar days, and within a time frame of 7 to 21 calendar days prior to shipment.

In addition, record the date and camber of each beam if the support or bunking point (distance from point of support to end of beam) changes by more than 2 feet during storage (except during shipping to the job site).

Record the initial camber on the casting bed, just prior to lifting or removal of the beam from the bed.

Measure beam camber as the vertical dimension between the top of the beam at midspan and a theoretical line at the top of the beam between centerline of bearings.

Perform and record each check at a time when the camber and alignment of the beam is not influenced by temporary differences in surface temperature. Make these records available for the Engineer's inspection and include in the "Record of Camber" (see attached sheet) document for each beam. Immediately notify the Materials Engineer and Bridge Construction Unit if any of the recorded cambers (other than initial) are outside a range of + 1 inch of the Erection Camber dimension shown in the Plans. At the time of shipment, provide the "Record of Camber" document for each beam to the Materials Engineer and the Engineer.

To help control camber, place 30MH, 35MH, 40MH, 27M, 36M, and MN45 beam shapes on storage bunks with at least 2 feet and no more than 4 feet of beam end overhang. Place beams with a design height exceeding 45 inches on storage bunks with at least 3 feet and no more than 6 feet of beam end overhang. Place all beams within the same span and for each bridge, on storage bunks with beam end overhangs that differ by no more than 2 feet from one another. Include the location of the bunk or support point from the end of the beam on the "Record of Camber" for each end of each beam.

If it is anticipated that the beams will be older than 180 calendar days at time of slab placement, the Contractor shall submit calculations to the Engineer showing the estimated beam camber and the residual camber at midspan, at the beam age anticipated at time of slab forming and at time of deck placement (if more than 45 calendar days after slab forming). Include in the submittal the Contractor's proposal for accommodating or preventing any excess camber in the construction, including but not limited to; increased frequency of camber measurement, potential changes to beam seat elevations, etc.

Take elevations at top of beams after erection and allow for deflection shown to enable building deck forms to correct grade and specified slab thickness. Take elevations no more than 45 calendar days prior to slab placement.

Record of Camber (V3 -06/18/13)

Fabrication Company: _____

Bridge No.: _____ **Beam Size:** _____

S.P. or S.A.P. No.: _____

Fabrication Date: _____ **Date Shipped:** _____

Unique Beam ID (Per Fabricator)	Beam No. From Framing Plans	Erection Camber Shown in Plans	Beam Length (Feet-Inches) (i.e. 101'-7")	Camber Measurement Date	Beam Age (Days)	Camber at Midspan (Inches)*	Method Used**	Bunking Distance From "X" End (Feet-Inches)	Bunking Distance At Opposite End (Feet-Inches)	Measured By (Initials)
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***Beam camber shall be measured as the vertical dimension between the top of the beam at midspan and a theoretical line at the top of the beam between centerline of bearings. Immediately notify the Materials Engineer and Bridge Construction Unit if any of the recorded cambers (other than initial) are outside a range of ± 1 inch of the Erection Camber dimension shown in the Plan.**

****Indicate the method used to measure the camber, i.e. Stringline, Survey instrument, etc.**

Notes:

SB2020-2405.4

Use on all prestressed I-beam projects.

CREATED 10/8/2003
REVISED 6/2/2015 (4)

SB-8.2 Prestress Transfer of I Shaped Beams

The Fabricator of prestressed concrete beams must closely monitor the ends of the beams during the strand release process. The following sequence of releasing the individual prestressing strands is 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 2405.3G, "Prestress Transfer," and replace with the following:

Conduct prestress transfer 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. Perform the sequence of individual prestressing strand release in accordance with the following criteria, unless different criteria are approved by the Engineer.

1. Beginning with the *straight* strands closest to the vertical axis of the beam and in the second row from the bottom of the beam, release the strands each side of center. Move two columns away from this column in the same row and release the strand on each side of the center. Then proceed to the outermost strands in this row and release the strand on each side of the center. Repeat the sequence for the third and subsequent rows from the bottom upward until approximately one-fourth of the straight strands have been released.
2. Release approximately one-half (+/- one strand) of the *draped* strands alternating about the vertical axis, starting from the bottom.
3. Release the hold-down anchors for the draped strands.
4. Release the remainder of the *draped* strands alternating about the vertical axis.
5. Release the remainder of the *straight* strands beginning with the strand in the bottom row nearest the vertical axis. The strands are released alternating each side of the center. Release all the strands in that column moving upward. Proceed two columns away from this column and release the strands bottom to top alternating each side of the center. Next, move to the outer most column and release strands bottom to top continuing to alternate each side of the center. Release the remainder of the strands bottom to top starting with the innermost column alternating each side of the center.

Once release has started, release all strands of that beam in the sequence described above even if cracking is noticed near the end of the beam. Notify the Engineer immediately of any cracking, and do not fabricate other beams with the same strand pattern until the Engineer has approved a revised release sequence.

SB2020-2405.6

Use for prestressed I-beam shapes (30MH, 35MH, 40MH, 36M, MN45, MN54, MN63, 82MW, 96MW). This SP is not intended to be used for 27M beams so DO NOT USE THIS SECTION IF 27M is the only size. If there are different beam sizes as stated above and including 27M, then incorporate the paragraph referenced by the designer note below.

CREATED 6/2/2015
REVISED 7/22/2019 (5)

SB-8.3 Prestressed Concrete Beam End Zone Crack Repair

Add the following as 2405.3I.1, "End of Beam Cracking and Repair":

The Fabricator of the Prestressed Concrete Beam (PCB) is responsible for evaluating, supplying the products, and their application per the following:

Use feeler gauges to measure cracking in the beams. Report any cracks that appear to be perpendicular to the draped strands to the Department Precast Inspection Engineer, who will evaluate the cracks perpendicular to the draped strands and give further direction to the Fabricator.

1. Reject PCB with cracks exceeding 0.050 inches.

2. Fill PCB cracks ranging in width from 0.025 inches to 0.050 inches using epoxy injection, approved by the Department Materials Engineer.

   Follow these directions for Epoxy injection:

   a. Within 48 hours of application, clean the crack area of any loose debris such as dirt, dust, curing compounds, waxes, laitance, oil, grease, or other contaminants with an oil free 125 psi compressed air blast leaving only clean sound concrete. No water washing is allowed,
   b. Ensure the epoxy injection is performed by a trained, approved, and certified applier of the manufacturer of the epoxy meeting these specifications. Training curriculum shall consist of the theory behind the causes of cracking, selection of materials, and injection technology including flow rates, operating pressures, and temperature effects,
   c. The applier shall submit for review by the Department Materials Engineer, a written description of the proposed epoxy materials, their acceptable approvals, and the injection procedure, at least 7 calendar days prior to proceeding. Include in the list the repair work proposed for each item,
   d. Utilize an epoxy injection system approved in writing by the Department Materials Engineer,
   e. The certified applier is responsible for crack preparation. Determine the exact location and length of the crack to be injected. Clean the crack and the adjacent surfaces or other areas of application of paint, dirt, dust, grease, oil, efflorescence, or other foreign matter detrimental to bond of epoxy injection surface seal system using a grinding wheel, wire brush, and compressed air. Open crack walls slightly along its length with a small crack chaser blade if the crack walls remain contaminated. Acids and corrosives are not permitted for cleaning, and
   f. Inject the approved system as recommended by the manufacturer.

Then apply Euclid Dural Prep AC or BASF MasterSeal 630 to the ends and the sides of the PCB (no coating applied to the top of the top flange or bottom of the bottom flange) for the greater of the following lengths, end four feet or from the end of the beam to the end of the furthest crack. Prepare and apply per the manufacturer's recommendations and as approved by Department Materials Engineer.

3. Fill girder cracks ranging in width from 0.012 inches up to 0.025 inches with Hilti RM 800. Follow these directions for packing the Repair Mortar:

   a. Within 48 hours prior to this application, clean the crack area of any loose debris such as dirt, dust, curing compounds, waxes, laitance, oil, grease or other contaminants with an oil free 125 psi compressed air blast leaving only clean sound concrete. No water washing is allowed and do not apply moisture to crack prior to mortar repair,
   b. Pack Hilti RM 800, a Portland cement based repair mortar, along the entire length of each crack, filling the voids of the crack, and
   c. Mix and apply the material per the manufacturer's recommendation, and as approved by Department Materials Engineer.

Then apply Euclid Dural Prep AC or BASF MasterSeal 630 to the ends and the sides of the PCB (no coating applied to the top of the top flange or bottom of the bottom flange) for the greater of the following lengths, end four feet or from the end of the beam to the end of the furthest crack. Prepare and apply per the manufacturer's recommendations and as approved by Department Materials Engineer.

4. Do not fill girder cracks less than 0.012 inch width but apply either Euclid Dural Prep AC or BASF MasterSeal 630 to the PCB sides and end (no coating applied to the top of the top flange or bottom of the bottom flange) for the greater of the following lengths, end four feet or from the end of the beam to the end of the furthest crack. Prepare and apply per the manufacturer's recommendations and as approved by Department Materials Engineer.

5. If there are no visible cracks, apply either Euclid Dural Prep AC or BASF MasterSeal 630 to the PCB sides and end (no coating applied to the top of the top flange or bottom of the bottom flange) four feet of the beam. Prepare and apply per the manufacturer's recommendations and as approved by Department Materials Engineer.

Make repairs at least three days after prestress transfer has been made, but no sooner than 3 weeks before shipping to site, unless approved by the Department Precast Inspection Engineer.

Give the Department Materials Engineer the opportunity to monitor all end of beam repair work.

The contract unit price for "PRESTRESSED CONCRETE BEAMS 27M" includes the cost for all the above mentioned.

SB2020-2433.8 B

Use in conjunction with SB2020-2475, "Metal Railing," only when adhesive anchorages are allowed. Use on other projects utilizing threaded rod anchorages EXCEPT when used in conjunction with Bridge Detail B920.

CREATED 5/1/2018
REVISED 3/20/2021 (2)

SB-8.4 Threaded Rod Anchorages

Except when part of a proprietary anchorage assembly, ensure threaded rods and bolts meet the requirements of 3385, "Anchor Rods," and 3391," Fasteners," respectively.

The Contractor may substitute cast-in-place anchorages for adhesive anchorages. Prior to any substitution, the Contractor must:

- Establish a written procedure for the accurate placement of anchorages which will allow for easy installation of attachment and submit to the Engineer;
- Provide a design and specifications for an anchorage system of comparable or better strength and durability than the specified system and is compatible with the components of the attachment;
- Obtain written approval from the Engineer for the substitution; and
- Obtain written approval from the Engineer of Record for the substitution.

Proof loading of anchorages is waived for cast-in-place anchorages.

DO NOT substitute adhesive anchorages for cast-in-place anchorages if cast-in-place anchorages are specified in the plan.

Ensure bolt heads and/or nuts are in contact with the adjacent surface and torqued to

- $^1/_2$ inch diameter = 30 ft pounds
- $^5/_8$ inch diameter = 60 ft pounds
- $^3/_4$ inch diameter and larger = 80 ft pounds

unless a different torque is recommended by the manufacturer.

A. Post-Installed Anchorages

Furnish and install a post-installed threaded rod anchorage system of the type, shape and size specified, and its satisfactory placement at the locations indicated in "Table 1 – Anchorage Location and Testing Frequency – Method 1".

Adhesive anchorages consist of a continuously threaded rod secured by an approved adhesive, as per the plan.

Adhesive anchorage installers must hold current ACI Adhesive Anchor Installer Certification credentials. Installers are required to check depth, diameter and condition of the drilled hole, clean the hole, and install the anchorage per the Manufacturer's Printed Installation Instructions (MPII). Record the name(s) of all certified installers on the *RECORD OF CONTRACTOR/INSTALLER ACI CERTIFICATION* form available on the www.dot.state.mn.us/bridge/construction.html under "Construction forms and tools".

Prior to installation coordinate a Pre-installation meeting. Include the Engineer, Inspectors, and Installers in the meeting to review the installation process and requirements. At the Pre-installation meeting, submit the following to the Engineer:

- RECORD OF CONTRACTOR/INSTALLER ACI CERTIFICATION form with a copy of each installer's ACI Adhesive Anchor Installer Certification card;
- A copy of the Independent Third Party Inspector's ACI Adhesive Anchor Inspector Certification card;
- Printed copy of the MPII; and
- Verification that the adhesive has an uncracked characteristic bond strength as specified in the plan.

Furnish only one of the systems listed on the Department's "Approved/Qualified Products List for Bridge Products, Concrete Anchorages – Threaded Rod Applications," (www.dot.state.mn.us/products). Verify that the adhesive has an uncracked characteristic bond strength as specified in the plan.

Meet the following conditions prior to installation and testing:

- Concrete is greater than 14 days old;
- Concrete surface is free of water prior to drilling;
- The hole is dry, as defined below; and
- Any additional requirements listed in the Manufacturer's Printed Installation Instructions.

A dry hole is defined as: *a hole with no water present within the hole*. If the hole is filled with water, partially filled with water, or water entered the hole during drilling, blow out the water using compressed air and allow a minimum of 24 hours dry-out time before cleaning the hole and installing the anchorage.

Install all anchors as specified by the MPII. Install in sound concrete to a depth equal to the minimum depth specified in the plan or as specified by the manufacturer, whichever is greater.

It is essential that the adhesive material completely fill the hole in the concrete for proper anchorage performance. Ensure that the hole is completely filled to the top of the concrete surface in which the anchorage is installed. Do not permit the adhesive to overtop the concrete surface in a way that will interfere with the placement of the elements.

A1. Testing of Post-installed Anchorages

Perform all testing by an independent third party testing agency. Testing agent must have current ACI Adhesive Anchor Inspector Certification credentials.

Verify the anchor strength and installation procedures by proof testing anchorages in accordance with this specification. Perform all testing in accordance with ASTM E488, *Standard Test Methods for Strength of Anchors in Concrete Elements*. Set up the tension testing device such that no portion of the device bears on the concrete surface within a distance equal to one and a half times the anchorage embedment depth. Test anchorages to not less than the required proof load as provided in the plan (if no anchor proof load is provided in the plan, contact the Engineer). Consider an anchorage to pass proof load testing if it can sustain the proof load for a minimum of 60 seconds prior to release of tension load. Failure criteria of an anchorage test is defined in ASTM E488.

Ensure that nothing interferes with the testing apparatus during the proof test. Do not perform any caulk prior to testing.

Verify the anchor strength and installation procedure using one of the two following methods:

1. Demonstrate the anchorage system at the first site of field installation. Five passing demonstrations are required to be able to move to the remaining production anchorage installations. Include a proof test in each demonstration installation. Failure of a proof test will require a modification of installation procedures or use of a different anchorage system and an additional five demonstrations of the modified or substituted system. Demonstration anchorages may be used as production anchorages, however, when using anchorages to attach ornamental metal railing or chain link fencing, no more than one demonstration may occur at any given post location. The Contractor assumes all liability for repairs that may need to be performed as a result of a failed test. Record all demonstration results on the *PRE-PRODUCTION ANCHORAGES QUALIFICATION TEST REPORT* available on the www.dot.state.mn.us/bridge/construction.html under "Construction forms and tools," and furnish the original of the completed form to the Engineer.

   In addition to the five demonstrations stated above, test the number of anchorages in each location as indicated in Table 1 (see below) at a later date. The Engineer will randomly select the locations of the additional anchors to be tested. If a failure occurs while testing anchorages, more testing at the location in which the failure occurred will be required at the rate indicated in Table 1, per each failure, at no additional cost to the Department. If the number of anchorages at a given location failing in concrete breakout exceed the maximum number of failures permitted in Table 1, stop testing, notify the Engineer, and provide a non-conformance anchorage replacement plan, to be accepted by the Engineer. Once accepted by the Engineer, remove and replace the remaining untested anchorages according to the approved plan and test anchorages as outlined in this provision. Concrete breakout failure is defined as: *a spall a minimum of two inches in diameter by one inch deep*. Furnish a completed original of the *PRODUCTION ANCHORAGES QUALIFICATION TEST REPORT* available on the www.dot.state.mn.us/bridge/construction.html under "Construction forms and tools," to the Engineer. No Ultrasonic Testing of anchorages need be performed.

Table 1 – Anchorage Location and Testing Frequency – Method 1

Location	Initial Production Anchorage Test	Additional Tests per Failure	Max Number of Breakout Failures
Ornamental Railing Type Special	27	27	13

2. Install all production anchorages. Test the number of anchorages in each location as indicated in Table 2 (see below) at a later date. The Engineer will randomly select the locations of the anchors to be tested. If a failure occurs while testing anchorages, more testing at the location in which the failure occurred will be required at the rate indicated in Table 2, per each failure, at no additional cost to the Department. If the number of anchorages at a given location failing in concrete breakout exceed the maximum number of failures permitted in Table 2, stop testing, notify the Engineer, and provide a non-conformance anchorage replacement plan, to be accepted by the Engineer. Once accepted by the Engineer, remove and replace the remaining untested anchorages according to the approved plan and test anchorages as outlined in this provision. Concrete breakout failure is defined as: *a spall a minimum of two inches in diameter by one inch deep*.

   In addition to the proof load testing above, perform Ultrasonic Testing (UT) to verify anchorage embedment on the proof loaded anchorages. Also perform UT on an additional number of anchorages as indicated in Table 2 randomly selected by the Engineer. If any anchorage fails the UT, test an additional number of anchorages as indicated in Table 2. At the Contractors option, remove and replace all anchorages that fail UT or proof load test all anchorages that fail UT. Ultrasonic Testing failure is defined as: an anchorage measured to have an embedment more than ½ inch shorter than the required installation embedment. Furnish a completed original of the *PRODUCTION ANCHORAGES QUALIFICATION TEST REPORT* available on the www.dot.state.mn.us/bridge/construction.html under "Construction forms and tools," to the Engineer.

Table 2 – Anchorage Location and Testing Frequency – Method 2

Location	Initial Production Anchorage Test	Additional Tests per Failure	Max Number of Breakout Failures	Number of Ultrasonic Tests
Ornamental Railing Type Special	32	32	13	13

Notify the Engineer immediately after any failure. Provide a non-conformance anchorage replacement plan, to be accepted by the Engineer. Once accepted by the Engineer:

- Remove all anchorages that fail the field test without damage to the surrounding concrete;
- Redrill holes to remove adhesive bonding material;
- Install replacement anchorages in accordance with the MPII; and,
- Test anchors using one of the two methods listed above.

Perform replacement of failed anchorages to the satisfaction of the Engineer and at no cost to the Department.

B. Basis of Payment

Payment for all costs of furnishing, testing, and installing the anchorages is included in payment for Metal Railings.

SB2020-2451.0

CREATED 2/15/1978
REVISED 6/2/2015 (2)

SB-9 (2451) STRUCTURE EXCAVATIONS AND BACKFILLS

The provisions of 2451, "Structure Excavations and Backfills," are supplemented as follows:

SB2020-2451.1

Use where excavation is lump sum. Not to be used where rock excavation may be encountered.

CREATED 8/1/1994
REVISED 6/2/2015 (4)

SB-9.1 Structure Excavation

Excavate, sheet, shore and/or protect, prepare foundation, and place backfill necessary for construction of Bridge(s) No 27138, which are not specifically included in the grading portion of the Contract. Dispose of surplus material.

Do not measure the excavated or backfill material. All work performed as specified above will 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 27138	Each Abutment 40%
	Each Pier 20%

SB2020-2471.0

Use on all jobs requiring 2471.

CREATED 9/15/2015
REVISED 3/20/2021 (6)

SB-10 (2471) STRUCTURAL METALS

SB-10.1 ***The section of 2471.3C.3, "Submittal for Engineer's Review and Approval," is modified with the following:***

Submit shop drawings from Fabricators directly to the MnDOT Bridge Office

MnDOT Bridge Office
Fabrication Methods Engineer
3485 Hadley Ave. North
Oakdale, MN 55128

Add the following to section 2471.3G.1, "General":

Artificial cooling of any production welds will not be allowed.

The section of 2471.3M.1.a(1), "General," is replaced with the following:

Use personnel certified as an American Society for Nondestructive Testing (ASNT) NDT Level II operator and qualified in accordance with *ASNT-TC-1A.*

SB2020-2473.0

Use when Expansion Devices or Modular Bridge Joint Systems are required.

CREATED 6/5/1996
REVISED 3/20/2021 (15)

SB-11 (2473) EXPANSION JOINT DEVICES

The provisions of 2473, "Expansion Joint Devices," are supplemented with the following:

Add the following to 2473.3A, "General":

The Department will invoke its Corrective Action Process if the routine inspections or audits indicate non-conformance. Any and all corrective actions deemed appropriate by the Engineer, are effective immediately and apply to any work remaining on a current project and all future projects. If the Engineer determines that work does not comply with the QM or that fabrication does not follow approved fabrication procedures, the Engineer will deem the materials as non-conforming in accordance with 1503, "Conformity with Contract Documents," and 1512, "Unacceptable and Unauthorized Work." If the Engineer finds non-conforming work, direct the supplier to immediately correct the procedure and submit a written non-conformance report, containing data required by the Engineer to ensure compliance with the QM, specifications, and drawings. Perform additional testing as required by the Engineer at no additional cost to the Department. For repeat offences or negligence, the Department will

require corrective action of hiring a third party Quality Control Inspector at no additional cost to the Department. A copy of the Department's Corrective Action Process may be obtained from the Engineer.

SB2020-2475.0

Include on all jobs with Metal Railing, except chain link fence. Final coating such as galvanized only, duplex coatings (powder coating or wet paint), or three-coat wet paint system is designated within. Include SB2020-2433.8 B when adhesive anchorages are allowed.

CREATED 03/20/2021
REVISED 03/20/2021

SB-12 (2475) METAL RAILING

The provisions of 2475, "Metal Railing," are supplemented as follows:

SB-12.1 ***The section of 2475.3B, "Fabrication and Inspection Requirements," is modified with the following:***

Fabricator shall supply QA/QC documentation to the Engineer and Metal Railing Installer 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.

SB-12.2 ***Add section 2475.3D, "Coating Requirements":***

Apply powder coating systems to the metal railing in accordance with applicable provisions of 2477, "Powder Coating," and associated special provisions. The finish color is defined in the special provisions for 2477.

SB-12.3 ***Add section 2475.3E, "Anchorage Requirements":***

Furnish and install a threaded rod anchorage system of the type, shape, and size specified in the Plan. The installation method, cast-in-place or adhesive, is specified in the Plan.

Ensure bolt heads and/or nuts are in contact with the adjacent surface and torqued to

- $^{1}/_{2}$-inch diameter = 30 ft pounds
- $^{5}/_{8}$-inch diameter = 60 ft pounds
- $^{3}/_{4}$-inch diameter and larger = 80 ft pounds

unless a different torque is recommended by the manufacturer or the Plan.

A. Cast-in-place anchorages

DO NOT substitute post-installed adhesive anchorages for cast-in-place anchorages if cast-in-place anchorages are specified in the plan.

Provide the Engineer with a QA/QC plan that will be used to ensure that the cast-in-place anchorages are installed in the correct location using templates or other means ensuring that the exposed threads of the anchorages will not be damaged or contaminated and that the anchorages will not be displaced or allowed to move during concrete placement.

If cast-in-place anchorages have been installed in the forms, but prior to placing the barrier concrete, the Contractor shall provide written documentation verifying that all of the anchorages are within the necessary tolerances to place the tubular railing without modifying the railing base plate configuration.

B. Adhesive anchorages

Refer to SB-8.4, "Threaded Rod Anchorages."

SB-12.4 *Add section 2475.3F, "Installation Requirements":*

SPECIAL ALERT: All hardware, fasteners, anchorage nut, washer, and threaded rod stick out, used to install metal railings in the field will no longer be required to be field coated after installation per 2478.3H, "Fasteners" or 2479.3H, "Fasteners".

Adjust the steel posts to obtain the grade and alignment as shown in the plans using the following method:

Shim the steel posts with galvanized steel shims or washers to the proper grade and alignment, not to exceed $^1/_4$ inch of shim height. Before attaching the nuts, **coat the entire surface between the base plate and concrete rail with an approved "Silicone Joint Sealant," as found on the Department's Approved Products website**. Tighten the anchor rod nuts as per 2475.3E and neatly smooth the caulk around the perimeter of the rail post base plate.

Ground all metal railings. Note that any powder-coating or wet-paint coating, will create a break in electrical continuity. Install all electrical grounding in accordance with the applicable provisions of 2557, "Fencing," and the National Electrical Code. Clamp or braze the ground wires to the grounding device, then practicably route and attach to the nearest rail by clamping, brazing, or any other approved means that will provide a permanent positive connection. If rail has non-continuous sections, use a #6 AWG solid copper wire to connect adjacent railing panels.

If the bridge does not include exposed electrical equipment, then ground the rails at points directly below or adjacent to the railing at all abutment corners. Ensure the grounding system consists of a #6 AWG solid copper wire connected to the railing which in turn is connected to a copper coated steel rod having a nominal diameter of $^{5}/_{8}$ inch or more and a minimum length of 8 feet installed to an elevation approximately flush with the ground surface.

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

SB2020-2477.0

Use on all projects that include powder coating of galvanized steel elements.

CREATED 3/20/2021
REVISED 3/20/2021

SB-13 (2477) POWDER COATING

The provisions of 2477, "Powder Coatings," are supplemented with the following:

Add the following after the second paragraph of 2477.2, "Materials":

The color of the ornamental railings finish coat must match Federal Standard RAL K5 Classic No. 6005 (Forest Green) and have a semi-matt finish.

SB2020-2545.0

Use on jobs where conduit systems are required.

CREATED 7/25/1991
REVISED 9/1/2017 (2)

SB-14 CONDUIT SYSTEMS

Furnish and install each Conduit System in accordance with the plans, approved erection drawing, the applicable requirements of 2545, "Electrical Lighting Systems," 2550, "Traffic Management System," 2565, "Traffic Control Systems," and the following:

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

Provide conduit hangers, clamps, straps, U-bolts, strut and bar supports, threaded rod, inserts and miscellaneous hardware in accordance with the NEC and 3805.2C, "Hangers and Supports for PVC Coated Hot Dipped Galvanized Rigid Steel Conduit" for hanging and surface mounted conduit.

Install the conduit hangers, clamps, straps, U-bolts, strut and bar supports, threaded rod, inserts and miscellaneous hardware as shown in the Plans and as approved by the Engineer. Ensure the installation allows for conduit expansion, contraction, and deflection. At time of installation, adjacent conduit sections to be coupled by fittings must be in true alignment.

Ensure fabrication and inspection of structural metals used for each Conduit System are in accordance with the applicable requirements of 2471, "Structural Metals".

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

Conform non-metallic conduit and fittings to the requirements of the NEMA Standards Publication No. TC 14, titled "Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings."

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

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

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

Each expansion fitting must be in accordance with 3839, "Conduit Expansion Fittings," and the plan, except that the fitting must provide for greater than 4 inches linear movement when required by the plans.

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

Furnish and seal any remaining conduit opening at the back face of each abutment with one of the materials listed on the Department's "Approved/Qualified Product Lists of Bridge Silicone Joint Sealants", after the conduit is in place.

All sidewalk or flush mounted junction boxes must be removable flange (NEMA 5) galvanized cast iron with checkered cast iron covers. Equip these junction boxes with $^{1}/_{2}$ inch diameter pipe drains. Each conduit entrance and the pipe drain entrance must be bossed and threaded to provide five full threads. Fasten the cover and flange with stainless steel screws. Equip the cover with pry bar slots and a neoprene gasket.

Include in each junction box conduit entrance an insulating bushing of the appropriate size.

SB2020-3348.0

Use this only for Prestressed Concrete Beam construction that requires MnDOT Grade 300 strand.

CREATED 2/9/2021
REVISED 2/9/2021

SB-15 (3348) SEVEN-WIRE STRAND FOR PRESTRESSED CONCRETE

Delete the entire contents of 3348, Seven-wire strand for prestressed concrete, and replace with the following:

3348.1 SCOPE

Provide the MnDOT Grade 300 seven-wire, uncoated, low-relaxation steel strand for prestressed concrete beam construction.

3348.2 REQUIREMENTS

Provide MnDOT Grade 300 steel strands meeting the requirements of *ASTM A416, Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete* with an ultimate tensile strength of 300,000 psi, based on the nominal area of the strand, except as detailed below:

Mechanical Requirements

Conduct tests for mechanical properties in accordance with the test methods of *ASTM A1061, Standard Test Methods for Testing Multi-Wire Steel Prestressing Strand*. Ensure the breaking strength of the finished strand conforms to the requirements prescribed in Table 1, Breaking Strength Requirements.

TABLE 1 - Breaking Strength Requirements

Nominal Diameter of Strand, inches	Minimum Breaking Strength of Strand, lbf	Steel Area of Strand, sq. inches	Weight of Strand lbs./1000 ft
0.600	65100	0.217	740

Measure yield strength in pounds at 1.0% extension under load. Ensure the minimum yield strength is at least 90% of the breaking strength listed in Table 1. Initial loads for the test and minimum yield strengths are listed in Table 2, Yield Strength Requirements.

TABLE 2 - Yield Strength Requirements

Nominal Diameter of Strand, inches	Initial Load, lbf	Minimum Load at 1.0% Extension, lbf
0.600	6510	58590

Dimensions and Permissible Variations

Express the size of the finished strand as the nominal diameter of the strand in inches.

Ensure the diameter of the center wire of any strand is larger than the diameter of any outer wire, in accordance with Table 3, Diameter Relation Between Center and Outer Wires.

TABLE 3 - Diameter Relation Between Center and Outer Wires

Nominal Diameter of Strand, inches	Minimum Difference Between Center Wire Diameter and Diameter of Any Outer Wire, inches
0.600	0.004

Ensure the MnDOT Grade 300 strand conforms to a size tolerance of +0.026, -0.006 inches from the nominal diameter measured across the crowns of the wires.

3348.3 SAMPLING AND TESTING

Submit two copies of the mill certificate, two copies of the stress-strain curve representing the lot, and steel strand samples to the Engineer. Provide mill certifications with bond strength test results representative of the current year's production, showing that the manufacturing process produces strand with a bond strength of at least 36,000 psi at a measured free-end slip no greater than 3/32 inch. Ensure a qualified independent testing laboratory performs or certifies bond strength tests. Perform bond strength tests on an embedment length of 18 inches in accordance with standard test procedures on file in the Department's Office of Materials.

SB2018-3394.0

Use on all jobs.

CREATED 8/30/2018
REVISED 3/20/2021 (1)

SB-16 (3394) GALVANIZED STRUCTURAL SHAPES

Add the following paragraphs to 3394.2, "Requirements":

It is the Galvanizer's responsibility to notify the Bridge Engineer at least 5 Working Days of intent to galvanize.

See 2452.3H.2, "Galvanized Piles," for hot-dipped galvanized (HDG) pile repair.

FOR STEEL INSTRUCTION PURPOSES ONLY

SB2020-2401.0

Use on all projects.

CREATED 8/3/1994
REVISED 2/22/2022 (16)

SB-1 (2401) CONCRETE BRIDGE CONSTRUCTION

The provisions of 2401, "Concrete Bridge Construction," are supplemented as follows:

SB2020-2401.3 B 2

Use for continuous steel girder structure ONLY when end span lengths are less than 80% of the adjacent span lengths.

CREATED 8/3/1994
REVISED 3/20/2021 (3)

SB-1.1 Beam Tie Downs for Slab Construction

The plans indicate that the bridge slab for Bridge No. _____ be placed in one continuous pour. In order to prevent uplift of the beams (during the placement of the concrete in the slab) at the abutment where the slab pour terminates, either counterweight or rigidly tie down the beams at that abutment before the placement of the concrete in the slab is started.

Counterweights or tie downs must resist an uplift of at least (3000) (_____) lbs. for each line of beams. Furnish to the Engineer, for acceptance, complete details of the proposed methods to use to hold down the beams at the location mentioned above. Do not remove counterweights or release tie downs until at least seventy-five (75) percent of the slab in the span where the devices are used is in place.

SB2020-2402.0

Use for all bridge projects where 2402 is required.

CREATED 7/29/2015
REVISED 9/1/2017 (3)

SB-2 (2402) STEEL BRIDGE CONSTRUCTION

The provisions of 2402, "Steel Bridge Construction," are supplemented with the following:

SB2020-2402.1

Use for all steel bridge projects with structural bolting.

CREATED 9/1/2017
REVISED 4/2/2018 (1)

SB-2.1 Connections Using High Strength Bolts

A. Bolted Connections

Prepare and install all bolted field connections for steel bridges using Direct Tension Indicator (DTI) washers. Ensure DTIs conform to the requirements of 3391, "Fasteners," and ASTM F959. All DTIs must have unique markings to indicate the gap locations between the protrusions and to allow the inspector to visibly differentiate them from a standard washer after installation. Mechanically galvanize supplied DTIs in accordance to 3392, "Galvanized Hardware".

Install fasteners in accordance with the DTI manufacturer's recommendations and 2402, "Steel Bridge Construction," as well as the requirements of AASHTO LRFD Bridge Construction Specifications, Third Edition, Article 11.5.6.4.7 Direct Tension Indicator Installation Method. Ensure a DTI manufacturer's representative is onsite at the beginning of the bolting operations to provide training and ensure proper installation.

Use of DTIs, as described above, are an incidental expense to the structural steel and no direct compensation will be made.

B. Precision Bolting Systems

To enable more accurate bolt tensioning, the Contractor **[may/will]** propose a precision bolting system. A precision bolting system is defined as the use of tools that have been calibrated to produce repeatable results in conjunction with an installation plan that addresses snugging and tensioning of a connection.

At least one week prior to the start of steel erection, but not prior to submittal of the job-specific fastener installation plan, provide on-site training to all personnel that will be operating the precision bolting system and the Engineer. The training will address the following:

(1) Procedures established in the job-specific fastener installation plan

(2) Instructions for operating the precision bolting system
(3) Acceptance criteria for the Direct Tension Indicator (DTI) washer based on the results of the Pre-Installation Verification (PIV) testing

Maintain a record of training of all personnel and make available to the Engineer upon request. Any person found operating the precision bolting system that has not completed the job-specific training will be removed from the project site until training requirements have been satisfied.

SB2020-2402.2

Use when detailed erection plans are required, as recommended by Regional Construction Engineer. This is intended for use when a bridge has unique geometry (i.e. high skews, long spans, significant curvature) or complex site constraints.

CREATED XX/XX/XXXX
REVISED XX/XX/XXXX (0)

SB-2.2 Erection Analysis and Plans

Delete the contents of 2402.3E.1, "Analysis and Plans", and substitute the following:

1 - DESIGNER NOTE: Include this special provision when there are unique circumstances around how the bridge will be erected. This may include work occurring over live traffic, railroads, navigable channels, or staged construction.

SB2020-2471.0

Use on all jobs.

CREATED 9/15/2015
REVISED 9/22/2022 (7)

SB-3 (2471) STRUCTURAL METALS

SB- The section of 2471.3C.3, "Submittal for Engineer's Review and Approval," is modified with the following:

Submit shop drawings from Fabricators directly to the MnDOT Bridge Office

MnDOT Bridge Office
Fabrication Methods Engineer
3485 Hadley Ave. North
Oakdale, MN 55128

Submit shop drawings from the Fabricator directly to

Add the following to section 2471.3G.1, "General":

Artificial cooling of any production welds will not be allowed.

The section of 2471.3M.1.a(1), "General," is replaced with the following:

Use personnel certified as an American Society for Nondestructive Testing (ASNT) NDT Level II operator and qualified in accordance with *ASNT-TC-1A.*

2 - DESIGNER NOTE: Use on weathering steel girder bridges when the fascia beam is unpainted.

Add the following to 2471.3K, "Uncoated Weathering Steel Surfaces":

(3) Uniformly spray full length all outboard steel surfaces of fascia girders/beams with clean potable water and allow to completely dry after blast cleaning prior to storing to accelerate formation of patina. Perform water spraying and drying in two repeated cycles using care to avoid puddling.

SB2020-2479.0

Use on new work only (shop prime and field paint). (See Structural Metals Engineer for paint system selection if unique conditions or applications are present).

CREATED 6/8/2005
REVISED 3/20/2021 (21)

SB-4 (2479) INORGANIC ZINC-RICH PAINT SYSTEM

The provisions of 2479, "Inorganic Zinc-Rich Paint System," are supplemented as follows:

2 - DESIGNER NOTE: For the following paragraph, use where beams are 3309, "High-Strength Low-Alloy Structural Steel," steel and are partially painted at bridge joints.

Paint in accordance with the provisions of 2479, "Inorganic Zinc-Rich Paint System," all structural steel and steel bearing assemblies for Br. No. _____ that are within 7 feet of the end of the beams or girders as measured along the centerline of the beams or girders. The fascia beams must be painted for their full length from end to end of bridge on the following designated surfaces:

- the outboard surfaces of the bottom of the top flange,
- the web,
- the top of bottom flange,
- the edge of the bottom flange,
- the bottom of the bottom flange,
- the inboard edge of the bottom flange.

3 - DESIGNER NOTE: For the following paragraph, use only when the District requires that all structural steel receive a full paint system (typical for 3309 steel is a partial paint system -- see memo by Gary Peterson dated 5/1/2006)

The work to be performed under this contract consists of painting all structural steel members, _____ of Bridge No. _____.

4 - DESIGNER NOTE: For the following TWO paragraphs, specify color.

Add the following to the first paragraph of 2479.3F.5, "Finish Coats":

The color must match AMS-STD-595A No. _____ (_____) and have a semi-gloss finish.