860-594-3150

January 11, 2001

Mr. Donald J. West
Division Administrator
Federal Highway Administration
628-2 Hebron Avenue, Suite 303
Glastonbury, Connecticut 06033

Dear Mr. West:

Subject: State Project No. 92-526
Federal Aid Project No. STPA-IBR-STPN-MGS-1092(110)
Church Street South Extension
City of New Haven

Forwarded herewith is a copy of Addendum No. 5 for the above-captioned project.

This Addendum is necessary to give bidders the option of metallizing or single dip galvanizing the structural steel (Segment 2), as well as to provide responses to contractor questions.

Please review this addendum and if found satisfactory, notify Mr. Brien Robertson so that he may make proper distribution.

Your early reply will be appreciated.

Very truly yours,

Joseph J. Obara, P.E.
Manager of Design Services
Bureau of Engineering
and Highway Operations

Enclosure

David A. Levesque/kac
bcc: Walter H. Coughlin
Arthur Gruhn - L. Brian Castler
Joseph J. Obara - Robert P. Raiola
Stephen M. Barton
Joseph DeMarco
Brien Robertson

860-594-3150

January 11, 2001

Mr. Donald J. West
Division Administrator
Federal Highway Administration
628-2 Hebron Avenue, Suite 303
Glastonbury, Connecticut 06033

Dear Mr. West:

Subject: State Project No. 92-526
Federal Aid Project No. STPA-IBR-STPN-MGS-1092(110)
Church Street South Extension
City of New Haven

Forwarded herewith is a copy of Addendum No. 5 for the above-captioned project.

This Addendum is necessary to give bidders the option of metallizing or single dip galvanizing the structural steel (Segment 2), as well as to provide responses to contractor questions.

Please review this addendum and if found satisfactory, notify Mr. Brien Robertson so that he may make proper distribution.

Your early reply will be appreciated.

Very truly yours,

Robert Raiola

Joseph J. Obara, P.E.
Manager of Design Services
Bureau of Engineering
and Highway Operations

Enclosure

David A. Levesque/kac
bcc: Walter H. Coughlin
Arthur Gruhn - L. Brian Castler
Joseph J. Obara - Robert P. Raiola
Stephen M. Barton
Joseph DeMarco
Brien Robertson

860-594-3150

January 11, 2001

Mr. Donald J. West
Division Administrator
Federal Highway Administration
628-2 Hebron Avenue, Suite 303
Glastonbury, Connecticut 06033

Dear Mr. West:

Subject: State Project No. 92-526
Federal Aid Project No. STPA-IBR-STPN-MGS-1092(110)
Church Street South Extension
City of New Haven

Forwarded herewith is a copy of Addendum No. 5 for the above-captioned project.

This Addendum is necessary to give bidders the option of metallizing or single dip galvanizing the structural steel (Segment 2), as well as to provide responses to contractor questions.

Please review this addendum and if found satisfactory, notify Mr. Brien Robertson so that he may make proper distribution.

Your early reply will be appreciated.

Very truly yours,

Joseph J. Obara, P.E.
Manager of Design Services
Bureau of Engineering
and Highway Operations

Enclosure

David A. Levesque/kac
bcc: Walter H. Coughlin
Arthur Gruhn - L. Brian Castler
Joseph J. Obara - Robert P. Raiola
Stephen M. Barton
Joseph DeMarco
Brien Robertson

860-594-3150

January 11, 2001

Mr. Donald J. West
Division Administrator
Federal Highway Administration
628-2 Hebron Avenue, Suite 303
Glastonbury, Connecticut 06033

Dear Mr. West:

Subject: State Project No. 92-526
Federal Aid Project No. STPA-IBR-STPN-MGS-1092(110)
Church Street South Extension
City of New Haven

Forwarded herewith is a copy of Addendum No. 5 for the above-captioned project.

This Addendum is necessary to give bidders the option of metallizing or single dip galvanizing the structural steel (Segment 2), as well as to provide responses to contractor questions.

Please review this addendum and if found satisfactory, notify Mr. Brien Robertson so that he may make proper distribution.

Your early reply will be appreciated.

Very truly yours,

Joseph J. Obara, P.E.
Manager of Design Services
Bureau of Engineering
and Highway Operations

Enclosure

David A. Levesque/kac
bcc: Walter H. Coughlin
Arthur Gruhn - L. Brian Castler
Joseph J. Obara - Robert P. Raiola
Stephen M. Barton
Joseph DeMarco
Brien Robertson

JANUARY 11, 2001
FEDERAL AID PROJECT NO. STPA-IBR-STPN-MGS-1092(110)
STATE PROJECT NO. 92-526

CONSTRUCTION OF CHURCH STREET SOUTH EXTENSION
OVER NEW HAVEN INTERLOCKING AND RAIL YARD
CITY OF NEW HAVEN

ADDENDUM NO. 5

SPECIAL PROVISIONS

REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted and replaced with the attached like-named Special Provisions:

SECTION 6.03 - STRUCTURAL STEEL
ITEM #521001A - ELASTOMERIC BEARING PADS
ITEM #522280A - ISOLATION BEARING ASSEMBLY
ITEM #603354A - STRUCTURAL STEEL (SEGMENT 2)

PLANS

REVISED PLAN SHEETS

The original plan sheets, numbered 1-1, 17, 138, 199, 212, and 220 are hereby deleted in their entirety and replaced with the attached like-numbered plan sheets.

QUESTIONS AND ANSWERS:

Q. Please reference drawing no. STR-76 & 77, showing floor beams with an FCM flag at the lower flange with no steel grade indicated. Please indicate steel grade for the floor beams and whether they are fracture critical material.

A. The FCM flag is explained on both sheets as "Indicates Fracture Critical Member". As such, on both sheets, the entire floor beam is a fracture critical member.

All steel members in Segment 2 shall be Grade 50 unless noted other wise. A note to this effect has been added to Dwg. STR-64, Truss Schedule, under Addendum No. 4. Please see Addendum No. 4 for details.

Q. Please reference drawing no. STR-78 showing stringers with no steel grade indication with the exception of note 6, which states that splice and filler plates to conform to ASTM A709 (GR 50). Please indicate steel grade for W21x111 stringers.

A. All steel members in Segment 2 shall be Grade 50 unless noted other wise. A note to this effect has been added to Dwg. STR-64, Truss Schedule, under Addendum No. 4. Please see Addendum No. 4 for details.

Q. We are assuming where no steel grade is indicated the steel grade is to be GR 50 as defined in note 1, drawing no. STR-65. Is this assumption correct?

A. All steel members in Segment 2 shall be Grade 50 unless noted other wise. A note to this effect has been added to Dwg. STR-64, Truss Schedule, under Addendum No. 4. Please see Addendum No. 4 for details.

Q. Please reference drawing no. STR-71 showing Lateral Plate in plan view. Please indicate the plate thickness and grade.

A. The thickness of the lateral plates has been added to Drawing STR-81, Bottom Lateral Bracing Details, under Addendum No. 4. All steel in Segment 2 shall be Grade 50 unless noted otherwise. See Dwg. STR-64, Addendum No. 4.

Q. On the drawings, sheet No. 17, at the pavement replacement detail the width "W" is shown to be "Dia + 35" for Dia 750 mm and over. Should this dimension be "Dia + 48" for 30" and over?

A. Yes. Refer to Revised Sheet No. 17 as provided by Addendum No. 5 to find that:
W = DIA. + 3'-0" FOR DIA. LESS THAN 2'-6"
W = DIA. + 4'-0" FOR DIA. 2'-6" AND OVER

Q. On sheet number 257 of the drawings within the high capacity crane area north of the oil storage facility there is a note "Yard Masters building to remain". Due to the conflicts with the work area required for the high capacity crane can this building be temporarily relocated?

A. Yes, however all costs associated with the relocation will be the responsibility of the Contractor and there will no disruptions allowed to the services provided by this building.

Q. The existing track number 7 (between piers 4 and 5) is electrified with overhead catenary. Due to the dimensions of the large equipment needed for this project and the need to transport the equipment under the catenary can the catenary wires be removed in this location for periods of time. If the wires cannot be removed can they be raised?

A. The overhead catenary wires at Track 7 (between proposed Piers 4 and 5) cannot be removed, nor can the wires be raised.

Q. All truss members are required to be hot-dip galvanized. We are having extreme difficulty in locating galvanizers that can handle the longest and heaviest members. Double-dipping will allow some sources to handle the larger sections, but this will increase the difficulty in controlling galvanizing thickness, especially at connections. Even with double-dipping, most galvanizers cannot handle the over-size members.

We offer the following:

Is it possible to provide an alternate panel point connection detail @ panel points L1, L3, L5 and L7 which would include a break in the bottom chord members at these points? This change would keep bottom chords lengths @ approx. 40' versus 80'.

Is it possible to provide an alternate bolted field splice in the floorbeams? Depth and weight will basically limit the galvanizing to a single source, and will be very cost prohibitive due to shipping considerations.

A. The Contractor shall provide all of the structural steel in Segment 2 with either a galvanized coating or a metallized coating. Whichever coating the contractor proposes to supply the structural steel in, all structural steel in Segment 2 shall have the same coating. The galvanized coating must be applied by a single-dip process that completely submerges the entire piece in the galvanizing bath. See the revised Special Provision "ITEM # 603354A-STRUCTURAL STEEL (SEGMENT 2) in this addendum.

Q. Are roadway stringer top flange shear connectors required to be galvanized? Even if not required, welding of studs after and thru galvanizing may be difficult and/or hazardous.

A. If the Contractor provides the structural steel in Segment 2 with a galvanized coating, then the shear connectors and the stringer shall be galvanized after the studs are attached to the stringer. If the Contractor provides the structural steel with a metallized coating, then the shear connectors and the stringer shall be metallized after the studs are attached to the stringer.

Q. The answer to the second question on page 5 of Addendum No. 2 states "The contractor is responsible for all other activities involving the excavated materials and water after the material is off-loaded" resulting from the utility companies operations. Is the contractor to be responsible for the cost of testing, maintaining of the material in the waste stockpile area, disposal of any controlled material, the transporting to the storage area of reusable controlled material, disposal of excess material which is not controlled material, and the handling of contaminated ground water, or will the cost be included under the items of payment? Should the cost be included under the items of payment, there is still an expense to the contractor to dispose of excess material offsite which is not classified as controlled material. In either case you have required the contractor to be responsible for an unknown quantity of material. Please clarify.

A. The contractor is not responsible for the cost of testing nor the physical testing of soils material. The contractor is responsible for maintaining the material in the waste stockpile area under the item "Controlled Materials Excavation", disposal of all controlled material under the item "Disposal of Controlled Materials", disposal of excess material which is deemed reusable on site but which cannot physically be reused on site, under the item "Disposal of Controlled Materials", and the handling of contaminated groundwater under the item "Handling Contaminated Groundwater". Then there is the item "Management of Re-Usable Controlled Materials" which allows the Contractor to get paid for reusing the material properly on site only after the Engineer has deemed the material reusable (after the Engineer characterizes it). All materials generated within project limits must be stockpiled by the Contractor at the waste stockpile area and characterized by the Engineer. The Engineer will then tell the Contractor if the material is controlled which must go off site or if it is deemed reusable within project limits. If material is classified by the Engineer as reusable but there is no area or all areas have been exhausted for the Contractor to reuse this material on site, then the material gets reclassified as a controlled material and the Contractor will get paid under the item "Disposal of Controlled Materials".

Q. Please verify if the bidders are to include the written proof required in the paragraph titled "Condition of Bid Acceptance" under Notice to Contractor – Erection of Structural Steel (Segment 2) of the Special Provisions with the bid.

A. This requirement in the paragraph "Condition of Bid Acceptance" under Notice To Contractor – Erection of Structural Steel (Segment 2) has been revised by Addendum No. 4. Please see Addendum No. 4 for the revised Notice to Contractor – Erection of Structural Steel (Segment 2).

Q. In the Special Provision for Item #603353A – Structural Steel (Segment 1 & 3), "Installation of work platforms/protective shielding over the railroad right of way for the purpose of deck forming ..." is mentioned. Will this work be needed for the entire length of segments 1 and 3 or only over any <u>active</u> tracks?

A. Work platforms/protective shielding will be required on Segments 1 and 3 over all existing tracks and all proposed tracks of the New Haven Rail Yard Projects noted on sheet STR-4, General Notes.

Q. Pages 9 – 11A of the Special Provisions (Notice to Contractor – Erection of Structural Steel Truss – Segment 2) includes the use of a single high capacity crane to erect Segment 2 and that alternative erection schemes will not be entertained. We have been contacted by a subcontractor that is proposing to use two cranes to erect Segment 2. Please advise if the use of two cranes to erect Segment 2 will be an acceptable method?

A. The use of two cranes to pick the steel truss of Segment 2 will not be an acceptable method. The erection sequence for the structural steel truss (Segment 2) includes the use of a single high capacity crane to lift and move the fully assembled truss segment to its final position. No Alternative Erection Schemes will be entertained for the erection of the structural steel truss (Segment 2).

The Detailed Estimate Sheets are not affected by these changes.

The Bid Proposal Form has been revised to reflect these changes.

There will be no change in the number of calendar days due to this addendum.

The foregoing is hereby made a part of the contract.

SECTION 6.03 - STRUCTURAL STEEL

Subarticle 6.03.03-8 - Plans: Add the following:

The Contractor shall not, under normal circumstances, request changes to the field splice locations shown on the plans which will result in shipping lengths and/or shipping weights that exceed the limits in Article 1.06.05.

If, during the course of the Contractor's review of the site in conjunction with the preparation of his steel erection plans, it is discovered that extenuating circumstances exist which could be mitigated by altering the location of field splices, the Contractor must bring this situation to the attention of the Engineer. Any request to alter field splice locations that would result in the fabrication of oversize members as defined in Article 1.06.05 must be submitted to the Engineer in writing. The Engineer shall submit the request to the designer and the Department's Motor Transport Services Unit for review and comments. The request must be made prior to the preparation and submittal of any shop drawings for review by the designer.

SECTION 6.03 - STRUCTURAL STEEL

Delete **Subarticle 6.03.03-19** - Bolted Connections and replace with the following:

19 - Connections Using High-Strength Bolts:

19 (a) General:

This Subarticle covers the assembly of structural joints using ASTM A325 or ASTM A490 high-strength bolts installed so as to develop the minimum required bolt tension specified in Table A.

19 (b) Bolted Parts:

All material within the grip of the bolt shall be steel, there shall be no compressible material, such as gaskets or insulation, within the grip. Bolted steel shall fit solidly together after the bolts are tensioned. The slope of the surfaces of parts in contact with the bolt head or nut shall not exceed 1:20 with respect to a plane normal to the bolt axis. The length of the bolts shall be such that the end of the bolt will be flush with or outside of the face of the nut when properly installed.

19 (c) Surface Conditions:

At the time of assembly, all joint surfaces, including surfaces adjacent to the bolt head and nut, shall be free of scale, except tight mill scale, and shall be free of dirt or other foreign material. Burrs that would prevent solid seating of the connected parts in the snug tight condition shall be removed.

Paint is permitted on the faying surface, including slip critical joints, when shown on the plans. The faying surfaces of slip-critical connections shall meet the requirements of the following paragraphs, as applicable:

(1) In joints specified to have un-coated faying surfaces, any paint, including any inadvertent over spray, shall be excluded from areas closer than one bolt diameter, but not less than one inch, from the edge of any hole and all areas within the bolt pattern.

(2) Joints specified to have painted faying surfaces shall be blast cleaned and coated in accordance with Article 6.03.03 - Construction Methods.

(3) Joints with coated faying surfaces shall not be assembled before the coating has cured for the minimum time used in the qualifying test.

(4) Faying surfaces specified to be galvanized shall be hot-dip galvanized in accordance with ASTM A123, and shall subsequently be roughened by means of hand wire brushing. Faying surfaces specified to be metallized shall be metallized in accordance with the Special Provisions and shall subsequently be roughened by means of hand wire brushing. Power wire brushing of either coating is not permitted.

19 (d) Installation:

(1) General: A "fastener assembly" is defined as a bolt, a nut, and a washer. Only complete fastener assemblies of appropriately assigned lot numbers shall be installed. Fastener assemblies shall be stored in an area protected from dirt and moisture. Only as many fastener assemblies as are anticipated to be installed and tensioned during a work shift shall be taken from protected storage. Fastener assemblies not used shall be returned to protected storage at the end of the shift. Fastener assemblies shall not be cleaned of lubricant that is required to be present in as-delivered condition. Fastener assemblies which accumulate rust or dirt resulting from site conditions shall be cleaned, relubricated and tested for rotational-capacity prior to installation. All galvanized nuts shall be lubricated with a lubricant containing a visible dye. Plain bolts must be oily to touch when delivered and installed. Lubricant shall be removed prior to painting.

A bolt tension measuring device (a Skidmore-Wilhelm calibrator or other acceptable bolt tension indicating device) shall be provided by the Contractor at all locations where high-strength fasteners are being installed and tensioned. The tension measuring device shall be used to perform the rotational-capacity test and to confirm (1) the suitability of the fastener assembly to satisfy the requirements of Table A, including lubrication if required, (2) calibration of the wrenches, if applicable, and (3) the understanding and proper use by the bolting crew of the method of tensioning to be used.

To perform the calibrated wrench verification test for short grip bolts, direct tension indicators (DTI) with solid plates may be used in lieu of a tension measuring device. The DTI lot shall be first verified with a longer grip bolt in the tension measuring device. The frequency of confirmation testing, the number of tests to be performed and the test procedure shall be as specified in Subarticles 19(d)(4) through 19(d)(6), as applicable. The accuracy of the tension measuring device shall be confirmed by an approved testing agency at least annually.

Complete fastener assemblies with washers of size and quality specified, located as required below, shall be installed in properly aligned holes then tensioned and inspected

by any of the methods described in Subarticles 19(e) through 19(g) to at least the minimum tension specified in Table A. Tensioning may be done by turning the bolt while the nut is prevented from rotating when it is impractical to turn the nut. Impact wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tensioning of each bolt in approximately 10 seconds.

Bolts shall be installed in all holes of the connection and brought to a snug condition. Snug is defined as having all the plies of the joint in firm contact. Bolt torquing to develop a snug condition shall progress systematically from the most rigid part of the connection to the free edges. The bolts of the connection shall then be retorqued in a similar manner as necessary until the connection is snug.

Nuts shall be located, whenever practical, on the side of the connection which will not be visible from the traveled way.

ASTM A490 fasteners and galvanized ASTM A325 fasteners shall not be reused. Other ASTM A325 bolts may be reused if approved by the Engineer. Touching up or retorquing previously tensioned bolts which may have been loosened by the tensioning of adjacent bolts shall not be considered as reuse provided the retorquing (snugging up) continues from the initial position and does not require greater rotation, including the tolerance, than that required by Table B.

(2) Rotational-Capacity Tests: Rotational-capacity tests are required and shall be performed at the location where the fasteners are installed and tensioned for all fastener assemblies. The following shall apply:

(a) Except as modified herein, the rotational capacity test shall be performed in accordance with the requirements of ASTM A325.

(b) Each combination of bolt production lot, nut lot and washer lot shall be tested as an assembly.

(c) A rotational-capacity lot number shall have been assigned to each combination of lots tested.

(d) The minimum frequency of testing shall be two assemblies per rotational-capacity lot.

(e) For bolts that are long enough to fit in a Skidmore-Wilhelm Calibrator, the bolt, nut and washer assembly shall be assembled in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device.

(f) Bolts that are too short to test in a Skidmore-Wilhelm Calibrator may be tested in a steel joint. The tension requirement of Section (g) need not apply. The maximum torque requirement, torque ≤ 0.25 PD, shall be computed using a value of P equal to the turn test tension (1.15 times the fastener tension in Table A).

(g) The tension reached at the rotation below (turn test tension) shall be equal to or greater than 1.15 times the required fastener tension (installation tension) shown in Table A.

(h) The minimum rotation, from an initial tension of 10% of the "Minimum Required Tension" listed in Table A, shall be two times the required number of turns indicated in Table B in a Skidmore-Wilhelm Calibrator or an equivalent device without stripping or failure.

(i) After the required installation tension listed above has been exceeded, one reading of tension and torque shall be taken and recorded. The torque value shall conform to the following:

$$\text{Torque} \leq 0.25\ PD$$

Where: Torque = measured torque (foot-pounds)
P = measured bolt tension (pounds)
D = bolt diameter (feet).

(3) Washer Requirements: All bolts shall have a hardened washer under the turned element (nut or bolt head), irrespective of the tension inspection method.

Where the outer face of the bolted parts has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a hardened beveled washer shall be used to compensate for the lack of parallelism. Hardened beveled washers for American Standard Beams and Channels shall be square or rectangular, taper in thickness and conform to the requirements of ASTM F436.

Where necessary, washers may be clipped on one side to a point not closer than 7/8 of the bolt diameter from the center of the washer. Circular and beveled washers, when used adjacent to direct tension indicator washers shall not be clipped. Direct tension indicator washers shall not be clipped.

Additionally, hardened washers shall be placed in connections as follows:

- Hardened washers shall be used under both the head and the nut when ASTM A490 bolts are to be installed in material having a specified yield point less than 40 ksi.

- Where ASTM A325 bolts of any diameter or ASTM A490 bolts equal to or less than one inch in diameter are to be installed in oversize or short-slotted holes in an outer ply, a hardened washer conforming to ASTM F436 shall be used.

- When ASTM A490 bolts over one inch in diameter are to be installed in an oversize or short-slotted hole in an outer ply, hardened washers conforming to ASTM F436 except with 5/16-inch minimum thickness shall be used under both the head and the nut in lieu of standard thickness hardened washers. Multiple hardened washers with combined thickness equal to or greater than 5/16-inch do not satisfy this requirement.

- Where ASTM A325 bolts of any diameter or ASTM A490 bolts equal to or less than one inch in diameter are to be installed in a long slotted hole in an outer ply, a plate

washer or continuous bar of at least 5/16-inch thickness with standard holes shall be provided. These washers or bars shall have a size sufficient to completely cover the slot after installation and shall be of structural grade material, but need not be hardened, except as follows. When ASTM A490 bolts over one inch in diameter are to be used in long slotted holes in external plies, a single hardened washer conforming to ASTM F436 but with 5/16-inch minimum thickness shall be used in lieu of washers or bars of structural grade material. Multiple hardened washers with combined thickness equal to or greater than 5/16-inch do not satisfy this requirement.

19 (e) Turn-of-Nut Inspection Method:

Verification testing using a representative sample of not less than three complete fastener assemblies of each diameter, length and grade to be used in the work shall be performed at the start of work in a device capable of indicating bolt tension. This verification test shall demonstrate that the method used to develop bolt tensions necessary to snug the condition and controlling the turns subsequently applied by the bolting crew develops a tension not less than five percent greater than the tension required by Table A. Periodic retesting shall be performed when ordered by the Engineer.

After snugging the connection, the applicable amount of rotation specified in Table B shall be achieved. During the torquing operation there shall be no rotation of the part not turned by the wrench. Torquing shall progress systematically from the most rigid part of the joint to its free edges.

19 (f) Calibrated Wrench Inspection Method:

Calibrated wrench inspection may be used only when wrenched are calibrated on a daily basis. Standard torques determined from tables or from formulas which are assumed to relate torque to tension shall not be acceptable.

When calibrated wrenches are used for installation, they shall be set to deliver a torque which has been calibrated to produce a tension not less than 5 percent in excess of the minimum tension specified in Table A. The installation procedures shall be calibrated by verification testing at least once each working day for each bolt diameter, length and grade using fastener assemblies that are being installed in the work. This verification testing shall be accomplished in a device capable of indicating actual bolt tension by tensioning three complete fastener assemblies of each diameter, length and grade from those being installed with a hardened washer under the element turned.

Wrenches shall be recalibrated when significant difference is noted in the surface condition of the bolts, threads, nuts or washers. It shall be verified during actual installation in the assembled steel work that the wrench adjustment selected by the calibration does not produce a nut or bolt head rotation from snug greater than that permitted in Table B. If manual torque wrenches are used, nuts shall be turned in the tensioning direction when torque is measured.

When calibrated wrenches are used to install and tension bolts in a connection, bolts shall be installed with hardened washers under the element turned to tension the bolts. Once the connection has been snugged, the bolts shall be torqued using the calibrated wrench. Torquing shall progress systematically from the most rigid part of the joint to its free edges.

The wrench shall be returned to "touch up" previously torqued bolts which may have been relaxed as a result of the subsequent torquing of adjacent bolts until all bolts are torqued to the prescribed amount.

19 (g) Direct Tension Indicator Inspection Method:

When Direct Tension Indicators (DTI) meeting the requirements of Subarticle M.06.02-5.1 are to be used with high-strength bolts to indicate bolt tension, they shall be subjected to the verification testing described in Subarticle 19(g)(1) and installed in accordance with the method specified in Subarticle 19(g)(2). Unless otherwise approved by the Engineer, the DTI shall be installed under the head of the bolt and the fastener assembly torqued by turning the nut. The manufacturer's recommendations shall be followed for the proper orientation of the DTI and additional washers, if any, required for the correct use of the DTI.

(1) Verification - Verification testing shall be performed in a calibrated bolt tension measuring device. A special flat insert shall be used in place of the normal bolt head holding insert. Three verification tests are required for each combination of fastener rotational-capacity lot, DTI lot, and DTI position relative to the turned element (bolt head or nut) to be used on the project. The fastener shall be torqued by turning the element not against the DTI. The element (bolt head or nut) against the DTI shall be prevented from rotating. The purpose of the verification testing is to ensure that the fastener will be at or above the desired installation tension when half or more of the spaces in the DTI have a gap less than 0.005 inches and that the fastener will not undergo excessive plastic deformation at the minimum gap allowed on the project.

The verification tests shall be conducted in two stages. The bolt, nut and DTI assembly shall be installed in a manner so that at least three and preferably not more than five threads are located between the bearing face of the nut and the bolt head. The bolt shall be tensioned first to the load equal to that listed in Table C under "Verification Tension" for the grade and diameter of bolt. If an impact wrench is used, the tension developed shall be no more than two thirds the required tension. Subsequently a manual wrench shall be used to attain the required tension. Determine and record the number of refusals of a 0.005 inch tapered feeler gage in the spaces between the protrusions. The number of refusals shall not exceed the number listed under "Maximum Verification Refusals" in Table C for the grade and diameter of bolt used. The maximum number of refusals for coated DTIs (galvanized, painted or epoxy coated), when used under the turned element shall be no more than the number of spaces on the DTI less one. The DTI lot is rejected if the number of refusals exceeds the values in the table or, for coated DTIs if the gage is refused in all spaces.

After the number of refusals is recorded at the verification load, the turned element shall be further torqued until the 0.005 inch feeler gage is refused at all the spaces and a visible gap exists in at least one space. The load at this condition shall be recorded and the bolt removed from the tension measuring device. The nut must be able to be turned down the bolt by hand for the complete thread length of the bolt excluding thread runout. If the nut cannot be rundown for this thread length, the DTI lot shall be rejected unless the load recorded is less than 95% of the average load measured in the rotational capacity test for the fastener lot as specified in Subarticle 19(d)(2)(g).

If the bolt is too short to be tested in the calibration device, the DTI lot shall be verified on a long bolt in a calibrator to determine the number of refusals at the "Verification Tension" listed in Table C. The number of refusals shall not exceed the values listed under "Maximum Verification Refusals" in Table C. Another DTI from the same lot shall then be assembled with the short bolt in a convenient hole in the work. The bolt shall be tensioned until the 0.005 inch feeler gage is refused in all spaces and a visible gap exists in at least one space. The fastener shall then be disassembled. Subsequently, the nut shall be able to be rundown by hand for the complete thread length of the bolt excluding thread runout. The DTI lot shall be rejected if the nut cannot be rundown for this thread length.

(2) Installation - Installation of fasteners using DTIs shall be performed in two stages. The element against the DTI shall be held against rotation during each stage of the installation. The connection shall be first snugged with bolts installed in all the holes of the connection and tensioned sufficiently to bring all the plies of the connection into firm contact. The number of spaces in which a 0.005 inch feeler gage is refused in the DTI after snugging shall not exceed those listed under "Maximum Verification Refusals" in Table C. If the number exceeds the values in the table, the fastener assembly shall be removed and another DTI installed followed by retensioning to snug the connection.

The bolts shall be further tensioned until the number of refusals of the 0.005 inch feeler gage is equal to or greater than the number listed under "Minimum Installation Refusals" in Table C. If the fastener is tensioned so that no visible gap in any space remains, the bolt and DTI shall be removed, and replaced by a new properly tensioned bolt and DTI.

19 (h) Inspection:

(1) The Contractor shall provide all the material, equipment, tools and labor necessary for the inspection, including access, of the bolted parts and fasteners both before and after the fasteners are installed and tensioned.

The Engineer shall determine that the requirements of Subarticles 19(h)(2) and 19(h)(3), following, are met in the work.

(2) Before the installation of fasteners in the work, the Engineer shall check the marking, surface condition and storage of fastener assemblies and the faying surfaces of joints for compliance with the requirements of Subarticles M.06.02-5, 19(a) and 19(d)(1). He shall observe calibration and/or testing procedures required in Subarticles 19(e) through 19(g) as applicable, to confirm that the selected procedure is properly used and that, when so used with the fastener assemblies supplied, the tensions specified in Table A are provided. He shall monitor the installation of fasteners in the work to assure that the selected procedure, as demonstrated in the initial testing to provide the specified tension, is routinely properly applied.

(3) Either the Engineer or the Contractor, in the presence of the Engineer at the Engineer's option, shall inspect the tensioned bolts using an inspection torque wrench, unless alternate fasteners or direct tension indicator devices are used, allowing verification by other methods. Inspection tests should be within 24 hours of bolt tensioning to prevent possible loss of lubrication or corrosion influence on tensioning torque.

Three bolts of the same grade, size, and condition as those under inspection shall be placed individually in a device calibrated to measure bolt tension. This calibration operation shall be done at least once each inspection day. There shall be a washer under the part turned in torquing each bolt. In the calibrated device, each bolt shall be tightened by any convenient means to the specified tension. The inspecting wrench shall then be applied to the tensioned bolt to determine the torque required to turn the nut or head five degrees in the tightening direction. The average of the torque required for all three bolts shall be taken as the job-inspection torque.

Ten percent (at least two) of the tensioned bolts on the structure represented by the test bolts shall be selected at random in each connection. The job-inspection torque shall then be applied to each with the inspecting wrench turned in the tightening direction. If this torque turns no bolt head or nut, the bolts in the connection shall be considered to be properly tensioned. But if the torque turns one or more bolt heads or nuts, the job-inspection torque shall then be applied to all bolts in the connection. Any bolt whose head or nut turns at this stage shall be retorqued and reinspected. The Contractor may, however, retension all the bolts in the connection and resubmit it for inspection, so long as bolts are not over tensioned or damaged by this action.

TABLE A
Minimum Bolt Tension in kips*

Bolt Size (Inches)	ASTM A325	ASTM A490
5/8	19	24
¾	28	35
7/8	39	49
1	51	64
11/8	56	80
1¼	71	102
13/8	85	121
1½	103	148

* Equal to 70% of specified minimum tensile strength of bolts (as specified in ASTM Specifications for tests of full-size A325 and A490 bolts with UNC threads, loaded in axial tension) rounded to the nearest kip.

TABLE C

Bolt Dia. (in.)	Verification Tension		Maximum Verification Refusals		DTI Spaces		Minimum Installation Refusals	
	A325	A490	325	490	325	490	325	490
5/8	20	25	1	2	4	5	2	3
¾	29	37	2	2	5	6	3	3
7/8	41	51	2	2	5	6	3	3
1	54	67	2	3	6	7	3	4
1 1/8	59	84	2	3	6	7	3	4
1¼	75	107	3	3	7	8	4	4
1 3/8	89	127	3	3	7	8	4	4
1½	108	155	3	4	8	9	4	5

TABLE B
Nut Rotation from the Snug Condition
Geometry[a,b] of Outer Faces of Bolted Parts

Bolt Length (measured from underside of head to end of bolt)	Both Faces Normal to Bolt Axis	One Face Normal to Bolt Axis and Other Face Sloped Not More Than 1:20, Bevel Washer Not Used	Both Faces Sloped Not More Than 1:20 From Normal to Bolt Axis, Bevel Washer Not Used
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters	2/3 turn	5/6 turn	1 turn

(a) Nut rotation, as used in Table B, shall be taken as relative to the bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance should be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance should be plus or minus 45 degrees.

To determine the nut rotation for installation and inspection of the fasteners, the nut and the end of the bolt or the head of the bolt and the adjacent steel shall be match marked.

(b) The values, given in Table B, shall be applicable only to connections in which all material within grip of the bolt is steel.

(c) No research work has been performed by the Research Council Riveted and Bolted Structural Joints to establish the turn-of-nut procedure when bolt lengths exceed 12 diameters. For situations in which the bolt length, measured from the underside of the head to the end of the bolt, exceeds 12 diameters, the required rotation shall be determined by actual tests in a suitable tension device simulating the actual conditions.

ITEM #521001A - ELASTOMERIC BEARING PADS

Description:

Work under this item shall consist of furnishing and installing elastomeric bearing pads and all other necessary materials and equipment to complete the work as shown on the plans.

Materials:

Elastomeric Bearing Pads: The elastomer shall be virgin neoprene (polychloroprene) Grade 3 and shall be of the Durometer (hardness) indicated on the plans and shall conform to the requirements of Section 18, Table 18.4.5.1-1A of Division II of the AASHTO Standard Specifications for Highway Bridges, Sixteenth Edition.

The internal steel laminae shall conform to ASTM A709 Grade 36 or approved equal. The laminae shall be sandblasted and cleaned of all surface coatings, rust and mill scale before bonding and shall be free of sharp edges and burrs.

The bearing shall be cast as a unit in a mold and shall be bonded and vulcanized under heat and pressure. The mold finish shall conform to standard shop practice.

Flash tolerance, finish and appearance shall meet the requirements of the latest edition of the Rubber Handbook, published by the Rubber Manufacturer's Association, Inc., RMA F3 and T.063.

Fabrication tolerances shall conform to Article 18.5.1.5-1 – Fabrication Tolerances of Division II of the AASHTO Standard Specifications for Highway Bridges, Sixteenth Edition.

The tests on the elastomer specified in Table 18.4.5.1-1A of AASHTO shall be conducted on each lot of bearings. A shear modulus test shall be performed on each batch of material. (A lot consists of a single type of bearing of the same size, manufactured from the same batch of elastomer, submitted for inspection at the same time. A batch of elastomer is the quantity of elastomer prepared and compounded at one time).

In lieu of the low temperature crystallization test for each lot of bearings and a shear modulus test for each batch of material, the manufacturer may provide certificates from tests performed on identical formulations within the preceding year.

Every bearing shall be visually inspected for compliance with dimensional tolerance and for overall quality of manufacture. Buffing, cutting, or any other attempt to alter the size of the bearings, for the purpose of meeting the tolerances stated herein will not be permitted.

The elastomer shall meet the minimum requirements specified in Table 18.4.5.1-1A for durometer hardness, tensile strength, ultimate elongation, heat resistance, compression set, ozone resistance, low temperature brittleness, low temperatures stiffness and low temperature crystallization. The shear modulus of the material shall be tested at 73° F using the apparatus and procedure described in Annex A of ASTM D4014. The steel laminae shall develop a minimum peel strength of 473 lbs./ft. when tested in accordance with ASTM D429 Method B.

Every bearing shall be tested as follows for a Short-Duration Compression Test:

1. The bearing shall be loaded in compression to 1.5 times the design load shown on the plans. The load shall be held constant for 5 minutes, removed and reapplied for another 5 minutes.

2. The bearing shall be carefully examined while under the second loading.

3. If the bulging pattern indicates laminate parallelism or layer thickness outside of specified tolerance, or poor laminate bond, the bearing shall be rejected. If there are three or more separate surface cracks, greater than 1/16 inch wide and 1/16 inch deep, the bearing shall be rejected.

A Certified Test Report in accordance with Section 1.06.07 shall be required for the specified tests on the elastomer and for the specified short duration compression tests.

Each elastomeric bearing pad shall have embossed on it the following: the work "CONN", project number, manufacturer's identification code or symbol, and the month and year of manufacture. The bearing shall also have stenciled on it, with indelible ink, the lot number, bridge number, and the bearing number. The marking shall be placed on a side of the bearing that is visible after installation.

For structures requiring less than fifty pads, one test pad shall be furnished. For structures requiring more than fifty pads, one extra test pad shall be furnished for each additional fifty pads or part thereof. If there are two or more types of pads in one structure, and only one test pad is required, the test pad will be furnished for the type of which there are the greater number. All test pads shall be furnished without charge.

All of the pads on one structure shall be manufactured by the same firm.

The manufacturer shall furnish facilities for the test and inspection for the completed bearing in his plant or at the independent test facility and the inspectors shall be allowed free access to the manufacturer's plant and test facility.

Load Plates: Load plates conforming to ASTM A709 Grade 50 w steel shall be vulcanized to the top of each elastomeric bearing pad. The size of the plate shall be as indicated on the plans. Holes in the load plates shall be made prior to vulcanizing the elastomeric pad to the load plate. The load plate contact surface to be vulcanized to the elastomeric pad shall not be painted, metallized or galvanized.

5.21.03 - Construction Methods:

Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Subarticle 1.05.02-3. These drawings shall include but not be limited to the following information. The name of the manufacturer, complete details of the pads and pertinent material designations.

The bearing areas of the masonry upon which the elastomeric bearing pads are to be place shall be carefully finished, by grinding if necessary, to a smooth, even surface of the required elevation, and shall show no variations from a true plane greater than 1/16 of an inch over the entire area upon which the elastomeric bearing pads are to rest.

After delivery of the bearings to the job site, the bearings shall be stored such that they are kept clean and dry at all times.

There shall be uniform bearing between the elastomeric bearing pad and the concrete seat after application of full dead load. Also after application of full dead load, there shall be uniform deflection of the elastomeric bearing pad.

Welding of the structural steel adjacent to elastomeric bearing pads shall be controlled such that no portion of the bearing pad will be subjected to temperatures in excess of 400° F.

The elastomeric bearing pads shall be installed when the ambient air temperature has been within the range of 32° – 80° F for a period of at least two hours.

Method of Measurement:

This work will be measured for payment by the number of cubic inches of elastomeric bearing pads, installed and accepted.

Basis of Payment:

This work will be paid for at the contract unit price per cubic inch of "Elastomeric Bearing Pads", complete-in-place, which price shall include all materials including the internal steel laminae, testing equipment, tools and labor incidental thereto, including the cost of furnishing test pads.

ITEM #522280A – ISOLATION BEARING ASSEMBLY

Description:

This work shall consist of furnishing and installing isolation bearings assemblies at the locations shown on the plans in accordance with these Special Provisions and the AASHTO Guide Specifications for Seismic Isolation Design, 2nd edition. Isolation bearing assemblies shall consist of one of the following isolation systems:

Elastomeric Isolation System:

This system shall consist of an elastomeric bearing with lead core type consisting of alternate layers of natural rubber and steel plates with a preformed hole at the center of the unit filled tight with a pure lead plug. This system shall include base isolation bearings (isolators), sole plates, base plates, masonry plates, load plates, prefabricated pads and connection hardware.

Sliding Isolation System:

This system shall be composed of sliding bearings consisting of TFE stainless steel surfaces used in conjunction with enclosed energy control devices. This system shall include base isolation bearings (isolators), distribution plates, distribution pads and connection hardware.

Isolation bearings shall be self-contained and shall not be susceptible to detrimental environmental conditions. All isolation bearings shall be designed to be easily removable in the future, if necessary.

All isolators shall be of the same isolation system and shall be provided by one supplier.

The following suppliers have been approved by the State and have displayed the capability of supplying isolation bearing assemblies with characteristics that conform to the general requirements of this Special Provision. **NO SUBSTITUTIONS WILL BE ALLOWED.**

Elastomeric Isolation System:

DIS, Inc.
3470 Mt. Diablo Blvd.
Suite A200
Lafayette, CA 94549
Telephone: 925-283-1166
Fax: 925-283-4307

Seismic Energy Products, L.P.
518 Progress Way
Athens, TX 75751
Telephone: 903-675-8571
Fax: 903-677-4980

Sliding Isolation System:

R.J. Watson, Inc.
P.O. Box 85
East Amherst, New York 14051
Telephone: 716-741-2166
Fax: 716-741-2580

Materials:

All materials shall be new and unused, with no reclaimed material incorporated in the finished bearing.

Elastomeric Isolation System:

The elastomers of the isolators shall be natural rubber. Type NR Grade 3 per ASTM D4014.89 meeting or exceeding the following requirements.

A. Heat Resistance

- ASTM D573 (158° for 7 days)
- Maximum permissible change in tensile strength – 25%
- Maximum permissible change in ultimate elongation – 25%
- Maximum permissible change in durometer hardness – 10 points

B. Compression Set

- ASTM D395 Method B (158° F for 22 hours)
- Maximum permissible set: 25%

C. Low Temperature Properties

- ASTM D1229 (Compression set at 14° F for 7 days at 25% compression)
- Maximum permissible set: 65%
- ASTM D2240 (Low Temperature Stiffness; conditioned for 22 hours at -13° F)
- Maximum permissible change in durometer hardness: +15 Shore A points

D. Ozone Resistance of Elastomer: Ozone resistance will be determined by tests on strips of representative material mounted as per Method A of ASTM D518. The tests will be performed by ASTM D1149 at an ozone concentration of 50 +5 parts per hundred million at 20% stain at 100° F for 100 hours. The ozone resistance will be regarded as satisfactory, if on conclusion of a test, no cracks are visible using 7X magnification.

E. Bond of Elastomer to Steel Laminate: The average of the peak values of force during separation to determine the minimum peel strength will be at least 40 lbs./in. The failure type shall be 100% rubber test. Peel strength tests will be performed by ASTM D429 Method B.

F. Tensile Strength and Ultimate Elongation of Elastomer: Minimum tensile strength and ultimate elongation tests will be performed by ASTM D412. The minimum tensile strength will be 2250 psi and the minimum ultimate elongation will be 550%.

G. Hardness of Elastomer: The durometer hardness will be determined by ASTM D2240.

H. Shear Modulus at 50% Shear Strain of Elastomer: The shear modulus of the elastomer at 50% shear strain will be determined by ASTM D4014. The tangent modulus will be the design value $\pm$ 10%.

Lead:

The purity of lead will be established by chemical analysis from a sample of the lead in the isolators. This test will confirm a minimum of 99% purity of the lead.

Sliding Isolation System:

Polyether Urethane Structural Element:

The physical properties of the polyether urethane shall conform to one of the following requirements:

	ASTM	Compound A		Compound B	
Physical Property	**Test Method**	**Min**	**Max**	**Min**	**Max**
Hardness, Shore D	D2240	46	50	60	64
Tensile Stress	D412				
At 100% elongation		1500		2000	
At 200% elongation		2800		3700	
Tensile Strength, psi	D412	4000		5000	
Ultimate Elongation, %	D412	350		220	
Compression Set	D395		40		40
22 hrs. at 158 F, &					

Steel:

All steel except stainless steel components of the bearing shall conform to the requirements of the type of steel designated in the Contract Plans.

Stainless Steel:

Stainless Steel shall conform to the requirements of ASTM A240, Type 304 or ASTM A240, Type 316. Stainless steel in contact with TFE Sheet shall be polished to a bright mirror finish, less than 20 micro-inches root mean square. The minimum thickness of the stainless steel shall be 0.050 inches.

Polytetrafluorethylene Sheet:

Polytetrafluorethylene (TFE) sheet shall be manufactured from pure virgin (not processed) unfilled TFE resin. TFE sheet shall meet the applicable material requirements of AASHTO standard Specifications for Highway Bridges; Section 18, Div. II.

Construction Methods:

The Contractor shall submit name of the isolator supplier to be used prior to the awarding of the contract.

Isolation Bearings Shown on the Contract Plans:

The dimensions of the isolation bearings detailed on the Contract Plans are of a conceptual nature; however, the beam seat elevations, as detailed, are computed based on the dimensions given. Any change in height of the isolation bearings shall be made up

in adjustments first to masonry and sole plates (minor changes), and second to the beam seat elevations, if absolutely necessary. Changes in the plan dimensions (i.e. width and length) shall take into consideration the physical limits of the beam seats which may be sized for future jacking clearance; and all bearings shall be centered directly beneath stiffeners and girder webs, as detailed on the plans.

Since adjustments to the beam seats may be necessary, the Contractor shall submit Shop Drawings to the Engineer for approval and shall have received said approval prior to construction of the beam seats and fabrication of bearings. These drawings shall include, but not be limited to the following information:

- Plans and elevation of each bearing size.
- Complete details and sections showing all materials (with ASTM or other designations) incorporated in the bearings.
- Vertical and horizontal load capacity (the minimum bearing capacities are given on the Contract Plans).
- Details of the connections of the isolators to the adjacent sole, base, masonry or distribution plates. Separate plates are required to allow for easy removal of bearings, if necessary.
- Any required revisions or additions to concrete reinforcement or other facilities.

System Description:

The "Bearing Data" tables given on the Contract Plans contain the design requirements for this bridge. These are supplied as a means of specifying the required performance characteristics for the isolation system. Analytical results showing the maximum seismic forces and displacements at all locations shall be submitted and approved by the Design Engineer. The peak ground acceleration for this analysis shall be as indicated in the AASHTO Standard Specifications for Highway Bridges, Division 1A. The stiffness of the piers shall be calculated by the bearing manufacturer. Also, calculations showing system compliance with all relevant provisions of the AASHTO Guide Specifications for Seismic Isolation Design, including the seismic isolation modifications to Section 14 of Division I and Section 18 of Division II of the AASHTO Standard Specifications, shall be submitted and approved by the Design Engineer.

Elastomeric Isolation System:

Fabrication Details:

The tolerance on isolator dimensions shall be as follows:

Dimensions	Tolerance
External Plan Dimensions	±1/4 inch
Flatness of Exterior Top and Bottom Surfaces of Completed Bearings	±1/16 inch from the main surface

Variation from Plane Parallel to the Theoretical Surface

Top	Slopes relative to the bottom no more than 0.005 radians
Sides	±1/4 inch
Overall Bearing Height	±1/4 inch

Exposed steel surfaces, if any, will be prepared for weathering or painting in accordance with the requirements of Article 6.03.03.

Each isolator will be permanently marked. The markings will consist of an isolator number specified by the manufacturer, date of fabrication (month and year), isolator type and manufacturer (name and address)

Testing:

Test results for combined compression and shear (as specified in Section 15 of the AASHTO Guide Specifications for Seismic Isolation Design) will be provided to the Engineer. The test load for each isolator type will be determined from the maximum design dead plus live load to be applied to that particular isolator type. All test results will identify the isolators by identification number.

During the combined compression and shear tests on all completed isolators, each isolator will be closely inspected for lack of rubber to steel bonds, laminate placement faults, or three (3) surface cracks wider and deeper than 0.08 inches. Any isolator showing such signs will be rejected.

The results of each isolator test shall be evaluated for the following performance requirements:

1. The effective stiffness (K_{eff}) shall fall within the range of $\pm$15% of the design value. The effective stiffness is defined as shear force (kips) divided by shear displacement (inches) at a displacement of D_t.
2. The slope of the loading (K_r) shall be greater than or equal to 80% of the design value.
3. The average value of energy dissipated per cycle (EDC) shall be equal to or greater than 90% of the design value. The value of EDC as determined by the load test shall be computed from the area of the hystersis loop for the shear force to shear displacement data.

Any tested bearings which fail to conform to the required K_{eff}, K_r or EDC design values shall be rejected.

Product Delivery, Storage and Handling:

The isolators shall be shipped in protective packing. They shall be stored under cover above the ground in the original packaging until installation.

Installation:

The Contractor shall certify to the Engineer that a skilled representative of the bearing manufacturer will be available to the Contractor to five such aid and instruction in the installation of bearings as is required to obtain satisfactory results.

The isolators shall be installed level and normal to the gravity loads. Superstructure gradients shall be accommodated with beveled sole plates.

There shall be no obstructions, including bolt extension, which prevent the isolators from deforming horizontally in any direction. The area around the isolator shall be cleaned of all debris and construction materials at the completion of the Contract.

No welding will be performed on steel in contact with an isolator.

Sliding Isolation System:

Seismic analysis shall include non-linear time history analyses, non-linear modeling shall include a varying pressure and velocity dependent friction element as well as any nonlinearities present in the restoring force.

Non-linear time history analysis shall include simultaneous orthogonal excitations to check for excessive torsional displacements.

The supplier shall show previous history in the design and fabrication of sliding bearings with restoring force elements to mitigate dynamic effects.

Sliding bearings shall be still in shear, i.e. negligible shear displacement shall occur with the load bearing element.

Isolation system shall be fully test verified utilizing shake table testing. Documentation of the testing shall be provided as well as verification from a member of the test team. In addition to shake table testing prototype bearing tests in accordance with the AASHTO Guide Specifications of Seismic Isolation Bearings will be required.

A copy of the manufacturing specification to be used in the project shall be supplied to the Engineer.

Energy dissipation shall not be achieved via the material degradation of a structural element in the bearing system. If such a structural element is to provide resistance to service load conditions (wind, braking forces, etc.) it shall not also be used in a manner that would lead to reduced capacity after material yielding.

Isolation bearing shall not contain elements known to be toxic, nor shall energy dissipation devices contain fluids.

Dynamic testing for both production testing, and prototype testing (if required) shall be performed at the undamped natural frequency of the isolation system, or, at a minimum of 0.5 Hz.

Fabrication Details:

The Contractor shall provide the Engineer with written notification thirty (30) days prior to the start of bearing fabrication. This notification shall include all of the information shown on the shop drawings which are required by Section of these specifications dealing with "Contract Document and Shop Drawings".

Contract Document and Shop Drawings:

The contract documents shall contain information necessary for proper design and detailing of the bearings. This information is listed in AASHTO Standard Specifications for Highway Bridges.

The Contractor shall submit detailed shop drawings in conformance with the applicable requirements of the Engineer for approval prior to the start of fabrication. Information to be noted on the plans shall be as required by AASHTO Standard Specifications for Highway Bridges.

All steel surfaces exposed to the atmosphere, except stainless steel surfaces and metal surfaces to be welded, shall be shop painted to match weathering steel, metallized color, or galvanized color in accordance with the Contract Plans. Prior to painting, the exposed steel surfaces shall be cleaned in accordance with the recommendations of the coating's manufacturer. Metal surfaces to be welded shall be given a coat of cleat lacquer, or other protective coating approved by the Engineer, if the time of exposure before welding takes place is to exceed three months. The coating shall be removed at the time of welding. No painting will be done to these surfaces prior to the completion of welding.

Stainless steel sheet shall be attached with a continuous seal weld. Weldment shall remain below the level of the stainless steel sheet.

All welding shall conform to, and all welders shall be qualified in accordance with the requirements of the ANSI/AASHTO/AWS D1.5 (Bridge Welding Code) including interims as modified by AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.

Except as noted, all bearing surfaces of steel plates shall be finished or machined flat within 0.010 inches per foot. Out-of flatness greater than 0.010 inches per foot on my plate shall be cause for rejection. The bottom surfaces of lower bearing plates (masonry plates) designed to rest on bearing pads shall not exceed and out-of-flatness value of 0.0625 inches per foot (1/16 inch per foot). Oxygen cut surfaces shall not exceed a surface roughness value of 1000 micro-inches, as defined by ANSI B46.1.

Gross bearing dimensions shall have a tolerance of –0, +1/8".

Every bearing shall have the Project Identification Number, Lot Number, and individual bearing number indelibly marked with ink on a side that will be visible after erection.

After assembly including sole plates and masonry plates, bearing components shall be held together with steel strapping, or other means, to prevent disassembly until the time or installation. Packing shall be adequate to prevent damage from impact as well as from dust and moisture contamination during shipping and storage.

Sampling and Testing:

Requirements for lot size shall be in accordance with AASHTO Standard Specifications for Highway Bridges.

Sampling and testing requirements shall be in accordance with AASHTO Standard Specifications for Highway Bridges with modifications as noted:

Test	Samples Required
Physical properties of polyether urethane (except compression set)	One 10" x 15" sheet of polyether urethane material (thickness of 0.063" to 0.120") per lot
Compression set of polyether urethane	One 4" x 4" sheet of polyether urethane per lot, molded or cut to the thickness requirements of ASTM D395, Method B.

Production Bearing Testing:

The sliding coefficients of friction shall be measured at the bearing's design capacity in accordance with AASHTO Standard Specifications for Highway Bridges and on the fifth and fiftieth cycles, at a sliding speed of 1 inch per minute. The sliding of one bearing, divided by the bearing's vertical design capacity. The test results will be evaluated as follows:

a. The measured sliding coefficients of friction shall not exceed 3%.

b. The bearing will be visually examined both during and after the proof load test. Any resultant defects, such as bond failure, physical destruction, cold flow of TFE to the point of debonding, or damaged components shall be cause for rejection.

Seismic tests on EQS bearings shall be tested in accordance with Section 13 of AASHTO Guide Specifications for Seismic Isolation Design. Results shall be within +/- 10% of the predicted values. Bearings which test outside this range may only be acceptable on the specific approval of the Engineer.

Proof load testing shall be performed in accordance with AASHTO Standard Specifications for Highway Bridges; Section 18.3.5.3.1, Div. II.

A test bearing shall be loaded to 150% of the bearings' rated design capacity and simultaneously subjected to design rotation for a period of one (1) hour.

Any visual defects, such as extruded or deformed polyether urethane or TFE, or cracked steel, shall be cause for rejection.

Installation:

Bearings delivered to the bridge site shall be stored under cover on a platform above the ground surface. Bearings shall be protected at all times from injury. When placed, bearings shall be dry, clean, and free from dirt, oil, grease, or other foreign substances.

Bearing devices shall not be disassembled unless otherwise permitted by the Engineer or Manufacturer.

Bearings shall be installed in accordance with the alignment plan and installation scheme as shown in the Contract Plans. Upon final installation of the bearings, the Engineer, in the presence of the Manufacturer's representative, shall inspect the bearing components to assure that they are level and parallel to centerline of girder with +/- 1/32" per foot. Any deviations in excess of the allowed tolerances shall be corrected.

Certificate of Compliance:

In addition to records of test results, the Contractor's isolator supplier shall submit Certificates of Compliance for the isolators indicating the materials, fabrication, testing, and installation are as specified herein.

Method of Measurement:

Isolation bearing assemblies will be measured for payment for each complete and accepted installation.

Basis of Payment:

This work will be paid for at the contract unit price each for "Isolation Bearing Assembly," which price shall include all materials, tools, furnishing and installing isolation bearing assemblies where shown on plans.

ITEM #603354A - STRUCTURAL STEEL (SEGMENT 2)

Work under this item shall conform to the requirements of Section 6.03 amended as follows:

Article 6.03.01 – Description:

Add the following to the end of the first paragraph:

The work includes all permanent and temporary work necessary for furnishing, fabricating, transporting, erecting, surface preparation, and coating of new structural steel as shown on the Plans and specified herein.

This item shall include the assembly of the structural steel truss of Segment 2 supported on the proposed welded girders of Segment 3, as shown on the "Suggested Erection Sequence – Truss Assembly" plans. The Contractor is completely responsible for the erection of the truss and shall completely design and detail the erection sequencing and methods. Also included under this item is the use of temporary transfer beams and hold-down devices, as shown on the "Suggested Erection Sequence – Truss Assembly" plans. It shall include the design of, and the furnishing, fabricating, transporting, erecting, installing, and the removal and disposal of, the transfer beams and hold-down devices, as required.

This item will also include supporting and jacking the fully assembled truss segment at the four reaction posts for the purpose of determining the correct installation of remain-in-place forms, and to allow for the installation of the proposed inspection platforms. The remain-in-place forms and the inspection platforms shall be installed when the truss is in the temporary location. This jacking will require the use of temporary support structures, including bracing and foundations, and hydraulic jacks, as required, and as determined by the Contractor. It shall include the design of, and the furnishing, fabricating, transporting, erecting, installing, jacking, and the removal and disposal of, the temporary supports, bracing, foundations and jacks, as required.

Included under this item is the preparation of working drawings and computations, as required, and as noted herein and elsewhere in these specifications, for the methods and temporary work the Contractor proposes to complete the work included under this item. All working drawings and computations shall be signed and sealed by a Professional Engineer licensed in the State of Connecticut and experienced in this type of work. The Department reserves the right to approve the use of any and all Professional Engineers performing the work.

It is anticipated that the placement and removal of the concrete forms for the cantilever deck slab will be completed after the structural steel truss of Segment 2 is lifted and moved into its final position. Metro-North Railroad and Amtrak requires that this work be completed above temporary work platforms/protective shielding.

The installation of the work platforms/protective shielding over the railroad right of way for the purposes of deck forming and any of the other Contractor's operations as required by the railroad(s) will be included under this item.

A one-year anniversary inspection, to be conducted approximately twelve months after the structure has been erected, will be included in this item. All aspects of this inspection (i.e. access, rigging, safety traffic control, etc.) and participation in this inspection with CDOT are included. Repair by the Contractor of all locations where the coating exhibits disbonding, cracking, rusting, or

other such defects, performed in accordance with this Special Provision and the coating manufacturer's written instructions, is included in this item.

This item will also include providing a coating system to all structural steel.

Structural Steel Protection

General

The coating system shall be one of the following: a two-coat system comprised of an aluminum thermally sprayed metallizing primer and a urethane sealer coat; a two-coat system comprised of an 85/15 zinc-aluminum alloy thermally sprayed metallizing primer and a urethane sealer coat; or a single dip galvanized coating.

All structural steel, including but not limited to, truss members, gusset plates, bracing members, floorbeams, stringers, steel components of the bearings, diaphragms (cross frames), shall be abrasive blast cleaned, metallized and seal coated or galvanized in conformance with the Plans and specifications.

This item will also include the removal and legal disposal of the abandoned transformer foundation and appurtenances at Pier 2 and the abandoned transformer crib at Pier 3, as indicated on the plans.

Article 6.03.02 - Materials:

The materials for this work shall conform to the requirements of Section M.06.02 of the Standard Specifications amended as follows:

Structural Steel:

Subarticle M.06.02-1 – Structural Steel: Delete the entire subarticle and replace with the following:

The structural steel shall be low alloy conforming to the requirements of AASHTO M270 (ASTM 709), Grade 50 or ASTM 709 HPS Grade 70W as shown on the plans.

The structural steel for the main load carrying components of the structure shall meet the Zone 2 Charpy V-notch Impact Testing requirements, for fracture critical and non-fracture critical members, in accordance with AASHTO M270 (ASTM A709).

Fasteners: All high strength ASTM A325 Type 1 bolts, nuts and washers shall be mechanically galvanized in accordance with ASTM B695, Class 50.

Structural Steel Protection:

Galvanizing:

Subarticle M.06.03 – Galvanizing: add the following:

Before hot dip galvanizing, the tanks shall be cleaned to remove surface and bottom

contamination, i.e. dross, sludge, ash and flux.

The steel members shall be single-dip hot-dip galvanized by completely submerging them in the galvanizing tank.

The hot-dip galvanizing shall conform to the requirements of ASTM A123 as amended as follows:

- Subarticle 6.2 – Add the following:

  The coating shall be inspected by visual means with the aid of straight edge and dry film thickness instruments. The overall dry film thickness shall be 3.4 – 8.0 mils. Joint faying surfaces shall have a dry film thickness of 3.4 – 4.5 mils.

- Subarticle 6.4 – Appearance: Delete the first three sentences and replace with:

  Galvanized articles shall be free from uncoated areas, blisters, flux deposits, acid and black spots, and dross inclusions. Lumps, projections, globules, or heavy deposits of zinc will not be permitted. All holes shall be clean and free of excess zinc.

Inspection shall be visual with the aid of straight edge instruments to determine compliance with the requirements of 6.2 and 6.4. Articles that have a nonuniform, rough coating shall be ground smooth with power tools such as disc grinders. If grinding has been performed, the resultant surface shall comply with 6.2 and 6.4.

All damage, (i.e., scratches, nicks, cracks), on the hot dip galvanized steel shall be repaired in accordance with ASTM A780 Annex A2 "Repair using Zinc-Rich Paints". The Zinc-Rich paint shall conform to Federal Specification TT-P-641 Type 1 and shall be brush applied with a dry film thickness range of 3 to 6 mils.

Note: The truss shall be shop assembled after galvanizing to ensure fit up of members prior to shipping to the job site.

Metallizing:

GENERAL

A. This section provides the workmanship requirements for surface preparation, the shop application of a thermal spray (metallizing) coating and a seal coat of urethane. All work shall be done in the shop unless otherwise noted.

B. Unless otherwise directed by CDOT, the coatings to be applied are as follows:

   1. The feedstock material used for metallizing must be one of the following: aluminum or 85/15 (Zn/Al).

   2. The sealer coat to be applied over the metallizing is an acrylic urethane coating.

C. The General Contractor is responsible for coordinating the work to assure that the

products of only one metallizing supplier and one sealer/paint manufacturer are utilized on the entire structure.

D. The Contractor(s) are required to implement and maintain programs and procedures which comply with the requirements of the specifications and all applicable Federal, state, and local OSHA and EPA standards and regulations. The Contractor is cautioned that it must comply with all applicable regulations even if the regulation is not specifically referenced herein. If a state or local regulation is more restrictive than the requirements of this specification, the more restrictive requirements prevail.

PRE-METALLIZING MEETING

A. A mandatory pre-metallizing meeting will be held prior to the beginning of any metallizing work. This meeting will be held separately from other general construction meetings for the overall project.

B. The following parties are required to attend this meeting: General Contractor, Metallizing Contractor, Coating Contractor, Thermal Spray Feedstock and Paint Manufacturer, Metallizing Equipment Manufacturer, Project Engineer, Paint Inspector, Test Laboratory, CDOT Personnel and other parties as deemed appropriate by the Engineer.

REFERENCE STANDARDS

A. The latest edition of the following standards and regulations form a part of this specification.

1. American Society for Testing and Materials (ASTM)

a) ASTM D1400, Standard Test Method for Non-Destructive Measurement of Dry Film Thickness of Non-Conductive Coatings Applied to a Non-ferrous Metal Base

b) ASTM D3359, Standard Test Methods for Measuring Adhesion by Tape Test

c) ASTM D4138, Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means

d) ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air

e) ASTM D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages

f) ASTM D4417, Standard Test Methods for field Measurement of Surface Profile of Blast Cleaned Steel

g) ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

h) ASTM D 4940, Standard Test Method for Conductmetric Analysis of Water-Soluble Ionic Contamination of Blasting Abrasive

2. American Welding Society

a) ANSI/AWS C2.18-93 Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites.

b) ANSI/AWS A5.33, "Specification for Solid and Ceramic Wires and Ceramic Rods for Thermal Spraying."

3. Code of Federal Regulations (CFR)

a) 29 CFR 1926, Occupational Safety and Health Regulations for the Construction Industry

b) 29 CFR 1926.104, Safety Belts, Lifelines, and Lanyards

c) 29 CFR 1926.105, Safety Nets

d) 29 CFR 1926.451, Scaffolding

4. Society for Protective Coatings (SSPC)

a) SSPC-SP 1, Solvent Cleaning

b) SSPC-SP 2, Hand Tool Cleaning

c) SSPC-SP 3, Power Tool Cleaning

d) SSPC-SP 10, Near White Metal Blast Cleaning

e) SSPC-PA 2, Measurement of Dry Film Thickness with Magnetic Gages

f) SSPC-VIS 1, Visual Standard for Abrasive Blast Cleaned Steel

g) SSPC-VIS 3, Visual Standard for Hand and Power Tool Cleaned Steel

h) SSPC-AB1, Abrasive Specification No. 1

i) SSPC-AB2, Specification for Cleanliness of Recycled Ferrous Metal Abrasives

j) SSPC-AB4, Newly Manufactured or Re-Manufactured Steel Abrasives

k) SSPC-QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors: Shop Applicators

l) SSPC-CS 23.00, Guide for Thermal Spray Metallic Coating Systems

5. Equipment and Metallizing Material and Coating Manufacturers' Published Instructions

SUBMITTALS

A. Submit the following plans and programs to CDOT for review and acceptance a minimum of fifteen (15) days prior to metallizing.

B. Surface Preparation/Metallizing and Sealing/Painting Plan

1. Provide written procedures for the preparation of surfaces and the application of the metallizing and the urethane sealer. Also include a procedure for the repair and touch up of any damage that occurs to the newly applied metallizing or coatings.

2. Provide a written QA/QC plan. Include quality control checkpoints for surface preparation, metallize application, adhesion testing of metallizing application and coating thickness measurements.

3. Identify the metallizing and coating materials to be applied. Include manufacturer's name, product names, and product numbers. Provide Product Data Sheets, VOC levels for liquid coatings, MSD sheets, and written application instructions including mixing requirements, specified thinners, and thinner amounts for liquid coatings.

4. Identify the type and brand name of the abrasive proposed for use.

5. In the event of a conflict between the manufacturer's technical data and this section, this section will govern unless the manufacturer's requirements are more restrictive.

6. Identify the thermal spray equipment to be used to apply the feedstock.

C. Work Schedule - Provide a schedule for surface preparation, metallizing and sealing/painting. CDOT shall be notified a minimum of one week prior to starting work.

D. CDOT Review

1. Do not construe CDOT acceptance of Contractor submittals to imply

approval of any particular method or sequence for conducting the work, or for addressing health and safety. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of this section, or to adequately protect the health and safety of all workers involved in the project including any members of the public who may be affected by the project.

2. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices and adherence to them.

SUPERINTENDENCE BY THE METALLIZING AND PAINTING CONTRACTORS

A. The Metallizing and Painting Contractors are responsible for supervising and directing the coating work efficiently using the best skills and attention, and are solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. Keep an experienced, competent, resident superintendent acceptable to CDOT on the project at all times. Do not replace the superintendent except under extraordinary circumstances, and only upon approval of the CDOT.

C. The superintendent is the Metallizing and Painting Contractors' representative and must have the authority to act on behalf of the Contractor. All communications given to the superintendents are binding upon the Contractor.

CONTRACTOR/WORKER QUALIFICATIONS

A. The Metallizing Contractor/Painting Contractor shall be certified by the SSPC Painting Contractor Certification Program QP-3, entitled "Standard Procedure for Evaluating Qualifications of Shop Painting Contractors" in the enclosed shop category or hold an AISC Quality Certificate with a "Sophisticated Paint Endorsement." The Metallizing Contractor/Painting Contractor shall be fully certified, including endorsements, for the duration of the time they are doing surface preparation and coating application.

B. The complete coating system shall be applied in an enclosed shop except for field touch-up painting which shall be applied after all bolts are fully tensioned and deck form work removed. The enclosed shop shall be a permanent facility with outside walls to grade and a roof where surface preparation and coating activities are normally conducted in an environment not subject to outdoor weather conditions and/or blowing dust.

C. All metallizing and coating work shall be performed by a Contractor with at least two years of experience performing metallizing of structural steel. Prior to the pre-metallizing meeting as required above, the Contractor shall submit written documentation of at least three successful metallizing projects in the last three years. Information shall include the name of owner of each metallizing project, number and location of each job and year each job was completed. The Contractor shall possess knowledge and experience in all areas of the surface

preparation and metallizing work. This documentation will be reviewed and verified by CDOT prior to beginning work on this project.

D. Each spray operator shall be qualified to metallize according to ANSI/AWS C2.18-93. Any operator who does not show evidence of qualification shall not be allowed to spray.

E. Technical Advisors: It is mandatory that the Contractor obtains the services of qualified technical advisors that represent the coating manufacturer, the thermal spray feedstock manufacturer, and the metallizing application equipment manufacturer. The Contractor shall make all necessary arrangements for technical advisor site visits. The technical advisors shall assist the Engineer and the Contractor in establishing the correct application methods for the metallizing and painting.

ABRASIVES

A. Provide abrasives that are clean, dry, and sized properly to provide the surface profile required by this section.

B. Use abrasives that are acceptable to CDOT. Abrasives shall be hard and sharp in order to produce an angular surface profile. Acceptable abrasives include, but are not limited to, angular aluminum oxide, angular steel grit and angular crushed slag. Silica sand shall not be used. Steel shot and other abrasives that produce a rounded surface profile shall not be used.

C. Abrasives shall conform to the following:

1. SSPC AB 1 for mineral slag abrasives

2. SSPC AB 2 for recycled ferrous metal abrasives

3. SSPC AB 3 for new steel abrasives

COATING MATERIALS

A. Thermal Spray Feedstock - Provide the type and quantity of thermal spray feedstock needed to metallize all carbon steel surfaces in the field and then seal those surfaces.

1. The aluminum or 85/15 Zn/Al shall be manufactured for thermal arc spraying and shall have a chemical composition that meets the requirements that meets ANSI/AWS A5.33, "Specification for Solid and Ceramic Wires and Ceramic Rods for Thermal Spraying."

2. The Contractor shall provide a certificate of the chemical composition of the feedstock from the feedstock supplier.

B. Urethane Sealer – Provide the type and quantity of urethane sealer needed to seal all surfaces of the metallizing.

1. The seal coat shall be a urethane applied over all metallizing in accordance with the manufacturer's requirements. The products of Carboline Company and Sherwin Williams Company listed below are examples of the standard of quality to be achieved. Equivalent products of other manufacturers may be submitted to CDOT for consideration:

   a) Carboline: Carbothane 134 HG

   b) Sherwin Williams: High Solid Polyurethane B65

   or

   Approved Equal

2. Use a single manufacturer to supply all thermal spray feedstock, and a single manufacturer to supply the coating materials and including thinners, additives, and touch-up coatings. Do not co-mix coating products or components produced by different manufacturers under any circumstances.

3. Only use materials that are packaged and sealed, original, labeled containers bearing manufacturer's name, type of material, brand name, shelf life, batch number, and instruction for mixing and thinning.

CAULKING MATERIALS - When caulking is required, provide 100% solids material that is recommended by the coating manufacturer.

SURFACE PREPARATION, THERMAL SPRAYING, AND PAINTING EQUIPMENT

A. Provide thermal spray metallizing, and surface preparation and painting equipment in accordance with the requirements of this section.

B. Use equipment and materials that are clean and sized properly to accomplish the work, including the required surface profile and finish as required by this section.

C. The thermal spray equipment shall be gas or electric arc equipment set up, calibrated, and operated in accordance with the manufacturer's written instructions. Proper set up and functioning of equipment shall be verified by performing a bend test in accordance with sub-section F.3 of the Metallizing Surface Preparation section below.

PERSONAL PROTECTIVE EQUIPMENT

A. Provide all of the necessary personal protective equipment (PPE) for the project to assure that workers are protected from hazards during surface preparation, metallizing, coating application, and clean-up activities.

B. Furnish and have available to the Engineer, two new NIOSH/MESA approved thermal spray air respirators and other safety equipment needed to permit the

inspection of ongoing metallizing/coating work.

C. Repair or replace PPE as required to assure that it continues to provide its' intended purpose.

Add the following Subarticle.

Subarticle M06.05 – Certified Tests Reports, Material Certificates and Certificates of Compliance:

The Contractor shall furnish Certified Test Report in conformance with Article 1.06.07 confirming that the structural steel meets the chemical and strength requirements stated herein. The Contractor shall furnish a Materials Certificate in conformance with Article 1.06.07 confirming that the selected structural steel coating system meets the requirements stated herein.

Temporary Supports: All steel for the temporary support of the structural steel shall conform to the requirements of ASTM A709 Grade 36 or Grade 50, as proposed by the Contractor and approved by the Engineer. All material shall be in conformance with the Connecticut Department of Transportation Standard Specifications Form 814A. The structural steel for the temporary supports need not be painted. All bolts shall be high strength bolts conforming to ASTM A325. Anchor bolts shall be fully threaded rods conforming to ASTM A449. Threaded rods for the hold-down devices shall conform to ASTM A354 Grade BD. All materials required for the temporary support of the proposed structural steel, which are not required in the completed structure, shall remain the property of the Contractor and shall be removed from the site when it is no longer needed.

Article 6.03.03 - Construction Methods:

Add the following to Subarticle 1 – Shop Drawings:

The Contractor shall prepare and submit to the Engineer, Working Drawings and Computations for review in accordance with Article 1.05.02(2), for the work required under this item. The working drawings and computations shall be stamped by a Professional Engineer Licensed in the State of Connecticut and experienced in this type of work. The drawings and computations shall fully depict the erection methods, sequences, details and materials and equipment the Contractor proposes to use.

The working drawings shall include, but not be limited to, the following information:

Truss Assembly:
- A sequencing plan for the complete assembly of the proposed truss, including bracing members and floor beams and stringers.
- A layout plan for the temporary supports required, including bracing and guying to be used during the assembly of the proposed truss.
- Complete member sizes, material specifications, dimensions, connection details, temporary support systems, working loads and design methods, field measurements and grades as required, and an estimated time schedule for the truss assembly operation.

Truss Jacking:
- A sequencing plan for supporting and jacking the fully assembly truss for the purpose of

determining the correct installation of remain-in-place forms, and to allow for the installation of the proposed inspection platforms.

- A layout plan for the temporary support structures, including bracing and foundations, and hydraulic jacks, as required. It shall include the design of, and the furnishing, fabricating, transporting, erecting, installing, jacking, and the removal and disposal of, the temporary supports, bracing, foundations and jacks, as required.

The Contractor's attention is directed to the fact that specific "Erection Sequencing" as shown on the plans and elsewhere in these specifications, have been developed for the erection of the Structural Steel Truss (Segment 2) over the Metro-North Railroad. The Contractor shall determine the specifics of and be responsible for the actual erection methods and sequencing with the approval of the Engineer. Prepare and submit to the Engineer working drawings and computations in accordance with Article 1.05.02-2 of Form 814A. The drawing shall be prepared and stamped by a professional Engineer licensed in the State of Connecticut fully depicting his proposed methods and sequencing. These drawings shall include, but not be limited to complete details of the methods, materials and equipment he proposes to use for this purpose.

Add the following subarticle:

39 – Removal of Existing Facilities

The contractor shall remove and legally dispose of the abandoned transformer foundation and appurtenances at Pier 2 and the abandoned transformer crib at Pier 3 to a minimum of 2 feet below grade or as directed by CDOT.

Add the following requirements:

Metallizing:

SURFACE PREPARATION

A. Weld Spatter, Sharp Edges, and Holes

1. Remove slag, flux deposits, and weld spatter and steel irregularities such as fins, tears and slivers. Grind any resulting burrs smooth, including burrs around holes.

2. All corners and edges shall be rounded to a 1/16-inch radius or chamfered to a 1/16-inch chamfer.

3. Flame cut edges shall be ground over their entire surface such that any hardened surface layer is removed, and subsequent abrasive blast cleaning produces the specified surface profile depth.

B. Pre-Surface Preparation Cleaning of Steel

1. Prior to surface preparation, remove visible grease and oil, etc. from bridge surfaces in accordance with SSPC-SP 1 using only solvents or detergents acceptable to the coating manufacturer and CDOT. The use of pressurized water for this cleaning is also acceptable.

2. Use clean cloths for the final wiping.

C. Compressed Air Cleanliness

1. Provide compressed air that is free from moisture and oil contamination.

2. Verify the cleanliness of the compressed air by the white blotter test in accordance with ASTM D4285 at least once per shift for each compressor system. Sufficient freedom from oil and moisture is confirmed if soiling or discoloration are not visible on the paper.

3. If air contamination is evident, change filters, clean traps, add moisture separators or filters, or make adjustments as necessary to achieve clean, dry air.

D. Ambient Conditions

1. Do not conduct final surface preparation which exposes bare steel under damp environmental conditions or when the surface temperature is less than 5° F greater than the dew point temperature of the surrounding air.

E. Abrasives/Profile

1. Use clean, dry, uniformly graded recyclable steel or disposable abrasives for blast cleaning that are free of oil, soluble salts and other similar substances that could contaminate the blast cleaned surface.

2. Provide abrasive that is sized to produce a sharp, angular, uniform surface profile height of 3.0 to 4.0 mils, unless the requirements of the metallizing products are otherwise. Measure the profile using the Keane-Tator Surface Profile Comparator or Testex Replica Tape in accordance with ASTM D4417.

F. Pre-Production Test Sections

1. Prior to proceeding with production surface preparation operations, blast clean and metallize at least 9 square feet of steel surface.

2. Use the same metallizing equipment, set up, materials, and calibration and operating procedures in the test section(s) that will be used for the production operations.

3. Spray parameters should be set for spraying the submitted feedstock and at a minimum, be validated by passing a bend test as follows:

a) Spray five carbon steel coupons with approximate dimensions of 2 x 4 to 8 x 0.050 inches. The surface of the coupons should be prepared to the same degree as specified for the project. Bolt, bracket or otherwise fasten the coupons to larger pieces of stock during the blast cleaning and metallizing operations.

b) Spray metallizing 8 to 10 mils thick in a right angle cross hatch spray passes laying down approximately 3 to 4 mils per pass.

c) Bend coupons 180 degrees around a 0.5 inch diameter mandrel.

1) Bend test passes if there is no cracking or only minor cracking visually observed on the bend-radius.

2) Bend test fails if the coating cracks and lifts from the substrate.

4. Metalographic analysis of additional coupons may be required by CDOT to establish the suitability of the surface preparation and the thermal spray coating. Supply, prepare, and thermal spray coat these panels using the same materials, equipment and process parameters for the contract work at no additional cost to CDOT.

5. Provide safe access for close visual inspection and testing.

6. Do not proceed with production surface preparation activities until CDOT agrees that the surfaces of the test section have been prepared to conform with the requirements.

SEALER/PAINT AND METALLIZING MATERIAL STORAGE, MIXING, AND HANDLING

A. Sealer/Paint and Metallizing Material Storage

1. Keep all containers unopened until required for use.

2. Store all sealer/paint, metallizing materials (i.e. feedstock wire), thinners, and solvents in accordance with OSHA regulations and the requirements of the manufacturer. Store the materials under cover, out of direct sunlight. Maintain the temperature between 40°F and 90°F, unless the requirements of the manufacturer are more restrictive.

3. Provide the size and number of fire extinguishers in proper proportion to the quantity of sealer/paint stored.

4. Do not permit smoking in sealer/paint storage, mixing, and application areas.

5. Do not open or mix sealer/paint in the storage area.

6. Do not return mixed sealer/paint to the storage area.

7. Bulk containers for solvents and thinners must be equipped with spring-loaded, self- closing, dispensing nozzles. Use Underwriter's Laboratories approved containers for transporting paint to mixing areas.

8. Use explosion-proof lighting fixtures.

9. Do not permit the accumulation of empty sealer/paint cans, combustibles, and other debris.

10. Maintain MSDS for all materials.

B. Mixing and Thinning of Sealer/Paint Materials

1. Verify that the sealer/paint to be mixed has not exceeded its' shelf life. When required by the manufacturer, warm paints stored at less than 40°F to above 50°F prior to mixing.

2. Utilize proper ventilation in the mixing area to prevent injury to workmen or the accumulation of volatile gases.

3. Mix all sealer/paint coatings in accordance with the requirements of the coating manufacturer.

4. Mix only complete kits of material. Mixing of partial kits is not allowed.

5. Do not use two component materials beyond the pot life established by the manufacturer's written instructions.

6. Thin sealer/paint in strict accordance with the coating manufacturer's written instructions. Use only those types, brands, and amounts of thinner recommended by the coating manufacturer. Limit the thinning to the minimum amount necessary to facilitate application except for the mist coat of urethane sealer applied over metallizing. Unless directed otherwise by the coating manufacturer, thin the sealer coating approximately 25% and first apply as a mist coat to seal the surface. When the mist coat has penetrated the metallizing, follow with the full coat with proper thinning.

COATING APPLICATION

A. Quality of Surface Preparation

1. Verify that the surface exhibits the specified SSPC-SP10 degree of cleaning immediately prior to metallizing.

2. Apply the metallizing on the same work shift that cleaned the steel to bare metal. If bare steel is allowed to remain uncoated for more than six hours, or re-rusting is evident, reclean the surface prior to metallizing.

B. Surface Cleanliness - Thoroughly clean the surface of each coat prior to the application of the next to remove overspray, spent abrasive, dirt, dust, and other interference material.

C. Grease/Oil - If grease or oil has become deposited on the bare steel or on the surface of any of the applied coats, remove by solvent cleaning in accordance with SSPC-SP1 prior to the application of the next coat.

D. Ambient Conditions -Apply metallizing and sealer/paint under the following

conditions unless the requirements of the coating manufacturer are more restrictive.

1. Surface and Air Temperatures – between 40°F and 110°F

2. Relative Humidity - Less than 85%.

3. Dew Point - Surface temperature at least 5°F above the dew point temperature of the surrounding air.

4. Frost/Rain - Do not apply coatings to surfaces containing frost or during rain, fog, or similar conditions.

5. Remove and replace any paint that is exposed to unacceptable conditions (e.g. rain or dew) prior to adequate curing.

E. Metallizing Application

1. The coating shall be applied in a neat and workmanlike manner and shall be applied uniformly and shall be free of ridges or other defects. The coating shall be applied by thermal spray employing multiple passes to achieve a thickness of 0.008 to 0.010 inches (8-10 mils). No single pass shall deposit more than 0.004 inches. Proper spray equipment set up, calibration, and operating procedures shall be verified by passing a bend test at the beginning of each work shift that metallizing is to be applied. Perform this bend test in accordance with sub-section F.3 of the Metallizing Surface Preparation section above.

2. In addition to the bend test, a cut test shall be performed once per every two hours that metallizing is being applied. The cut test consists of a single cut 1.5 inches long through the thermal spray coating to the substrate without severely cutting the substrate. A cut shall be made with a hammer and sharp chisel. The chisel cut should be made at a shallow angle. The bond of the metallizing is considered unsatisfactory if any part of the metallizing lifts from the substrate along the cut.

3. Spraying shall be performed in a block pattern, typically 2 square feet or as per the equipment manufacturer's written recommendation. Overlapping spray passes to ensure uniform coverage, and produce the required thickness and uniformity. A minimum of two passes are required, overlapping and at right angles to each other. The gun shall be held at such a distance from the work surfaces so that the metal is still plastic on impact, typically 5 to 8 inches from the surface. The coating shall be firmly adherent and free from uncoated spots, lumps or blisters, and have a fine sprayed texture.

4. Special care shall be exercised to avoid contamination of surrounding areas or property by over spraying. Containment tarps should be used when spray application is performed.

5. The work area shall be properly ventilated to assure proper worker

protection.

F. Metallizing Adhesion

1. Adhesion strength of the metallizing shall be 700 psi minimum as measured with approved equipment as per ASTM D4541 using apparatus under Annex A4. All adhesion test locations shall be re-metallized in accordance with this specification at no additional cost. Measurements shall be taken every 500 square feet. If adhesion is less than 700 psi but greater than 560 psi, four additional adhesion tests shall be made. If any of the additional adhesion tests are less than 700 psi, the coating shall be removed and re-applied at the Contractor's expense. Any adhesion test result less than 560 psi, will be grounds for the Contractor to remove the entire coating at their expense.

G. Sealer/Paint Application

1. Apply all sealer/paint by the methods shown below unless the methods recommended by the sealer/paint manufacturer are more restrictive. Apply the sealer/paint to all previously metallized surfaces. Do not allow the metallized surface to stand for longer than 8 hours before application of the seal coat, and in no cases shall the seal coat be applied over visible oxidation of the metallizing.

2. Apply the sealer/paint in a two-coat operation, a mist coat and a full coat. Thin the mist coat up to the manufacturers written maximum amount using the recommended thinner in order to penetrate the metallizing layer. Apply the full finish sealer/paint coat without thinning.

3. Airless or conventional spray application - If conventional spray is used, verify that the compressed air supply is clean and dry as determined by the blotter test. When spraying, use extreme care to avoid contamination of surrounding areas or property by overspray.

4. Brush or roller application - Brushes or rollers may be used to control overspray, or for localized application such as touch-up, in areas of limited accessibility for spraying, or for stripe coating.

H. Recoat Times For Liquid Coatings

1. Apply each coat only after the previous coat has been allowed to dry as required by the manufacturer's written instructions, but as soon as possible to minimize the length of time that the coating is exposed to dust and contamination.

2. Do not allow any coat to remain exposed for longer than fourteen (14) calendar days prior to overcoating.

I. Coverage and Continuity

1. Apply each coat to assure thorough wetting of the substrate or underlying coat, and to achieve a smooth, streamline surface relatively free of dryspray, overspray, and orange peel. Shadow-through, pinholes, bubbles, skips, misses, lap marks between applications, or other visible discontinuities in any coat are unacceptable. Runs or sags in liquid coatings may be brushed out while the material remains wet. If the discontinuities remain in the film after drying, remove and replace the defective coating as described later in the "Repair" section of this specification.

2. Thoroughly coat all surfaces with special attention to hard-to-reach areas, and irregular surfaces. Some configurations may require spraying from multiple directions to assure complete coverage.

J. Tint - Tint successive coats (if approved by the manufacturer), or use materials of sufficiently different color to facilitate proper coverage and to provide a visual distinction between coats.

K. Sealer/Paint Adhesion

1. Apply sealer/paint in such a manner to assure that they are well-adherent to each other and to the underlying surface. If the application of any coat causes lifting of an underlying coat, or there is poor adhesion between coats or to the substrate, remove the coating in the affected area to adjacent sound, adherent, coating, and reapply the material.

2. If sealer/paint adhesion is suspect, conduct adhesion tests in accordance with ASTM D3359 or ASTM D4541 as directed by CDOT and repair all test areas. The acceptance criteria for the testing will be established by CDOT and the coating manufacturer. Replace all defective coating that is revealed by the testing.

L. Wet Film Thickness - Use wet film thickness gages in accordance with ASTM D4414 to verify the thickness of each liquid coat at the time of application.

M. Dry Film Thickness

1. Apply each coat to the thicknesses specified below:

a)	Metallizing	8 to 10 mils
b)	Urethane Sealer	2 to 4 mils

1) TOTAL SYSTEM
10 to 14 mils

2. Measure the thickness of each coat using nondestructive magnetic dry film thickness gages. Comply with SSPC-PA2 for the calibration and use of the gages, and the frequency of thickness measurements. Spot readings both 20% above and 20% below the thicknesses shown above are permitted, provided the average thicknesses are within the specified

tolerances.

3. If there are questions regarding the non-destructive measurements of coating thickness, a Tooke Gage (destructive scratch gage) may be used when authorized by CDOT. Conduct measurements in accordance with ASTM D4138, but limit its' use to a minimum of locations. Mark and repair all damage caused by the destructive testing, whether created by CDOT or the Contractor.

4. Apply additional coating to areas of insufficient thickness with care to assure that all repairs blend in with the surrounding material.

5. Unless directed otherwise by CDOT, remove excessive coating thickness and reapply the affected coat(s).

REPAIR OF FILM DISCONTINUITIES AND DAMAGE TO COATING SYSTEM AFTER ERECTION

A. Surface Preparation of Film Discontinuities or Damage

1. Remove localized film discontinuities (e.g., runs, sags, shadow-through, etc.) or damage and corrosion by solvent cleaning in accordance with SSPC-SP 1 followed by sanding or power tool cleaning.

2. In damaged metallized areas, if the repair operation exposes the substrate, remove all loose material and prepare the steel in accordance with SSPC-SP 5 and achieve a uniform and dense surface profile of 2 to 4 mils.

3. If the substrate is not exposed, remove all loose material and prepare the surface in accordance with SSPC-SP 3.

B. Feathering of Repair Areas

1. Feather the existing material surrounding each repair location. Feather for a distance of 1 to 2 inches to provide a smooth, tapered transition into the existing intact coating.

2. Verify that the edges of coating around the periphery of the prepared areas is tight and intact by probing with a putty knife in accordance with the requirements of SSPC-SP3. Roughen the existing coating in the feathered area to assure proper adhesion of the repair coats.

C. Coating Application

1. When the bare substrate is exposed in the repaired area, apply the metallizing and urethane sealer/paint.

2. When the repair does not extend to the bare substrate, apply only the seal coats.

3. Maintain the thickness of the system in overlap areas within the specified total thickness tolerances.

INSPECTION

A. CDOT may inspect any or all phases of the Work to verify that it is in accordance with the requirements of this section. Facilitate this inspection as required, including allowing ample time for the inspections and access to the work. Inspections may include, but are not limited to, surface preparation, pre-painting cleanliness, paint application, dry film thickness, film appearance and continuity, and adhesion.

B. The presence or activity of CDOT inspections in no way relieves the Contractor of the responsibility to comply with all requirements of this Section and to provide adequate inspections of its' own.

C. Furnish, until final acceptance of the coating system, all equipment and instrumentation needed to inspect all phases of the work.

ONE-YEAR ANNIVERSARY INSPECTION

A. A one-year anniversary inspection will be conducted approximately twelve months after the structure has been erected. Provide for all aspects of this inspection (i.e. access, rigging, safety traffic control, etc.) and participate in this inspection with CDOT. All at no additional cost to CDOT.

B. Repair, at no cost to CDOT, all locations where the coating exhibits disbonding, cracking, rusting, or other such defects. Perform all repairs in accordance with this Section and the coating manufacturer's written instructions.

Article 6.03.04 – Method of Measurement

Add the following at the end of the second paragraph:

The following items will not be measured for payment and are included in the cost of this item:

- All permanent and temporary work necessary for furnishing, fabricating, transporting, erecting, surface preparation, and coating of new structural steel as shown on the Plans and specified herein.
- The assembly of the structural steel truss of Segment 2 supported on the proposed welded girders of Segment 3, as shown on the "Suggested Erection Sequence – Truss Assembly" plans.
- The use of temporary transfer beams and hold-down devices, as shown on the "Suggested Erection Sequence – Truss Assembly" plans. The design of, and the furnishing, fabricating, transporting, erecting, installing, and the removal and disposal of, the transfer beams and hold-down devices, as required.
- Supporting and jacking the fully assembled truss segment at the four reaction posts for the purpose of determining the correct installation of remain-in-place forms, and to allow

for the installation of the proposed inspection platforms. The design of, and the furnishing, fabricating, transporting, erecting, installing, jacking, and the removal and disposal of the temporary supports, bracing, foundations and jacks, as required for this jacking.

- The preparation of working drawings and computations, as required, and as noted herein and elsewhere in these specifications, for the methods and temporary work the Contractor proposes to complete the work included under this item.
- Work platforms/protective shielding over the railroad right of way for the purposes of deck forming and any of the other Contractor's operations as required by the railroad(s).
- Providing a coating system to all structural steel.
- A one-year anniversary inspection, to be conducted approximately twelve months after the structure has been erected. All aspects of this inspection (i.e. access, rigging, safety traffic control, etc.), participation by the Contractor in this inspection with CDOT, and repair by the Contractor of all locations where the coating exhibits disbonding, cracking, rusting, or other such defects, performed in accordance with this Special Provision and the coating manufacturer's written instructions.

Article 6.03.05 – Basis of Payment

Replace the second paragraph with:

Payment under either method shall be for structural steel, complete in place, which price shall include:

- Furnishing, fabricating, transporting, erecting, surface preparation, and all materials, equipment, tools and labor incidental thereto.
- All permanent and temporary work necessary for furnishing, fabricating, transporting, erecting, surface preparation, and coating of new structural steel as shown on the Plans and specified herein.
- The assembly of the structural steel truss of Segment 2 supported on the proposed welded girders of Segment 3, as shown on the "Suggested Erection Sequence – Truss Assembly" plans.
- The use of temporary transfer beams and hold-down devices, as shown on the "Suggested Erection Sequence – Truss Assembly" plans. The design of, and the furnishing, fabricating, transporting, erecting, installing, and the removal and disposal of, the transfer beams and hold-down devices, as required.
- Supporting and jacking the fully assembled truss segment at the four reaction posts for the purpose of determining the correct installation of remain-in-place forms, and to allow for the installation of the proposed inspection platforms. The design of, and the furnishing, fabricating, transporting, erecting, installing, jacking, and the removal and disposal of, the temporary supports, bracing, foundations and jacks, as required for this jacking.
- The preparation of working drawings and computations, as required, and as noted herein and elsewhere in these specifications, for the methods and temporary work the Contractor proposes to complete the work included under this item.
- Work platforms/protective shielding over the railroad right of way for the purposes of deck forming and any of the other Contractor's operations as required by the railroad(s).
- Providing a coating system to all structural steel.
- A one-year anniversary inspection, to be conducted approximately twelve months after the structure has been erected. All aspects of this inspection (i.e. access, rigging, safety

traffic control, etc.), participation by the Contractor in this inspection with CDOT, and repair by the Contractor of all locations where the coating exhibits disbonding, cracking, rusting, or other such defects, performed in accordance with this Special Provision and the coating manufacturer's written instructions.

Add the following at the end of the article:

No additional payment will be made for the removal and legal disposal of existing facilities under this item. The cost will be included in the unit price for this item.