GENERAL NOTES

Item 400, 403, 416, 420, 426, 427, 441, 446, 447, 448, 449, 450 and 454:

Contractor will develop, engineer and submit a detailed "Erection Manual" for the fabrication and erection of arch and transition bent foundations, the steel arch, longitudinal girders, floor beams, bracing, precast concrete panels, cast-in-place concrete deck, bearings and cables in accordance with the Contract Documents, applicable portions of Texas Department of Transportation Standard Specifications, Special Specifications and these Project Special Provisions.

A suggested erection sequence representing the sequence of construction assumed in the design of the steel arch, steel superstructure, concrete deck and bridge cables has been included as part of the Contract Documents. Utilization of this suggested erection sequence as presented is not mandatory.

A registered professional engineer licensed in the State of Texas (Contractor's Erection Engineer) is required to prepare and seal all design calculations, plans, methods and procedures to be used in the submitted "Erection Manual" for approval. The registered professional engineer will have proven experience in the erection engineering of arch bridges or other cable supported structures and his qualifications will be presented to the Engineer of Record for review at the pre-construction meeting.

The final agreed upon "Erection Manual" will prevail over the Standard or Supplemental Specifications where there is conflict. The Engineer of Record's judgment will prevail over all contract documents including the "Erection Manual" if deemed necessary.

Erection assumptions have been provided with the suggested erection sequence to permit analysis of the structure for the load effects during erection of the steel arch, steel superstructure, concrete deck and bridge cables. If the Contractor elects to use the suggested erection sequences provided, the Contractor ascertains the practicality thereof and assumes complete responsibility for these and any other erection sequences proposed in the "Erection Manual".

Prepare and submit the draft "Erection Manual" prior to the pre-construction conference for the fabrication and erection of arch and transition bent foundations, the steel arch, longitudinal girders, transverse girders, bracing, precast concrete panels, cast-in-place concrete deck, bearings and bridge cables for review and approval. The draft "Erection Manual" may contain erection sequences similar to the suggested erection sequences shown on the Contract Plans or may be alternative sequences. Specifically, the draft "Erection Manual" will outline the intended methods of constructing the bridge components or tasks outlined in articles "A. and B." below. Submit the draft "Erection Manual" in advance of the date scheduled for the pre-construction conference in order to afford the Engineer of Record 21 calendar days for review time.

Submit the final "Erection Manual" for review prior to beginning work. Work will not start prior to the receipt by the Contractor of the agreed upon final "Erection Manual". At the contractor's option, the final "Erection Manual" may be submitted in parts which when compiled into one erection manual will address each of the tasks in articles "A., B., C. and D." below.

Submit the final "Erection Manual" in advance of the date scheduled for beginning the work for each task in order to afford the Engineer 30 calendar days for review time prior to the scheduled commencement of work. Work will not start prior to the receipt by the Contractor of the agreed upon "Erection Manual" for any portion of the structure. Upon receiving final agreement for every task in articles "A., B., C. and D." below, seven (7) copies of the final "Erection Manual" will be provided to the Engineer.

The review of the "Erection Manual" by the Engineer of Record will not relieve the Contractor of the full responsibility for the safety adequacy of the work. The Engineer of Record's review will be based solely on loads and sequence of construction presented in the Contractor's proposed "Erection Manual". Any deviation from the approved construction loads and erection sequence will be submitted to the Engineer of Record for review 21 calendar days prior to those steps occurring. Work will not start prior to the receipt

by the Contractor of the Engineer of Record's review and approval of the proposed changes to the "Erection Manual".

The proposed "Erection Manual" will include, but not be limited to:

A. Detailed Design.

1. Complete sequence of erection for temporary and permanent structures
2. All erection equipment to be used on site
3. All shored excavations
4. Installation procedures and schedules for all temporary falsework supports, including any proposed limits of required excavation and subsequent recompaction of the temporary staging work areas.
5. Crane Mats and other temporary foundations including size and locations
6. Temporary falsework supports of the steel superstructure
7. Temporary bracing and falsework as required for the erection of the arch
8. Cable system including bridge cables, anchors, HDPE pipes and jacks
9. All proposed bolting procedures
10. All proposed field welding procedures
11. Falsework removal plan.
12. Deck and Arch required camber

B. Methods and Procedures for Erection.

1. Methods for controlling mass concrete heat of hydration where applicable.
2. Details and limits of any structures including temporary falsework supports and open excavations to be constructed in the Trinity River Floodplain and/or natural river channel.
3. Sequence for installing temporary falsework supports, permanent bearings, removing temporary falsework supports and transferring loads to permanent bearings at the interior arch and the transition bents.
4. Sequence and manner of erecting arch legs and supporting tower prior to installation of cables including details indicating provisions for stability of the partially erected towers legs.
5. Sequence and schedule for erection of the composite concrete and steel deck system including all intermediate procedures relating to staging of steel erection, placement of precast deck panels and concrete slab pouring sequence.
6. Sequence and manner for performing, testing and inspecting all bolted connections.
7. Sequence and manner for performing, testing and inspecting all field welding procedures including provisions for protecting welding operations from exposure to inclement weather conditions.
8. Sequence and manner of installing and stressing cables including details of cable fabrication, stressing monitoring, cable lengths, shims, stressing order as well as a complete history of the initial jacking force, any supplemental jacking forces and incremental loads for each cable.
9. Details of the disposition and use of special erection equipment, falsework, temporary supports, including all loads or reactions from such equipment applied to the structure during erection and sequences and timings of these effects in accordance with the

erection schedule. Details should address method of attachments to any permanent structure element and subsequent removal of attachments.

C. Factors of Safety for all applicable equipment and procedures to be used as agreed upon by the Engineer of Record. These factors of safety shall be specified by the Contractor's Erection Engineer.

D. Design calculations will consist of, but not be limited to:

1. Design and details of any temporary falsework support foundations and shored excavations.
2. Design and details of all temporary falsework supports and temporary bracing and subsequent temporary connections to the permanent structures.
3. Minimum and maximum vertical and horizontal reactions at all temporary falsework support locations.
4. The expected maximum bearing, shear, compression and tensile stresses in the steel arch as may be produced with the Contractor's proposed sequences and methods of erection.
5. Verification that the permanent structure is not overstressed during erection including computations of moments, shears, axial loads and other forces in the steel tower and composite superstructure at a sufficient number of points to demonstrate that the load demand will not exceed the capacity and allowable stresses for erection.
6. Design of arch and deck camber curves.
7. Methods and procedures for verifying and correcting any discrepancies in the arch alignment. Absolute tolerance in arch alignment is ± 0.02%.
8. Methods and procedures for verifying and correcting any discrepancies in the elevations of the deck after completion of erection. Absolute tolerance in deck elevation cable attachment points shall follow, within a tolerance of ±0.05 ft, a smooth parabolic curve passing through the final deck elevation at the centerline of bridge.
9. Methods and procedures for verifying and correcting any discrepancies in the cable loads after completion of erection. Cables shall be adjusted for the dead load condition such that each individual cable shall not exceed values at ± 5% of the cable dead load computed from approved working drawings. It is possible that one individual cable may have to be adjusted to lesser tolerances to prevent stress in other cables from exceeding the ± 5% tolerance.
10. Final cable adjustments, if required, shall be performed after all other dead loads are in place.

The Contractor is completely responsible for protection of the structural integrity of the steel arch, steel superstructure, concrete deck, bridge cables, barriers, rails and lighting. The Contractor will repair any damage sustained by steel arch, steel superstructure, concrete deck, bridge cables, barriers, rails and lighting during erection to the satisfaction of the Engineer of Record at no additional cost to the project.

The Contractor's erection sequence will ensure the intermediate static and dynamic stability of the structure for the various stages of the construction. A series of wind tunnel model tests have been conducted on the completed prototype structure as well as the "free standing" steel arch. A report of the test results will be made available to the contractor upon request. The accuracy of the information in this report is not guaranteed and it is not to be considered as part of the plans governing construction of the project. Contractors need to make their own determinations and evaluations of the information as made available in this report.

The Contractor will be responsible for geometric control of construction so that the completed structure will conform to the lines, grades, and dimensions and cable stresses shown on the contract documents. A geometric control plan will provide for the regular monitoring of the superstructure deflections beginning

with the first cable stressing and concluding with the last cable stressing. Final vertical geometry of the superstructures will be set such that at 10 years after completion, the final theoretical vertical geometry is achieved when considering the affects of creep and shrinkage.

The Contractor will check the elevations and alignment of the structure, at every stage of the construction. All surveying will be performed at a time that will minimize the influence of temperature. Surveying will be provided to an accuracy of 0.01 ft. The Contractor will maintain a record of all surveys, check readings, adjustments, and corrections and will file such data with the Engineer daily.

The Contractor will be responsible for maintaining temporary work/staging areas to the satisfaction of the Engineer of Record.

The Contractor is responsible for obtaining any necessary variances or revisions to the permits previously obtained for this project that result from construction within the Trinity River basin that extend beyond the proposed structure such as Corps of Engineers permits or other permits for open excavations, temporary falsework foundations and temporary staging areas.

Any damaged shop painted areas of the steel components will be repaired to the satisfaction of the Engineer of Record at the Contractor's expense.

Changes in the agreed upon "Erection Manual" will not be allowed unless agreed upon in writing by the Engineer of Record in advance of the work to be performed.

Upon completion of construction operations and Engineer of Record approval of final superstructure placement, all equipment will be removed and site conditions will be restored to undamaged existing condition unless approved otherwise by the Engineer.

Item 416:

Provide a minimum of one core per bent, regardless of placement method.

Item 420:

Mass concrete is a plans quantity item.

Apply an ordinary surface finish to all concrete surfaces within 30 days after form removal.

Items 420, 422 and 440:

Provide bridge slab reinforcing steel with epoxy coating complying with Item 440 requirements.

Item 421:

Furnish mix designs to the Engineer in a format compatible to the latest version of the Department’s Construction Management System (SiteManager). Mix Design templates will be provided by the Engineer.

Provide type II cement in Class “C” and “S” Concrete.

Strength evaluation using maturity testing, Tex-426-A, may be used for all concrete elements except drill shafts and mass concrete pours.

Maturity meters may be used for temperature gradient determination in mass concrete pours.

Provide compression testing equipment.

Items 422:

The use of Permanent Metal Deck Form (PMDF) is not permitted.

Item 427:

Finish concrete structures surface area I with an opaque sealer of the color(s) shown elsewhere in the plans in accordance Item 427.

Ensure that surfaces are free of weak surface material, curing compounds and other surface contaminants prior to coating.

Items 427 and 446:

Unless otherwise noted, it is the intent of these plans that all exposed surfaces (concrete or steel) of bridges be given a tinted coating as shown or as directed. Such coating shall meet the applicable provisions of Item 427 or Item 446.

There is not a Federal Standard 595b color that matches the architectural color requirement. Use color "09010" per the RAL color chart.

Element	Specification Number
Abutments (all parts)	Bright Red (TBC by the architect)
All components of the underside of the slab, either precast or cast-in-place including the slab edge	RAL 09010
Steel Arch Including concrete connection	Bright Red (TBC by the architect)
Internal Longitudinal Girder	RAL 09010
External Longitudinal Girder	RAL 09010
Transverse Girder	RAL 09010
K-Bracing	RAL 09010
Exterior Steel Fascia on Approach Spans	RAL 09010
Roadway Illuminaire (all components)	RAL 09010
Rail (All Steel Components)	RAL 09010
Overhead Sign Bridge (all steel components)	RAL 09010
Drain Pipes	RAL 09010

Provide a sample panel(s) with the specified color and paint system for review and approval. The panel(s) will be a minimum of 2' x 2' on the same steel grade selected for fabrication. The sample panel(s) will not be paid for directly but is considered subsidiary to structural steel pay items.

Paint the inside of the Arch, with white zinc rich primer.

Item 441:

The Arch, Internal Longitudinal Girder, External Longitudinal Girder, Transverse Girders and K-bracing shall be fabricated at a facility that is certified under the AISC Quality Certification Program, Category CBR, Major Steel Bridges.

The following steel components are designated as primary members:

- webs, flanges and diaphragms of the arch;
- webs and flanges of internal longitudinal girder;
- webs and flanges of external longitudinal girder;
- webs and flanges of transverse girder;
- webs and flanges of K-bracing;

Item 442:

Use temperature Zone 1 for CVN testing.

Item 446:

Paint all structural steel except the arch using protective “System IV" paint in accordance with Item 446. Paint colors are shown previously under Item 427 and 446.

Paint arch with the following paint specification:

- Outside of arch only:
  - 3 mils DFT - Zinc rich primer (e.g. International Paints Interzinc 52HS)
  - 5 mils DFT - Polysiloxane appearance coat (e.g. International Paints Interfine 979)

- Inside of arch only:
  - 3 mils DFT - Zinc rich primer (e.g. International Paints Interzinc 52HS)

After all concrete placement has been completed, remove any concrete or other contaminate from the structural steel members by hand cleaning methods so as not to damage the primer and then water blast / wash with a minimum of 2,500 psi pressure.

Item 450 and 440:

Provide epoxy coated reinforcing steel that embeds into the bridge slab.

Item 471:

Tackweld all inlet grates and manhole covers to the frame with two 1-inch welds.

SPECIAL PROVISION

421---035

Hydraulic Cement Concrete

For this project, Item 421, "Hydraulic Cement Concrete," of the Standard Specifications is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 421.2.D. Water, Table 1. Chemical Limits for Mix Water is voided and replaced by the following:

Table 1
Chemical Limits for Mix Water

Contaminant	Test Method	Maximum Concentration (ppm)
Chloride (Cl)	ASTM C 114	
Prestressed concrete		500
Bridge decks and superstructure		500
All other concrete		1,000
Sulfate (SO_4)	ASTM C 114	2,000
Alkalies ($Na_2O + 0.658K_2O$)	ASTM C 114	600
Total Solids	ASTM C 1603	50,000

Article 421.2.B. Supplementary Cementing Materials (SCM) is supplemented with the following:

6. **Modified Class F Fly Ash (MFFA).** Furnish MFFA conforming to DMS-4610, "Fly Ash."

Article 421.2.D. Water, Table 2. Acceptance Criteria for Questionable Water Supplies is voided and replaced by the following:

Table 2
Acceptance Criteria for Questionable Water Supplies

Property	Test Method	Limits
Compressive strength, min. % control at 7 days	ASTM C 31, ASTM C 39[1,2]	90
Time of set, deviation from control, h:min.	ASTM C 403[1]	From 1:00 early to 1:30 later

1. Base comparisons on fixed proportions and the same volume of test water compared to the control mix using 100% potable water or distilled water.
2. Base comparisons on sets consisting of at least two standard specimens made from a composite sample.

Article 421.2.E.1 Coarse Aggregate. The fourth paragraph is voided and replaced by the following:

Unless otherwise shown on the plans, provide coarse aggregate with a 5-cycle magnesium sulfate soundness when tested in accordance with Tex-411-A of not more than 25% when air

entrainment is waived and 18% when air entrainment is not waived. Crushed recycled hydraulic cement concrete is not subject to the 5-cycle soundness test.

Article 421.2.E.2 Fine Aggregate. The fifth paragraph is voided and replaced by the following:

Acid insoluble (%) = {(A1)(P1)+(A2)(P2)}/100
where:

A1 = acid insoluble (%) of aggregate 1
A2 = acid insoluble (%) of aggregate 2
P1 = percent by weight of aggregate 1 of the fine aggregate blend
P2 = percent by weight of aggregate 2 of the fine aggregate blend

Article 421.2.E.2. Fine Aggregate. The final paragraph is voided and replaced by the following:

For all classes of concrete, provide fine aggregate with a fineness modulus between 2.3 and 3.1 as determined by Tex-402-A.

Article 421.2.E. Aggregate is supplemented by the following:

4. **Intermediate Aggregate.** When necessary to complete the concrete mix design, provide intermediate aggregate consisting of clean, hard, durable particles of natural or lightweight aggregate or a combination thereof. Provide intermediate aggregate free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material, and containing no more than 0.5% clay lumps by weight in accordance with Tex-413-A.

   If more than 30% of the intermediate aggregate is retained on the No. 4 sieve, the retained portion must meet the following requirements:

   - must not exceed a wear of 40% when tested in accordance with Tex-410-A.
   - must have a 5-cycle magnesium sulfate soundness when tested in accordance with Tex-411-A of not more than 25% when air entrainment is waived and 18% when air entrainment is not waived.

   If more than 30% of the intermediate aggregate passes the 3/8" sieve, the portion passing the 3/8" sieve must not show a color darker than standard when subjected to the color test for organic impurities in accordance with Tex-408-A and must have an acid insoluble residue, unless otherwise shown on the plans, for concrete subject to direct traffic equal to or greater than the value calculated with the following equation:

$$AIi_a \geq \frac{60 - (AI_{fa})(P_{fa})}{(P_{ia})}$$

   where:

   AI*fa* = acid insoluble (%) of fine aggregate or fine aggregate blend
   P*fa* = percent by weight of the fine aggregate or fine aggregate blend as a percentage of the total weight of the aggregate passing the 3/8" sieve in the concrete mix design
   P*ia* = percent by weight of the intermediate aggregate as a percentage of the total weight of the aggregate passing the 3/8" sieve in the concrete mix design

Article 421.2.F. Mortar and Grout is supplemented by the following:

Section 421.4.A.6, "Mix Design Options," does not apply for mortar and grout.

Article 421.3.A. Concrete Plants and Mixing Equipment is supplemented by the following:

When allowed by the plans or the Engineer, for concrete classes not identified as structural concrete in Table 5 or for Class C concrete not used for bridge-class structures, the Engineer may inspect and approve all plants and trucks in lieu of the NRMCA or non-Department engineer sealed certifications. The criteria and frequency of Engineer approval of plants and trucks is the same used for NRMCA certification.

Article 421.3.A.2. Volumetric Mixers is supplemented by the following:

Unless allowed by the plans or the Engineer, volumetric mixers may not supply classes of concrete identified as structural concrete in Table 5.

Article 421.4.A Classification and Mix Design. The first paragraph is voided and replaced by the following:

Unless a design method is indicated on the plans, furnish mix designs using ACI 211, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete," Tex-470-A, or other approved procedures for the classes of concrete required in accordance with Table 5. Perform mix design and cement replacement using the design by weight method unless otherwise approved. Do not exceed the maximum water-to-cementitious-material ratio.

Article 421.4.A. Classification and Mix Design, Table 5 Concrete Classes is voided and replaced by the following:

Table 5
Concrete Classes

Class of Concrete	Design Strength, Min. 28-day f'_c (psi)	Maximum W/C Ratio[1]	Coarse Aggregate Grades[2,3]	General Usage[4]
A	3,000	0.60	1–4, 8	Inlets, manholes, curb, gutter, curb & gutter, conc. retards, sidewalks, driveways, backup walls, anchors
B	2,000	0.60	2–7	Riprap, small roadside signs, and anchors
C[5]	3,600	0.45	1–6	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, concrete traffic barrier (cast-in-place)
C(HPC)[5]	3,600	0.45	1-6	As shown on the plans
D	1,500	0.60	2–7	Riprap
E	3,000	0.50	2–5	Seal concrete
F[5]	Note 6	0.45	2–5	Railroad structures; occasionally for bridge piers, columns, or bents
F(HPC)[5]	Note 6	0.45	2–5	As shown on the plans
H[5]	Note 6	0.45	3–6	Prestressed concrete beams, boxes, piling, and concrete traffic barrier (precast)
H(HPC)[5]	Note 6	0.45	3–6	As shown on the plans
S[5]	4,000	0.45	2–5	Bridge slabs, top slabs of direct traffic culverts

Class of Concrete	Design Strength, Min. 28-day f'_c (psi)	Maximum W/C Ratio[1]	Coarse Aggregate Grades[2,3]	General Usage[4]
S(HPC)[5]	4,000	0.45	2–5	As shown on the plans
P	See Item 360	0.45	2–3	Concrete pavement
DC[5]	5,500	0.40	6	Dense conc. overlay
CO[5]	4,600	0.40	6	Conc. overlay
LMC[5]	4,000	0.40	6–8	Latex-modified concrete overlay
SS[5]	3,600[7]	0.45	4–6	Slurry displacement shafts, underwater drilled shafts
K[5]	Note 6	0.45	Note 6	Note 6
HES	Note 6	0.45	Note 6	Note 6

1. Maximum water-cement or water-cementitious ratio by weight.
2. Unless otherwise permitted, do not use Grade 1 coarse aggregate except in massive foundations with 4-in. minimum clear spacing between reinforcing steel bars. Do not use Grade 1 aggregate in drilled shafts.
3. Unless otherwise approved, use Grade 8 aggregate in extruded curbs.
4. For information only.
5. Structural concrete classes.
6. As shown on the plans or specified.
7. Use a minimum cementitious material content of 650 lb/cy of concrete. Do not apply Table 6 over design requirements to Class SS concrete.

Article 421.4.A. Classification and Mix Design, Table 6 Over Design to Meet Compressive Strength Requirements. Footnote 3 is supplemented by the following:

For Class K and concrete classes not identified as structural concrete in Table 5 or for Class C concrete not used for bridge-class structures, the Engineer may designate on the plans an alternative over-design requirement up to and including 1,000 psi for specified strengths less than 3,000 psi and up to and including 1,200 psi for specified strengths from 3,000 to 5,000 psi.

Article 421.4.A.1. Cementitious Materials is supplemented by the following:

The upper limit of 35% replacement of cement with Class F fly ash specified by mix design Options 1 and 3 may be increased to a maximum of 45% for mass placements, high performance concrete, and precast members when approved.

Article 421.4.A.3. Chemical Admixtures is supplemented by the following:

When a corrosion-inhibiting admixture is required, use a 30% calcium nitrite solution. The corrosion-inhibiting admixture must be set neutral unless otherwise approved. Dose the admixture at the rate of gallons of admixture per cubic yard of concrete shown on the plans.

Article 421.4.A.4 Air Entrainment is voided and replaced by the following:

Air entrain all concrete except for Class B and concrete used in drilled shafts unless otherwise shown on the plans. Unless otherwise shown on the plans, target an entrained air content of 4.0% for concrete pavement and 5.5% for all other concrete requiring air entrainment. To meet the air-entraining requirements, use an approved air-entraining admixture. Unless otherwise shown on the plans, acceptance of concrete loads will be based on a tolerance of ± 1.5% from the target air content. If the air content is more than 1.5 but less than 3.0% above the target air, the concrete

may be accepted based on strength tests. For specified concrete strengths above 5,000 psi, a reduction of 1% is permitted.

Article 421.4.A Table 7 Air Entrainment is voided.

Article 421.4.A.6. Mix Design Options. The first and second paragraphs are voided and replaced by the following:

For structural concrete identified in Table 5 and any other class of concrete designed using more than 520 lb. of cementitious material per cu. yd., use one of the mix design Options 1–8 shown below, unless otherwise shown on the plans.

For concrete classes not identified as structural concrete in Table 5 and designed using less than 520 lb. of cementitious material per cu. yd., use one of the mix design Options 1–8 shown below, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3, and 4 unless sulfate-resistant concrete is shown on the plans.

Do not use mix design Options 6 or 7 when High Performance Concrete (HPC) is required. Option 8 may be used when HPC is required provided: a minimum of 20% of the cement is replaced with a Class C fly ash; Tex-440-A, "Initial Time of Set of Fresh Concrete" is performed during mix design verification; the additional requirements for permeability are met; and the concrete is not required to be sulfate-resistant.

Article 421.4.A.6.b. Option 2 is voided and replaced by the following:

b. Option 2. Replace 35 to 50% of the cement with GGBFS or MFFA.

Article 421.4.A.6.c. Option 3 is voided and replaced by the following:

c. Option 3. Replace 35 to 50% of the cement with a combination of Class F fly ash, GGBFS, MFFA, UFFA, metakaolin, or silica fume; however, no more than 35% may be fly ash, and no more than 10% may be silica fume.

Article 421.4.A.6.f. Option 6 is voided and replaced by the following:

f. Option 6. Use lithium nitrate admixture at a minimum dosage determined by testing conducted in accordance with Tex-471-A, "Lithium Dosage Determination Using Accelerated Mortar Bar Testing." Before use of the mix, provide an annual certified test report signed and sealed by a licensed professional engineer, from a laboratory on the Department's List of Approved Lithium Testing Laboratories, certified by the Construction Division as being capable of testing according to Tex-471-A, "Lithium Dosage Determination Using Accelerated Mortar Bar Testing."

Article 421.4.A.6.g. Option 7 is voided and replaced by the following:

g. Option 7. When using hydraulic cement only, ensure that the total alkali contribution from the cement in the concrete does not exceed 3.5 lb. per cubic yard of concrete when calculated as follows:

$$\text{lb. alkali per cu. yd.} = \frac{(\text{lb. cement per cu. yd.}) \times (\%\ Na_2O \text{ equivalent in cement})}{100}$$

In the above calculation, use the maximum cement alkali content reported on the cement mill certificate.

Do not use Option 7 when any of the aggregates in the concrete are listed on the Department's List of Aggregate Sources Excluded from Option 7 ASR Mitigation.

Article 421.4.A.6.h. Option 8 is voided and replaced by the following:

h. Option 8. For any deviations from Options 1–5, perform annual testing on coarse, intermediate, and fine aggregate separately in accordance with ASTM C 1567. Before use of the mix, provide a certified test report signed and sealed by a licensed professional engineer, from a laboratory on the Department's List of Approved ASTM C 1260 Laboratories, demonstrating that the ASTM C 1567 test result for each aggregate does not exceed 0.08% expansion at 14 days.

Do not use Option 8 when any of the aggregates in the concrete are listed on the Department's List of Aggregate Sources Excluded from Option 8 ASR Mitigation. When HPC is required, provide a certified test report signed and sealed by a licensed professional engineer demonstrating that AASHTO T 277 test results indicate the permeability of the concrete is less than 1,500 coulombs tested immediately after either of the following curing schedules:

- Moist cure specimens 56 days at 73ºF.
- Moist cure specimens 7 days at 73ºF followed by 21 days at 100ºF.

Article 421.4.B. Trial Batches is supplemented by the following:

Once a trial batch substantiates the mix design, the proportions and mixing methods used in the trial batch become the mix design of record.

Article 421.4.B. Trial Batches. The fourth sentence of the second paragraph is voided and replaced by the following:

Test at least one set of design strength specimens, consisting of two specimens per set, at 7-day, 28-day, and at least one additional age.

Article 421.4.D. Measurement of Materials, Table 9 is voided and replaced by the following:

Table 9
Measurement Tolerances – Non-Volumetric Mixers

Material	Tolerance (%)
Cement, wt.	-1 to +3
SCM wt.	-1 to +3
Cement + SCM (cumulative weighing), wt.	-1 to +3
Water, wt. or volume	±3
Fine aggregate, wt.	±2
Coarse aggregate, wt.	±2
Fine + coarse aggregate (cumulative weighing), wt.	±1
Chemical admixtures, wt. or volume	±3

Article 421.4.E. Mixing and Delivering Concrete. The first paragraph is supplemented with the following:

Do not top-load new concrete onto returned concrete.

Article 421.4.E.3. Truck-Mixed Concrete. The first paragraph is voided and replaced by the following:

Mix the concrete in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer to produce a uniform concrete mix. Deliver the concrete to the project in a thoroughly mixed and uniform mass and discharge the concrete with a satisfactory degree of uniformity. Additional mixing at the job site at the mixing speed designated by the manufacturer is allowed as long as the requirements of Section 421.4.A.5, “Slump” and Section 421.4.E, “Mixing and Delivering Concrete” are met.

SPECIAL PROVISION
440---006
Reinforcing Steel

For this project, Item 440, "Reinforcing Steel" of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 440.2 Materials, Section A. Approved Mills is supplemented by the following:

Contact the Construction Division with the name and location of the producing mill for stainless steel reinforcement at least 4 weeks prior to ordering any material.

Article 440.2. Materials, Section D. Weldable Reinforcing Steel is supplemented by the following:

Do not weld stainless reinforcing steel without permission from the Engineer. If welding is required, provide stainless steel reinforcing suitable for welding and submit welding procedures and electrodes to the Engineer for approval.

Article 440.2. Materials, Section F. Epoxy Coating. The second paragraph is voided and replaced by the following:

Furnish coated reinforcing steel meeting the requirements in Table 3.

Article 440.2. Materials, Section F. Epoxy Coating. Paragraph four is voided and not replaced.

Article 440.2. Materials, Section G. Mechanical Couplers is voided and replaced by the following:

When mechanical splices in reinforcing steel bars are shown on the plans, use couplers of the type specified in DMS-4510, "Mechanical Couplers for Reinforcing Steel," Article 4510.5.A, "General Requirements."

Furnish only couplers produced by a manufacturer pre-qualified in accordance with DMS-4510. Do not use sleeve-wedge type couplers on coated reinforcing. Sample and test couplers for use on individual projects in accordance with DMS-4510. Furnish couplers only at locations shown on the plans.

Furnish couplers for stainless reinforcing steel with the same alloy designation as the reinforcing steel.

Article 440.2. Materials is supplemented by the following:

H. Fibers. When allowed by the plans, supply fibers at the minimum dosage listed on the Material Producer List maintained by the Materials and Pavements Section of the Construction Division. When shown on the plans, use fibers that do not corrode due to carbonation of concrete or the use of deicing salts.

I. Stainless Steel. When stainless reinforcing steel is required in the plans, provide deformed steel bars of the types listed in Table 3a and conforming to ASTM A 955, GR 60 or higher.

Table 3a
Acceptable Types of Deformed Steel Bar

UNS Designation	S31653	S31803	S24100	S32304
AISI Type	316LN	2205	XM-28	2304

Article 440.3.Construction, Section A. Bending is supplemented by the following:

Bend stainless reinforcing steel in accordance with ASTM A955.

Article 440.3.Construction, Section C. Storage is supplemented by the following:

Do not allow stainless steel reinforcement to be in direct contact with uncoated steel reinforcement, nor with galvanized reinforcement. This does not apply to stainless steel wires and ties. Store stainless steel bar reinforcement separately, off the ground on wooden supports.

Article 440.3. Construction, Section D. Splices. The fifth bullet is voided and replaced by the following:

- For box culvert extensions with less than 1 ft. of fill, lap the existing longitudinal bars with the new bars as shown in Table 5. For extensions with more than 1 ft. of fill, lap at least 1 ft. 0 in.

Article 440.3. Construction, is supplemented by the following:

G. Handling and Placing Stainless Steel Reinforcing.
Handle, cut, and place stainless steel bar reinforcement using tools that are not used on carbon steel. Do not use carbon steel tools, chains, slings, etc. when handling stainless steel. Use only nylon or polypropylene slings. Cut stainless steel using shears, saws, abrasive cutoff wheels, or torches. Remove any thermal oxidation using pickling paste. Do not field bend stainless steel without approval.

Use 16 gauge fully annealed stainless steel tie wire conforming to the material properties listed in 440.2.I. “Stainless Steel”. Support all stainless steel on solid plastic, stainless steel, or epoxy coated steel chairs. Do not use uncoated carbon steel chairs in contact with stainless steel.

SPECIAL PROVISION

441---XXX

STEEL STRUCTURES

For this project, Item 441, "Steel Structures," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 441.3 Construction, Section A. General Requirements, Section 6. Drawings. Section a. Erection Drawings is supplemented by the following:

At the completion of the structure, one set of prints of the corrected original working drawings shall be furnished to the Engineer of Record.

Drilling of holes in the permanent structure for temporary clamping will not be allowed except as approved by the Engineer of Record. Holes approved by the Engineer of Record shall be drilled during shop fabrication. The details of any fastenings which the Contractor may require in any part of the permanent works for erection equipment shall be submitted to the Engineer of Record for approval.

Article 441.3 Construction, Section A. General Requirements, Section 6. Drawings. Section b. Shop Drawings is supplemented by the following:

At the completion of the structure, one set of prints of the corrected original working drawings shall be furnished to the Engineer of Record.

Article 441.3 Construction, Section A. General Requirements, Section 7. Welding Procedures, Section a. Weld Procedures is supplemented by the following:

All welding shall be performed using qualified joints. All complete joint penetration groove welds and partial joint penetration groove welds shall conform to AWS D1.5 Figures 2.4 and 2.5 unless otherwise qualified in accordance with AWS Section 5.7.7.

Longitudinal, transverse and vertical butt joints shall be complete joint penetration groove welds. The welding sequence and distortion control plan shall be submitted to the Engineer of Record for review and comment. Members to be welded shall be brought into correct alignment per the specified tolerances and held in position by the use of jigs, fixtures or other suitable devices until welding is complete. The procedure qualification testing performed before the start of the work shall demonstrate that the weld can be made to the required quality and that angular deformation caused by shrinkage of the welding can be counteracted by suitable measures.

Article 441.3 Construction, Section B. Welding, Section 1. Details, Section c. Weld Termination is supplemented by the following:

Unless otherwise shown on the plans, terminations of fillet welds and all weld pass stops and starts visible in the final weld shall be ground smooth.

Article 441.3 Construction, Section D. Dimensional Tolerances, is supplemented by the following:

4. Superstructure Tolerances

a. **General**. Structural steel shall be detailed and fabricated so that dimensions shown on the plans will be obtained with the specified tolerances under full dead load at a mean temperature of 70 degrees F throughout the erected structure.

Based on the fixed or referenced working points established by the Engineer of Record, the Contractor shall examine the position of the adjoining structures to determine deviations from the theoretically correct position. If the deviations are found which exceed the stated tolerances for the adjoining structures, the Contractor shall immediately propose a procedure to the Engineer of Record, for approval, to correct the deviation.

In the completed structure, the transverse slope shall not deviate more than 0.5 percent from the horizontal.

The coordinate system is based on the following:

x- axis	parallel to the horizontal alignment (longitudinal)
y – axis	perpendicular to the horizontal alignment (transverse)
z – axis	vertical (elevation)

b. Transverse Floorbeams

The allowable variance in straightness shall not exceed 1/16 in./10 ft of the total length.

The vertical profile of the top flange shall be horizontal and shall not deviate more than 0.5 percent from the specified slope.

The maximum variance for web plate flatness shall be limited to 1/4” over the total depth of the web.

The allowable x-axis (longitudinal) variance for the transverse floorbeam / longitudinal girder is -1/8”, +1/8”.

The allowable z-axis (vertical) variance of the transverse floorbeam / longitudinal girder connection is -1/16”, +1/16” for the top flange and -1/8”, +1/8” for the transverse floorbeam / longitudinal girder bottom flange connection.

The overall depth of the section shall be within 0, +3/16” of the plan dimension. The overall width shall be within -0, 1/8” of the plan dimension.

c. Interior Longitudinal Girder

The allowable variance within the interior longitudinal girder for the deck cable working points relative to the outside of the web of the interior longitudinal girder, centerline of the transverse floorbeam and top flange shall be:

x- axis	-1/8”, +1/8” (longitudinal)
y – axis	-1/8”, +1/8” (transverse)
z – axis	-1/8”, +1/8” (vertical)

The overall offset of the deck cable working points is additive with the allowable camber and horizontal sweep of the interior longitudinal girder.

The allowable variance for straightness for an individual field segment shall not exceed 3/32”/10 ft of total field segment length.

The offset of the centerline of interior longitudinal girder relative to the horizontal alignment shall be limited to:

-1/8”, +1/8”	at connection to transverse floorbeam
-1”, + 1”	intermediate field splice points
-1/8”,+1/8”	end connection to arch

The angular misalignment of the centerline of interior longitudinal girder for an individual field segment between temporary supports shall not exceed L/500 where L is the length of the field segment in inches.

The allowable variance for camber shall be limited to:

-1/8”, +1/8”	connection to transverse floorbeam
-0, +1 1/2”	at midpoint of 600 ft span
at intermediate points (in):	-0, + [6a (1 – a/600)]/600

a = distance from inspection to nearest support (ft)

The interior web stiffeners shall be placed vertically and shall be located within -1/8”, +1/8” of the theoretical floor beam centerline.

The maximum variance for web and flange flatness shall be limited to 3/16” between longitudinal stiffeners or longitudinal stiffener and internal longitudinal girder corners in inches. The maximum variance for web and bottom flange plate flatness shall be limited to a 3/8” measured over the total depth of the web or total width of the flange.

The overall width and depth of the section shall be within -0, +3/16” of the plan dimension and within -1/8”, +1/8” of that adjacent section to which it will be joined.

The maximum out of parallel alignment of the interior longitudinal girder section assembled in the shop, including the intersection of web and flange plates, shall be limited to -3/32”, +3/32” in 10 ft.

d. Exterior Longitudinal Girder.

The allowable variance within the exterior longitudinal girder for the deck cable working points relative to the outside of the web of the exterior longitudinal girder, centerline of the transverse floorbeam and top flange shall be:

x- axis	-1/8”, +1/8” (longitudinal)
y – axis	-1/8”, +1/8” (transverse)
z – axis	-1/8”, +1/8” (vertical)

The overall offset of the deck cable working points is additive with the allowable camber and horizontal sweep of the exterior longitudinal girder.

The allowable variance for straightness for an individual field segment shall not exceed 3/32”/10 ft of total field segment length.

The offset of the centerline of exterior longitudinal girder relative to the horizontal alignment shall be limited to:

-1/8", +1/8"	at connection to transverse floorbeam
-1", + 1"	intermediate field splice points
-1/8",+1/8"	end connection to arch

The angular misalignment of the centerline of exterior longitudinal girder for an individual field segment between temporary supports shall not exceed L/500 where L is the length of the field segment in inches.

The allowable variance for camber shall be limited to:

-1/8", +1/8"	connection to transverse floorbeam
-0, +1 1/2"	at midpoint of 600 ft span
at intermediate points (in):	-0, + [6a (1 – a/600)]/600

a = distance from inspection to nearest support (ft)

The interior web stiffeners shall be placed vertically and shall be located within -1/8", +1/8" of the theoretical floor beam centerline.

The maximum variance for web and flange flatness shall be limited to 3/16" between longitudinal stiffeners or longitudinal stiffener and exterior longitudinal girder corners in inches. The maximum variance for web and bottom flange plate flatness shall be limited to a 3/8" measured over the total depth of the web or total width of the flange.

The overall width and depth of the section shall be within -0, +3/16" of the plan dimension and within -1/8", +1/8" of that adjacent section to which it will be joined.

The maximum out of parallel alignment of the exterior longitudinal girder section assembled in the shop, including the intersection of web and flange plates, shall be limited to -3/32", +3/32" in 10 ft.

5. Arch Tolerances

a. General. Structural steel shall be detailed and fabricated so that dimensions shown on the plans will be obtained with the specified tolerances under full dead load at a mean temperature of 70 degrees F throughout the erected structure.

Based on the fixed or referenced working points established by the Engineer of Record, the Contractor shall examine the position of the adjoining structures to determine deviations from the theoretically correct position. If the deviations are found which exceed the stated tolerances for the adjoining structures, the Contractor shall immediately propose a procedure to the Engineer of Record, for approval, to correct the deviation.

The coordinate system is based on the following:

x- axis	parallel to the horizontal alignment (longitudinal)
y – axis	perpendicular to the horizontal alignment (transverse)
z – axis	vertical (elevation)

b. Arch

The allowable variance within the arch for the cable working points relative to the theoretical geometry of the arch shall be:

x - axis	-1/4”, +1/4” (longitudinal)
y – axis	-1/4”, +1/4” (transverse)
z – axis	-1/4”, +1/4” (vertical)

The overall offset of the cable working points is additive with the allowable longitudinal and transverse tolerance of the arch alignment.

The allowable angular tolerance for the guide pipe within the arch shall be limited to 3/16” / 10 ft relative to the theoretical cable line defined between the deck cable working points and the arch cable working points.

The maximum variation for the base plate flatness shall be limited to ½” over the total width (x-axis) and depth (y-axis) of the base plate.

The absolute tolerance for the completed free standing arch alignment prior to installation and stressing of the cables is as follows:

Working Points WB-A-W-END, WB-A-E-END, EB-A-W-END and EB-A-E-END:

x - axis	-1/8”, +1/8”
y – axis	-1/8”, +1/8”
z – axis	-1/8”, +1/8”

Working Points WB-A-0 and EB-A-0:

x - axis	-3”, +3”
y – axis	-3”, +3”

with $[x^2 + y^2]^{1/2} = 3”$; defines a 3” circular radius for combination of x and y coordinates

z – axis	-3”, +3”

The x, y and z tolerances for the intermediate working points between end points and WB-A-0 / EB-A-0 is limited to a linear interpolation between the values shown above:

at intermediate points (in): +/-, 1/8” + 3a/396

a = vertical distance from working point PA2 (ft)

The erection of the arch within the above noted alignment tolerances does not relieve the contractor’s responsibility for erecting the arch in such a manner that all joined field segments are within the fit up tolerances for adjacent segments including the closure segment.

The angular twist of the arch shall be limited as shown in the plans.

The interior cable diaphragms shall be placed in vertical plane to the arch working points and shall be located with -1/2”, +1/2” of the theoretical vertical plane.

The maximum variance for arch fascia plate flatness shall be limited to 3/16” between vertical stiffeners, vertical stiffener/plate intersections or plate intersections in the straight section of the arch. The maximum variance for web and bottom flange plate flatness shall be limited to a 3/8” measured over the total width of the arch fascia plates.

The maximum out of parallel alignment of the arch section assembled in the shop for the intersection of fascia plates, shall be limited to -1/16”, +1/16” in 10 ft.

The straightness of the vertical plate stiffeners perpendicular to the theoretical plane shall be limited to 1/8”/10 ft of the total length.

The overall width (x-axis) and depth (y-axis) of the section shall be within -0, +1/4” of the plan dimension and within -1/8”, +1/8” of that adjacent section to which it will be joined.

Article 441.3 Construction, Section G. Shop Assembly, Section 1. General Shop Assembly, is supplemented by the following:

Per the suggested erection sequence, the longitudinal girders are separated into field sections.

The Contractor shall build a shop assembly jig that will simulate the in-place support conditions and which will permit the check and verification of all specified tolerances of the assembled sections. The layout, design and construction of this assembly jig shall be subject to the Engineer of Record’s approval.

On the completion of each trail erection, at least one unit shall be retained to provide a basis of the continuity for the next field section, allowing adjacent field sections to match and fit when erected.

Per the suggested erection sequence, the arch is separated into field segments. The Contractor shall build a shop jig that will simulate the in-place support conditions and which will permit the check and verification of all specified tolerances of the assembled field segments. The layout, design and construction of this assembly jig shall be subject to the Engineer of Record’s approval. The jig assembly shall be provided with facilities to hold the segment accurately in line and position for both welded and bolted connections.

On the completion of each trail erection, at least one unit shall be retained to provide a basis of the continuity for the next field segment, allowing adjacent field segments to match and fit when erected.

For both the superstructure and arch, any jigs and/or fixtures that are required in the field to maintain or correct the specified alignment tolerances shall be checked and verified in the shop assembly.

SPECIAL PROVISION

447---001

Structural Bolting

For this project, Item 447, “Structural Bolting,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 447. Section 4. Construction, Section C. Preparation of Faying Surfaces. The second paragraph is voided and replaced by the following:

Perform blast-cleaning or painting of faying surfaces in accordance with Item 446, "Cleaning and Painting Steel." Provide an SSPC-SP 10 blast cleaning prior to shipment if surfaces to be in contact after final bolting will be left unpainted. Do not wire-brush uncoated faying surfaces. Roughen galvanized faying surfaces by hand wire-brushing. For main girder splices, perform a brush-blast to provide an SSPC-SP 6 finish not sooner than 48 hours prior to assembling the connection unless otherwise approved.

SPECIAL PROVISION

447---002

Structural Bolting

For this project, Item 447, “Structural Bolting,” of the Standard Specifications is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 447. Section 4. Construction, Section C. Preparation of Faying Surfaces. The second paragraph is voided and replaced by the following:

Perform blast-cleaning or painting of faying surfaces in accordance with Item 446, "Cleaning and Painting Steel." Provide an SSPC-SP 10 blast cleaning prior to shipment if surfaces to be in contact after final bolting will be left unpainted. Do not wire-brush uncoated faying surfaces. Roughen galvanized faying surfaces by hand wire-brushing. For main girder splices, perform a brush-blast to provide an SSPC-SP 6 finish not sooner than 48 hours prior to assembling the connection unless otherwise approved.

Article 447.4. Construction, Section D. Bolt Installation, Section 3. Tension Bolts is supplemented by the following:

Tension all bolts in a connection within 10 days of installation. Bolts not tensioned within 10 days of installation are subject to field R-C testing. Relubricate or replace any installed bolts that do not have sufficient lubrication as determined by the field R-C test.

Article 447.4. Construction, Section E. Bolt Tensioning, Section 1. Turn-of-the-Nut Method, Table 2. Note 1 below Table 2 is voided and replaced by the following:

1. Nut rotation is relative regardless of the element (nut or bolt) being turned. The tolerance is –0°, +30° for bolts installed by 1/2 turn or less and –0°, +45° for bolts installed by 2/3 turn or more.

SPECIAL PROVISION

448---001

Structural Field Welding

For this project, Item 448, "Structural Field Welding," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 448.4 Construction, Section A. Procedure Qualification is voided and replaced by the following:

Use the proper classification and size of electrode, arc length, voltage, and amperage for the thickness of the material, type of groove, welding positions, and other circumstances of the work. All complete joint penetration groove welds and partial joint penetration groove welds shall conform to AWS D1.5 Figures 2.4 and 2.5 unless otherwise qualified in accordance with AWS Section 5.7.7.

Submit WPSs for all welding, qualified in accordance with AASHTO/AWS 1.5, for approval before any field welding on the project.

Longitudinal, transverse and vertical butt joints shall be complete joint penetration groove welds. The welding sequence and distortion control plan shall be submitted to the Engineer for review and comment. Members to be welded shall be brought into correct alignment per the specified tolerances and held in position by the use of jigs, fixtures or other suitable devices until welding is complete. The procedure qualification testing performed before the start of the work shall demonstrate that the weld can be made to the required quality and that angular deformation caused by shrinkage of the welding can be counteracted by suitable measures.

No welding shall be started at a field splice until the correct relative alignment of 2 adjacent sections is achieved and fixed with approved attachments. After the removal of temporary attachments, the steel surface shall be reconditioned by grinding level with the surrounding material. Scars in the surface shall be filled by welding in accordance with an approved welding procedure and ground flush. Magnetic-particle examination shall be performed to ensure that the surface is free from cracks prior to welding and then following any repair welding.

Article 448.4 Construction, Section C. Welding Steel Structures, Section 3. Assembly and Fitup is voided and replaced by the following:

The method of erection for the project shall be determined by the Contractor to ensure control of the structure within the specified tolerances. The Contractor is responsible for all temporary attachments, supports, field assembly jigs, fixtures and other suitable devices required to align and hold the structural components in the correct position during welding.

The contractor shall verify that the ends of the member to be welded are prepared in accordance with the weld joint detail specified. The separation and fitup between the components to be joined shall be in accordance with the weld joint detail prior to welding.

Bring the parts to be joined by fillet welds into as close contact as possible, not separated by more than 3/16 in. If the separation is 1/16 in. or more, increase the leg of the fillet weld by the amount of the separation. Keep the separation between faying surfaces of lap joints and of butt joints landing of backing strips to no more than 1/16 in.

When plates of abutting parts differ in thickness by more than 1/8 in., make the joint with a smooth transition between offset surfaces and with a slope of no more than 1:4.

When the joint spacing provides a root opening up to ¼" larger than specified, correction may be made by buildup up to 1/8 in. on each bevel nose. Allow buildups to cool to the maximum preheat and interpass temperatures before welding the joint.

Article 448.4 Construction, Section C. Welding Steel Structures, Section 5. Welding Practice the 2nd sentence in the first paragraph is voided and replaced by the following:

Weld in accordance with an approved WPS.

Article 448.4 Construction, Section C. Welding Steel Structures, Section 5. Welding Practice, Section b. Welding Sequence the entire section is voided and replaced by the following:

The Contractor shall prepare and submit a welding sequence to the Engineer for information and comment for each member or component that is to be field welded. The Contractor shall submit a Distortion Control Plan that includes the proposed temporary attachments, supports, field assembly jigs, fixtures, methods and procedures proposed to control and minimize shrinkage and distortion. The Distortion Control Plan shall include any post-welding measures required to achieve the specified tolerances.

The Contractor shall demonstrate the adequacy of the proposed welding sequence, including the specified NDE testing, with "mock-up" sections as indicated in the general notes.

The "mock up", 2 feet minimum in all applicable directions, shall be representative of the anticipated field conditions and shall be subject to the Engineer's approval. After completion of a successful "mock up" for the proposed welding sequence, macroetch tests shall be performed on the specimen in accordance with AWS D1.5. Macroetches of complete joint penetration welds shall meet the requirements for partial joint penetration welds. The "mock ups", including NDE and macroetch testing, will not be paid for directly but shall be considered subsidiary to the various structural steel pay items.

Article 448.4 Construction, Section C. Welding Steel Structures, Section 7. Radiographic Inspection the 3rd paragraph is deleted and by the following:

Radiographically retest repaired welds for butt joints. Make necessary repairs before any further work is done. Additional RT required because of unacceptable welding or poor radiograph quality is at the Contractor's expense.

SPECIAL PROVISION

448---002

Structural Field Welding

For this project, Item 448, "Structural Field Welding," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 448.3 Equipment is voided and replaced by the following:

Provide electrode drying and storing ovens that can maintain the required temperatures specified in Section 448.4.C.1, "Electrode Condition." Each oven must have a door that is sealed and can be latched. Each oven must have a small port that may be opened briefly to insert a thermometer or the oven must be equipped with a thermometer that allows for direct reading of temperature inside the oven without opening the oven. Provide equipment able to preheat and maintain the temperature of the base metal as required and as shown on the plans. Provide approved equipment, temperature indicator sticks, infrared thermometer, etc., for checking preheat and interpass temperatures at all times while welding is in progress. Provide welding equipment meeting the requirements of the approved welding procedure specifications (WPS), if required, and capable of making consistent high-quality welds.

Article 448.4.B.2.Certified Steel Structures Welder. The second bulleted item is voided and replaced by the following:

- Use metal for test plates that meets Item 442, "Metal for Structures," with a minimum yield point of 36 ksi. The minimum width of test plate must be sufficient to accommodate the radiograph inspection of 6 continuous inches of the weld, not counting the ends of the weld.

Article 448.4.C.5. Welding Practice. The second paragraph is voided and replaced by the following:

Use the stringer-bead technique where possible for groove welds. In vertical welding passes, progress upward using a back-step sequence keeping the end of the low-hydrogen electrode contained within the molten metal and shield of flux, unless the electrode manufacturer's specifications indicate otherwise

Article 448.4.C.7. Radiographic Inspection is supplemented by the following:

Meet the requirements specified in Section 441.3.B.5.a, "Radiographic Testing" for radiograph film quality.

SPECIAL SPECIFICATION

High Load Multi-Rotational Disk Bearings

PART 1 - GENERAL

1.1 Description

Furnish and install high load multi-rotational (HLMR) disk bearings in accordance with the details shown on the plans, the recommendations of the manufacturer, and requirements of this Item.

1.2 General. Spherical bearings shall consist of concave and convex elements surface with Polytetrafluoroethylene (PTFE) and mirror finish stainless. Bearings shall adequately provide for the thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members, where applicable. The bearing shall have a shear restriction device to prevent relative horizontal movement of the bearing plates.

Disc bearings shall be supplied as fixed bearings, expansion bearings, or guided expansion bearings as shown on the plans and as defined below:

Type 1 Expansion bearings allow vertical rotation and horizontal movement, in all directions, of the supported member.

Example: "HLMR Bearing (**E**-1000)"
Nonguided Expansion Bearing, Service Load Capacity 501 - 1000k

Type 2 Guided expansion bearings allow vertical rotation and horizontal movement, in the transverse direction only, of the supported member. Longitudinal movement is restricted by guide bars or keyways.

Example: "HLMR Bearing (**GET** - 1500)"
Guided Expansion Transverse Bearing, Service Load Capacity -500 - +800K

Type 3 Guided expansion bearings allow vertical movement, vertical rotation, and horizontal movement, in the longitudinal direction only, of the supported member. Transverse movement is restricted by guide bars or keyways.

Example: "HLMR Bearing (**GEVL** - 0000)"
Guided Expansion Vertical and Longitudinal Bearing, Service Load Capacity "NO VERTICAL LOADING"

Type 4 Fixed bearings allow vertical rotation but no horizontal movement of the supported member.

Example: "HLMR Bearing (**F** - 500)"
Fixed Bearing, Service Load Capacity 0 - 500k

Expansion bearings shall contain sliding components as specified under "Design" of this Item.

1.3 Design. Spherical bearings shall be designed and constructed in accordance with AASHTO LRFD Bridge Design Specifications 5th Edition, Section 14, and AASHTO LRFD Bridge Construction Specifications 3rd Edition, Section 18. Disc bearings shall be designed

by the Manufacturer for the service loads and movements shown on the plans. The minimum horizontal load capacity of the bearings shall be 70% of the vertical capacity and the minimum rotational capacity shall be 0.05 radians. Allowable bending, shear and bearing stresses for steel and concrete shall be in accordance with the current AASHTO LRFD**.**

The following minimum values shall apply to the manufacturer's design: (D = Diameter of disc)

1. Disc Bearings
   a. Thickness of disc: .07D
   b. Thickness of plate beneath disc: .06D
   c. Depth of limiting ring: .014D

Expansion bearings shall be designed for the horizontal movement shown on the plans plus 1 in. in each direction of movement. The mating surface between sliding components shall be polished stainless steel and PTFE. The total nominal clearance between guides and guided parts shall be 0.12 in.

Bolster plates shown on the plans shall be 3 inches longer and wider than the sole plate and beveled to match the supported member.

The connection between the bearing and the girder shall be designed by the manufacturer to transmit the required vertical and horizontal loads within the specified allowable stresses.

All bearings shall be seated on preformed fabric pads in accordance with Item 441, “Steel Structures”.

Bearings shall be designed such that all rotational and sliding elements can be replaced with a minimum of jacking.

PART 2 - MATERIALS

2.1 Materials.

All steel in the disc bearings and masonry plates shall conform to ASTM A709.

Flat brass sealing rings shall conform to ASTM B36, Half Hard. The minimum thickness of the rings shall be 0.05 in.

Bolts for attaching guide bars shall conform to ASTM A325.

Anchor bolts shall conform to Item 449, “Anchor Bolts”. The size, type, quantity and grade shall be as specified on the plans.

Stainless steel shall conform to ASTM A167 or A240, Type 304.

PTFE resin shall be virgin material meeting the requirements of ASTM D1457 and “Materials” of Item 434, “Elastomeric Bridge Bearings”. PTFE sheet material for horizontal sliding surfaces shall be unfilled. PTFE sheet material for guide bars may be filled or unfilled.

Disc elements for disc bearings shall be molded monolithically from polyether urethane conforming to the following requirements:

Property	ASTM Test Method	Compound A	Compound B
Hardness	D2240 Shore D	48 ± 2	62 ± 2
Minimum tensile stress, psi	D412		
at 100% elongation	20 in/min	1500	2000
at 200% elongation		2800	3700
Minimum tensile strength, psi	D412 20 in/min	4000	5000
Minimum ultimate elongation %	D412 20 in/min	300	220
Maximum compression set, % 22 hours at 158°F.	D395	40	40

All polyether urethane disc elements shall be marked, color coded or otherwise identified to indicate the type of compound used in their manufacture.

Preformed fabric pads for bearing seats shall conform to the requirements of Item 434, “Elastomeric Bridge Bearings”.

2.2 **Shop Drawings.** The Contractor shall submit, for approval, 8 copies of detailed shop drawings and 2 copies of design calculations for the bearings and connection to the Engineer. Drawings shall be 11 by 17 in. sheets. The drawings shall contain all dimensions and describe all materials and processes necessary to fabricate and assemble the bearings. Each bearing shall be given an identification mark indicating the bearings' position in the structure.

2.3 **Manufacture.** All components of each disc bearing shall be assembled by the same manufacturer.

Manufacture of bearings shall not begin until the shop drawings are approved. All bearings of a specific type for a project shall be produced by the same manufacturer.

Each disc for disc bearings shall be cast monolithically in a mold. The disc shall be contained by a limiting ring, consisting of a recess machined into or a steel strip welded onto the upper and lower bearing plates.

The shear restriction device may be connected to the bearing plate by welding or other means acceptable to the Engineer of Record.

Restriction of transverse movement may be accomplished with guide bars or shear keys. Guide bars shall be machined or attached to the upper sliding plate by welding or bolting. Shear keys shall be machined or shall be fitted in a keyway slot, machined for a press fit, and bolted or welded. The sliding surface shall be faced with PTFE sheets and mechanically attached to the steel plate. The mating surface shall be a stainless steel sheet welded to the steel plate.

The thickness of the finished PTFE sheet shall not be less than 1/8 in. nor more than 3/16 in.. The PTFE sheet shall be recessed for 0.06 in. into the horizontal sliding surface. The

recess shall be a snug fit and have square corners. The contact area shall be grit blasted and the PTFE etched and bonded into the recess using an epoxy resin adhesive in accordance with instructions from the adhesive manufacturer.

Stainless steel sheets shall have a minimum thickness of 0.06 in. (16 gauge). The sliding surface shall be polished to a mirror finish. Stainless steel sheet shall be attached to the steel backing plate by epoxy bonding and continuous fillet welding around the edges. The sequence of welding must not cause distortion of the sheet.

Irregularities in the steel backing surfaces or uneven adhesive application causing wrinkling or other detrimental impressions in the sliding surfaces will be cause for rejection of the bearing.

Permissible variation from the dimensions and configuration required by the shop drawings and this Item shall be as follows:

Disc Bearings

Disc	
< 20" Diameter	± .06"
> 20" Diameter	± .09"
Thickness	-0", +.10"
Limiting Ring	
< 20" Diameter	± .03"
> 20" Diameter	± .03"
Shear Restriction Device	
Shear Pin	-.005", +0"
Shear Ring	-0", +.005"
Masonry Plate	
Plan Dim. < 30"	-0", +.30"
Plan Dim. > 30"	-0", +.50"
Thickness	-.03", +.06"
Flatness	
Top	Cl.A
Bottom	Cl.C
Sole Plate	
Plan Dim. < 30"	-0", +.20"
Plan Dim. > 30"	-0", +.30"
Thickness at centerline	-.03", +.12"
Flatness *	
Steel Beam	Cl.B
C.I.P. Concrete	Cl.C
Beveled Surface	
Angle	.002 Rad.
Flatness	Cl.A
Guide Bar or Keyway	
Length	± .12"
Section Dimensions	± .06"
Bar to Bar	± .03"
Nonparallel	.03"
Flatness	Cl.A

Disc Bearings

Overall Bearing Height	-.06", +.20"

* Flatness tolerances are a multiple of the length under the straight edge (L) as follows:

Class A	.0005 L
Class B	.0010 L
Class C	.0020 L

Machined surfaces shall have a finish of 125 rms or better. Oxygen cut surfaces shall have a finish of 1000 rms or better. Roughness values shall be as defined in ANSI B46.1.

Steel surfaces in contact with discs of disc bearings shall have commercial shot blast finish.

Unless otherwise shown on the plans, all steel surfaces, except the surfaces to be bonded to stainless steel or PTFE, shall be painted with System III according to Item 446, “Cleaning and Painting Steel”.

Bearing assemblies shall be securely fixed together as units and wrapped in moisture and dust resistant material. Project and bearing identification shall be clearly marked on the wrapping.

Anchor bolts and preformed fabric pads for the bearing seat may be shipped separately.

2.4 **Inspection and Testing.** Sampling and testing of polyether urethane, polychloroprene, polyisoprene and polytetrafluoroethylene shall be in accordance with Test Methods Tex-716-I and Tex-601-J.

All arrangements for sampling and testing shall be coordinated with the Materials and Pavement Section of the Construction Division (CST/M&P), 125 East 11th Street, Austin, Texas 78701-2483.

CST/M&P shall be notified prior to the manufacture of any bearings or bearing components and after completion of manufacture of all or a significant number of bearings for the project.

The bearing manufacturer shall arrange for the following load tests, to be applied to the bearings. The tests will be observed by a designated representative of the CST/M&P.

5 Minute Vertical Load Test
- 1.5 Times Required Vertical Load Capacity
- No Horizontal Load
- .02 Radians Rotation
- One Bearing from each Group of 25 Bearings in each 500 kip Load Range

5 Minute Vertical and Horizontal Load Test
- 1.0 Times Required Vertical Load Capacity
- 1.5 Times Required Horizontal Load Capacity
- No Rotation
- One Fixed Bearing from each 500 kip Load Range
- One Guided Expansion Bearing from each 500 kip Load Range

24 Hour Vertical Load
Test 1.5 Times Required Vertical Load
No Horizontal Load
.01 Radians Rotation
One Maximum Size Bearing and
One Minimum Size Bearing for the Project

Each of the above tests shall be applied to a different bearing.

After testing, the bearings shall be disassembled for visual inspection. Any malfunction, such as lift-off, galling between components, extrusion of elastomer, breaking of seals, excessive deflection, yielding of steel, wrinkling of stainless steel, flow of PTFE or bond failure will be cause for rejection. All bearings represented by rejected bearings shall be repaired to the satisfaction of the Engineer. Additional testing of bearings will be as directed by the Engineer.

Sliding friction tests will not be required.

2.5 **Construction Methods.** Bearings shall be stored horizontally at the job site in a dry, sheltered area. Wrapping shall be maintained in good condition until time for installation. Bearings shall be lifted by their undersides only and shall be protected at all times from damage, dirt, oil, grease, and other foreign substances. Bearings shall not be disassembled unless otherwise approved by the Engineer of Record.

Preparation of bearing seats, furnishing and placing of preformed fabric pads and installation of bearings and anchor bolts shall be as shown on the plans and in accordance with Item 441, “Steel Structures”.

At the beginning of the bearing installation or when directed by the Engineer, a representative of the manufacturer shall be present at the job site for guidance in proper installation procedures.

Any field welding required for the installation of a disc bearing shall be done with extreme care to prevent damage to the elastomer, disc element, PTFE or stainless steel surface. Bearings damaged by field welding will be replaced by the Contractor at his expense.

Repair of damage to the prime coat on the bearings and application of the specified final appearance coat shall be in accordance with Item 446, “Cleaning and Painting Steel”.

PART 3 - MEASUREMENT

This Item will be measured by each bearing of the various types and load ranges shown on the plans.

SPECIAL SPECIFICATION

CABLES

PART 1 – GENERAL

1.1 Description

Fabricate and erect structural strand assemblies.

PART 2 – MATERIALS

2.1 Materials

Provide new materials that comply with the dimensions, shape, details, strength requirements, and construction sequence shown on the plans, and the requirements of this Item. Use materials that meet the following:

1. **Structural Strand.** Furnish strands that conform to ASTM A 586 and requirements shown on the plans.

2. **Sockets.** Provide high strength steel sockets that meet the details shown on the plans and the following requirements:

Description	Standard(s)
Socket Bodies	ASTM A 148 Gr 105/85
Socket Pins	UNS S21800, Nitronic 60
Rods	ASTM A 668 Class F (G) or 4130-4140 equa1105/85
Nuts	ASTM A 563 Grade DH or A 194 Grade 2H

Obtain sockets from the same manufacturer fabricating the strands or from a manufacturer with demonstrated experience in the manufacture and erection of sockets for at least five projects within the past ten years.

3. **Boot and Dampers.** Provide neoprene boots and neoprene dampers manufactured from 100% virgin chloroprene (neoprene) of the thickness, shapes and hardness shown on the plans. The sole polymer shall be 100% virgin chloroprene which shall be less than 60% by volume of the total compound. Neoprene shall meet the requirements of ASTM C 864.

4. **Bands/Fasteners**. Ali bands/fasteners must be Type 316 stainless steel meeting the requirements of ASTM A 240.

2.2. Construction.

1. **Submittals.** Submit shop drawings in accordance with the requirements of Item 5.2 for review and approval to the Engineer of Record prior to any fabrications. Shop drawings must include the following:

   - show the specification of the structural strands and sockets to be used,

- show connection details between the strand to the structure including boots, dampers, bands/fasteners, and other accessories
- show the initial and final tensioning methods,
- show sequencing for cable erections,
- be signed and sealed by a licensed professional engineer registered in the State of Texas.

Submit three (3) full sets of manufacturer's literature for the selected structural strand assembly for review and approval to the Engineer of Record. Provide document demonstrating that the manufacturer has satisfactory experience in fabricating and erecting the structural strand assembly at least five projects in the past ten years, and capability performing the work.

Provide a twelve inches (12") sample of the structural strand and hardware assemblies required for the project for review and approval.

Provide test reports from an independent laboratory certifying that the structural strand assemblies proposed for use have been tested and met all requirements shown on the plans and set forth in this specification. Structural strand testing must meet requirements of ASTM A 586. Socket testing must meet requirements of ASTM A 148 for steel castings or ASTM A 668 for steel forgings. All costs for testing will be borne by the Contractor.

Once the shop drawings are approved, furnish three (3) copies of manufacturer's manuals for installation, inspection, and maintenance.

2. Strand Fabrication. Strand shall be made on machines of sufficient size to insure good workmanship and shall be fabricated in the greatest length possible. Once the manufacture of the strand has been started, no changes shall be made as to the grade of wire, construction, or lay of strand, or other factors, which affect the uniformity of the product.

The manufacturer shall pre-stretch the strand by stressing with a load equal to 55 percent of the breaking strength in straight tension. Load shall be maintained *and/or* repeated until the strand reaches a stable condition as defined by ASTM A 586. The manufacturer shall determine and report the modulus of elasticity of each manufactured length of strand in accordance with ASTM A 586. The minimum modulus of elasticity shall be 24,000 ksi.

Strand and assemblies shall show a well-defined and uniform elastic stretch and recovery under stressing as measured during proof loading operations.

A red or white line shall be painted down the horizontal length of the prestressed length of strand, for socket orientation.

3. Socket Fabrication. Ali sockets shall be designed to meet or exceed the specified minimum strand breaking strength.

4. Installation. Install strands and sockets in accordance with the approved shop drawings.

5. Proof loading. Each completed strand/socket assembly shall be proof loaded to 50 percent of the specified minimum ultimate breaking strength of the strand. Apply a load to 5 percent of listed nominal ultimate strength measure and record the length, increase force to 20 percent of the listed nominal ultimate strength of the strand and measure and record

the overall length. Finally increase the load to 50 percent of the listed nominal ultimate strength and measure and record the overall length again.

After load testing, visually inspect all sockets and cables over the entire length for damage or other signs of inadequate performance. Remove and replace, at no additional cost to the Authority, any damaged or visual defect in the strand, sockets, or paint stripe as directed by the Engineer of Record. Provide certified load testing and length measurement data to the Engineer of Record with the identity of the individual strand assembly tested clearly indicated.

6. Shipping, Handling, and Storage. After socketing and measuring, each strand shall be rolled on wooden reels of appropriate diameter and in a manner that will prevent twisting of and damage to the strand and that will minimize the loss of pre-stretching. Obtain approval of the Engineer of Record before employing alternate methods of packaging strand assemblies for shipping.

No more than four cable assemblies shall be shipped on each wooden reel. Any kinked or damaged strand will be rejected. Straightening of bent wires will not be permitted. Reels shall be stored in a well protected location. Handling and shipping of strand shall be in accordance with the applicable requirements of the AISI Wire Rope User's Manual.

House and store cable assemblies at least 18 inches above the ground. Keep the cables free of dirt, sand, or other deleterious materials.

Cable assemblies shall be carefully removed from wooden reels by revolving them. The unreeled cable assemblies shall not be permitted to lay on the ground, on a dirty or dusty surface, on oily and abrasive surface such as the concrete bridge deck. They shall be supported on timber blocking for the entire length, spaced closely enough to prevent kinking and contact with the ground. The cable assemblies shall be lifted into position in the structure in a manner which causes no kinking or other distress to the cables. Nylon straps shall be used to lift cable assemblies at all times.

7. Tensioning. After installation, conduct initial tensioning of hanger assemblies in accordance with the approved shop drawings.

After all dead load has been placed on the structure, verify existing load in strand assemblies at each hanger location by lifting the structure using hydraulic rams reacting against the bottom of the longitudinal girder. Make final tension adjustments as necessary to balance the load between adjacent strands at each hanger location and to make longitudinal girder elevation adjustments.

Perform final tensioning of hanger assemblies in accordance with the approved shop drawings. A pair of hydraulic jacks shall be operated in tandem, and shall be equipped with an accurate pressure gauge at least six inches in diameter. The combination of two jacks and the pressure gauge shall have been calibrated within the last six months. A certified calibration chart, showing the calibration of the two jacks operated in tandem with the gauge, shall be furnished to the Engineer of Record. The range of calibrations shall encompass the range of final cable dead load forces shown on the plans.

During the final cable tensioning operation, the bridge deck shall be kept free of materials whose weight would, in the opinion of the Engineer of Record, affect the accurate measurement of dead load tensions.

Submit the final measured cable forces to the Engineer of Record for approval.

After installation is complete, clean the structural strand assemblies with materials and methods as recommended by the manufacturer.

8. Inspection. Provide quarterly inspections of the strands and sockets in accordance with the manufacturer's manual until the project's acceptance.

PART 3 - MEASUREMENT

This Item will be measured lump sum for all cables complete in place.

SPECIAL SPECIFICATION

CABLE TESTING

PART 1 – GENERAL

1.1 Description

Cable testing shall be required for the following items prior to fabrication of cable anchorages, or installation of cables. This work shall consist of the furnishing of all materials, anchors, cable specimens, strand specimens and all labor and equipment for fatigue, ultimate fatigue strength, ductility and static load testing as follows:

1. Fatigue and ultimate strength of fully assembled cables for acceptance of the anchorage system.

2. Ductility and fatigue strength of individual strand for acceptance of strand to be incorporated into the final structure.

The specimen assemblies shall be tested by a recognized independent testing laboratory approved by the Engineer of Record. The Contractor shall supply all materials for testing to the laboratory a minimum of one month prior to the actual tests. The Engineer of Record shall be notified a minimum of 30 days in advance of any fabrication or testing so that a representative of the Engineer of Record may be present when the respective work is being performed.

All testing data and testing results shall be submitted to the Engineer of Record.

Fabrication of anchors or cable strands for permanent installation on the structure shall not begin until the tests are successfully completed and written approval is given by the Engineer of Record.

The testing laboratory shall provide certification that the cable testing was performed in accordance with the specifications and that the cables meet the requirements of the specifications.

PART 2 - MATERIALS

2.1 Materials

1. **Cable Acceptance Test.** Two completed fully assembled cable specimens shall be fabricated for testing, one specimen shall be made representing the smallest cable, and the other the largest cable in the bridge. Each specimen shall be fully representative of all details and procedures proposed for the production cables.

   The Contractor shall fully detail the cable specimens including end anchorages and submit to the Engineer of Record, complete detailed drawings and calculations (including reinforcements, jack specifications, concrete strength, etc.) for review. Samples need not be wrapped with tape.

   The Contractor shall assemble the test cables at the laboratory. Assembly of the cable shall represent the sequence of operations that will be used in the actual construction.

   The specimens representing the cables shall be fabricated straight and consist of two anchorages (including all appurtenances) with a clear space of 20 feet between bearing faces and a clear length of 4 feet of typical pipe between anchorage assemblies.

2. **Fatigue Acceptance Test.** Each specimen of the cable assemblies shall be tested for two million cycles of fatigue loading with an upper stress of 45% of the guaranteed ultimate tensile strength (GUTS) of the material and a stress range of 23 ksi.

   During fatigue testing, not more than two percent of the number of individual wires (rounded to the nearest whole number) may fail. Multiple fractures of the same wire shall be counted as one failure. Failures shall be distributed on a random basis throughout the cable. No failure shall occur within the anchorage zones, or in any components of the anchorage. The frequency of the test load for all fatigue tests shall be a constant value between 2 Hz and 4 Hz.

   After fatigue testing, each test specimen shall be reloaded and tested; it shall develop a minimum tensile force equal to 95 percent of GUTS of the cable. Failure of the specimen to achieve 95 percent of GUTS will require retesting of the cable assembly.

   Actual ultimate tensile strength of cable is defined as the average ultimate tensile strength of 9 test specimens of single strands, according to ASTM Designation: A 416 and A 370, from the same reel of strand used for the above tests.

3. **Quality Control Testing of Cable Materials.** In order to ensure strand fatigue resistance is incorporated into the cables, the following conditions shall be met:

   a. One 16-foot sample strand shall be taken for every 10 tons of strands produced from each heat of steel. This sample shall be used for both fatigue and ductility testing.

   b. All strands and test samples shall be marked in such a manner to ensure traceability during production, transit, storage and testing.

   c. The test strands shall be protected from failure in the gripping zone. Should any test strand fail in the gripping zone, the test will be discarded and another test specimen made from the sample.

   d. One test for each manufactured length of strand shall be made for the following:

Minimum guaranteed ultimate tensile strength	f's = 270 ksi
Minimum yield strength	f'y = 0.9 f's
Young's Modulus	E = 28, 600 ksi ± 5%

4. **Fatigue and Static Testings.** One tensile fatigue test shall be conducted on an approximately 6-foot long test specimen from each sample. Minimum length shall be 3 feet face-to-face of grips. The strands shall be anchored in such a way as to avoid failures in the gripping zone. Should any specimen fail within the gripping zone, the test shall be discarded and another specimen used from the same sample.

   The strand specimens shall be tested at an upper stress of 0.45 f's and a stress range of 64 ksi for 100,000 cycles.

   One static test to failure shall be conducted after completion of each strand fatigue test. Specimens shall provide not less than 95 percent of the Guaranteed Ultimate Tensile Strength (GUTS) in the static test without failure.

   If the actual tensile strength of material used in acceptance tests of cables exceeds f's by more than 5%, material used in production cables shall be tested to demonstrate comparable tensile strength (f's x A_s). The actual guaranteed ultimate tensile strength of the test cable shall be determined from the results of tensile test for individual

strands. The actual fatigue strength of the cable test material shall be determined from the results of the fatigue tests from companion strands.

a. **Rejection Criteria.** If the first valid test strand from each sample fails, two additional tests shall be made from the same samples. If failure occurs in either of these tests, the strand represented by that sample shall be rejected. Retesting shall not be permitted.

5. **Ductility Testing.** A "One-Pin Test" shall be conducted on a sample taken from each manufactured length. The details and method of the test shall be as defined in Appendix "A" of "PTI Guide Specifications, Recommendations for Stay Cable Design, Testing and Installation", Fourth Edition, February 2001.

a. **Acceptance Criteria.** For acceptance, the tensile force in the sample during the one-pin test shall equal at least 80% of the ultimate strength of the sample.

The sample taken for the One-Pin Test shall be long enough for two ultimate strength tests and three One-Pin Tests. If the first specimen fails the one-pin test, two additional samples shall be tested. If both samples pass, the material is acceptable. If either sample fails, the material from which the sample was taken shall be rejected.

PART 3 - MEASUREMENT

Cable Testing will not be measured and is considered incidental to the cables.

SPECIAL SPECIFICATION

"BRIDGE EXPANSION JOINTS"

PART 1 - GENERAL

1.1 Scope of Work

Furnish all labour, materials and equipment required for the supply and installation of the expansion joint assemblies shown on the Contract Drawings. The joint(s) shall be made to be watertight and prevent transmission of surface water through the joint assembly.

1.2 Related Work Specified in Other Sections

- Item 420, “Concrete Structures”
- Item 454, “Bridge Expansion Joints”

1.3 Reference Standards

All standards shall be latest issue at time of bid.

1. ASTM A780, “Repair of Damaged Hot Dip Galvanized Coatings”.
2. American Society for Testing and Materials (ASTM) where noted.
3. ASTM A108, “Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality”.

1.4 Submittals

1. Verifiable list of prior installations showing successful experience with the proposed systems.

2. Provide photographic sample of proposed cover plate approximately to Architect, Zurich office. Fit sample with all connected devices that are visible by bridge users and any surface treatment required to meet testing requirement below. Issue drawings of standard system proposed for adaptation for project application.

3. Mark up contract drawings of expansion joint assembly return as part of bid documentation showing extent of works by Movement Joint manufacturer/installer.

4. Return of these drawings will be taken as an understanding by the Movement Joint manufacturer/installer that his standard system will be adjusted in accordance with the drawings. The Movement Joint manufacturer/installer is free to provide alternate details with his tender return for consideration by the Architect but the bid must reflect the work specified on the drawings unless agreed in writing with the Architect in advance of the bid return.

5. Submit copies when requested of mill test reports properly correlated to the materials used.

6. Prior to commencing the work, the Contractor’s engineer is to submit documentation showing evidence of registration in the State of Texas plus qualifications and experience. The Contractor’s engineer is to further acknowledge in writing that he or she has reviewed the specifications and drawings and is aware that he or she is to inspect the fabrication and installation of work and certify the work at completion.

1.5 Shop Drawings and Final Submittals

1. Submit shop drawings to the Engineer of Record for review and approval.

2. Clearly indicate plate and angle sizes, connection attachments, anchorage sizes and types of fasteners and accessories.

3. Include installation drawings, elevations and details where applicable.

4. Indicate welded connections using AWS standard welding symbols. Clearly indicate net weld lengths.

5. The drawings are to be signed and sealed by a professional engineer registered in the State of Texas.

6. Provide sample of proposed cover plate approximately 2' x 2' to be delivered to TxDOT project site office. Fit sample with all connected devices that are visible by bridge users and any surface treatment required to meet testing requirement.

1.6 Testing

1. Provide a test report from an accredited independent agency justifying the movement joint for the intended use including cyclic testing under load and representative (Dallas) environmental conditions. This testing should include a verification of the system to accommodate foot and cycle traffic loading over extended periods of time (75 years service life and 10 years to first service requiring principal part replacement) and occasional loading from the AASHTO standard maintenance vehicle.

2. The movement joint will be subject to continuous foot and cycle traffic. Provide test certificate from an accredited independent agency verifying that the wet and dry coefficient of friction of the surface exceeds a value of 0.6 when tested against ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine or resulting in wet and dry static coefficient of friction not less than 0.6 when tested according to ASTM C 1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and other like Surfaces by the Horizontal Dynamometer Pull-Meter Method.

3. If these test results are available for a standard system then provide with the bid return.

4. Exposed Metal Products (e.g. patterned stainless steel surface) shown to meet the above criteria will not require further surface treatment and is the preferred solution. Other surfaces failing to meet these criteria will require a (Grey color) Stirling Lloyd Safetrack SC American Safety AS-550 non-slip coating or approved equivalent.

5. Carry out trial assembly of the movement joint at the movement joint manufacturer / installer works before delivery to site. Provide photographic record of the trial assembly to the Architect / Engineer of Record.

PART 2 - PRODUCTS

2.1 Bridge Expansion Joints

1. Base bid shall be the Watson Bowman Acme (WABO) type "APX 1000" where the surface cover plate is of a matt finished Grade 316L stainless steel material with Grade A4 stainless steel fixings The assembly must include a drain and down spout.

2. Install expansion assembly in strict compliance with the manufacturer's recommendations and directions. Install the assemblies as a waterproof expansion joints.

3. Seal material shall be a flexible, non-reinforced extruded neoprene compound that is resilient to temperature changes, oil and ozone, and abrasion. The extruded shape of the seal shall have smooth surfaces and of uniform dimensions and be supplied in one complete length. The seal shall be held mechanically between two opposing and anchored metal extrusions. The joint shall not rely exclusively on compression of the seal at or between the metal extrusions.

4. Supply seal 4 inches longer than the length shown on the drawings. Remove the overlength amount from the seals in the attendance of the Engineer or their representative. The Engineer will use the samples to conduct any tests that he or she may desire to have carried out in order to verify the quality of the seal.

5. Supply such information as is required to fully indicate the qualifications of the particular seal in regard to physical requirements set out above.

6. The Engineer is to inspect the seals when delivered to determine visual compliance with requirements that do not require physical tests, including surface quality and dimensional compliance.

7. Replace seals that are not manufactured to meet the physical requirements or that fail to pass compliance with visual inspection at no additional cost.

8. Replace individual lengths of seal if tests on samples show that the seal or material do not meet the requirements set out in this specification at no additional cost.

9. Supply an adequate amount of approved liquid lubricant-sealer complete with full instructions for proper and approved application procedures.

10. All visible stainless steel shall be Grade 316L, with a minimum molybdenum content of 2.5% - 3.0%, Surface finish to be ASTM 1D

11. All stainless steel elements must be cleaned, passivated to ASTM A 380 or equivalent before delivery to site.

12. All stainless steel elements must be degreased, cleaned, passivated and ferroxyl tested (including a Ferroxyl test certificate) prior to delivery to site and again at completion on site. This can be achieved by using Avesta 401, 410, 420, 430 and 630 products or similar approved products.

13. Shear stud connectors: Headed concrete anchors conforming to ASTM A108.

14. Coating for expansion joint cover plates (if required to meet the testing specification requirements) shall be American Safety AS-550 (Color- Grey) non-slip coating or equivalent approved by the Engineer of Record.

PART 3 - EXECUTION

3.1 Examination of Work by Other Trades

1. Before commencing fabrication of the work of this section, the supplier is to inspect and take field measurements of work done by other trades which may affect the work and is to notify the Engineer of Record in writing of their acceptance of the work done under other sections by other trades. If any conditions exist that will prejudice a proper installation of the work, the supplier is to notify the Contractor in writing and is not to proceed with

installation of the work until deficiencies are corrected and the Engineer of Record has received the letter of acceptance.

3.2 Cooperation

1. The Movement Joint manufacturer / installer will work with the Engineer of Record to develop the design of the movement joint to suit this project application. The Movement Joint manufacturer/installer should allow for attending 4 video/teleconferences to discuss the construction and provide feedback on drawing submissions, testing, trial assemblies etc. The Movement Joint manufacturer/installer shall allow for sending suitably qualified staff to site to discuss the installation and carry out site measurements.

2. Where items of other trades are to be built into the work of this section or items of this section are to be built into the work of other trades, such items are to be procured or provided in ample time to avoid delay.

3. Attend upon and cooperate with other trades with respect to the work of this section and is to do everything necessary to enable the work of other trades to be fitted in a first class manner without delay. Specific attention is drawn to the need to secure the movement joint to different material substrates of reinforced concrete and structural steel. The Movement Joint manufacturer/installer must coordinate any fixing requirements with these trades and any other connected trade to ensure that fixing details have been agreed and incorporated into the shop drawings of the preceding and following trades.

3.3 Delivery and Joint Assembly

1. Package the seal and lubricant-sealer in suitable fashion so as to prevent damage and contamination. Materials will not be accepted until they have been inspected and approved by the Engineer of Record.

2. Provide adjustment devices for the expansion joint assembly to allow for setting the joint width to suit the temperature when the joints are cast into the concrete blockouts.

3. Adjust the gap on the job site to suit the ambient temperature at the time of final fixing of the joint to each side of the blockout. Take care to remove all buried adjustment clamps and bolts prior to concrete placement.

3.4 Installation

1. Require the expansion joints to be installed by the supplier or their authorized agent as approved by the Engineer and in strict compliance with the manufacturer's recommendations and directions.

2. Install the strip seals in the field after all formwork (styrofoam, etc.) for the expansion joint has been removed.

3. Protect top surface of joint gap during concrete pour.

4. Protect the surface of the movement joint (including a protective film) in a sufficiently robust manor to allow following trades to pass over the movement joint without damaging the product or its appearance in any way. Return to site to remove the protective cover once work to the remainder of the bridge is complete as and when requested by the main contractor. Making good of any damage caused to the movement joint through failure of the protective cover shall be made good by the Movement Joint manufacturer / installer at no additional cost and to the satisfaction of the Architect.

3.5 Certification

1. Certify at completion of work all components fabricated and erected by the fabricator under the seal and signature of the Contractor's professional engineer responsible for this work.

2. Certify that all designed components are fabricated and erected in accordance with the reviewed shop drawings.

3.6 Guarantee

1. The performance of the expansion joint assembly is to be guaranteed in writing by the expansion joint supplier for a period of five (5) years from the date of issuance of the Construction Completion Certificate. The guarantee is to provide for the replacement and/or repair of the joint at no cost to the Owner in the event that the joint does not perform satisfactorily in the range of design movement. An attached Expansion Joint Guarantee Form is provided and is to be completed in full for acceptance of the new expansion joints.

END OF SECTION

SPECIAL SPECIFICATION

PEDESTRIAN RAILING

PART 1 - GENERAL

1.1 Description

1. Fabricate and install prefabricated pedestrian railing according to drawings.

PART 2 - PRODUCTS

2.1 Materials

Use materials that meet requirements of the following Items.

- Item 441, "Steel Structures"
- Item 442, "Metal for Structures"
- Item 446, "Cleaning and Painting Steel"
- Item 450, “Railing”
- Special Specification, “Stainless Steel”

PART 3 - EXECUTION

3.1 Construction

The contractor shall:

1. Separate stainless steel elements from mild steel elements with appropriate non conducting layers (nylon washers, neoprene pads or similar) to prevent contact corrosion.
2. Install pre-manufactured pre-coated stainless steel mash panels according to supplier’s recommendations.
3. Include electrical conduits as shown on drawings and as specified in electrical works Special Specification “XXXX”.
4. All pedestrian rail supports to be set plumb on base plats pre-installed with cast-in-place concrete deck. Shim supports where necessary to achieve plumb-line.
5. For rail supports Type 2 include appropriate fixings for driver, illumination and junction box. See electrical Special Specification “XXXX”.
6. Ensure full working of handrail expansion joint assembly prior to installation.
7. Provide a complete sample mockup of the pedestrian railing per Section 3.3 “Mock-up”.
8. Prepare and submit shop / erection drawings to the Engineer of Record in accordance with Item 441 “Steel Structures”. Show all splice locations and details on the shop / erection drawings. Splice locations permitted as shown on the plans unless otherwise approved by the Engineer of Record.
9. Field weld when required in accordance with Item 448, “Structural Field Welding.”

3.2 Storage

Store railing materials above the ground on platforms, skids, or other supports, and keep them free from grease, dirt, and contact with dissimilar metals. Avoid scratching, marring, denting, discoloring, or otherwise damaging the railing.

3.3 Mock-up

A full scale mock-up (using the actual materials proposed for the installation) shall be constructed for review by the Architect, Engineer of Record and City. The mock-up is to be constructed 4 weeks minimum prior to manufacture of the pedestrian railing for the bridge and is to show the following:

4 ~ Type 1 supports

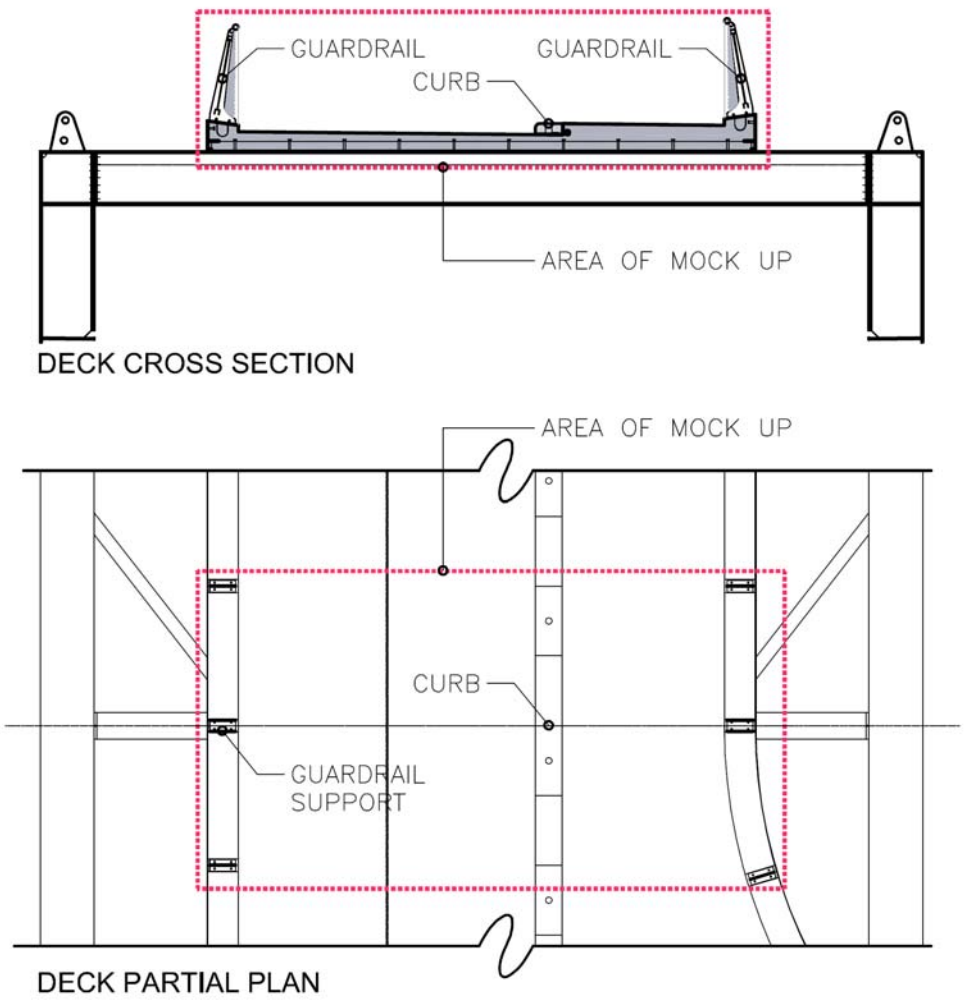
2 ~ Type 2 supports with functional illumination

4 ~ Regular (straight) pre-manufactured pre- coated stainless steel mash panels

2 ~ Partial curved pedestrian rail sections with curved pre- coated stainless steel mash panels

The steel work contractor's representative and site installation manager shall be present when the Architect / Engineer of Record / City review the mock up and suitably able staff shall be present to allow minor alteration to the mock-up to take place during the review.

Should the review prove satisfactory then photographic records shall be made of the mock up and this shall be considered to represent the agreed quality of installation that can be expected by all parties. The pedestrian railing contractor shall receive a written statement from the Architect stating that the mock up is considered to be a satisfactory representation of the completed work at which time he shall complete the manufacture of the pedestrian railing for the bridge.



Location of Mock Up Details (Section 3.3)

3.4 Finishes

1. All mild steel elements to be powder coated to RAL 09010 prior to installation on the bridge deck. All stainless steel elements (handrail) to be nylon coated.

2. Mesh to be fabricated from pre-coated Stainless steel wire. Coating the finished mesh panel at the end will not be accepted.

PART 4 - MEASUREMENT

Measurement for the Pedestrian Railing shall be made by the linear foot.

SPECIAL SPECIFICATION

STAINLESS STEEL

PART 1 - GENERAL

1.1 Work Included

Stainless Steel required for this work is indicated on the drawings and includes, but is not necessarily limited to

1. Bridge Expansion Joint (Transition and Movement) accessories
2. Pedestrian Railing meshes and handrail.
3. High Load Multi-Rotational Disk Bearing attachments
4. Drainage Inlets

1.2 Related Work Specified in Other Sections

1. Project General Notes
2. Pedestrian Railing
3. High Load Multi-Rotational Disk Bearing
4. Bridge Expansion Joints

1.3 Reference Standards

1. All standards to be latest issue at time of tender.
2. ASTM A167, “Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip”.
3. ASTM A276, “Standard Specification for Stainless Steel Bars and Shapes”.
4. ASTM F738M, “Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs”.

PART 2 - PRODUCTS

2.1 Materials/Components

2.2 Stainless Steel Plate to be Grade 316L in accordance with ASTM A167 unless noted otherwise on the drawings.

1. All visible stainless steel shall be Grade 316L, with a minimum molybdenum content of 2.5% - 3.0%.
2. Handrail finish to be SA 2.5, prepared for further coating.
3. All visible surfaces in stainless steel materials shall be as defined by samples provided by the contractor. The proposed finish for externally visible stainless steel elements is to be a wet polished finish, equivalent to Outokumpu 4N finish type, or similar approved, or otherwise noted in the drawings. Note, all welds and edges are required to achieve the finish as noted above.
4. Samples shall produced using precisely the processes proposed for site and shall be minimum 24 inches x 24 inches for pipe material 2 feet of length. Samples shall demonstrate the following for approval by the architect:
    a. Range of surface roughness to be expected on site (upper and lower limits)
    b. Uniform surface finish at welded joints (in-plane and corner)
5. No contaminated finishing media are to be used in the production process of stainless steel elements. Special precautions must be undertaken if elements are processed in multi-metal fabrication facilities. Stainless steel supplier to provide written QA documentation verifying that elements have been processed in an area of the facility which has been cleaned of contaminating elements.
6. The contractor shall make provision for analysis of the stainless steel alloy and surface roughness and provision of certificate of compliance from the stainless steel manufacturer confirming compliance with the specification requirements.
7. The contractor shall provide the Architect / Engineer of Record with certificates from the stainless steel fabricator which state that the alloy and finish complies with the requirements of this specification. The Architect / Engineer of Record prior to the receipt of the Applicator's Certification cannot sign certificates of practical completion, or any other documentation accepting the finished works.
8. All surfaces shall be fully protected for the duration of the works. Protective coverings shall be resistant to all weathers and be removed from areas inaccessible after installation. They shall be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Materials, assembled units, elements of framing and all components shall be protected in such a manner that will prevent damage, distortion, uneven weathering or degradation under normal conditions of handling, storage and installation. Particular attention shall be given to the protection of edges, projecting features, corners and other vulnerable areas.
9. All stainless steel elements must be cleaned, passivated to ASTM A 380 or equivalent before delivery to site.
10. All stainless steel elements must be degreased, cleaned, passivated and ferroxyl tested (including a Ferroxyl test certificate) prior to delivery to site and again at completion on site. This can be achieved by using Avesta 401, 410, 420, 430 and 630 products or similar approved products.
11. Stainless Steel Bar to be Grade 316L in accordance with ASTM A276 unless noted otherwise on the drawings.

12. Stainless Steel Bolted Connections to be Grade A4 to ISO 3506 or ASTM F738M security type to prevent unlawful loosening or removal.

2.3 Fabrication

1. Notify Engineer and inspection and testing firm a minimum of forty eight (48) hours prior to fabricating steel to allow for inspection.
2. Fabricate steel in accordance with Item 441, the drawings and specifications and the reviewed shop drawings.
3. Verify dimensions of existing work prior to commencing fabrication.
4. Verify all drawing dimensions and conditions prior to commencing fabrication.
5. Do not place any unspecified holes or openings in stainless steel members without the written approval of the Engineer.

PART 3 - EXECUTION

3.1 Installation

1. Install steel in accordance with drawings and Item 441.
2. Make adequate provision for all erection loads and for sufficient temporary bracing to maintain steel items safe, plumb and in true alignment until completion of installation.
3. Do not field cut or alter steel members without the written approval of the Engineer of Record. Report to the Engineer of Record every failure of material to fit together properly. Corrective measures are to be approved by the Engineer of Record.
4. The Contractor shall prepare specific welding procedures for joining stainless steel with low alloy steel (e.g. SS hinges to manholes/structural steel). Those welds, made with specific filler, shall be continuous through the entire joint. After that, the proposed coating system shall be applied over those welds as indicated on the drawings.
5. The approved paint system shall be applied to 2 inch return on stainless steel next to dissimilar welds between stainless steel and carbon or low alloy steel.
6. Stainless steel elements shall be protected using a laser grade protective film (black underside – white on top) minimum thickness 0.1 mm. Protective film must be capable of remaining intact and in position on the stainless steel elements for a minimum period of 18 months or until immediately prior to practical completion, whichever is the lesser, just before the first sub-contractor cleaning and passivating process. Protective film must be easily removable during the scheduled and agreed removal period immediately prior to Practical Completion.
7. Contractor must allow in his costing for the removal of protective film and final clean-down to presentation quality (see also 2.1.11 above).
8. Any protective film used shall be applied and removed in accordance with the recommendations of the stainless steel and film manufacturer guidelines. Written method statements shall be sought from the protection film manufacturer.
9. Protective films shall not be kept in contact with surfaces for longer than 6 months and when removed shall not leave an adhesive residue.
10. Should the protective covering need to remain in place following installation, the contractor shall, propose to the Architect / Engineer of Record a program for monthly inspections and make good / replace the coverings as may be required.
11. Site rectification of damage to, or contamination of, stainless steel elements is not allowed. Damaged or contaminated panels will not be accepted and will require removal and replacement by the contractor without additional expense to the Owner or effect on the project schedule.

END OF SECTION

SPECIAL SPECIFICATION

GRANITE CURB AND BENCHES

PART 1 - GENERAL

1.1 Scope of Work

1. Furnish all labour, materials and equipment required for the supply, testing and installation of the granite as shown on the drawings.
2. The granite work includes any and all dowel or other fixing methods, sealant and surface treatments and joint fillers.
3. The stone curb generally supports foot traffic but must be capable of supporting the AASHTO Maintenance Vehicle. To justify this occasional loading a test of the system is proposed. See Testing section below.
4. Illumination housing to be installed in granite curbs shall be coordinated between the electrical contractor and stone contractor. Stone contractor is responsible for grouting and appropriate sealing of illumination housing.
5. Deck drainage inlets in stainless steel to be supplied and coordinated between the contractor and stone contractor. Stone contractor is responsible for grouting in and appropriate sealing of deck drainage system.

1.2 Reference Standards

All standards to be latest issue at time of bid.

1. ASTM ASTM A167, “Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip”.
2. ASTM A276, “Standard Specification for Stainless Bars and Shapes”.
3. ASTM A480/A480M, “Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip”.
4. ASTM C97, “Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone”.
5. ASTM C99, “Standard Test Method for Modulus of Rupture of Dimension Stone”.
6. ASTM C170, “Standard Test Method for Compressive Strength of Dimension Stone”.
7. ASTM C241, “Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic”.
8. ASTM C615-03, “Standard Specification for Granite Dimension Stone”.
9. ASTM C666/C666M, “Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing”.
10. ASTM C880, “Standard Test Method for Flexural Strength of Dimension Stone”.

1.3 Quality Standards

The contractor shall:

1. Perform all granite work in accordance with National Building Granite Quarries Association (NBGQA), Inc. “Specifications for Architectural Granite”.

2. Provide evidence that each type of stone meets the performance requirements as described in this section, including Petrographic analysis, prior to the supply of stone.
3. Stones which are considered as being of a suitable aesthetic quality standard are: "xxxxx" meeting the required strength criteria will be considered (at the discretion of the Architect). The minimum quality standard for appearance is as per the attached images.
4. The Architect shall review the samples and shall decide whether the quality achieved in the samples is acceptable or not. His decision will be final. Material shall only be ordered once the Architect has accepted (in writing) the samples provided.
5. The samples provided must show the color, texture and "pattern" variance that is anticipated for the completed work. The samples will be held on site for the purpose of comparison with the completed work. Completed work exhibiting color, texture, pattern or other quality variations outside the range indicated in the accepted samples (in the opinion of the Architect) shall be removed and replaced (at the cost of the contractor) at the Architects discretion.
6. Obtain each type of granite through one location within a single quarry. Sufficient stone (having been successfully accepted (from samples) by the Architect) from said location and a sufficient reserve is to be set aside for the project. Provide the Engineer of Record with documentary evidence that this stone has been set aside for the project. The Architect and Engineer of Record reserve the right to visit the quarry/masons yard to inspect the stone being used at anytime.
7. Delegate full responsibility for the entire installation to a suitably experienced (10 years minimum of experience as a qualified mason) site manager in the employ of the stone contractor.
8. The stone contractor shall carry out his own survey of the completed bridge deck and satisfy himself that all the stone elements can be installed to the agreed quality (including joint size) of the accepted mock up construction. The contractor shall make any adjustments to the curb stone to allow the stone work to meet or exceed the agreed quality of the mock up.

1.4 Bid Submittal

1. Verifiable list of prior installations (including photographs) showing successful experience using similar products.
2. Provide photographic sample of proposed granite to the Architect,
3. Mark up contract drawings of stonework package and return as part of bid documentation showing extent of works by Stone Contractor. Mark all work deemed to be by others. Any work not marked as being by others will be deemed to have been included in the Stone Contractor's scope of works.
4. The Stone Contractor is free to provide alternate details with his bid for consideration by the Architect but the bid must reflect the work specified on the drawings unless agreed in writing with the Architect in advance of the bid submittal.

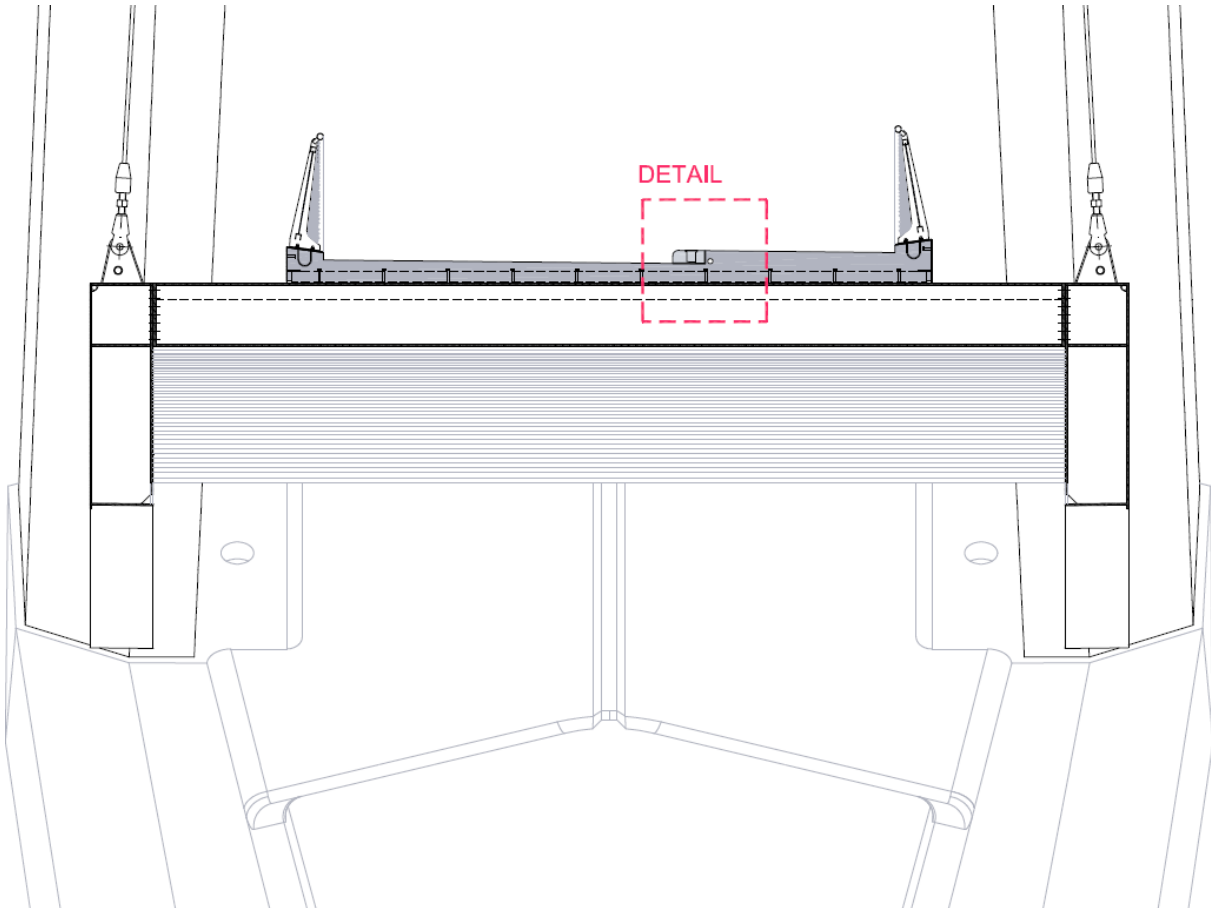
1.5 Shop Drawings and Final Submittals

1. Within 4 weeks of bid award, provide samples for review of up to 5 stone samples (1' x 1' x 1") each with 2 different surface finishes , 2 on each side (as per table below) to the Architect's Office in Zurich (Each sample is to be clearly marked with the Stone Contractors contact information, Project name, Granite source and surface finish on identifiable surface)

Thermal: (flame)	Plane surface with flame finish applied by mechanically controlled means to ensure uniformity

8-cut:	Fine bush-hammered; interrupted parallel markings not over 3/16 in apart to give a corrugated finish.

2. Submit shop drawings to the Engineer of Record for review and approval.
3. Drawings shall be submitted 8 weeks minimum prior to manufacture of elements shown in the shop drawings.
4. Work performed without an approved shop drawing marked by the Architect / Engineer of Record shall be at the risk of the Contractor.
5. Clearly indicate element sizes, joint setting out, recesses for technical installations, anchorage sizes and types of fasteners and accessories.
6. Include installation drawings, elevations and details where applicable.
7. A full scale mock-up (using the actual materials proposed for the installation) shall be constructed for review by the Architect, Engineer of Record and the City. It shall be erected at the Stone Contractors Works. The mock-up is to be constructed 4 weeks minimum prior to manufacture of the stonework for the bridge and is to show the following:
    a. Proposed surface finish (as agreed from samples) for at least two sample finishes (both passing the friction testing noted in the testing section of this specification).
    b. Mounted, sealed light fitting to curb stone
    c. Mounted and sealed in storm drain
    d. Proposed joint achievable around all Steel Elements (which may be mocked up in an alternative material for the purpose of the mock up)
    e. Shall be constructed on the floor to allow “real” viewing position of bridge user to be considered)



Location of Mock Up Details (Section 1.5 – 7)

Additional Mock Up Requirements:

The Stone Contractor representative and site installation manager shall be present when the Architect / Engineer of Record / City review the mock up and suitably able staff shall be present to allow minor alteration to the mock-up to take place during the review.

Should the review prove satisfactory then photographic records shall be made of the mock up and this shall be considered to represent the agreed quality of installation that can be expected by all parties. The stone contractor shall receive a written statement from the Architect / Engineer of Record stating that the mock up is considered to be a satisfactory representation of the completed work at which time he shall complete the manufacture of the stone for the bridge.

Should the mock up be considered unsatisfactory for a reason deemed (by the Architect) to be under the control of the stone contractor (e.g. failure to meet the requirements of this specification or the quality accepted from the sample provided) then the mock up shall be redone at the no additional cost to the Owner until it is deemed satisfactory by the Architect.

Should the mock up be considered unsatisfactory but is agreed to reflect the approved shop drawings (and the sample provided) the Stone contractor shall redo the mock up but his costs shall be paid by the Owner.

At the discretion of the Architect, the stonework used for the accepted mock up may be incorporated into the final stone construction.

1.6 Delivery and Storage

The Contractor shall:

1. Carefully pack and load granite for shipment and take all necessary precautions against damage.
2. Exercise extreme care to prevent physical and climatic damage and staining during storage.

1.7 Environmental Conditions

The Contractor shall:

1. Maintain a 55 ºF minimum air temperature at the granite installation area for one day prior to, during, and for twenty-four (24) hours after installation.
2. Limit the maximum moisture content of the substrate to 10%.
3. Maintain the minimum substrate temperature as recommended by NBGQA.
4. Ensure negative alkalinity of the substrate before applying stone. Test the surface using litmus paper.
5. Provide adequate continuous ventilation during and after applying stone.
6. Ensure concrete surfaces are suitably level and prepared to receive stone.

PART 2 - PRODUCTS

2.1 Materials

The Contractor shall use the following materials:

1. Granite according to ASTM C615. Granite shall be sound, hard, durable, well seasoned and uniform in strength, colour and texture. It shall be free of quarry sap, flaws, seams, sand holes, iron pyrites, harmful quantities of radiation, and other mineral or organic defects. If there is a distinguishable rift in the granite, cut all granite for the project in one direction only, unless otherwise directed by the Architect.
2. Setting bed as prescribed in the contract drawings.
3. The Granite shall be shown to have a characteristic flexural strength of minimum 15 N/mm^2 when tested in accordance with ASTM C880.

2.2 Testing

1. The curb stone will be subject to continuous foot traffic. Provide test certificate from an accredited independent agency 8 weeks minimum prior to manufacture of the stonework for the bridge verifying that the wet and dry coefficient of friction of the surface exceeds a value of 0.6 when tested against ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
2. The stone paving system shall be subject to occasional loading by wheeled vehicles (maintenance and emergency). A test shall be carried out of the actual system 8 weeks minimum prior to manufacture of the stonework for the bridge to show that the stone curb is capable of supporting a concentrated load of 6 kips over an area 10 inches by 6 inches. The stone contractor shall make photographs of the test underway with the load applied at varying locations over the stone surface. This build up for the test may be the same system as presented for the mock up (at the discretion of the stone contractor).

PART 3 - EXECUTION

3.1 Installation

The contractor shall:

1. Apply the setting bed and stone to non-frozen, frost-free surfaces.
2. Install granite in accordance with NBGQA details recommendations, and quality standards set by the approved mock-up.
3. Make cut edges smooth and even, and free of chips and cracks.
4. Butt joint wall pieces with all joints plumb, straight, and true.
5. Ensure no metal debris or other contaminants become embedded in mortar setting beds or substrates;
6. Ensure that no water puddles on the completed floor areas and granite treads.
7. Mask edges of joints prior to grouting and pointing.
8. Grout joints (other than control joints) solid with mortar where specified and point with an approved coloured pointing compound.
9. Protect areas in which granite is being installed against staining and any other damage at all times.
10. Protect the finished stone installation, make good damage, remove all debris and rubbish, and leave the work area in a clean and tidy condition.

PART 4 - MEASUREMENT

Measurement for the Granite Curb shall be made by the linear foot. Measurement for the Granite Benches shall be made by each.

PART 5 - IMAGE OF POSSIBLE GRANITES

xxxx

END OF SECTION

SPECIAL SPECIFICATION

DECK SURFACING

PART 1 - GENERAL

1.1 Scope of Work Summary

1. Furnish all labour, materials and equipment required for the supply and installation of the coating to the concrete deck as per pavement drawings.
2. The prepared substrate (CIP bridge deck) deck shall be coated with a colored liquid resin binder that incorporates fine aggregates to provide a slip resistant finish.
3. The system shall be seamless when applied and the pigmentation shall be UV resistant to avoid premature fading of the color.

1.2 Reference Standards

All standards to be latest issue at time of bid.

Technical Performance:

Tensile Adhesion	XXXXXX
Concrete substrate	> 150 psi
Steel substrate	> 300 psi
Asphalt substrate	> 75 psi
Skid Resistance Value (TRL Pendulum)	45 (minimum)
Wheel Tracking Test HD28/94	Zero Erosion
Low Temperature Flexibility (ASTM C836 at 14oF)	No Visible Cracks
Crack Accommodation (BS 8110 Part 2:1985)	Pass

1.3 Quality Standards

The Contractor shall:

1. All components of the system shall be supplied by a company that operates a quality system registered to ISO 9001:2000.
2. The system shall have good resistance to wear and shall be capable of being maintained / overcoated in the long-term future without removal of the existing layers.
3. The system shall be resistant to De-icing salts and spillages of Petrol, Oil, Battery Acid and Anti-Freeze.
4. Slip resistance will be achieved by rolling the surface to produce a textured finish. The aggregates within the system, combined with the textured finish, shall provide the slip resistant surface.
5. Delegate full responsibility for the entire installation to a suitably experienced site manager in the employ of the stone contractor
6. In order to substantiate durability, the system shall have similar applications in the United States that are available for inspection by the client's representative.

1.4 Submittals

Verifiable list of prior installations (including photographs) showing successful experience using similar products.

1.5 Shop Drawings and Final Submittals

1. Within 8 weeks of bid award provide samples for review (1'x1') of below color options to the Architects Office in Zurich. Each sample is to be clearly marked with the color code, Contractor's contact information and Project name.
2. Color samples requested include: SL137, SL154, SL142, SL010, SL108 and SL100. The Architect will confirm the choice of color for an on site sample.
3. A full scale sample of an 8' section of the deck shall be constructed for review by the Architect, Engineer of Record and City. The mock-up is to be constructed 4 weeks minimum prior to carrying out the surfacing for the bridge and is to show the following:
   a. Proposed surface finish (as agreed from samples) for at least two sample finishes.
   b. Granite curb stone, see Special Specification, "Granite Curb and Benches".
   c. Pedestrian Railing, see Special Specification, "Pedestrian Railling".
   d. Shall be constructed to allow "real" viewing position by bridge user.

   The Contractor's representative and site installation manager shall be present when the Architect / Engineer of Record / City review the mock up and suitably able staff shall be present to allow minor alteration to the mock-up to take place during the review.

   The installer shall receive a written statement from the Architect / Engineer of Record stating that the mock up is considered to be a satisfactory representation of the completed work at which time he can proceed with the surfacing works.

1.6 Delivery and Storage

The Contractor shall:

1. All materials must be supplied to site in unopened packaging, with batch numbers marked and corresponding manufacturers certificates of conformity, and must be used within the products shelf life or 'use by date'.
2. Exercise extreme care to prevent physical and climatic damage and staining during storage.

1.7 Environmental Conditions

The Contractor shall:

1. All components/layers of the system shall have an application temperature range of 32°F to 85°F to allow winter and overnight application/maintenance.
2. All components of the system shall be unaffected by rain 20 minutes after application at 32°F.
3. Site conditions should be regularly monitored to ensure the substrate is above the dew point during application.

PART 2 - EXECUTION AND TESTING

2.1 Installation

1. Substrate Preparation: preparation of the substrate should be in accordance with the manufacturer's instructions.
2. Surfaces with a high negative texture (such as SMA) should be filled using a rapid cure filler material, which is compatible with the resin surfacing system and suitable for application to a feathered edge. Both materials shall be produced by the same manufacturer.
3. Application: application should be in accordance with the manufacturer's instructions.
4. The resin material shall be a cold applied resin, contain no isocyanates and should present no risk to other trades or the general public who may be in close proximity to the works.

5. The system shall comprise be a reactive resin system, requiring the addition of a catalyst to create a chemical cure and shall not depend on solvent or water evaporation.
6. Coverage rates should be a minimum of 32 ft^2/gal on a flat substrate.
7. Coverage rates and applied coating thickness must be monitored and recorded for each day's production together with material batch numbers, ready for inspection by the Engineer of Record if requested

2.2 Testing

Texture depth analysis of the surface should be carried out to ascertain the correct coverage rates taking into account all variations in site conditions. The minimum required coverage will increase with surface irregularity.

2.3 Surfacing system

The system shall be the '**Safetrack SC'** slip resistant colour demarcation system, or approved equivalent, manufactured and distributed by:

Stirling Lloyd Products, Inc.
152 Rockwell Road,
Newington, Connecticut, 06111
United States of America

Website: www.stirlinglloyd.com/northamerica

Safetrack SC Components:

Safetrack SC Coating,
PAR 1 Primer (on concrete substrates only),
MR6 Primer (on metal substrates only)

PART 3 - MEASUREMENT

Measurement for Deck Surfacing shall be made by the square foot.

END OF SECTION