Kosciuszko Bridge Project – (BIN 1075699)
PIN X731.24, Contract D900011

CONTRACT DOCUMENTS

PART 5
SPECIAL PROVISIONS

Final August 27, 2013
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New York State Department of Transportation

SP 1. SPECIAL PROVISION TO SECTION 100 OF NYSDOT STANDARD SPECIFICATIONS CONSTRUCTION AND MATERIAL

Delete the entire Section 100 of the New York State Department of Transportation Standard Specifications Construction and Materials, dated May 1, 2008, amended as of January 12, 2012. Replace Section 100 of the NYSDOT Standard Specifications Construction and Materials by Part 2, DB § 100.

SP 2. SPECIAL PROVISION TO SECTIONS 200 THROUGH 699 OF THE NYSDOT STANDARD SPECIFICATIONS CONSTRUCTION AND MATERIAL

The following amendments apply to Sections 200 through 699 inclusive of the New York State Department of Transportation Standard Specifications Construction and Materials, dated May 1, 2008, amended as of January 12, 2012, and any NYSDOT Special Specifications referenced in Part 3, Project Requirements or that otherwise might be required during the design and construction of the Project, with the exception of Section 800 Specifications contained in Part 8 – Special Specifications:

A. All contact with Department staff or offices except for personnel assigned to the Project shall be through the Department's Project Manager.

B. References to “plans” or “contract plans” shall mean “Design Plans” prepared by the Design-Builder.

C. There will be no measurement for payment except for Unit Priced items specifically shown in the Price Proposal. All Work will be paid on the basis specified in Part 2 – DB § 109.

D. All references to “Section 100” Specifications shall mean equivalent references to Part 2 - DB § 100 Specifications.

E. Delete the following phrases:
   1. “deemed necessary by the Engineer”;
   2. “to the satisfaction of the Engineer”;
   3. “as determined by the Engineer”;
   4. “subject to the approval of the Engineer”;
   5. “as specified by the Engineer”;
   6. “approved by the Engineer”;
   7. “ordered by the Engineer”;
   8. “established by the Engineer”;
   9. “acceptable to the Engineer”;

Or similar phrases denoting instruction by or consent from the Engineer and replace with "as shown on the Design Plans and/or Project Specifications released for construction per DB § 111-12”.

If the relevant information is not shown on the Design Plans or covered in the Project Specifications, the Design-Builder shall have the Designer change the Design Plans and/or Project Specifications to incorporate the missing information.

F. Delete references to “payment lines” and replace with “lines shown on the Design Plans”.

G. References to “Proposal” or “proposal” shall be interpreted to mean the “Contract Documents”;

H. Unless specifically stated otherwise in the Contract Documents, sampling and testing specified to be done by the Engineer or other Department staff, shall be performed by the Design-Builder’s Construction Quality Control (QC) staff;

I. Working Plans or working drawings, as defined in Part 2 – DB § 101-3, shall be reviewed per DB § 111-12;

J. “Submission” or “submittal” used in the design shall be subject to review and Department acceptance per DB § 111-12;

K. All references to “the Engineer” or “the Engineer-in-Charge” shall mean the Department’s Project Manager or designated representative;

L. All references to “Contractor” shall mean “Design-Builder”;

M. References to: “Deputy Chief Engineer Design, Construction, Technical Services”; any Division in Main Office NYSDOT; “Regional Director”; “Regional Design Engineer”; “Materials Engineer”; “Construction Engineer”; or any other similar title and role shall mean the Department’s Project Manager or a designated representative;

N. References to “Departmental Engineering Geologist” shall have the meaning defined in Part 2 DB § 101-3;

O. References to “Departmental Geotechnical Engineer” shall have the meaning defined in Part 2 DB § 101-3;

P. References to “Contract Award” shall mean Notice to Proceed;

Q. References to “preconstruction meeting” shall mean “pre-work meeting”;

R. There shall be no quality payment adjustments under this Contract;

S. In each Specification delete the sections titled “Method of Measurement” and “Basis of Payment”;

T. Delete Section 637 – Engineer’s Field Office, Laboratory and Equipment;

U. Add the following to Section 648 – Subsurface Explorations:

“The Design-Builder shall be responsible to determine the nature, extent, and locations of subsurface explorations needed to obtain data and support subsequent analysis, design, and construction. The Design-Builder shall also be responsible for determining the adequacy of any subsurface exploration data provided by the Department to support its analyses, design, and construction and to supplement such data provided by the Department as the Design-Builder deems necessary.

“In planning and conducting its subsurface explorations, the Design-Builder shall comply with the technical requirements of Section 648, unless the Department agrees otherwise. The Design-Builder is not required to comply with the administrative requirements specified in Section 648”.

V. Delete Section 697 – Field Change Payment;

W. Delete Section 698 – Price Adjustments; and

X. Delete Section 699 – Mobilization.
SP 3. ERECTION OF CABLE-STAYED AND CONCRETE SEGMENTAL BRIDGE

3.1 GENERAL

A. The Project requires that the main span shall be a cable stayed structure. This section applies to a cable stayed main span. The Design Builder may elect to design and construct a concrete segmental approach structure, in which case this section shall also apply. In addition, the provisions for post tensioning and grouting shall apply to all post tensioned construction on the Project.

B. Stay cable design, testing and installation shall conform to the Post Tensioning Institute PTI DC45.1-12 Recommendations for Stay Cable Design, Testing and Installation (PTI Recommendations) as modified by these Special Provisions.

C. The erection of the structure and the field workmanship shall be in accordance with the best practice and shall conform to these specifications and Special Provisions.

D. The Design-Builder shall be responsible for the cable stayed and concrete segmental bridge design, construction and erection. All computations submitted to the Department for review shall be prepared, signed, and sealed by the Design-Builder’s Engineer of Record, who shall be a Professional Engineer registered in the State of New York who is experienced in the design and construction of cable stayed and segmental concrete bridges and is qualified to be responsible for all aspects of this work.

E. The Design-Builder shall submit complete detailed shop and erection drawings of his proposed erection sequence, including complete and checked erection design calculations to the Department for review. The review by the Department of the Design-Builder’s erection sequence and plans shall not relieve the Design-Builder from his responsibility for performing the work required by the Contract, including these Special Provisions.

F. The following items shall be performed by the Design-Builder and submitted to the Department for review:

1. Complete detailed erection sequence drawings are required. Erection and erection wind stresses in permanent and temporary members including temporary piers and false work reactions shall be determined for each stage. Moments, shears, axial loads and other forces shall be computed and tabulated for all pertinent members at a sufficient number of points to demonstrate that the load demand will not exceed the capacity and allowable stresses for erection. Details of contemplated elevations, cable lengths, adjustments and shims required shall also be shown for each stage. Final cable adjustment shall be performed after all dead loads are in place.

2. The Design-Builder shall prepare and submit detailed shop and erection drawings to the Department for review.

3. All submittals by the Design-Builder shall be submitted sufficiently in advance of the start of construction. The review shall be conducted in accordance with Part 2 – DB Section 111.

G. The Design-Builder shall meet with the Department to discuss the proposed erection procedure, erection design criteria, and structure capabilities to support the proposed erection scheme. The Department will review the preliminary erection procedure proposal for general compliance with the Contract requirements.

H. The Design-Builder shall develop and submit to the Department a complete description and stress calculations of the proposed process and sequence or erection including positions and weights of equipment at each stage in sufficient details to allow review of the effects of the erection procedure on the...
I. The Design-Builder shall submit to the Department the detailed design of all erection equipment, temporary bracing and other items as required for erection.

J. The Design-Builder shall ensure the intermediate static and dynamic stability of the structure for the various stages of the construction. To fulfill this requirement, the Design-Builder may have to construct temporary support bents or install auxiliary cables to stabilize the bridge. Temporary cable ties may be required to provide damping of wake galloping in the stay cables until final stabilizing cables are installed.

K. The Design-Builder shall devise, and submit to the Department for review and evaluation, a scheme for stabilizing the cable stayed structure against wind loads at all construction stages, should stabilization be required. All details and layouts of any tie down assembly including all connections, foundation elements, and material properties shall be submitted for review.

L. All computations shall be prepared, signed and sealed by the Engineer of Record. Calculations shall be submitted in a neat organized manner that is easy to follow.

M. The Design-Builder will be responsible for determination of and monitoring of forces, and deflections in the permanent structure at all erection stages as are caused by his proposed erection process.

N. No Work shall be performed on the cable stayed structure until the Design-Builder’s erection sequence has been totally reviewed and approved by the Engineer of Record.

O. The as-built plans shall indicate the final erection forces so that future analysis, rating or modification of the structure can properly account for these forces.

P. Monitoring Program. The Design-Builder shall submit a monitoring program to verify that the profile, stay cable forces and edge girder stresses in the as built structure are as predicted by the design analysis. The Monitoring program shall include establishing that all the dead load is on the main span before it is open to traffic. The baseline monitoring shall include:

1) the baseline profile survey of the edge girders and deck;
2) the baseline position and elevation of the towers; and
3) the baseline load in each stay cable based on the vibration method as listed in Section 7.4 of the PTI Recommendations for Stay Cable Design, Testing and Installation.

As part of the Monitoring Program the Design-Builder shall install strain gauges on the edge girders at mid span, quarter span of both the main and back spans as well as the tower, strain gauges together with a means of remote reading of the strain gauges.

3.2 STAY CABLE INSTALLATION

A. Stay cables shall be installed in accordance with PTI Recommendations for Stay Cable Design, Testing and Installation, Section 6.9.

B. Jacks and gauges for stay cable installation shall be calibrated as per PTI Recommendations Section 6.9.3.

C. The cable installation program shall prescribe both force and cable elongation, for each jacking operation.

D. The Design-Builder shall develop procedures to ensure that the initial stressing is equalized for all tensile elements in a given cable within a range of 2.5%.

E. The stay cable installation procedure shall include provisions for monitoring the installation of each cable.

F. Permanent records shall be established for each cable installation. such records shall
include survey records, date, time and ambient temperature; cable forces; cable elongation measurements; shim pack or lock nut setting; and all other special notations necessary and sufficient to establish the conditions under which the cable was installed.

3.3 FALSEWORK

Temporary supports and/or falsework may be required to erect the structure. Falsework shall be properly designed for all anticipated loads in accordance with the AASHTO Guide Design Specifications for Bridge Temporary Works. The Design-Builder shall submit detailed plans for all falsework to be used showing all loadings assumed by the Design-Builder's design. Review of the plans by the Department shall not relieve the Design-Builder of his responsibility for the work.

3.4 GEOMETRIC CONTROLS AND LOADS

A. The Design-Builder shall be responsible for geometric control of construction so that the completed structure will conform to the lines, grades, and dimensions and cable stresses on the plans. The Design-Builder shall furnish competent engineering and surveying personnel and equipment to establish and verify elevations and alignment of the structure and cable stays at every stage of construction. The Design-Builder shall be responsible to determine the need for the amount of shimming that may be required in the erection stages, but not less than the minimum shown on the plans. The Department shall review each such use of shims.

B. The structure shall have a geometric configuration at 68 °F normal temperature in general conformance with the dimensions shown on the plans for the dead load conditions. The Design-Builder shall provide sufficient computation and analysis, for the structure to reasonably assure that final adjustments can be made to obtain the dead load cable stress and deck elevations with the following tolerances:

1. Absolute tolerance in deck elevation at the centerline of bridge at center span shall be ± 5.5", provided that the deck elevation at cable attachment points shall follow, within a tolerance of 1" (unless a tighter tolerance is required to satisfy drainage) from the elevation based on the bridge cross-slope. A smooth parabolic curve shall pass through the final deck elevation at the centerline of the bridge and the deck elevation at the end of the cable stayed span.

2. Cables shall be adjusted for the dead load condition such that each individual cable shall not exceed values of ± five percent (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 ± five percent (5%) tolerance.

3. Final fabrication lengths for the stay cables shall be calculated by the Design-Builder after erection loads and methods are known and detailed erection stress calculations have been completed. The tolerance in the fabrication length of the cable in the unstressed condition shall be as follows:

<table>
<thead>
<tr>
<th>Length between bearing faces (ft)</th>
<th>Permissible tolerance (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>plus 1.0, minus 0.0</td>
</tr>
<tr>
<td>300</td>
<td>plus 1.5, minus 0.0</td>
</tr>
<tr>
<td>500 and over</td>
<td>plus 2.0, minus 0.0</td>
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</tbody>
</table>
C. Intermediate values may be interpolated. Differences between the actual and planned fabricated length shall be compensated for by shims at either anchorage.

D. The Design-Builder shall prepare and furnish to the Department complete detailed erection sequence drawings.

E. Based on the Design-Builder's construction equipment and procedures, the Design-Builder shall compute and prepare tables of anticipated cable tensions in each cable at corresponding stages of erection including, but not limited to the stages of:

1. Structural steel erection
2. Placement of precast panels
3. After full dead load including concrete parapets

F. The tables of anticipated cable tensions and computations shall be submitted to the Department for review and evaluation.

G. If cable forces exceed the design forces as shown in the plans, the Design-Builder shall investigate adequacy of all cable components and anchorages. Cost for all and any additional material required shall be borne by the Design-Builder.

H. At some intermediate stage of superstructure erection, which the Department will designate depending on the approved sequence and method of erection, the tension in each cable shall be checked again to ensure that it is within the anticipated range. Any cable requiring adjustment at this stage shall be properly jacked and shimmed.

I. Each pair of cables anchoring at the same segment of deck shall be installed and stressed simultaneously. The difference in force in the two cables shall not exceed five percent (5%) of the corresponding designed cable forces.

J. Promptly after erection of each cable, the tension in the cable shall be checked to ascertain that it is within the range of anticipated tension for the corresponding stage of superstructure erection. Maximum cable tension during construction shall not exceed fifty-six percent (56%) of the cable’s guaranteed ultimate tensile strength.

K. Stay cables shall be erected at the appropriate times to suit the Design-Builder's erection scheme.

L. The Design-Builder's cable installation procedure shall specify which is the live (stressing) end anchorage of the cable, i.e. at the tower anchorage or deck girder anchorage, and the live end anchorage detailed to provide for future cable replacement. The stay cable anchorage shall allow for future force adjustments (increase or decrease) of 2.5% of the guaranteed ultimate strength of the stay cable. The Design-Builder shall include in the cable installation plan fully developed details and procedures for removing/detensioning strands and re-installing strands.

M. Care shall be exercised during cable erection to prevent damage to the polyethylene sheathing and to prevent damage to the steel components of the cable. All damage to the polyethylene pipe sheathing or steel cable anchorage pipe shall be immediately repaired to the satisfaction of the Department. Severely damaged sheathing shall be replaced, at the Design-Builder's expense.

N. Stay cables shall be installed so that there are no wedge marks on the stressed portion of any strand. Any strand that remains with wedge marks on the stressed portion of the strand shall be replaced.

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<th>Permissible tolerance (inches)</th>
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<td></td>
</tr>
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</table>
3.5 CLOSURE

A. To make up the closure pours, if required, the suspended ends of the bridge shall be brought into vertical and horizontal alignment by jacking, counterweighting or adjusting selected cables. This shall be included in the Design-Builder’s erection scheme submitted to the Department for review and evaluation.

B. After the closure concrete has attained the required strength, certain selected cables shall be adjusted to produce the required stresses in the structure.

C. Upon completion of placing and post-tensioning the closure concrete and the placement of the concrete parapets and overlay, the cables shall be adjusted as required to their planned tension by jacking and shimming.

D. After all final adjustments have been made, wedges shall be post-blocked.

E. Fully developed details for side span and central span closures, including placement of tiedown units as required, jacking, and counterweighting and stay cable adjustments shall be included in the Design-Builder's erection scheme submittal to the Department.
SP 4.  STAY CABLES

4.1  GENERAL

The complete stay cable system includes, but is not limited to, all anchorage components, steel anchor guide sleeves, split shims, wedges, bearing plates, cable sheathing, elastomeric boots, bolts, steel clamping bands, temporary corrosion protection provisions, strand sheathing/coating, main tension elements, corrosion barriers, sealing and damping components, stay cable vibration suppression (damper) system, and stressing/erection recommendations along with all permanent incidental Materials necessary to complete the stay cables in accordance with the Contract requirements.

The stay cable system shall allow control on the tension of the individual strands and future strand replacement. The system shall provide independency for the strands regarding anchoring, corrosion protection, installation, tensioning, and replacement.

Stay cables are to be provided in accordance with the PTI Recommendations for Stay Cable Design, Testing and Installation unless otherwise noted. These Special Provisions are intended to complement the PTI recommendations. In cases of disagreements, these Special Provisions for stay cables shall govern over the PTI Recommendations.

The following exceptions are taken to the PTI recommendations:

   A. High strength bars shall not be used for the main tension elements of the stay cables;
   B. Steel pipe cable sheathing shall not be used for stay cables;
   C. Saddles and cradles shall not be used for stay cables;
   D. Epoxy coated strands are not permitted;
   E. Portland cement grout is not considered an acceptable corrosion protection barrier.

The independent material testing firm, laboratory or laboratories selected by the Design-Builder (subject to Department review and written comment) shall test all Materials, strands, and cable specimen assemblies required for both the initial acceptance testing phase and the cable stay component fabrication/production phase. The Design-Builder’s supplier shall supply and deliver all Materials for testing to the laboratory. The Design-Builder shall be responsible for all coordination between the laboratory and supplier. The Design-Builder shall be responsible for performance of the completed stay cable system. The Design-Builder shall furnish all Material and written test procedures for each test, as prepared by the supplier, to the Department for review and written comment. Each component of the assembly, including wedges, shall have an AASHTO or ASTM Material and test specification. The supplier and the laboratory shall prepare separate reports. Each of these reports shall be submitted by the Design-Builder to the Department as independent records of the testing. The Design-Builder shall be responsible for contracting and coordinating with the laboratory and supplier for all testing laboratory services. No Material, anchorages, or other components tested during the acceptance phase shall be incorporated into the actual structure.

All items that comprise the permanent production stay cables shall be identical in nature, origin, and composition to those that were the basis of the stay cable acceptance tests. The supplier shall provide written detailed recommendations to the Design-Builder regarding storage, handling, transporting, assembly, installation, and stressing of all the stay cable system components. The supplier shall simultaneously provide copies of all such recommendations.
4.2 MATERIAL

4.2.1 STRAND

Strand for cables shall be 0.6 inch diameter uncoated seven wire strand conforming to the requirements of ASTM A416, grade 270, $F'_{y} = 0.9 f'_{u}$, weldless grade, low-relaxation strand. The strand shall be a greased and sheathed strand in accordance with the specifications set forth herein.

Galvanized strand may be permitted provided it meets or exceeds the requirements of ASTM A416 as well as the requirements of Section 8 of the PTI recommendations.

During the process of manufacture of individual wires for "weldless" strand, welding is permitted only prior to or at the site of the last thermal treatment of the rod, for example, patenting or controlled cooling. There shall be no welds in the wire after it has been drawn through the first die in the wire drawing process.

The Design-Builder shall require the strand supplier to furnish to the Department for review and evaluation, complete mill test reports and certificates for the strand from each heat, including stress-strain curves and modulus of elasticity.

Greased and Sheathed Strand

A. Strand shall be furnished by the supplier in coils and shall have padded contact areas, wherever possible. Each coil shall be protected by a manufacturer approved method to ensure a uniformly coated strand having no adhering foreign matter or damage to the sheathing, including that from ultraviolet exposure. The ends of the strand shall be sealed to prevent intrusion of moisture into the annular space between the individual wires. No welds or joints shall be present in the finished strand.

B. Upon delivery to the cable fabricator, the strand shall be properly stored in a weatherproof building to prevent corrosion. Each coil shall be marked with the order number, coil number and heat number. The starting end of each coil shall also be marked. When uncoiled, the strand shall lay straight with a maximum deviation not exceeding 4 inch off set from a theoretical centerline in any 6 feet of length. Sharp kinks or short radius bends (less than the reel radius) shall be cause for rejection.

Stay Cable Pipe Sheathing

A. Cable sheathing for each parallel strand cable shall be high density polyethylene plastic pipe (HDPE) of light color (coextrusion method) conforming to ASTM F714 and to section 3.5.3 of the PTI recommendations.

B. The maximum allowable ratio of outside diameter of the HDPE pipe to the minimum wall thickness shall be 32.

C. The required length of the HDPE pipe shall be obtained by continuous extrusion or by fusion welding. Fusion welding of the HDPE shall be performed in accordance with ASTM D2657.

D. The manufacturer of the proposed cable sheathing shall certify that the construction procedure utilized by the Design-Builder shall not result in any damage to the cable sheathing.

E. Procedures for packaging, handling and shipping the pipe shall ensure the pipe will not
be damaged when delivered at the fabricator's plant and/or the job site. A certificate of analysis shall be furnished for each shipment of pipe stating the material supplied meets this specification and showing results of tests.

F. Verification tests may be performed by the Department on each size of pipe used. Samples for verification testing will consist of one 6-foot length of pipe per size and thickness per 3000 feet. Additionally, the fabricator shall submit samples to qualify the fusion welding procedure and these samples shall consist of three (3) 6-foot lengths of pipe per pipe size thickness.

G. Sheathing of individual strands in greased and sheathed strands shall be in accordance with the requirements of PTI Recommendations Section 3.3.

Stay Cable-Anchorages

A. Stay cable anchorages shall meet the acceptance criteria as specified in the PTI recommendations and elsewhere in these Special Provisions (Section 8). The Design-Builder shall submit to the Department for review and evaluation design calculations for the cable anchorages.

B. The cable anchorages used for the full scale cable testing shall be fully instrumented and monitored during the total test program in order to verify the design and performance of the cable system.

C. The stay cable anchorage system shall consist of a wedge type or wedge socket type. The Design-Builder shall furnish all material specifications to the Department for review and evaluation. Each component of the assembly shall have an AASHTO or ASTM material and test designation number.

D. The anchorage system shall provide approximately five percent additional holes in each anchor head for contingency. The approximately five percent additional holes requirement applies to each stay cable and cannot be grouped. These additional holes shall be positively sealed, to protect the stay cable interior from the elements, using approved plugs that can resist any stresses that may be imposed on it.

E. The anchorage assembly and components shall be protected at all times against corrosion. Corrosion protection measures shall be shown on the shop drawings. The system shall include a steel cap to protect the exposed anchor plate and wedges from corrosion. The steel cap shall be galvanized in accordance with AASHTO M-111. Prior to the installation of the cap, the anchor plate and exposed strand shall be coated with a suitable grease.

F. All other components such as bearing plates, keeper plates, recess tubes, steel flanges, socket bearing flanges, wedges, rubber gaskets, o-rings, etc. shall be of suitable type and sufficient strength suitable for the intended use. The supplier of the stay cable system shall submit to the Department for review and evaluation material specifications, calculations and detail drawings for the sizes, types and materials for such components.

G. Shop drawings shall be submitted to the Department for review and evaluation showing all dimensions, materials and operations for fabrication of the anchorage assembly. Detailed procedures for installing all socket assembly components, insertion of the strands, installation of wedges, stressing and grouting the assembly shall be developed and submitted to the Department for review. Complete shop drawings with supporting calculations shall be submitted showing all equipment (jack, stressing chairs, etc.) and procedures required for stay cable force adjustments and for complete detensioning.

H. Review and evaluation by the Department of the various submissions made by the Design-Builder does not relieve the Design-Builder from the responsibility for the accuracy and adequacy of the work.

I. No approval will be given to any portion of the stay anchorage assembly or procedures
until all required submittals are made and found acceptable by the Engineer of Record.

**4.2.2 STRAND SPACER**

**Greased and Sheathed Strand**

The spacer shall be helically wound and made of high-density polyethylene (HDPE). Helical spacer material requirements will be the same as that specified for polyethylene sheathing in accordance with the PTI recommendations.

**Neoprene Boots and Neoprene Dampers**

Neoprene boots and neoprene dampers shall be manufactured from 100% virgin chloroprene (neoprene). The sole polymer shall be 100% virgin chloroprene, which shall be not less than 60% by volume of the total compound. Neoprene shall meet the following requirements (ASTM C864 as amended herein):

<table>
<thead>
<tr>
<th>Physical Requirements</th>
<th>Procedure as per ASTM Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness, Duro A Durometer A</td>
<td>50±5</td>
</tr>
<tr>
<td>Tensile Str., kpa, min.</td>
<td>360</td>
</tr>
<tr>
<td>Ultimate Elongation, Percent, min.</td>
<td>450</td>
</tr>
<tr>
<td>Accelerated Test to Determine Long-term Characteristics Oven-aged – 70 hours at degrees F</td>
<td></td>
</tr>
<tr>
<td>Change Durometer Hardness, max pts. Maximum Points</td>
<td>+15</td>
</tr>
<tr>
<td>Change in Tensile Strength, ma) maximum percent</td>
<td>-15</td>
</tr>
<tr>
<td>Change in Elongation at Break Maximum percent</td>
<td>-40</td>
</tr>
<tr>
<td>ppm ozone in air by volume -- 20 percent strain 38°C ± 1°C hours mounting procedure ASTM D518 procedure A</td>
<td>no cracks</td>
</tr>
<tr>
<td>Compression Set - 22 hrs at 100°C, % max.</td>
<td>35</td>
</tr>
</tbody>
</table>

**Washers, Shims, Bearing Plates and Guide Pipes**

Material for split washers, shims, bearing plates and cable guide pipes, embedded in concrete, used in the cable anchorage shall be high-strength low-alloy structural steel conforming to the
requirements of AASHTO M222, Grade 50.

Stainless Steel Bands

Bands for securing the neoprene boots in place around the polyethylene pipe and the neoprene sleeve shall be a minimum 1.0 inch wide by 0.03 inch thick stainless steel strapping material grade 316 with stainless crimp type seal of a type proposed by the supplier of the stay cable system.

Stainless Steel Bolts and Nuts

Bolts and nuts for use as retainer devices for the elastomer washers at the upper and lower cable anchorages shall be stainless steel alloy 316 meeting the requirements of ASTM F593, for bolts and F594 for nuts and shall be passivated in accordance with U.S. Federal Specs QQ-P-35.

Stay Cables Vibration Suppression Systems

For requirements on stay cables vibration suppression systems, refer to the Special Provisions "Stay Cable Vibration Suppression Systems".

Protection System for Stay Cables and Stay Cable Components

A supplemental waterproof protection system shall be provided near deck level to prevent snow, ice, rain and other deleterious substances from coming into contact with the stay cable (defined for purposes of this requirement to be the individual strands and the stay cable pipe enclosing the strands) and with the stay cable end anchorage. Such protection shall extend from the lower anchorage to a height of sixteen (16) feet above the top of the sidewalk/bikeway deck or roadway deck whichever is higher.

In addition, a vandal resistant sleeve, pipe or other protection shall be provided from the lower anchorage to a minimum vertical height of sixteen (16) feet above the top surface of the deck. The vandal resistant sleeve may be part of the supplemental waterproof protection system. Refer to Project Requirements 17 – Security with regard to additional requirements for the vandal resistant sleeve.

Both protection systems shall include provisions for removal and replacement to facilitate inspection.

The details of both supplemental protection systems shall be submitted in Shop Drawings to the Engineer of Record for approval including a list of reusable components for each protection system. Shop Drawings shall be submitted to the Department for review and comment.

4.2.3 INSTALLATION OF STAY CABLES

Quality Control Program

The Quality Control Program (QCP) shall conform to PTI Recommendations Section 6.1 and the requirements of these Special Provisions.

A. The QCP shall address inspection of materials in conformance to these Special
Provisions.
B. Review and evaluation of the QCP by the Department does not relieve the Design-Builder from the responsibility for the accuracy and adequacy of the work.
C. The Quality Control program shall be approved by the Engineer of Record prior to procuring any stay cable materials.

Fabrication
A. Stay cables shall be fabricated in conformance with PTI Recommendations Section 6.2.
B. Appropriate measures shall be taken to ensure that all strands are installed parallel to each other. The pitch of the helix strand spacer shall not exceed three feet.
C. Flame cutting of the strands is not permitted.
D. The individual strands comprising the cable shall be cut to their precalculated lengths while fully supported on a rigid calibrated cutting bed. Standard calibrated steel measuring tapes shall be employed to set and check the position of the stop and the cutting tool. Care shall be exercised throughout the fabrication process to protect the strands from damage and corrosion.

Shipping and Storage
A. Completed cable shall be wound or spooled on reels for shipment to and handling at the job site in conformance with PTI Recommendations Section 6.3.2.
B. Cables shall be stored at the job site prior to erection in an approved weatherproof building in order to prevent damage to the cable. If, in the opinion of the Engineer of Record, the strands in a cable have been damaged or if they have adhering foreign matter, that cable shall be replaced at the Design-Builder's expense. The fabrication and installation schedule for each cable shall be coordinated in such a way that the storage time on site for the cables is minimized.

Handling
The Design-Builder shall develop procedures for handling stay cable components in conformance with PTI Recommendations Section 6.3.

Silicone sealant
Prior to clamping the stainless steel bands, the Design-Builder shall seal the interface of the neoprene boot and the stay cable using an approved silicone sealant, suitable for permanent bonding to the neoprene boots and stainless steel bands.

Painting
All ferrous metal surfaces, other than stainless steel and hot dip galvanized surfaces of the stay cables system shall be painted with a three coat system as per the NYSDOT Standard Specifications.

Stressing
Procedures for stressing the cables shall be in conformance with PTI Recommendations Section 6.9.4.
4.2.4 TESTING

Scope of Work

This work shall consist of the furnishing of all materials, anchorages, stay cable specimens, strand specimens and all labor and equipment for fatigue, and static load testing.

A. The specimen assemblies shall be tested by a recognized independent testing laboratory approved by the Department. The Design-Builder shall supply all materials for testing to the laboratory a minimum of one month prior to the actual tests. The Department shall be notified a minimum of 30 Working Days in advance of any fabrication or testing so that a representative of the Department may be present when the following work is performed:

1. Testing of fully assembled cables for fatigue, ultimate strength, and acceptance.
2. Testing individual strands for fatigue, ultimate strength and acceptance.
3. Strand anchorage acceptance.
4. Corrosion protection (in accordance with Section 4.1 of the PTI Recommendations).

B. All testing data and testing results shall be submitted to the Department for review and evaluation. The review and evaluation by the Department does not relieve the Design-Builder from the responsibility for the accuracy and adequacy of the work.

C. Fabrication of anchors or stay cable strands shall not begin until the tests are successfully completed and written approval is given by the Engineer of Record.

Strand Acceptance Test

A. In order to ensure strand fatigue resistance is incorporated into the stays, the following conditions shall be met:

1. One 16-foot long sample of 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.
2. All strands and test samples shall be marked in such a manner to ensure traceability during production, transit, storage and testing.
3. 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 same sample.
4. One test for each manufactured length shall be made for the following:
   a) Minimum guaranteed ultimate tensile strength: \( f'_s = 270 \) ksi;
   b) Minimum yield strength: \( F'_y = 0.90 f'_s \);
   c) Young’s modulus: \( E = 28,600 \) ksi ± 5%.

B. Fatigue strength test

1. One tensile fatigue test shall be conducted on an approximately 6-foot long specimen from each sample. Minimum length shall be 36 inches from face-to-face of grips.
2. The strand/wire specimens shall be tested at an upper stress of 0.45 \( f'_s \) and a stress...
range of 42.5 ksi for 500,000 cycles.

3. After successful completion of the fatigue testing, each test specimen shall withstand a minimum static load of 95.0 percent of the guaranteed ultimate tensile strength (GUTS) of the strand.

4. 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.

C. Ductility testing

"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 the PTI Recommendations. 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.

Fatigue Strength Testing of Stay Cables

Fatigue strength testing of stay cables shall be in conformance with PTI Recommendations Section 4.2.

A. Three completed fully assembled stay cable specimens shall be fabricated for testing. One specimen each shall be made representing the smallest stay cable, a mid-range stay cable and the largest stay cable in the bridge. Each specimen shall be fully representative of all details and procedures proposed for production of anchorages, but need not be full length. All specimens shall be fabricated in accordance with these Special Provisions.

1. The Design-Builder shall submit full details of the stay cable specimens, including anchorages, detailed drawings and computations. Tests will proceed upon written approval by the Engineer of Record.

B. Fatigue Acceptance Test

1. The actual fatigue strength of the stay cable test materials shall be determined from the result of fatigue tests from companion strands. Test procedures for the individual companion specimen fatigue tests shall be as outlined previously in Section 5.2.4.2 "Fatigue Strength Test" in this Section.

2. The requirements for fatigue strength testing of stay cable anchorages may be waived by the Department if the Design-Builder submits previous test data in conformance with PTI Recommendations Section 4.3. The Department is on no way obligated to waive this requirement for any reason.
SP 5. STAY CABLES CORROSION PROTECTION SYSTEMS

5.1 GENERAL

Stay cable corrosion protection systems shall be provided in accordance with the Post Tensioning Institute "PTI DC45.1-12: Recommendations for Stay Cable Design, Testing and Installation" (PTI Recommendations) Section 4.1, unless otherwise noted.

Unless noted otherwise, all barrier qualification and temporary corrosion tests shall consist of three independent specimens, each 6-foot long. In order to satisfy these recommendations, all specimens shall satisfy the acceptance criteria as noted in these Special Provisions.

The supplier's Quality Control program shall include provisions to assure that the materials used in each cable installation are of the same specification and quality as those used for the qualification testing required under these Special Provisions.

5.1.1 BARRIERS

Corrosion protection shall be provided in accordance with PTI Recommendations Section 4.1.2.

5.1.2 MATERIALS

Materials used in the corrosion protection system shall be provided in accordance with PTI Recommendations Section 4.1.3. Use of alternative materials shall be subject to review and evaluation by the Department.

5.1.3 QUALIFICATION OF BARRIERS

Internal Barriers

Internal barriers shall be provided in accordance with PTI Recommendations Section 4.1.4.1.

External Barriers

External barriers shall be provided in accordance with PTI Recommendations Section 4.1.4.2.

5.1.4 QUALIFICATION OF TEMPORARY CORROSION PROTECTION SYSTEM

Qualification of temporary corrosion protection shall be provided as required in accordance with PTI Recommendations Section 4.1.5.

5.1.5 QUALIFICATION OF ANCHORAGE ASSEMBLY

Qualification of anchorage assembly corrosion protection shall be provided as required in accordance with PTI Recommendations Section 4.1.6.

5.1.6 ACCEPTANCE CRITERIA

Acceptance criteria for corrosion protection shall be in conformance with PTI Recommendations Section 4.1.7.
DOCUMENTATION

A. Test documentation for corrosion protection shall be in conformance with PTI Recommendations Section 4.1.8.
SP 6. STAY CABLE VIBRATION SUPPRESSION SYSTEM

6.1 DESCRIPTION

This work shall consist of the design, installation, and testing of a stay cable vibration suppression system as specified herein. The stay cable system shall include a vibration suppression system consisting one or more overlapping systems (dampers other than neoprene washers, cross ties, and/or cable surface modifications) to prevent excessive wind-induced vibrations. The design of dampers shall provide for damping factors required by "established criteria" for stay cable vibrations. An independent Subcontractor (i.e., independent of the Design-Builder and stay cable supplier) shall verify the design and adequacy of damper system for stay cables.

In order to determine the appropriate damping system, it is necessary to estimate the effective damping ratio of the proposed stay cable with the supplemental damping system (if proposed). The determination of effective damping ratio shall be based upon full-scale test results and shall be subject to review and evaluation by the Department.

In order to improve the dynamic behavior of stay cables under the action of wind or under the combined action of wind and rain, the Design-Builder shall consider certain modifications to the cable surface, i.e. addition of well defined protrusions or dimples. The effect of such additions on all possible kinds of dynamic excitation, as well as on the static drag coefficient, shall be evaluated and submitted to the Department for review.

The structural damping of cable shall be sufficient to limit amplitudes of vibrations and to prevent aeroelastic instability. The Design-Builder is required to measure the inherent cable damping for selected cables during construction. The damping system shall be developed in accordance with the recommendations of Section 4 of the FHWA Wind Induced Vibration of Stay Cables, FHWA-HRT-05-083, August 2007.

Provisions shall be made by the Design-Builder to facilitate rapid introduction of temporary suppression measures for stay cables susceptible to vibrations during construction. The cables shall be monitored for vibrations. Monitoring shall take place during erection at the time of major wind events and under the combined action of wind and rain.

6.1.1 MATERIALS

Dampers shall be fabricated of corrosion resistant materials that have a minimum service life of 40 years and shall require minimal maintenance. The dampers must be accessible for easy maintenance and inspection.

6.1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Full scale damping measurements of 20% of the stay cables shall be made to ensure that stay cable damping estimates used in the design of the vibration suppression system are met. If actual damping differs sufficiently from the values used in design of the vibration suppression system, damping shall be provided, at no cost to the Department to ensure that the vibration suppression system meets with the intended performance level.

B. Following completion of these tests, the Design-Builder shall submit to the Department a report that demonstrates that the performance of the vibration suppression system meets or exceeds the required performance level.
SP 7. POST-TENSIONING

7.1 GENERAL

7.1.1 DESCRIPTION

The Design-Builder shall furnish and install all post-tensioning systems and any other pertinent items necessary for the particular prestressing system used, including, but not limited to, ducts, anchorage assemblies, and local zone reinforcement. The Design-Builder shall furnish all components of a post-tensioning system, including steel pipes and not including the prestressing steel, from a single supplier.

The Design-Builder shall install prestressing steel, which may be strands or bars, through ducts in the concrete. The Design-Builder shall stress to a predetermined load and anchor directly against the hardened concrete. The Design-Builder shall grout ducts to fill all voids and install protection at end anchorages.

The Design-Builder shall submit shop and working drawings and manuals in accordance with this Design-Build (DB) Special Provision Post-Tensioning. The Design-Builder shall produce all shop drawings related to post-tensioning which shall bear the signature and seal of the responsible engineer licensed in the State of New York.

7.1.2 QUALIFICATIONS AND INSPECTION

The Design-Builder shall perform all post-tensioning field operations under the direct supervision (crew foreman) of a qualified post-tensioning and grouting technician. The crew foreman for post-tensioning tendon installation and grouting shall be a valid “Post-Tensioning Institute (PTI) Certified Level 1 & 2 Bonded PT Field Specialist” and “American Segmental Bridge Institute (ASBI) Certified Grouting Technician.”

The Design-Builder shall conduct all stressing and grouting operations in the presence of the Department’s representative.

7.1.3 SHOP DRAWINGS

The Design-Builder shall prepare shop drawings to address all requirements stated in the plans and the requirements stated herein. The Design-Builder shall indicate the approved post-tensioning systems to be used. The Design-Builder shall show tendon geometry and locations complying with the plans and the limitations of the selected post-tensioning system. The Design-Builder shall show all inlets, outlets, high point outlet inspection details, anchorage inspection details and permanent grout caps, protection system materials, and application limits.

7.1.4 MATERIAL STORAGE

The Design-Builder shall store all materials in a weatherproof building, shed, or container until time of use.

7.2 CERTIFICATION OF POST-TENSIONING SYSTEMS

The Design-Builder shall use only post-tensioning systems that are approved by an independent testing laboratories approved by the Department. The Design-Builder shall submit test results to
the Department and include certified test reports from independent laboratories audited by AASHTO Materials Research Laboratory (AMRL) which shows the post-tensioning system meets all the requirements specified herein. The Design-Builder shall test plastic components in certified independent laboratories accredited through the laboratory accreditation program of the Geosynthetic Accreditation Institute (GAI) or the American Association for Laboratory Accreditation (AALA). Certification of test reports may be performed by an independent laboratory located outside the United States (US), if the independent laboratory is approved by the Department. If any component of the post-tensioning system is modified or replaced, the entire system shall be retested in accordance with the directions herein and a new report shall be submitted to the Department.

The Design-Builder shall perform a certification test for the plastic on a sample formed or cut from the finished product. The Design-Builder shall provide the Department’s representative with certification that the plastic from the sample complies with all requirements of the specified cell class, stress crack rating, and amount of antioxidant. The Design-Builder shall certify to the Department’s representative that the post-tensioning system being furnished is in compliance with all requirements stated herein.

The Design-Builder shall ensure that all components of a system are stamped with the supplier’s name, trademark model number, and size corresponding to catalog designation. Post-tensioning systems consist of an assembly of components for various sizes of strand or bars assembled and pressure tested. Post-tensioning systems shall be developed and tested for bar systems and both internal (corrugated duct) and external (smooth duct) applications for the Department’s standard tendon sizes consist of 0.6 inch diameter strand in anchorages containing four, seven, 12, 15, 19, and 27 strands.

### 7.2.1 DEFINITIONS

A. Anchorage Assembly: An assembly of various hardware components which secures a tendon at its ends after it has been stressed imparting the tendon force into the concrete.

B. Anticipated Set: The wedge set assumed to occur in the design calculation of the post-tensioning forces at the time of load transfer.

C. Bar: Post-tensioning bars are high strength steel bars, normally available from 5/8 to 1 3/4 inches diameter and usually threaded with very coarse thread.

D. Bearing Plate: Any hardware that transfers the tendon force directly into a structure or the ground.

E. Bleed: The autogenous flow of mixing water within or its emergence from newly placed grout caused by the settlement of the solid materials within the mass.

F. Coupler: A device used to transfer the prestressing force from one partial length prestressing tendon to another. (Strand couplers are not allowed.)

G. Duct: Material forming a conduit to accommodate prestressing steel installation and provide an annular space for the grout which protects the prestressing steel.

H. Family of Systems: Group of post-tensioning tendon assemblies of various sizes which use common anchorage devices and design. All components within the family of systems shall be furnished by a single supplier and shall have a common design with varying sizes.

I. Fluidity: A measure of time, expressed in seconds necessary for a stated quantity of grout to pass through the orifice of a flow cone.

J. Grout: A mixture of cementitious materials and water with or without mineral additives or admixtures, proportioned to produce a pumpable consistency without segregation of the constituents, when injected into the duct to fill the space around the prestressing steel.
K. Grout Cap: A device that contains the grout and forms a protective cover sealing the post-tensioning steel at the anchorage.

L. Inlet: Tubing or duct used for injection of the grout into the duct.

M. Outlet: Tubing or duct to allow the escape of air, water, grout and bleed water from the duct.

N. Post-tensioning: A method of prestressing where tensioning of the tendons occurs after the concrete has reached a specified strength.

O. Prestressing Steel: The steel element of a post-tensioning tendon, which is elongated and anchored to provide the necessary permanent prestressing force.

P. Post-Tensioning Scheme or Layout: The pattern, size and locations of post-tensioning tendons provided by the Designer on the Contract Plans.

Q. Post-tensioning System: An assembly of specific models of hardware, including but not limited to anchorage assembly, local zone reinforcement, wedge plate, wedges, inlet, outlet, couplers, duct, duct connections and grout cap, used to construct a tendon of a particular size and type. The entire assembly must meet the system pressure testing requirement. Internal and external systems are considered independent of one another.

R. Pressure Rating: The estimated maximum pressure that water in a duct or in a duct component can exert continuously with a high degree of certainty that failure of the duct or duct component will not occur (sometimes referred to as working pressure).

S. Set (Also Anchor Set or Wedge Set): Set is the total movement of a point on the strand just behind the anchoring wedges during load transfer from the jack to the permanent anchorages. Set movement is the sum of slippage of the wedges with respect to the anchorage head and the elastic deformation of the anchor components. For bars, set is the total movement of a point on the bar just behind the anchor nut at transfer and is the sum of slippage of the bar and the elastic deformation of the anchorage components.

T. Strand: An assembly of seven high strength steel wires wound together. Strands usually have six outer wires helically wound around a single straight wire of a similar diameter.

U. Tendon: A single or group of prestressing steel elements and their anchorage assemblies imparting prestress forces to a structural member or the ground. Also, included are ducts, grouting attachments, grout and corrosion protection filler materials or coatings.

V. Tendon Size: The number of individual strands of a certain strand diameter or the diameter of a bar.

W. Tendon Type: The relative location of the tendon to the concrete shape, internal or external.

X. Thixotropic: The property of a material that enables it to stiffen in a short time while at rest, but to acquire a lower viscosity when mechanically agitated.

Y. Wedge Plate: The hardware that holds the wedges of a multi-strand tendon and transfers the tendon force to the anchorage assembly.

Z. Wedge: A conically shaped device that anchors the strand in the wedge plate.

### 7.2.2 MATERIALS

The Design-Builder shall meet the requirements of the following:

- **A.** Wire Strand, ASTM A 416;
- **B.** Bar, ASTM A 722;
- **C.** Grout, see Special Provision for Post Tensioning Grout; and
- **D.** Epoxy Grout for Anchorages, see Special Provision for Epoxy Compounds for Post
Tensioning Anchorages;

7.2.3 PRESTRESSING STEEL

A. Strand: Unless otherwise approved by the Department, the Design-Builder shall use uncoated strand (Grade 270), low relaxation seven-wire strand meeting the requirements of ASTM A 416.

B. Bar: Unless otherwise approved by the Department, uncoated Grade 150, high strength, coarse thread bar meeting the requirements of ASTM A 722, Type II.

7.2.4 POST-TENSIONING SYSTEM

The Design-Builder shall use approved post-tensioning systems, of the proper size and type to construct tendons shown on the Contract Documents. Substitution of components of approved post-tensioning systems is not allowed. The Design-Builder shall use only post-tensioning systems that utilize tendons fully encapsulated in anchorages and ducts. Systems which transfer prestress force by bonding the prestress steel strand directly to concrete are not allowed. Embedded anchors for bars are permitted.

Post-Tensioning Anchorages

The Design-Builder shall ensure that the anchorages develop at least 95% of the actual ultimate tensile strength of the prestressing steel, when tested in an unbonded state, without exceeding the anticipated set.

The Design-Builder shall design anchorages so that the average concrete bearing stress is in compliance with the “AASHTO LRFD Bridge Design Specifications.” The Design-Builder shall test and provide written certification that anchorages meet or exceed the testing requirements in the AASHTO LRFD Bridge Construction Specifications.

The Design-Builder shall galvanize the body of the anchorage in accordance with ASTM 123. Other components of the anchorage, including, wedges, wedge plate, and local zone reinforcement are not required to be galvanized. The Design-Builder shall construct the bearing surface and wedge plate from ferrous metal. The Design-Builder shall equip all anchorages with a permanent fiber reinforced plastic grout cap that is vented and bolted to the anchorage.

The Design-Builder shall provide wedge plates with centering lugs or shoulders to facilitate alignment with the bearing plate.

The grout outlet will serve a dual function of grout outlet and post-grouting inspection access. The geometry of the grout outlets must facilitate being drilled using a straight bit to facilitate endoscope inspection directly behind the anchor plate. Anchorages may be fabricated to facilitate both inspection locations or may be two separate anchorages of the same type each providing singular inspection entry locations.

Bar Couplers

Use couplers meeting the requirements of AASHTO LRFD Bridge Design Specifications and Bridge Construction Specifications. Test and provide written certification that the couplers meet or exceed the testing requirements in the AASHTO LRFD Bridge Construction Specifications.
Inlets, Outlets, Valves and Plugs

Provide permanent grout inlets, outlets, and threaded plugs made of ASTM A 240 Type 316 stainless steel, nylon or polyolefin materials. For products made from nylon a cell class of S-PA0141 (weather resistant) is required. Products made from polyolefin shall contain antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D 3895 of not less than 20 minutes. Test the remolded finished polyolefin material for stress crack resistance using ASTM F 2136 at an applied stress of 348 psi resulting in a minimum failure time of 3 hours. All inlets and outlets will be equipped with pressure rated mechanical shut-off valves or plugs. Inlets, outlets, valves and plugs will be rated for a minimum pressure rating of 150 psi. Use inlets and outlets with a minimum inside diameter of 3/4 inch for strand and 3/8 inch for single bar tendons and four-strand duct.

Use dual mechanical shutoff valves when performing vertical grouting.

Temporary items, not part of the permanent structure, may be made of any suitable material.

Permanent Grout Caps

Use permanent grout caps made from fiber reinforced polymer. The resins used in the fiber reinforced polymer shall be either nylon, Acrylonitrile Butadiene Styrene (ABS) or polyester. For products made from nylon a cell class of S-PA0141 (weather resistant) is required. Seal the cap with “O” ring seals or precision fitted flat gaskets placed against the bearing plate. Place a grout vent on the top of the cap. Grout caps must be rated for a minimum pressure rating of 150 psi. Use ASTM A 240 Type 316L stainless steel bolts to attach the cap to the anchorage.

Duct and Pipe

7.2.4.1.1 General

Use only plastic duct, steel pipe or a combination of plastic duct and steel pipe. Ensure that all connectors, connections and components of post-tensioning system hardware are air and water tight and pass the pressure test requirements herein. Use smooth plastic duct in all post-tensioning systems used for external tendons. Use corrugated plastic duct in all post-tensioning systems used for all internal tendons except where steel pipe is required.

7.2.4.1.2 Duct or Pipe Minimum Diameter

Provide duct with a minimum internal diameter of at least 1/2 inch larger than the outside diameter, measured across the deformations, of the prestressing bar. For prestressing bars with couplers, size the entire length of duct to be 1/2 inch larger than the diameter of the coupler.

For multi-strand tendons, provide ducts with a minimum cross-sectional area 2 1/2 times the cross-sectional area of the prestressing steel.

7.2.4.1.3 Connection Tolerance between Pipe and Duct

Steel pipe and plastic duct may be connected directly to each other when the outside diameters do not vary more than ± 0.08 inch. Use a reducer when the diameters of the steel pipe and the plastic duct are outside of this tolerance.
7.2.4.1.4 Steel Pipes

Schedule 40 galvanized steel pipes shall conform to ASTM A53 “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless.”

7.2.4.1.5 Corrugated Plastic Duct

The Design-Builder shall not use ducts manufactured from recycled material. The Design-Builder shall use seamless fabrication methods to manufacture ducts. Ducts shall be sufficiently rigid to withstand concrete placement, grouting, and construction loads without damage or excessive deformation, while remaining watertight.

The Design-Builder shall use corrugated duct manufactured from non-colored, unfilled polypropylene meeting the requirements of ASTM D4101 “Standard Specification for Polypropylene Plastic Injection and Extrusion Materials” with a cell classification range of PP0340B14542 to PP0340B67884. The duct shall be white in color containing antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D 3895 of 20 minutes and containing a non-yellow light stabilizer. The Design-Builder shall furnish duct with a minimum thickness as defined in the following table:

<table>
<thead>
<tr>
<th>Duct Shape</th>
<th>Duct Diameter</th>
<th>Duct Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>any size</td>
<td>0.08 inches</td>
</tr>
<tr>
<td>Round</td>
<td>0.9 inches</td>
<td>0.08 inches</td>
</tr>
<tr>
<td>Round</td>
<td>2.375 inches</td>
<td>0.08 inches</td>
</tr>
<tr>
<td>Round</td>
<td>3.0 inches</td>
<td>0.10 inches</td>
</tr>
<tr>
<td>Round</td>
<td>3.35 inches</td>
<td>0.10 inches</td>
</tr>
<tr>
<td>Round</td>
<td>4.0 inches</td>
<td>0.12 inches</td>
</tr>
<tr>
<td>Round</td>
<td>4.5 inches</td>
<td>0.14 inches</td>
</tr>
<tr>
<td>Round</td>
<td>5.125 inches</td>
<td>0.16 inches</td>
</tr>
<tr>
<td>Round</td>
<td>5.71 inches</td>
<td>0.16 inches</td>
</tr>
</tbody>
</table>

7.2.4.1.6 Testing Requirements for Corrugated Plastic Duct

The Design-Builder shall ensure that the duct system components and accessories meet the requirements of Chapter 4, Articles 4.1 through 4.1.8, of International Federation of Structural Concrete (FIB) Technical Report, Bulletin 7, titled "Corrugated Plastic Duct for Internal Bonded Post-Tensioning" as modified herein.

The requirements in FIB Technical Report, Bulletin 7, are modified as follows:

A. The Design-Builder shall conduct the lateral load resistance test (FIB 4.1.4) without the use of a duct stiffener plate using a load of 150 lbs. for all sizes;
B. The wear resistance of duct (FIB 4.1.7) shall not be less than 0.06 inches for duct up to 3.35 inches in diameter and not less than 0.08 inch for duct greater than 3.35 inches in diameter; and
C. The bond length test (FIB 4.1.8) shall achieve 40% GUTS in a maximum length of 16 duct diameters.

7.2.4.1.7 Minimum Bending Radius for Corrugated Plastic Duct

In addition to the component testing stated herein, the manufacturer shall establish, through testing, the minimum bending radius for the duct. The test consists of a modified duct wear test as described in Chapter 4, Article 4.1.7, of FIB Technical Report, Bulletin 7, titled "Corrugated Plastic Duct for Internal Bonded Post-Tensioning." The test apparatus shall be identical to the wear test apparatus with the same clamping force as a function of the number of strands in the duct; however, the Design-Builder shall modify the procedure as follows:

A. The Design-Builder shall not move the sample along the strand to simulate wear; and
B. The test duration shall be seven calendar days.

Upon completion of the test duration, the Design-Builder shall remove the duct and the minimum wall thickness along the strand path shall not be less than 0.06 inch for duct up to 3.35 inches diameter and not less than 0.08 inch for duct greater than 3.35 inches in diameter.

7.2.4.1.8 Corrugated Duct Connections and Fittings

The Design-Builder shall make all splices, joints, joints between segments (segmental construction), couplings, and connections to anchorages with devices or methods (i.e., mechanical couplers and plastic sleeves in conjunction with shrink sleeve) producing a smooth interior alignment with no lips or kinks. The Design-Builder shall design all connections and fittings to be airtight. Tape of any kind is not permitted to join or repair duct connections.

The Design-Builder shall construct connections and fittings from polyolefin materials containing antioxidant stabilizer(s) meeting the requirements established in Section 8.2.4.3 Inlets, Outlets, Valves and Plugs.

For post-tensioned systems intended for use with segmental constructed box girder bridges, the post-tensioning system shall include duct couplers at the segment joints. The tendon duct coupler located at the segment joint shall be mounted perpendicular to the bulkhead and designed to receive a duct at an angle of 6 degrees deviation from perpendicular. The coupler must be able to accommodate angular deviation of the duct without the tendon strands touching the duct or coupler on either side of the segment joint.

7.2.4.1.9 Smooth Duct

The Design-Builder shall use smooth duct manufactured from 100% virgin polyethylene resin meeting the requirements of ASTM D 3350 with a minimum cell class of 344464C. The Design-Builder shall use resin containing antioxidant(s) with a minimum Oxidative Induction Time (OIT) according to ASTM D 3895 of 40 minutes. The Design-Builder shall manufacture duct with a Dimension Ratio (DR) of 17.0 as established by either ASTM D 3055 or ASTM F 714 as appropriate for the manufacturing process used.

The Design-Builder shall use smooth duct meeting the minimum pressure rating (working pressure) of 100 psi and manufactured to either of the following specifications:

A. ASTM D 3035 "Standard Specifications for Polyethylene (PE) Plastic Pipe (DR-PR)"
B. ASTM F 714 "Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter."

7.2.4.1.10 External Duct Connections

The Design-Builder shall use heat welding techniques in making all splices between sections of plastic duct in accordance with the duct manufacturer's instructions or with mechanical couplers meeting the requirements of this Special Provision Post-Tensioning. The Design-Builder shall ensure all connections have a minimum pressure rating (working pressure) of 100 psi and produce a smooth interior alignment and a connection with no lips or kinks.

The Design-Builder shall ensure all connections between steel pipe embedded in concrete and plastic duct are made by using a mechanical coupler or a circular sleeve made of Ethylene Propylene Deine Monomer (EPDM) having a minimum pressure rating (working pressure) of 100 psi. The Design-Builder shall use EPDM materials having 100% quality retention as defined by ASTM D 1171 Ozone Chamber Exposure Method B.

The Design-Builder shall use EPDM sleeves having a minimum wall thickness of 3/8 inch and be reinforced with a minimum of four ply polyester reinforcement. The Design-Builder shall use a 3/8 inch wide power seated band and clamps constructed from ASTM A240, Type 316 stainless steel on each end of the boot to seal against leakage of grout. The Design-Builder shall install the band with an 80 to 120 pound [356 to 534 N] seating force.

7.2.4.1.11 Corrugated Ferrous Metal Ducts

The Design-Builder shall not use corrugated ferrous metal ducts in any location.

7.2.4.1.12 Shipping and Storage of Ducts

The Design-Builder shall furnish duct with end caps to seal the duct interior from contamination. The Design-Builder shall ship duct in bundles which are capped and covered during shipping and storage. The Design-Builder shall protect ducts against ultraviolet degradation, crushing, excessive bending, dirt contamination, and corrosive elements during transportation, storage, and handling. The Design-Builder shall not remove end caps supplied with the duct until the duct is incorporated into the bridge component. The Design-Builder shall store duct in a location that is dry and protected from the sun. Storage must be on a raised platform and completely covered to prevent contamination. If necessary, the Design-Builder shall wash duct before use to remove any contamination.

Internal Mechanical Couplers, O-Ring Assemblies, and Heat Shrink Sleeve Requirements

The Design-Builder shall construct mechanical internal duct couplers with stainless steel or plastic or a combination of these materials. The Design-Builder shall use plastic resins meeting the requirements of Section 8.2.4.3 and 8.2.4.5.5 to construct plastic couplers. The Design-Builder shall use ASTM A240 Type 316 stainless steel to make metallic components. Duct for prestressing bars used exclusively for temporary post-tensioning are not required to be coupled across segment joints.

O-ring duct coupler assemblies shall be made from plastic resins meeting the requirements of Section 8.2.4.3 and 8.2.4.5.5. Assemblies holding the O-ring shall mount to the form bulkheads...
and provide for duct alignment. The maximum force to compress the O-ring to its final compressed position shall not be greater than 25 psi times the area encircled by the O-ring. O-rings used in duct coupling assemblies between precast segment joints shall meet the following additional requirement: the volume change in water and diesel fuel oil at 70 hours at 125 c % ASTM D471 < 3.

All O-ring materials shall conform to the following requirements:

A. Mechanical Properties

1. Shore hardness A ASTM D2240 30-75;
2. Ultimate elongation % ASTM D412 > 300;
3. Tension set at 100%, 200%, and ultimate elongation ASTM D412 < 5; and
4. Tear strength die T, pli ASTM D624 110;

B. Accelerated Testing

1. Thermal deterioration 70 hours at 125 C ASTM D573;
2. Change in tensile strength % < 3;
3. Change of hardness % < 5; and
4. Compression set 22 hours @ 125 C % ASTM D573 < 20; and

C. Environmental Resistance

1. Ozone resistance 70 hours at 40 C and 50 MPa partial ozone pressure ASTM D 1149 no cracks; and
2. Low temperature at -20C ASTM D 746 not brittle pass.

The Design-Builder shall furnish and install heat shrink sleeves manufactured specifically for the size of the duct being coupled consisting of an irradiated and cross linked high density polyethylene backing for external applications and linear-density polyethylene for internal applications. Adhesive must bond to steel and polyolefin plastic materials. Ensure the heat shrink sleeves have an adhesive layer that will withstand 150° F operating temperature and meet the requirements of the following table:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Internal Application</td>
</tr>
<tr>
<td>Minimum Fully Recovered Thickness</td>
<td>ASTM D 1000</td>
<td>92 mils</td>
</tr>
<tr>
<td>Peel Strength</td>
<td>ASTM D 1000</td>
<td>29 pli</td>
</tr>
<tr>
<td>Softening Point</td>
<td>ASTM E 28</td>
<td>162° F</td>
</tr>
<tr>
<td>Lap Shear</td>
<td>DIN 30 672M</td>
<td>87 psi</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 638</td>
<td>2,900 psi</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D 2240</td>
<td>46 Shore D</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D 570</td>
<td>Less than 0.05%</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td>Yellow</td>
</tr>
</tbody>
</table>
The Design-Builder shall install heat shrink sleeves using procedures and methods in accordance with the manufacturer’s recommendations.

System Test Requirements

For each family of post-tensioning systems, the Design-Builder shall assemble systems and perform the pressure test defined herein. For each family of post-tensioning systems, the Design-Builder shall test two assemblies (largest and smallest) from the family. The post-tensioning assembly includes at least one of each component required to make a tendon from grout cap to grout cap. If applicable, the Design-Builder shall include plastic duct to steel pipe connections and segment duct couplers.

7.2.4.1.13 External Duct Systems

System testing for external duct consists of three separate tests. First, the anchorage and its connection to the duct/pipe must be tested in accordance with and meet the requirements for internal duct systems. Second, the grout cap to anchorage fit and, third, the duct and pipe assembly must comply with the following test. The Design-Builder shall condition the assembly by maintaining a pressure of 150 psi in the system for three hours. After conditioning, the assembly must sustain a 150 psi internal pressure for five minutes with no more than 15 psi reduction in pressure. The length of the test pipe assembly for the third test is 15 feet. Alternately, the second and third tests can be performed with either air or grout.

7.2.4.1.14 Internal Duct Systems

Perform a system test of the assembly for compliance with the requirements of Chapter 4, Article 4.2, Stage 1 and Stage 2 Testing contained in FIB Technical Report, Bulletin 7, titled “Corrugated Plastic Duct for Internal Bonded Post-tensioning”. For bar systems modify the system test length to 15 feet. For systems being tested for use in precast segmental construction, modify this test to include one duct coupler (or O-ring assembly) which is to be used at the segment joint.

Test the coupler for proper function by casting the coupler into a two part concrete test block using match cast techniques. Pull blocks apart and clean the surface of any bond breaker materials. Using an external apparatus, clamp the blocks together and maintain 40 psi pressure on the block cross section during the pressure test. Do not apply epoxy between the blocks for this portion of the test. Pressurize the duct within the test block to 5 psi and lock-off the outside air source. The assembly must sustain a 5 psi internal pressure for five minutes with no more than a 0.5 psi reduction in pressure. Separate the duct coupler blocks from the duct system remove the clamping device and place a 1/16 inch layer of epoxy on the face of both blocks, clamp the blocks together and maintain a pressure of 40 psi on the block cross section for 24 hours. Upon removal of the clamping force, demolish the blocks. The coupler and the attached ducts should be intact and free of epoxy, and properly attached without crushing, tearing or other signs of failure.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrinkage</td>
<td>33%</td>
<td>23%</td>
</tr>
</tbody>
</table>
7.2.5 GROUT

The Design-Builder shall use only grouts that meet the requirements of the Special Provision for Post Tensioning Grout. The Design-Builder shall select the post-tensioning grout for use by the proper application - either repair, horizontal, or vertical. Grout shall be mixed with potable water meeting the requirements of the NYSDOT’s Standard Specifications Section 712-01. The Design-Builder shall maintain grout fluidity in strict compliance with the grout manufacturer’s recommendations and test grout fluidity with a flow cone.

Grout Storage

The Design-Builder shall store grout in a location that is both dry and convenient to the Work. Storage in the open must be on a raised platform and with adequate waterproof covering to protect the material. On site storage of grout is limited to a maximum period of one month.

7.2.6 SAMPLES FOR TESTING AND IDENTIFICATION

General

Testing must conform to the applicable ASTM Specifications for the prestressing material used.

The Design-Builder shall furnish all material samples for testing at no cost to the Department.

The Design-Builder shall consider the job site or site referred to herein as the location where the prestressing steel is to be installed, whether at the bridge site or at the casting yard.

Prestressing Steel

The Design-Builder shall furnish samples for testing as described below for each manufacturer of prestressing strand and bar to be used on the Project.

With each sample of prestressing steel strand or bar furnished for testing, the Design-Builder shall submit a certification stating the manufacturer’s minimum guaranteed ultimate tensile strength of the sample furnished.

The Department’s representative will sample the following materials, at the plant or jobsite, from the prestressing steel used for post-tensioning operations:

A. For strand: three randomly selected samples, five feet long, per manufacturer, per size of strand, per shipment, with a minimum of one sample for every ten reels delivered; and
B. For bars: three randomly selected samples, five feet long, per manufacturer, per size of bar, per heat of steel, with a minimum of one sample per shipment.

One of each of the samples furnished to represent a LOT will be tested. The remaining sample(s), properly identified and tagged, shall be stored by the Department for future testing. In the event of loss or failure of the component the stored sample will be utilized to evaluate for minimum strength requirements. For acceptance of the LOT represented, test results must show 100% of the guaranteed ultimate tensile strength.

LOTs and Identification

A LOT is that parcel of components as described herein. All bars, of each size from each mill
heat of steel, and all strand from each manufactured reel to be shipped to the site must be assigned an individual LOT number and must be tagged in such a manner that each such LOT can be accurately identified at the job site. The Design-Builder shall submit records to the Department’s representative identifying assigned LOT numbers with the heat or reel of material represented. All unidentified prestressing steel or bars received at the site will be rejected. Also, loss of positive identification of these items at any time will be cause for rejection.

The Design-Builder shall provide a copy of the grout QC Data Sheet to the Department’s representative from the manufacturer for each LOT number and shipment sent to the job site. Materials with a total time from manufacturer in excess of six months shall be retested and certified by the supplier before use or be removed from the Project and replaced.

7.3 TESTING BY THE DESIGN-BUILDER

Testing is not required on post-tensioned, precast flat slab bridges, and double tee bridges.

7.3.1 TENDON MODULUS OF ELASTICITY TEST

If required in the Contract Documents or ordered by the Department’s representative, the Design-Builder shall perform a tendon modulus of elasticity test in accordance with the following procedure.

For the purpose of accurately determining the tendon elongations while stressing, the Design-Builder shall bench test two samples of each size of tendon to determine the modulus of elasticity prior to stressing the initial tendon.

For the purpose of this test, the bench length between anchorages must be at least 40 feet and the tendon duct at least two inches clear of the tendon all around. The test procedure must consist of stressing the tendon at an anchor assembly with a load cell at the dead end. The Design-Builder shall tension the test specimen to 80% of ultimate in ten increments and then detension from 80% of ultimate to zero in ten decrements. For each increment and decrement, the Design-Builder shall record the gauge pressure, elongations, and load cell force. The Design-Builder shall note elongations of the tendon for both ends and the central 30 feet, measured to an accuracy of ± 1/32 inch. The Design-Builder shall correct the elongations for the actual anchorage set of the dead end.

Calculate the modulus as follows:

\[
E = \frac{PL}{ADl}
\]

where;

\[P = \text{force in tendon,}\]

\[L = \text{distance between pulling wedges and dead end wedges or exact length in center 30 feet of the tendon.}\]

\[A = \text{cross sectional area of the tendon based on nominal area.}\]

\[Dl = \text{strand elongation for load } P.\]
If the bench test varies from the modulus of elasticity used for the shop or working drawings by more than 1%, submit revisions to the theoretical elongations to the Engineer of Record for approval.

When the observed elongations of the tendons in the erected structure fall outside the acceptable tolerances or to otherwise settle disputes, additional Tendon Modulus of Elasticity Tests may be required to be performed to the satisfaction of the Engineer of Record.

If the source of prestressing steel changes during the Project, additional test series or substantiation from previous projects, not to exceed two per source will be required.

The apparatus and methods used to perform the test must be submitted to the Engineer of Record for approval. Tests must be conducted in the Engineer of Record’s presence, or his designee.

7.3.2 IN-PLACE FRICTION TEST

For tendons in excess of 100 feet long, test in place a minimum of one tendon in tendon group performing the same function. Functional tendon groups are cantilever tendons, continuity tendons, draped external tendons or continuous profiled tendons passing through one or more spans, etc. The selected tendon will represent the size and length of the group of tendons being tested. The in-place friction test is not required on projects with straight tendons used in flat slabs or precast voided slabs.

The test procedure consists of stressing the tendon at an anchor assembly with a load cell or a second certified jack at the dead end. Stress the test specimen to 80% of ultimate tendon strength in eight equal increments. For each increment, record the gauge pressure, elongations and load cell force. Take into account any wedge seating in both the live end (i.e., back of jack) and the dead end (i.e., back of load cell) and any friction within the anchorages, wedge plates and jack as a result of slight deviations of the strands through these assemblies. For long tendons requiring multiple jack pulls with intermediate temporary anchoring, keep an accurate account of the elongation at the jacking end allowing for intermediate wedge seating and slip of the jack’s wedges.

If the elongation’s fall outside the ± 5% range compared to the anticipated elongations, investigate the reason and make detailed calculations confirming the final tendon forces are in agreement with the approved Plans.

In reconciling theoretical and actual elongations, do not vary the value of the expected friction and wobble coefficients by more than ± 10%. Significant shortfall in elongations is indicative of poor duct alignments and/or obstructions. Correct or compensate for such elongations in a manner proposed by the Design-Builder and reviewed and approved by the Engineer of Record at no additional cost to the Department.

The Engineer of Record will require one successful friction test for each tendon group for the Project.

If there are irreconcilable differences between forces and elongations or other difficulties during the course of routine stressing operations, the Department’s representative may require additional in place friction tests.
Tests must be conducted in the Department’s representative’s presence.

7.3.3 TESTS REPORTS REQUIRED

If required, the Design-Builder shall submit two test reports of the “Tendon Modulus of Elasticity Test” to the Department’s representative at least 30 calendar days before installing the tendon.

The Design-Builder shall submit two test reports of the “In Place Friction Test” to the Department’s representative within two weeks after successful installation of the tested tendon.

7.3.4 APPLICATION OF TEST RESULTS

The Design-Builder shall reevaluate the theoretical elongations shown on the post-tensioning shop or working drawings using the results of the tests for Tendon Modulus of Elasticity and In Place

7.4 PROTECTION OF PRESTRESSING STEEL

7.4.1 SHIPPING, HANDLING, AND STORAGE

The Design-Builder shall protect all prestressing steel against physical damage and corrosion at all times, from manufacturer to final grouting or encasing in the concrete. The Department’s representative will require replacement of prestressing steel that has sustained physical damage. The Design-Builder shall carefully inspect any reel that is found to contain broken wires during use and remove and discard lengths of strand containing broken wires. The wire shall be bright and uniformly colored, having no foreign matter or pitting on its surface.

Prestressing steel shall be packaged in containers for protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor which prevents rust shall be placed in the package or be incorporated in a corrosion inhibitor carrier type packaging material. The corrosion inhibitor shall have no deleterious effect on the steel, the concrete, or the bond strength of steel to concrete. Inhibitor carrier type packaging material shall conform to the provisions of Federal Specification MIL-P-3420. The Design-Builder shall immediately replace or restore packaging damaged from any cause to the original condition.

The shipping package shall be clearly marked with a statement that the package contains high-strength prestressing steel; the care to be used in handling; and the type, kind, and amount of corrosion inhibitor used, including, the date when placed, safety orders, and instructions for use. The Design-Builder shall specifically designate low relaxation (stabilized) strands per requirements of ASTM A 416. Strands not so designated shall be replaced.

7.4.2 DURING INSTALLATION IN THE STRUCTURE

The time between the first installation of the prestressing steel in the duct and the completion of the stressing and grouting operations shall not exceed seven calendar days. Any light surface corrosion forming during this period of time shall not be cause for replacement of the prestressing steel.

Flushing of grout is not permitted and vacuum grouting is required to repair all voids and blockages. Flushing of ducts is only permitted as defined in Sections 8.8 and 8.9.5. When flushing is permitted, the Design-Builder shall use flush water containing slake lime (calcium
hydroxide) or quicklime (calcium oxide) in the amount of 0.17 lb/gal [0.2 kg/L].

Except when waived by the Department’s representative in writing, failure to grout tendons within the seven calendar days specified shall result in stoppage of the affected Work.

### 7.5 FABRICATION

#### 7.5.1 GENERAL

The Design-Builder shall accurately and securely fasten all post-tensioning anchorages, ducts, inlet and outlet pipes, miscellaneous hardware, reinforcing bars, and other embedments at the locations shown on the plans or on the shop or working drawings. The Design-Builder shall construct tendons using the minimum number of duct splices possible.

#### 7.5.2 DUCTS

The Design-Builder shall accurately align ducts and position at the locations shown on the plans or according to the shop or working drawings. The Design-Builder shall securely fasten all internal ducts in position at regular intervals not exceeding 30 inches for steel pipes, 24 inches for round plastic duct, and 12 inches for flat ducts to prevent movement, displacement, or damage from concrete placement and consolidation operations. The Design-Builder shall show the method and spacing of duct supports on appropriate shop drawings. The Design-Builder shall ensure that ducts for external tendons are straight between connections to internal ducts at anchorages, diaphragms, and deviation saddles and are supported at intermediate locations according to the plans or shop drawings.

The Design-Builder shall ensure that all alignments, including curves and straight portions, are smooth and continuous with no lips, kinks, or dents. This also applies to curves in pre-bent steel pipe.

The Design-Builder shall carefully check and repair all ducts as necessary before placing any concrete.

After installing the ducts and until grouting is complete, the Design-Builder shall ensure that all ends of ducts, connections to anchorages, splices, inlets, and outlets are sealed at all times. The Design-Builder shall provide an absolute seal of anchorage and duct termination locations by using plumber’s plugs or equal. Grout inlets and outlets shall be installed with plugs or valves in the closed position. The Design-Builder shall leave low point outlets open. The use of any tapes is not permitted.

#### 7.5.3 SPLICES AND JOINTS

All splices, joints, couplings, connections (inlet and outlet), and valves shall be part of the approved post-tensioning system. Approved shrink-sleeve material may be used to repair duct. The use of any tapes to repair or seal duct is not permitted.

#### 7.5.4 LOCATION OF GROUT INLETS AND OUTLETS

The Design-Builder shall show locations of all grout inlets and outlets on the plans and shop drawings. The Design-Builder shall equip all grout inlets and outlets with positive shut-off
devices. At a minimum, grout inlets and outlets shall be placed in the following positions:

A. Top of the tendon anchorage;
B. Top of the grout cap;
C. At the high points of the duct when the vertical distance between the highest and lowest point is more than 20 inches;
D. At a location 3 feet past high points of the duct on the downstream side opposite the direction of grouting;
E. At all low points;
F. At major changes in the cross section of the duct;
G. At other locations required by the Engineer of Record; and
H. Extend grout tubes a sufficient distance out of the concrete member to allow for proper closing of the valves.

7.5.5 TOLERANCES

Ensure that post-tensioning ducts in their final position are within the following tolerances:

<table>
<thead>
<tr>
<th>Tolerances</th>
<th>Vertical position</th>
<th>Lateral position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal tendons in slabs or in slab regions of larger members</td>
<td>±1/4</td>
<td>±1/2</td>
</tr>
<tr>
<td>Longitudinal draped super-Structure tendons in webs. Tendon over supports or in middle third of span</td>
<td>±1/4</td>
<td>±1/4</td>
</tr>
<tr>
<td>Tendon in middle half of web depth</td>
<td>±1/2</td>
<td>±1/4</td>
</tr>
<tr>
<td>Longitudinal, generally horizontal, superstructure tendons usually in top or bottom of member</td>
<td>±1/4</td>
<td>±1/4</td>
</tr>
<tr>
<td>Horizontal tendons in substructures and foundations</td>
<td>± 1/2</td>
<td>± 1/2</td>
</tr>
<tr>
<td>Vertical tendons in webs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal position</td>
<td>±1</td>
<td>±1/4</td>
</tr>
<tr>
<td>Transverse position</td>
<td>±1/4</td>
<td></td>
</tr>
<tr>
<td>Vertical tendons in pier shafts</td>
<td>±1/2</td>
<td>±1/4</td>
</tr>
</tbody>
</table>

In all other cases, ensure that tendons are not out of position by more than ± 1/4 inch in any direction.

Ensure entrance and exit angles of tendon paths at anchorages and/or at faces of concrete are within ± 3 degrees [± 5%] of desired angle measured in any direction and any deviations in the alignment are accomplished with smooth transitions without any kinks.

Angle changes at duct joints must not be greater than ± 3 degrees [± 5%] in any direction and must be accomplished with smooth transitions without any kinks.

Locate anchorages within ± 1/4 inch of desired position laterally and ± 1 inch along the tendon.
except that minimum cover requirements must be maintained.

Position anchorage confinement reinforcement in the form of spirals, multiple U shaped bars or links, to be properly centered around the duct and to start within 1/2 inch of the back of the main anchor plate.

If conflicts exist between the reinforcement and post-tensioning duct, the position of the post-tensioning duct shall prevail and the reinforcement shall be adjusted locally with the Engineer of Record’s approval.

7.5.6 INTERNAL DUCT PRESSURE TEST

Pressure test all internal ducts, except longitudinal ducts in individual segments of segmental box girders, before casting concrete. Seal the duct at the termini and test with compressed air to determine if the duct connections require repair. Pressurize the duct to 5 psi and lock-off the outside air source. Record the pressure loss over five minutes. If the pressure loss exceeds 2 psi repair the leaks in the duct using methods approved by the Engineer of Record.

7.6 PLACING CONCRETE

7.6.1 PRECAUTIONS

Use methods to place and consolidate concrete which will not displace or damage any of the post-tensioning ducts, anchorage assemblies, splices and connections, reinforcement or other embedments. Fabricate all duct splices to prevent duct kinks during concrete placement. Use mandrels as needed to maintain duct alignment and shape.

7.6.2 PROVING OF POST-TENSIONING DUCTS

Upon completion of concrete placement, prove that the post-tensioning ducts are free and clear of any obstructions or damage and are able to accept the intended post-tensioning tendons by passing a torpedo through the ducts. Use a torpedo having the same cross-sectional shape as the duct and that is a 1/4 inch smaller all around than the clear, nominal inside dimensions of the duct. Make no deductions to the torpedo section dimensions for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, use a torpedo at least 2 feet long. For curved ducts, determine the length so that when both ends touch the outermost wall of the duct, the torpedo is 1/4 inch clear of the innermost wall. If the torpedo will not travel completely through the duct, the Engineer of Record will reject the member, unless a workable repair can be made to clear the duct. The torpedo must pass through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

7.6.3 PROBLEMS AND REMEDIES

The Engineer of Record will reject ducts or any part of the work found to be deficient. Perform no remedial or repair work without the Engineer of Record’s approval.

7.7 INSTALLING TENDONS

For tendons subjected to contamination with chlorides (construction location in an aggressive environment), flush the duct before placing the prestressing strands, with lime treated potable water and test for presence of chlorides and oils. Chlorides in the water must be less than 600
If chloride levels are in excess of 600 ppm, continue to flush the duct until the chloride level is below 250 ppm. Blow oil-free compressed air through the duct to remove any excess water in the duct.

Push or pull post-tensioning strands through the ducts to make up a tendon using methods which will not snag on any lips or joints in the ducts. Strands which are pushed should be rounded off on the end of the strand or fitted with a smooth protective cap. During the installation of the post-tensioning strand into the duct, the strand shall not be intentionally rotated by any mechanical device.

Alternatively, strands may be assembled to form the tendon and pulled through the duct using a special steel wire sock (“Chinese finger”) or other device attached to the end. The ends of the strands may not be welded together for this purpose. Round the end of the pre-assembled tendon for smooth passage through the duct. Cut strands using an abrasive saw or equal. Flame cutting is not allowed.

Do not install permanent tendons before the completion of testing as required by these Specifications or Plans. As a sole exception, the tendon to be tested in the “In Place Friction Test” may be installed for the test.

7.8 POST-TENSIONING OPERATIONS

7.8.1 GENERAL

Do not apply post-tensioning forces until the concrete has attained the specified compressive strength as determined by cylinder tests.

7.8.2 STRESSING TENDONS

Tension all post-tensioning steel with hydraulic jacks so that the post-tensioning force is not less than that required by the plans or approved shop drawings, or as otherwise approved by the Engineer of Record. Do not utilize monostrand jacks to stress tendons with five or more strands.

Maximum Stress at Jacking

The maximum temporary stress (jacking stress) in the post-tensioning steel must not exceed 80% of its specified minimum ultimate tensile strength. Do not overstress tendons to achieve the expected elongation.

Initial and Permanent Stresses

The post-tensioning steel must be anchored at initial stresses that will result in the long term retention of permanent stresses or forces of no less than those shown on the plans or the approved shop drawings. Unless otherwise approved by the Engineer of Record, the initial stress after anchor set must not exceed 70% of the specified ultimate tensile strength of the post-tensioning steel.

Permanent stress and permanent force are the stress and force remaining in the post-tensioning steel after all losses, including long term creep and shrinkage of concrete, elastic shortening of concrete, relaxation of steel, losses in the post-tensioning steel from the sequence.
of stressing, friction and unintentional wobble of the ducts, anchor set, friction in the anchorages and all other losses peculiar to the post-tensioning system.

Stressing Sequence

Except as noted on the plans, or the approved shop drawings, permanent post-tensioning tendons must be stressed from both ends. The required force may be applied at one end and subsequently at the other end or simultaneously at both ends.

Single end stressing is permitted when the following are satisfied:

A. Space limitations prohibit double end stressing;
B. The calculated elongation of the post-tensioning steel at the second end is 1/2 inch or less and wedges are power seated; and
C. Single end stressing applied at alternate ends of paired adjacent post-tensioning tendons is required to produce a symmetrical force distribution in agreement with the plan design.

For construction in stages where some tendons are required to be stressed before others, install and stress in accordance with the plans or approved shop drawings or as otherwise approved by the Engineer of Record.

7.8.3 STRESSING EQUIPMENT

Only use equipment furnished by the supplier of the post-tensioning system (tendons, hardware, anchorages, etc.).

Stressing Jacks and Gauges

Each jack must be equipped with a pressure gauge for determining the jacking pressure. The pressure gauge must have an accurate reading gauge with a dial at least six inches in diameter.

Calibration of Jacks and Gauges

The Design-Builder shall calibrate each jack and its gauge(s) as a unit. The calibration must consist of three test cycles with the cylinder extension of the jack in various positions (i.e., two inch, four inch, and eight inch stroke). At each pressure increment, the Design-Builder shall average the forces from each test cycle to obtain an average force. The Design-Builder shall perform the calibration with the equipment (such as, jack, pump, and hoses) setup in the same configuration that is intended to be used at the job site. The post-tensioning supplier or an independent laboratory shall perform initial calibration of jacks and gauge(s). The Design-Builder shall use load cells calibrated within the past 12 months to calibrate stressing equipment. For each jack and gauge unit used on the Project, the Design-Builder shall furnish certified calibration charts and curves to the NYSDOT’s representative prior to stressing. The Design-Builder shall supply documentation denoting the load cell(s) calibration date and tractability to NIST (National Institute of Standards and Technology) along with the jack/gauge calibration.

The Design-Builder shall provide the NYSDOT’s representative with certified calibration charts and curves prior to the start of the Work and every six months thereafter, or as requested by the NYSDOT’s representative. Calibrations subsequent to the initial calibration with a load cell may
be accomplished by the use of a master gauge. The Design-Builder shall supply the master
gauge to the NYSDOT’s representative in a protective waterproof container capable of
protecting the calibration of the master gauge during shipment to a laboratory. The Design-
Builder shall provide a quick-attach hydraulic manifold to enable quick and easy installation of
the master gauge to verify the permanent gauge readings. The master gauge shall be
calibrated and provided to the NYSDOT’s representative. The master gauge shall remain in the
possession of the NYSDOT’s representative for the duration of the Project.

Any jack repair, such as replacing seals or changing the length of the hydraulic lines, is cause
for recalibration using a load cell.

No extra compensation will be allowed for the initial or subsequent calibrations or for the use
and required calibrations of the master gauge.

7.8.4 ELONGATIONS AND AGREEMENT WITH FORCES

The Design-Builder shall ensure that the forces being applied to the tendon and the elongation
of the post-tensioning tendon can be measured at all times.

Elongations shall be measured to the nearest 1/16 inch.

For the required tendon force, the observed elongation must agree within seven percent of the
theoretical elongation or the entire operation must be checked and the source of error
determined and remedied to the satisfaction of the NYSDOT’s representative before proceeding
further. The Design-Builder shall not overstress the tendon to achieve the theoretical
elongation.

In the event that agreement between the observed and theoretical elongations at the required
force falls outside the acceptable tolerances, the NYSDOT’s representative may, at his or her
discretion and without additional compensation to the Design-Builder, require additional tests for
“Tendon Modulus of Elasticity” and/or “In-Place Friction” in accordance with Sections 8.3.1 and
8.3.2.

7.8.5 FRICTION

The Contract Plans shall note the assumed friction and wobble coefficients and anchor set
assumed in the calculations. Submit calculations and show a typical tendon force diagram, after
friction, wobble and anchor set losses, on the shop drawings based upon the expected actual
coefficients and values for the post-tensioning system to be used. Show these coefficients and
values on the shop drawings.

If, in the opinion of the Engineer of Record, the actual friction significantly varies from the
expected friction, revise post-tensioning operations so the final tendon force is in agreement
with the plans.

When friction must be reduced, graphite may be used as a lubricant, subject to the approval of
the Engineer of Record. Flush lubricants from the duct as soon as possible after stressing is
completed by use of lime treated potable water. After ducts are flushed, immediately blow dry
with oil-free air.
7.8.6 WIRE FAILURES IN POST-TENSIONING TENDONS

Multi-strand post-tensioning tendons, having wires which fail, by breaking or slippage during stressing, may be accepted provided the following conditions are met:

A. The completed structure must have a final post-tensioning force of at least 98% of the design total post-tensioning force.
B. For precast or cast-in-place segmental construction and for any similar construction that has members post-tensioned together across a common joint face, at any stage of erection, the post-tensioning force across a mating joint must be at least 98% of the post-tensioning required for that mating joint for that stage of erection.
C. Any single tendon must have no more than a 5% reduction in cross-sectional area of post-tensioning steel due to wire failure.

Any of the above conditions may be waived with approval of the Engineer of Record, when conditions permit the Design-Builder to propose acceptable alternative means of restoring the post-tensioning force lost due to wire failure.

7.8.7 CUTTING OF POST-TENSIONING STEEL

Cut post-tensioning steel with an abrasive saw within 3/4 to 1 1/2 inches away from the anchoring device. Flame cutting of post-tensioning steel is not allowed.

7.8.8 RECORD OF STRESSING OPERATIONS

Keep a record of the following post-tensioning operations for each tendon installed:

A. Project name, Financial Project ID;
B. Design-Builder and/or subcontractor;
C. Tendon location, size and type;
D. Date tendon was first installed in ducts;
E. Reel number for strands and heat number for bars;
F. Tendon cross-sectional area;
G. Modulus of elasticity;
H. Date Stressed;
I. Jack and gauge numbers per end of tendon;
J. Required jacking force;
K. Gauge pressures;
L. Elongations (theoretical and actual);
M. Anchor sets (anticipated and actual);
N. Stressing sequence (i.e., tendons to be stressed before and after);
O. Stressing mode (one end/two ends/simultaneous);
P. Witnesses to stressing operation; and
Q. Date grouted.

The Design-Builder shall record any other relevant information. The Design-Builder shall provide the NYSDOT’s representative with a complete copy of all stressing and grouting operations.
7.8.9 DUCT PRESSURE FIELD TEST

After stressing and before grouting internal or external tendons, the Design-Builder shall install all grout caps, inlets, and outlets and test the tendon with compressed air to determine if duct connections require repair. The Design-Builder shall pressurize the tendon to 100 psi and lock-off the outside air source. The Design-Builder shall record pressure loss for five minutes. A pressure loss of 10 psi is acceptable. If the pressure loss exceeds 10 psi, the Design-Builder shall repair leaking connections.

7.8.10 TENDON PROTECTION

Within four hours after stressing, the Design-Builder shall install grout caps and seal all other tendon openings. If acceptance of the tendon is delayed, the Design-Builder shall seal all tendon openings and temporarily weatherproof the open ends of the anchorage. If tendon contamination occurs, the Design-Builder shall remove and replace the tendon.

7.9 GROUTING OPERATIONS

7.9.1 GROUTING OPERATIONS PLAN

The Design-Builder shall submit a grouting operations plan for review and written comment at least six weeks in advance of any scheduled grouting operations. All comments provided by the NYSDOT pertaining to the grouting operations plan are required to be resolved before any grouting of the permanent structure takes place.

At a minimum, the grouting operations plan shall address and provide procedures for the following items:

A. Names and proof of training for the grouting crew and the crew supervisor in conformance with this Special Provision Post-Tensioning;
B. Type, quantity, and brand of materials used in grouting including all certifications required;
C. Type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts;
D. General grouting procedure;
E. Duct pressure test and repair procedures;
F. The method to be used to control the rate of flow within ducts;
G. Theoretical grout volume calculations;
H. Mixing and pumping procedures;
I. The direction of grouting;
J. The sequence of use of the inlets and outlet pipes;
K. Procedures for handling blockages; and
L. Procedures for possible post grouting repair.

Before grouting operations begin, a joint meeting of the Design-Builder, its grouting crew, and the NYSDOT shall be conducted. At the meeting the grouting operation plan, required testing, corrective procedures, and any other relevant issues shall be discussed.

7.9.2 GROUT INLETS AND OUTLETS

The Design-Builder shall ensure the connections from the grout pump hose to inlets are free of
dirt and are air-tight. The Design-Builder shall inspect valves to be sure that they can be opened and closed properly. The grout inlets and outlets over the bridge deck shall be protected from damage. In addition, all grout inlets and outlets shall be properly labeled and identified.

7.9.3 SUPPLIES

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

7.9.4 EQUIPMENT

General

The Design-Builder shall provide grouting equipment consisting of measuring devices for water, a high-speed shear colloidal mixer, a storage hopper (holding reservoir), and a pump with all the necessary connecting hoses, valves, and a pressure gauge. The Design-Builder shall provide pumping equipment with sufficient capacity to ensure that the post-tensioning ducts to be grouted can be filled and vented without interruption at the required rate of injection in not more than 30 minutes.

The Design-Builder shall provide an air compressor and hoses with sufficient output to perform the required functions.

The Design-Builder shall provide vacuum grouting equipment (volumetric measuring type) prior to the start of grouting operations and retain the equipment on the job during the duration of tendon grouting operations.

Mixer and Storage Hopper

The Design-Builder shall provide a high speed shear colloidal mixer capable of continuous mechanical mixing producing a homogeneous and stable grout free of lumps and undispersed cement. The colloidal grout machinery shall have a charging tank for blending and a holding tank. The blending tank shall be equipped with a high shear colloidal mixer. The holding tank shall be kept agitated and at least partially full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

The Design-Builder shall add water during the initial mixing by use of a flow meter or calibrated water reservoir with a measuring accuracy equal to one percent of the total water volume.

Grout Pumping Equipment

The Design-Builder shall provide pumping equipment capable of continuous operation which shall include a system for circulating the grout when actual grouting is not in progress.

The equipment shall be capable of maintaining pressure on completely grouted ducts and shall be fitted with a valve that can be closed off without loss of pressure in the duct.

Grout pumps shall be positive displacement type, shall provide a continuous flow of grout, and
shall be able to maintain a discharge pressure of at least 145 psi.

Pumps shall be constructed to have seals adequate to prevent oil, air, or other foreign substances entering the grout and to prevent loss of grout or water. The capacity shall be such that an optimal rate of grouting can be achieved.

A pressure gauge having a full scale reading of no more than 300 psi shall be placed at the duct inlet. If long hoses (in excess of 100 feet) are used, the Design-Builder shall place two gauges, one at the pump and one at the inlet.

The diameter and rated pressure capacity of the grout hoses shall be compatible with the pump output.

Vacuum Grouting Equipment

The Design-Builder shall provide vacuum grouting equipment at the job site, concurrently with all pressure grouting operations, consisting of the following:

- A volumeter for the measurement of void volume;
- A vacuum pump with a minimum capacity of ten cfm and equipped with flow-meter capable of measuring amount of grout being injected;
- Manual colloidal mixers and/or dissolvers (manual high speed shear mixers) for voids less than 20 liters in volume; and
- Standard colloidal mixers for voids 20 liters and greater in volume.

9.4.5 Stand-by Equipment

During grouting operations, the Design-Builder shall provide a stand-by grout mixer and pump.

7.9.5 GROUTING

General

The Design-Builder shall perform a test to confirm the accuracy of the volume-measuring component of the vacuum grouting equipment each day before performing any grouting operations. The Design-Builder shall use either water or grout for testing using standard testing devices with volumes of 0.5 gal and 6.5 gal and an accuracy of equal to or less than four ounces. The Design-Builder shall perform one test with each device. The results shall verify the accuracy of the void volume-measuring component of the vacuum grouting equipment within one percent of the test device volume and must verify the accuracy of the grout volume component of the vacuum grouting equipment within five percent of the test device volume. The Design-Builder shall ensure the NYSDOT’s representative is present when any tests are performed.

Grout tendons in accordance with the procedures set forth in the approved grouting operation plan. Grout all empty ducts.

Temperature Considerations

Maximum grout temperature must not exceed 90°F at the grout inlet. Use chilled water and/or pre-cooling of the bagged material to maintain mixed grout temperature below the maximum
allowed temperature. Grouting operations are prohibited when the ambient temperature is below 40°F or is 40°F and falling.

Mixing and Pumping

Mix the grout with a metered amount of water.

The materials will be mixed to produce a homogeneous grout. Continuously agitate the grout until grouting is complete.

Grout Production Test

During grouting operations the fluidity of the grout must be strictly maintained within the limits established by the grout manufacturer. A target fluidity rate will be established by the manufacturer's representative, based on ambient weather conditions. Determine grout fluidity by use of either test method found in Special Provision for Post Tensioning Grout. Perform fluidity test for each tendon to be grouted and maintain the correct water to cementitious ratio. Do not use grout which tests outside the allowable flow rates.

Prior to grouting empty ducts condition the grout materials as required to limit the grout temperature at the inlet end of the grout hose to 90°F. Prior to performing repair grouting operations, condition the grout materials to limit the grout temperature at the inlet end of the grout hose to 85°F. Check the temperature of the grout at the inlet end of the grout hose hourly.

At the beginning of each days grouting operation, perform a wick induced bleed test in accordance with Special Provision for Post Tensioning Grout. If zero bleed is not achieved at the end of the required time period, do not begin grouting of any new or additional tendons until the grouting operations have been adjusted and further testing shows the grout meets the specified requirements.

Grout Operations

Open all grout outlets before starting the grouting operation. Grout tendons in accordance with the Grouting Operations Plan.

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

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

The Design-Builder shall pump grout through the duct and continuously discharge it at the anchorage and grout cap outlets until all free water and air are discharged and the consistency of the grout is equivalent to that of the grout being pumped into the inlet. The Design-Builder shall close the anchorage outlet and discharge a minimum of two gallons of grout from the grout cap into a clean receptacle. The Design-Builder shall close the grout cap outlet.

For each tendon, immediately after uncontaminated uniform discharge begins, the Design-
Builder shall perform a fluidity test using the flow cone on the grout discharged from the anchorage outlet. The measured grout efflux time shall not be less than the efflux time measured at the pump or minimum acceptable efflux time as established in the Special Provision Post Tensioning Grout. Alternately, the Design-Builder shall check the grout fluidity using the Wet Density method contained in the Special Provision Post Tensioning Grout. The measured density shall fall within the values established in DB Special Provision Post Tensioning Grout. The density at the final outlet shall not be less than the grout density at the inlet. If the grout fluidity is not acceptable, the Design-Builder shall discharge additional grout from the anchorage outlet and test the grout fluidity. The Design-Builder shall continue this cycle until an acceptable grout fluidity is achieved. The Design-Builder shall discard grout used for testing fluidity. After all outlets have been bled and sealed, the Design-Builder shall elevate the grout pressure to ±75 psi, seal the inlet valve, and wait two minutes to determine if any leaks exist. If leaks are present, the Design-Builder shall fix the leaks. The Design-Builder shall repeat the above stated process until no leaks are present. If no leaks are present, the Design-Builder shall bleed the pressure to five psi and wait a minimum of ten minutes for any entrapped air to flow to the high points. After the minimum ten minute period has expired, the Design-Builder shall increase the pressure as needed and discharge grout at each high point outlet to eliminate any entrapped air or water. The Design-Builder shall complete the process by locking a pressure of 30 psi into the tendon.

If the actual grouting pressure exceeds the maximum allowed, the inlet shall be closed and the grout shall be pumped at the next outlet which has just been, or is ready to be, closed as long as a one-way flow is maintained. Grout shall not be pumped into a succeeding outlet from which grout has not yet flowed. If this procedure is used, the outlet/inlet which is to be used for pumping shall be fitted with a positive shut-off and pressure gauge.

When complete grouting of the tendon cannot be achieved by the steps stated herein, the Design-Builder shall stop the grouting operation. After waiting 48 hours, the Design-Builder shall fill the tendon with grout in accordance with the procedure outlined in Section 8.9.5.8.

Vertical Grouting

Grouting of cable stays is not covered by this DB Special Provision Post-Tensioning. For all vertical tendons, the Design-Builder shall provide a standpipe at the upper end of the tendon to store bleed water and grout and maintain the grout level above the level of the prestressing plate and anchorage. This device shall be designed and sized to maintain the level of the grout at an elevation which shall assure that bleeding shall at no time cause the level of the grout to drop below the highest point of the upper anchorage device. The Design-Builder shall design the standpipe to allow all bleed water to rise into the standpipe, not into the uppermost part of the tendon and anchorage device.

The Design-Builder shall discharge grout and check grout fluidity as described in Section 8.9.5.5. As grouting is completed, the standpipe shall be filled with grout to a level which assures that, as settlement of the grout occurs, the level of the grout shall not drop below the highest point in the upper anchorage device. If the level of the grout drops below the highest point in the anchorage device, the Design-Builder shall immediately add grout to the standpipe. After the grout has hardened, the standpipe shall be removed. In the presence of the NYSDOT's representative, the Design-Builder shall visually inspect for voids using an endoscope or probe. The Design-Builder shall fill all voids found in the duct using volumetric measuring vacuum grouting processes.
For vertical tendons in excess of 100 feet or if the grouting pressure exceeds the maximum recommended pumping pressure, then grout shall be pumped at increasingly higher outlets which have been or are ready to be closed as long as a one-way flow of grout is maintained. Grout shall be allowed to flow from each outlet until all air and water have been purged prior to using that outlet for pumping.

Construction Traffic and Operations Causing Vibrations

During grouting and for a period of four hours upon completion of grouting, the Design-Builder shall eliminate vibrations from all sources, such as, moving vehicles, jackhammers, compressors, generators, pile driving operations, and soil compaction, that are operating within 300 feet down-station and 300 feet up-station of the ends of the span in which grouting is taking place.

Post-Grouting Operations and Inspection

The Design-Builder shall not remove or open inlets and outlets until the grout has cured for 24 to 48 hours. The Design-Builder shall perform inspections within one hour after the removal of the inlet/outlet. After the grout has cured, the Design-Builder shall remove all outlets located at anchorages and high points along the tendon to facilitate inspection. The Design-Builder shall drill and inspect all high points along the tendon as well as the inlets or outlets located at the anchorages. Depending on the geometry of the grout inlets, drilling may be required to penetrate to the inner surface of the trumpet or duct. The Design-Builder shall use drilling equipment that shall automatically shut-off when steel is encountered. Unless grout caps are determined to have voids by sounding, the Design-Builder shall not drill into the cap. The Design-Builder shall perform inspections in the presence of the NYSDOT’s representative using endoscopes or probes. Within four hours of completion of the inspections, the Design-Builder shall fill all duct and anchorage voids using the volumetric measuring vacuum grouting process.

The Design-Builder shall seal and repair all anchorage and inlet/outlet voids that are produced by drilling for inspection purposes as specified in Section 8.10.2. The Design-Builder shall use an injection tube to extend to the bottom of the drilled holes for backfilling with epoxy.

Post grouting inspection of tendons having a length of less than 150 feet may utilize the following statistical frequency for inspection:

A. For the first 20 tendons, the Design-Builder shall inspect all outlets located at anchors and tendon high points by drilling and probing with an endoscope or probe. If one or more of the inspection locations are found to contain a defect (void), the Design-Builder shall continue testing all tendons until 20 consecutive tendons have been inspected and no voids have been found; and

B. When no defects are detected as defined in Section 8.9.5.8(A), the frequency of inspection can be reduced to inspect every other tendon (50%). If a defect is located, the Design-Builder shall inspect the last five tendons grouted. The Design-Builder shall renew the cycle of 100% tendon inspection.

If tendon grouting operations were prematurely terminated prior to completely filling the tendon, the Design-Builder shall drill into the duct and explore the voided areas with an endoscope. Probing is not allowed. The Design-Builder shall determine the location and extent of all voided areas. The Design-Builder shall install grout inlets as needed and fill the voids using volumetric
measuring vacuum grouting equipment.

Grouting Report

The Design-Builder shall provide a grouting report signed by the Design-Builder and/or the Subcontractor within 72 hours of each grouting operation for review by the NYSDOT’s representative.

The Design-Builder shall report the theoretical quantity of grout anticipated as compared to the actual quantity of grout used to fill the duct. The Design-Builder shall notify the NYSDOT’s representative immediately of shortages or overages.

Information to be noted in the records shall include, but not necessarily be limited to, the following:

A. Identification of the tendon;
B. Date grouted;
C. Number of days from tendon installation to grouting;
D. Type of grout;
E. Injection end and applied grouting pressure;
F. Ratio of actual to theoretical grout quantity;
G. Summary of any problems encountered; and
H. Corrective action taken.

7.10 FORMING AND REPAIRS OF HOLES AND BLOCK-OUTS

7.10.1 REPAIR OF LIFTING AND ACCESS HOLES

The Design-Builder shall repair all holes with Epoxy Compound for Post Tensioning Anchorages meeting the requirements of the Special Provision Epoxy Compound for Post Tensioning Anchorages. Immediately before casting the concrete (within 24 hours), the Design-Builder shall mechanically clean and roughen the mating concrete surfaces to remove any laitance and expose the small aggregate. Grit blasting or water blasting using a minimum 10,000 psi nozzle pressure is required. The Design-Builder shall flush the surface with water and blow dry. The Design-Builder shall mix, place, and cure the material in strict compliance with the manufacturer’s recommendations.

7.10.2 REPAIR OF GROUT INLETS AND OUTLETS

The Design-Builder shall place threaded plastic caps in all inlet/outlet locations required in the plans. The Design-Builder shall repair inlets/outlets as shown on the plans using an epoxy grout or epoxy polysulfide grout meeting the requirements of Section 721-03 of the NYSDOT’s Standard Specifications. The Design-Builder shall prepare the surface to receive the epoxy material in strict compliance with the manufacturer’s recommendations.

7.11 PROTECTION OF POST-TENSIONING ANCHORAGES

Within seven calendar days of completion of the grouting, the Design-Builder shall protect the anchorage of post-tensioning bars and tendons as indicated in the plans. The application of the elastomeric coating may be delayed up to 90 calendar days after grouting. The Design-Builder shall use plastic or threaded caps to plug all grout inlets/outlets. The Design-Builder shall use
an epoxy grout meeting the requirements of the Special Provision Epoxy Compound for Post Tensioning Anchorages to construct all pour-backs located in the area considered as extremely aggressive, such as expansion joints. Post-tensioning block out in the top deck is also considered as extremely aggressive. The Design-Builder shall apply Methyl Methacrylate coating over the pour-back in the top deck and extending 12 inches outside the perimeter of the pour-back. In other areas, Magnesium Ammonium Phosphate Concrete can be used.

The Design-Builder shall remove all laitance, grease, curing compounds, surface treatments, coatings, and oils by grit blasting or water blasting using a minimum 10,000 psi nozzle pressure. The Design-Builder shall flush the surface with water and blow dry. Surfaces shall be clean, sound, and without any standing water. In case of a dispute, the Design-Builder shall use ACI 503 for substrate testing and develop a minimum of 175 psi tension (pull-off value).

The Design-Builder shall mix and apply epoxy as per the manufacturer’s current standard technical guidelines. The Design-Builder shall construct all pour-backs in leak proof forms creating neat lines. The epoxy grout may require pumping for proper installation. The Design-Builder shall construct forms to maintain a liquid head to ensure intimate contact with the concrete surface. The Design-Builder shall use vents as needed to provide for the escape of air to ensure complete filling of the forms.

The Design-Builder shall coat the exposed surfaces of all pour-backs and grout caps with an elastomeric coating system having a thickness of 30 to 45 mils and extending 12 inches outside the pour-back perimeter. The Design-Builder shall assure concrete, grout caps, or other substrates are structurally sound, clean, and dry. Concrete shall be a minimum of 28 calendar days old. The Design-Builder shall remove all laitance, grease, curing compounds, surface treatments, coatings, and oils by grit blasting or water blasting using a minimum 10,000 psi nozzle pressure to establish the anchor pattern. The Design-Builder shall blow the surface with compressed air to remove the dust or water. For elastomeric coated pour-backs which are to receive a special surface finish, the Design-Builder shall apply a manufacturer’s approved primer over the elastomeric coating before applying the special surface finish.

The Design-Builder shall construct a two by four foot concrete test block with a similar surface texture to the surfaces to be coated and coat a vertical face with the elastomeric coating system chosen. The Design-Builder shall determine the number of coats required to achieve a coating thickness between 30 to 45 mils without runs and drips. The Design-Builder shall mix and apply elastomeric coating as per the manufacturer’s current standard technical specifications. The Design-Builder shall spray or a roller application is permitted (although a spray application is preferred). The Design-Builder shall have the coating manufacturer representative on site to supervise and comment on the application of the elastomeric coating onto the test block. The Design-Builder shall apply coatings using experienced personnel with a minimum of three years experience applying similar polyurethane systems. The Design-Builder shall submit the credentials of these persons to the NYSDOT’s representative for review and written comment.

**SP 8. POST-TENSIONING GROUT**

**8.1 GENERAL REQUIREMENTS**

This Section covers grouts to be used to protect post-tensioning steel. Grout applications are differentiated into two applications

A. Horizontal; and
B. Vertical.

Grouts shall be prepackaged in moisture proof containers. Grout bags shall indicate application, date of manufacture, LOT number and mixing instructions. Any change of materials or material sources requires new testing and certification of the conformance of the grout with this Specification. A copy of the Quality Control Data Sheet for each LOT number and shipment sent to the job site shall be provided to the Design-Builder by the grout supplier and furnished to the Engineer of Record. Materials with a total time from manufacture to usage in excess of six months shall be tested and certified by the supplier that the product meets the QC Control Specifications before use or the material shall be removed and replaced.

8.2 APPROVED MATERIALS LIST

Only post-tensioning grouts listed on the Department's Approved Materials List shall be used. A written certification from the manufacturer that the product meets the requirements of this Section must be provided. Grout products will be qualified by application (horizontal, vertical).

8.3 MIXING

The material shall be mixed in accordance with the manufacturer's recommendations.

8.4 GROUT PHYSICAL PROPERTIES

8.4.1 GAS GENERATION

The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

8.4.2 LABORATORY TESTS

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Chloride Ions</td>
<td>Max. 0.08% by weight of the mixed grout</td>
<td>ASTM C 1152</td>
</tr>
<tr>
<td>Fine Aggregate (if utilized)</td>
<td>99% passing the No. 50 Sieve (300 micron)</td>
<td>ASTM C 136*</td>
</tr>
<tr>
<td>Hardened Height Change @ 24 hours and 28 days</td>
<td>0.0% to +0.2%</td>
<td>ASTM C 1090**</td>
</tr>
<tr>
<td>Expansion</td>
<td>&lt;2.0% for up to 3 hours</td>
<td>ASTM C 940</td>
</tr>
<tr>
<td>Wet Density – Laboratory</td>
<td>Report maximum and minimum obtained test value 1b/ft³</td>
<td>ASTM C 185</td>
</tr>
<tr>
<td>Wet Density – Field</td>
<td>Report maximum and minimum obtained test value 1b/ft³</td>
<td>ASTM C 138</td>
</tr>
<tr>
<td>Compressive Strength 28 day (Average of 3 cubs)</td>
<td>≥7,000 psi</td>
<td>ASTM C 842</td>
</tr>
<tr>
<td>Initial Set of Grout</td>
<td>Min. 3 hours</td>
<td>ASTM C 953</td>
</tr>
<tr>
<td>Max. 12 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of Efflux</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>(a) Immediately after mixing</td>
<td>Min. 20 Sec.</td>
<td>ASTM C 939</td>
</tr>
<tr>
<td>Max. 30 Sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>Min. 9 Sec.</td>
<td>ASTM C 939****</td>
</tr>
<tr>
<td>Max. 20 Sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) 30 minutes after mixing with remixing for 30 sec</td>
<td>Max. 30 Sec.</td>
<td>ASTM C 939</td>
</tr>
<tr>
<td>or</td>
<td>Max. 30 Sec.</td>
<td>ASTM C 939****</td>
</tr>
<tr>
<td>Bleeding @ 3 hours</td>
<td>Max. 0.0 percent</td>
<td>ASTM C 940*****</td>
</tr>
<tr>
<td>Permeability @ 28 days</td>
<td>Max. 2,500 coulombs at 30 V for 6 hours</td>
<td>ASTM C 1202</td>
</tr>
</tbody>
</table>

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

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

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

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

*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

1) Use a wick made of a 20 inch length of ASTM A416 seven wire 0.5 inch diameter strand. Wrap the strand with 2 inch wide duct or electrical tape at each end prior to cuffing to avoid splaying of the wires when it is cut. Degrease (with acetone or hexane solvent) and wire brush to remove any surface rust on the strand before temperature conditioning.

2) Condition the dry ingredients, mixing water, prestressing strand, and test apparatus overnight at 65 to 75°F.

3) Mix the conditioned dry ingredients with the conditioned mixing water and place 800 ml of the resulting grout into the 1,000 ml graduated cylinder. The Design-Builder shall measure and record the level of the top of the grout.

4) Completely insert the strand into the graduated cylinder. The Design-Builder shall center and fasten the strand so it remains essentially parallel to the vertical axis of the cylinder. The Design-Builder shall measure and record the level of the top of the grout.

5) Completely insert the strand into the graduated cylinder. Center and fasten the strand so it remains essentially parallel to the vertical axis of the cylinder. Measure and record the level of the top of the grout.

6) Store the mixed grout at the temperature range listed in 2) above.

7) Measure the level of the bleed water every 15 minutes for the first hour and hourly for two successive readings thereafter.

8) Calculate the bleed water, if any, at the end of the three hour test period and the resulting expansion as per the procedures outlined in ASTM C940, with the quantity of bleed water expressed as a percent of the initial grout volume. The Design-Builder shall note if the bleed water remains above or below the top of the original grout height. The Design-Builder shall note if any bleed water is absorbed into the specimen during the test.
8.4.3 CHLORIDE ION TEST

One chloride ion concentration test shall be performed on the mixed grout once per Project and minimum every 18 tons (40,000 lbs) of material before the addition of water.

8.4.4 INCLINED TUBE TEST

The inclined tube test shall be performed in accordance with Section 4.4.9 of PTI Specification for Grouting of Post-tensioned Structures, 3rd Edition.

8.4.5 FIELD MOCK-UP TEST

The Design Builder shall perform a minimum of two field mock-up tests representing the most complicated tendon geometry / profile of the Project using the proposed grout material to be used, 3 months prior to the production grout. The field mock-up test is designed to verify and demonstrate that the proposed materials, outlets, inlets, mixer, grouting equipment, methods, and procedures are appropriate and will result in complete filling of the duct. At least 4 weeks before scheduled start of field mock-up test, the Design-Builder shall submit to NYSDOT for approval of a detail written field mock-up test plan covering test set-up, materials, ducts, inlets, outlets, anchorages, prestressing element, grouting, and dissection procedures. Supervisory personnel and equipment used for the mock-up test shall be the same as those to be used in production grouting. Changes in supervisory personnel, materials, equipment, and procedures shall be allowed only after a written approval by the NYSDOT. Not less than 3 days after grouting, the Design Builder shall dissect the test specimens for a thorough examination of grout, prestressing steel, and the duct in the presence of NYSDOT representative. Special attention shall be given to the examination of the tendon high points for water, bleed pocket, soft grout, segregation, or corrosion. A report describing the trial test (including any variations from the test plan) and its findings shall be submitted for approval a maximum of 2 weeks after dissection. The NYSDOT shall determine whether the results of the mock-up test satisfy the acceptance requirements in the contract. If the test results do not meet the acceptance requirements, the NYSDOT may require additional tests at the Design Builder's expense.

8.5 ACCELERATED CORROSION TEST METHOD (ACTM)

The Design-Builder shall perform the Accelerated Corrosion Test Method (ACTM) as outlined in Appendix B of the “Specification for Grouting of Post-Tensioning Structures” published by the Post-Tensioning Institute, Third Edition, 2012. Report the time to corrosion for both the grout being tested and the control sample using a 0.45 water-cement neat grout.

A grout that shows a longer average time to corrosion in the ACTM than the control sample and the time to corrosion exceed 1,000 hours is considered satisfactory.

8.6 VARIATION IN TESTING FOR SPECIFIC APPLICATIONS

8.6.1 HORIZONTAL APPLICATIONS

Horizontal grout applications are defined as grouting of all superstructure tendons and transverse substructure tendons in caps, struts, etc. All physical requirements defined in Special Provision for Epoxy Compounds for Post Tensioning Anchorages are applicable for
grouts used in horizontal applications.

8.6.2 VERTICAL APPLICATIONS

Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in Special Provision for Epoxy Compounds for Post Tensioning Anchorages are applicable for grouts used in vertical applications. In addition, perform the Schupack Pressure Bleed Test Procedure for Cement Grouts for Post-Tensioned Structures as outlined in Section 4.4.6.2 of the “Specification for Grouting of Post-Tensioned Structures” published by the Post-Tensioning Institute, Third Edition. Report the percent bleed for the grout tested. Test grout at the specified pressure of 100 psi. An acceptable test will result in no bleed water (0.0 percent).
SP 9. GROUTING TENDON VOIDS

9.1 GENERAL

Grout all voids located in tendons and anchorages using either volumetric vacuum grouting, vacuum assist grouting or pressure grouting techniques as delineated in the "Tendon and Anchorage Inspection Report" developed in the inspection phase of the work. The requirements for volumetric vacuum grouting are stated herein and requirements for pressure grouting are found in the Post-Tensioning Section.

If required, install all inlets and outlets as needed.

9.2 GROUT

Use grout which meets or exceeds the requirements of PT Grout Section and contains no aggregate.

9.3 QUALIFICATIONS OF GROUTING PERSONNEL

Perform all post-tensioning field operations under the direct supervision (crew foreman) of ASBI Certified Grouting Technician. Construction operations that require a qualified grouting technician must not begin until the Department verifies that the technician is on ASBI list of qualified technicians.

In addition to the above, perform all vacuum grouting operations under the direct supervision of a crew foreman who has been trained and has experience in the use of vacuum grouting equipment and procedures. Submit the crew foreman’s credentials for verification of the Engineer of Record prior to performing any vacuum grouting operations.

9.4 EQUIPMENT

Use the following equipment to perform vacuum grouting: vacuum hoses; vacuum pump, air filter to protect the vacuum pump and void measuring device; power supply; grout mixer and grout pump.

9.5 DEBRIS REMOVAL AND DRYING OF VOID

Use oil free high volume compressed air to remove debris and eliminate any free water from the voids prior to the grouting operation.

9.6 MEASURE THE VOID

Using equipment set-up no. 2 (sketch no. 2), measure the volume of air in the void to determine volume of the void. Perform this operation a second time. The measurements of void volume between the first and second pumping should be very close. Repeat this process if necessary.

9.7 GROUTING VOID

Use equipment set-up no. 1 (sketch no. 1) to perform grouting. Prepare the grout in sufficient quantity to fill the void. Circulate the grout between the grout pump and the four-way valve. Set pump vacuum to 1 bar (-14.7 psi). Start the vacuum pump and establish a vacuum of 1 bar (-14.7 psi) and then inverse the four-way valve to simultaneously close the vacuum pump hose.
and open the grout hose. Quickly, pump the required volume of grout into the void and maintain a grouting pressure of 5 bar (+74 psi) for 1 minute before turning off the vacuum pump. Reduce the pressure on the grout to 2 bar (+30 psi) and close the valve at A to lock-in 2 bar (30 psi) positive pressure. Release the pressure in the system. Dismantle and clean the equipment as needed.

9.8 REPAIR OF GROUT INLETS AND OUTLETS

Without causing the concrete to spall around the inlet/outlet, use a slightly larger drill remove the inlet/outlet piping. Drill to a depth of 2 inches. Clean the hole with compressed air and back fill with grout. Inject the grout through a tube and fill the hole from the bottom to the top.
SP 10. EPOXY COMPOUNDS FOR POST TENSIONING ANCHORAGES

10.1 GENERAL

Epoxy resin compounds for use in post tensioning anchorage protection systems shall contain no volatile solvent and shall be basically pure reactive material with a maximum ash content of two percent.

All types shall have simple mix ratios of one to one or two to one or shall be supplied in pre-measured containers in which all of the contents of both packages shall be mixed.

10.2 QUALIFIED PRODUCTS

Only NYSDOT approved epoxy resin compounds shall be used.

10.3 CERTIFICATION

The Design-Builder shall provide the NYSDOT’s representative with certification from the manufacturer of the epoxy confirming that the requirements of this Special Provision Epoxy Compounds for Post Tensioning Anchorages are met. Each certification shall cover only one batch of epoxy materials.

10.4 REQUIREMENTS

These epoxy materials shall be used to protect the anchorages of post-tensioning tendons or bars and other uses indicated in the plans. The epoxy pour back material is required only in the area considered as extremely corrosive, such as expansion joints. The material shall produce a low exotherm reaction and have flow and fill characteristics suitable for machine base plate applications. The material shall be extended with the aggregate supplied by the manufacturer. The Design-Builder shall mix with the full aggregate loading.

The material shall be factory pre-proportioned including factory supplied aggregate. The Design-Builder shall deliver products in original containers with the manufacturer’s name, date of manufacture, product identification label, and batch numbers. Materials shall be within the manufacturer’s recommended shelf life. The Design-Builder shall store and condition the product in full compliance with the manufacturer’s recommendations.

The epoxy grout plus aggregate mix shall meet or exceed the specified physical properties stated herein as determined by the following standard ASTM test methods.
<table>
<thead>
<tr>
<th>Property</th>
<th>Test Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive strength cubes seven calendar day cure at</td>
<td>&gt; 10,000 psi 77°F</td>
<td>ASTM C 579B</td>
</tr>
<tr>
<td>Tensile strength at seven calendar days</td>
<td>&gt; 2,100 psi</td>
<td>ASTM C 307</td>
</tr>
<tr>
<td>Flexural strength at seven calendar day cure at 77°F</td>
<td>&gt; 3,600 psi 77°F</td>
<td>ASTM C 580</td>
</tr>
<tr>
<td>Modulus of elasticity seven calendar day cure at 77°F</td>
<td>&lt; 2,100,000 psi 77°F</td>
<td>ASTM C 580</td>
</tr>
<tr>
<td>Coefficient of thermal expansion at 74 to 210°F</td>
<td>&lt; 20 x 10⁻⁶ in/in/°F</td>
<td>ASTM C 531</td>
</tr>
<tr>
<td>Peak exotherm, specimen 12 by 12 by three inches</td>
<td>&lt; 150°F</td>
<td>ASTM D 2471</td>
</tr>
<tr>
<td>Slant shear at seven calendar days (bond strength to concrete)</td>
<td>&gt; 3000 psi</td>
<td>ASTM C 882</td>
</tr>
<tr>
<td>Thermal compatibility</td>
<td>5 Cycles Passed</td>
<td>ASTM C 884</td>
</tr>
<tr>
<td>Linear shrinkage at seven calendar days</td>
<td>0.025%</td>
<td>ASTM C 531</td>
</tr>
<tr>
<td>Flowability and bearing area</td>
<td>90% Contact area</td>
<td>ASTM C 1339</td>
</tr>
<tr>
<td>Gel time, specimen 12 by 12 by three inches</td>
<td>&lt; 4:00 (hr.)</td>
<td>ASTM D 2471</td>
</tr>
</tbody>
</table>

10.4.1 PACKAGING, LABELING, AND SAFETY

All containers shall be identified as Component A - contains epoxy resin or Component B - contains hardener and shall show the type, mixing directions, batch numbers, manufacturer's name, date of packaging, shelf life, expiration date, and quantity in pounds or gallons. Mix ratios shall be prominently shown on labels. Potential hazards shall be stated on each package in accordance with the Federal Hazardous Products Labeling Act.

10.4.2 STORAGE

Epoxy materials which have been in storage for more than 12 months shall not be used.
SP 11.  PRECAST CONCRETE SEGMENTAL CONSTRUCTION

11.1  GENERAL

The work specified in these Special Provisions shall consist of the manufacture of precast concrete superstructure elements, including the storage, transport and the erection of the elements into the completed structure. The final structure shall conform to the lines and grades and the dimensions shown on the plans and shall be in accordance with the Special Provisions, the Special Provisions for "Erection of Cable-Stayed and Concrete Segmental Bridge" and the AASHTO LRFD Specifications, Section 5.

A. The safe erection of the structure is the Design-Builder's responsibility.
B. The Design-Builder shall prepare a complete erection sequence for its proposed method of construction and shall submit complete detailed shop and erection drawings of its proposed erection sequence, including complete and checked erection design calculations to the NYSDOT for review. Review by the NYSDOT of the Design-Builder's erection sequence and plans shall not relieve the Design-Builder from its responsibility for the accuracy and adequacy of the work.
C. No work shall be performed until the Design-Builder's erection sequence is totally reviewed and approved by the Engineer of Record.
D. The Design-Builder will be responsible for determination of and monitoring of forces, and deflections in the permanent structure at all erection stages as are caused by his proposed erection process.
E. All details and stress computations submitted by the Design-Builder shall be prepared, signed and sealed by the Engineer of Record. All computations shall be in accordance with the Performance Criteria.
F. Any modifications to the structure for erection purposes shall be submitted to the NYSDOT for review. The Design-Builder shall demonstrate that such modifications will have no adverse effect on the completed structure. Any additional materials required shall be provided at no cost to the Project. Completed details and stress computations will be required for all revisions to the plans. The Design-Builder shall submit for NYSDOT's review all proposed modifications to details shown on the plans. No such work shall be performed until it is reviewed and approved by the Engineer of Record.

11.1.1  DEFINITIONS

The following definitions apply to segmental bridge construction:

A. Plans: Approved design plans prepared by the Design-Builder’s Engineer of Record.
B. Segment: A modular section of the superstructure and/or substructure consisting of a certain cross-section shape and length as detailed on the Plans.
C. Match Cast: A precast concrete fabrication process whereby a segment is cast against the preceding segment producing a matching interface which permits the re-establishment of the cast geometry at erection time. Match casting is accomplished by either the short line or long line casting method.
D. Short Line Casting: Casting segments one at a time in a casting cell between a bulkhead at one end and a previously cast segment at the other. The first segment is cast between the bulkhead and another, temporary bulkhead.
E. Long Line Casting: Casting segments on a casting bed of sufficient length to permit the cumulative casting of segments for the entire length of a span or cantilever between field closure pours without repositioning the segments on the casting bed. With this method,
the first segment is cast between bulkheads and successive segments are cast between a movable bulkhead on one end and the previously cast segment on the other.

F. Casting Cell: A special formwork arrangement usually consisting of a fixed vertical bulkhead of the cross section shape at one end and adjustable soffit, side and core forms all designed and assembled into a machine for making a single superstructure segment. A casting cell for a substructure pier shaft segment consists of exterior and interior side forms and a soffit form of the cross section shape.

G. Wet Joint System: Where segments are made in a casting cell between two bulkheads and are not match cast. The segments are then erected in the superstructure with a narrow cast-in-place joint between each segment. (During erection, all the segments of a span or multiple spans are supported by falsework, truss or other technique until the joints have gained strength and the longitudinal post-tensioning installed to make them self supporting.)

H. Span By Span (Erection): Placing a specified number of segments on a temporary support system, aligned and post-tensioned longitudinally forming a completed span of the superstructure.

I. Balanced Cantilever (Erection): The segments are sequentially erected alternately on either side of the pier in cantilever to a point where a closure is cast-in-place.

J. Progressive Cantilever (Erection): The segments are erected progressively in cantilever, in one direction, from one pier to the next, using temporary intermediate piers, or other systems as required to support the advancing cantilever between piers.

K. Casting Curve: The curve of casting geometry that has to be followed in the casting cell or bed for achieving the theoretical bridge profile and alignment after all the final structural and time dependent (creep and shrinkage) deformations have taken place. The casting curve is a combination of the theoretical bridge geometrical profile grade, alignment and the camber.

L. Camber: The amount by which the concrete profile at casting time shall differ from the theoretical geometric profile grade to compensate for all structural dead load, post-tensioning, all long term and time dependent deformations (creep and shrinkage) including all the intermediate erection stages and effects. (The opposite of deflections).

M. Erection Elevation: The elevation at which a segment is set in the structure at the time it is erected. (This is profile grade corrected by the amount of deflection calculated to occur from that stage onwards.)

N. Segmental Duct Coupler: The special duct coupler used for internal tendon duct connections at segment match cast joints meeting the requirement of "Post-tensioning" Project Special Provision (PSP).

11.1.2 DESIGN-BUILDER RESPONSIBILITIES

The following shall be performed by the Design-Builder and working plans submitted to the NYSDOT for review:

A. Complete detailed erection sequence drawings are required. Erection and erection wind stresses in permanent and temporary members including temporary piers and false work reactions shall be determined for each stage. Moments, shears, axial loads, and other forces shall be computed and tabulated at a sufficient number of points to demonstrate that the load demand will not exceed the capacity and allowable stresses for erection.

B. The Design-Builder shall prepare and submit detailed shop and erection drawings to the NYSDOT in accordance with the requirements outlined in these Special Provisions.

C. All submittals by the Design-Builder shall be submitted sufficiently in advance of the start of construction.
D. The Design-Builder shall meet with the NYSDOT to discuss the proposed erection procedure, erection design criteria, and structure capabilities to support the proposed erection scheme. The NYSDOT will review the preliminary erection procedure proposal for general compliance with the contract requirements.

E. The Design-Builder shall develop and submit to the NYSDOT a complete description and stress calculations of the proposed process and sequence of erection including positions and weights of equipment at each position and weights of equipment at each stage in sufficient details to allow review of the effects of the erection procedure on the structure.

F. The stresses and capacities shall be in accordance with the performance criteria.

G. The Design-Builder shall submit to the NYSDOT the detailed design of all erection equipment, erection truss, falsework, temporary bracing, and other items as required for erection.

H. The Design-Builder’s sequence of erection shall ensure the intermediate static and dynamic stability of the structure for the various stages of the construction.

I. All computations submitted to the NYSDOT for review shall be prepared, signed, and sealed by the Engineer of Record and shall be submitted in a neat, organized manner and shall be easy to follow.

J. The NYSDOT shall engage in a thorough design review process.

11.1.3 SHOP DRAWINGS

The Design-Builder shall submit detailed working plans that include, but are not necessarily limited to, the following:

A. Fully and accurately dimensioned views showing the geometry of each superstructure segment, including, projections, recesses, notches, openings, blockouts, and the like.

B. Complete details of the fabrication system to be used, including the forms, geometry control, and sequence of fabrication.

C. Complete geometric layouts for each post-tensioning tendon. Tendon layouts shall be accomplished so as to cause no curvature within the longitudinal limits of the trumpet component of a tendon anchorage device. Integrated shop drawings shall not be submitted until these tendon layouts have been reviewed by the NYSDOT.

D. Fully integrated drawings showing reinforcing steel, pretensioning strands, post-tensioning ducts, post-tensioning hardware, sockets, anchorages, inserts, lifting devices, and any other items to be embedded in a segment. Details of mild steel reinforcing shall be clearly shown as to size, spacing, and location, including any anchorage reinforcing not shown in the plans which may be required by the post-tensioning anchorage system selected by the Design-Builder. Details of post-tension ducts shall clearly indicate the size, type, and horizontal and vertical profiles of ducts and the duct supports, grout pipes, and concrete cover. Details of post-tensioning anchorage locations and external tendon entrance and exit points in segment diaphragms and anchor blocks shall be dimensioned locally in the face of concrete and with reference to a corner of the anchor blocks or diaphragms sections. Each segment shall be assigned an erection mark indicating its location and order in the erection sequence.

E. Casting curves shall be prepared by and in accordance with the casting and erection methods, schedule, loads, and material properties proposed by the Design-Builder. The casting curves shall be of sufficient accuracy for casting the segments. The preparation of the casting curve shall recognize all deviations from straight line and deformations due to the final required alignment and due to each load and future superimposed dead loads; erection loads; post-tensioning stresses, including secondary moments; creep;
and shrinkage. Each submitted casting curve shall be accompanied by all information (such as, loads; casting and erection sequence; and schedules and material properties) considered in its development. In developing casting curves, deformations due to creep and shrinkage and the concrete modulus of elasticity shall be computed in accordance with the bridge design criteria for the Project. The preparation of casting curves is dependent upon the erection sequence and the Design-Builder's schedule. Therefore, if the Design-Builder proposes a change to an erection procedure, it shall develop a new casting curve in the same manner as required for the original casting curve. The Design-Builder shall include with submittal of a revised casting curve its proposed method(s) and location(s) for transitioning between the current curve(s) in use and the submitted curve(s).

F. The Design-Builder shall similarly adjust initial bearing elevations and tower geometry for time dependent displacements.

G. Complete details of handling, storing, and transporting precast segments. These details shall include, for each type of segment, the method of lifting (such as, location of any inserts and configuration of lifting devices) and the method of supporting segments. Double stacking of superstructure segments may be permitted under controlled conditions using a three point support system with two supports under one web and one in the center of the other web. An analysis of the loaded segment must show acceptable stresses. The details shall be accompanied by calculations indicating that the forces imposed on a segment during lifting, storage, transportation, and erection will not adversely affect the structural adequacy of the segment.

H. The Design-Builder shall provide a step-by-step erection manual to be used for erection of segments, stay cables, and post tensioning, including the sequence in which these items are to be erected and a table of theoretical elevations and alignment of the geometry control points established during casting of each segment computed at each stage of erection.

I. Stages for which theoretical positions of control points are to be computed shall include segment in place prior to applying post-tensioning, segment with post-tensioning applied, and, when applicable, segment with cable-stay forces applied.

J. The theoretical positions shall be computed taking the following into consideration:

1. The effect of as-cast geometry established from surveys during casting of segments.
2. Effects of construction dead and live loads.
4. Effects of creep and shrinkage.
5. Effect of the final profile of the roadway as shown in the plans.

K. The erection manual shall also include a method for measuring and recording the elevation and alignment of all control points at each stage of erection.

L. The Design-Builder shall submit a new erection procedure at any time proposals are made to deviate from the sequence or schedule of erection contained in an erection procedure under which the Design-Builder is operating.

M. Complete details covering equipment to be used to handle segments and stay cables and incorporate them into the structure, erection methods to be used, the sequence of erection, all loads to be imposed on any portion of the permanent structure by the erection equipment, and details covering the procedure for load testing of erection equipment. This shall include a complete layout of the casting and storage areas.

N. Calculations that show that the loads imposed on the permanent structure by the erection equipment will not adversely affect the structural adequacy of the permanent structure, nor exceed allowed stresses during construction. Any modifications of the
magnitude or position of construction stresses that become "locked in" and are thus superimposed upon the structure in its final state shall be brought to the attention of the NYSDOT.

O. Complete details including dimensions and showing reinforcing steel, permanent and temporary post-tensioning ducts, and hardware and other embedded items for precast concrete which include reinforcement or prestressing tendons which extend or pass into precast concrete units.

P. The NYSDOT will engage in a thorough design review process in accordance with Part 2 - DB Section 111.

11.2 MATERIALS

Concrete for precast superstructure segments shall be in accordance with the Bridge Design Criteria for the Project.

11.3 EQUIPMENT

A. The Design-Builder shall submit design calculations performed, signed and sealed by a professional engineer licensed in the State of New York for any specialized erection equipment, falsework and any other temporary construction that may be required to accomplish this work.

B. Notice to NYSDOT by the Design-Builder that their specialized erection equipment is proprietary, will not be recognized by NYSDOT as a reason to not comply with the above requirements.

C. Prior to the use of any equipment which is fabricated for the specific purpose of erecting any portion of the work included in this contract, the Design-Builder shall demonstrate by a full scale load test that his equipment is adequate for its intended use on this Project.

D. If an erection truss is to be supported by any part of a pier, in designing the supporting brackets, a lateral force of not less than ten percent of the truss supports shall be attached by positive means. Supports relying on friction shall not be allowed.

E. Prior to using an erection truss on the Project, the Design-Builder shall demonstrate the capability of the truss to perform as intended by a full-scale load test. The load test shall include:

1. Constructing two temporary piers approximately the size and shape of the upper portion of the permanent piers for the Project. The elevation of the top of these piers shall be such that when the erection truss and supporting brackets are assembled to them it will be a sufficient distance above the ground to allow any necessary working space beneath it. The temporary piers may be constructed on foundations for permanent piers.

2. Assembling the truss supported on the piers in the same manner and using the same supporting devices (beams, brackets, etc.) as will be used on the Project.

3. Loading the truss with the maximum weight segments it will support during erection of the bridge plus an additional load equal to 25 percent of the weight of the segments.

4. Measurement of vertical displacement and midspan and horizontal movements at support points.

5. The Design-Builder shall give NYSDOT written notice at least 72 hours in advance of the time at which the loading of the truss will be accomplished.

6. The Design-Builder may propose alternate test procedures for review by NYSDOT provided that all equipment components are equivalently tested to the above
method.

7. Observation of the load testing of the erection truss, erection equipment nor review of any design calculations or drawings covering the erection truss or other erection equipment by NYSDOT shall be construed as any assumption of responsibility by NYSDOT for means, methods, techniques, sequences, procedures of construction, safety precautions, or safety program incident thereto. The above items shall in all cases remain the sole responsibility to the Design-Builder.

8. Results of the entire load test program should be compiled and submitted to NYSDOT as soon as possible after completion of the test.

11.3.1 CONSTRUCTION REQUIREMENTS

Casting Concrete

All materials, details and procedures shall be as specified in the Design-Builder's plans and these Special Provisions. The casting of any segment shall not begin until the review and approval of all applicable shop drawings and required calculations have been completed by the Engineer of Record.

Preparation for Casting

Care shall be exercised in setting up forms for casting segments. All materials to be encased within the concrete of the segments shall be properly positioned and supported. Provisions for all Projections, recesses, notches openings, blockouts and the like shall be in accordance with the approved shop drawings.

Geometric Control

A. Before commencing the casting operation, the Design-Builder shall submit to NYSDOT for review, his proposed method of geometry control for both the casting and erection operations. This submittal shall include all measuring equipment, procedures and the location of the control points to be established on each segment. Casting shall not commence without NYSDOT's review of the control method. A detailed narrative of the geometry control theory, a detailed narrative of the step-by-step geometry control procedure, detailed calculation forms and a set of sample calculations shall be submitted.

B. The geometric control plan shall provide for regular monitoring of the superstructure deflections beginning with the addition of the first cantilever segments and concluding with the last cantilever segment. The plan shall include the adjusting procedure to be utilized should the cantilever, as erected, deviate from the predicted alignment by more than one inch.

C. The geometry control plan shall similarly address span-by-span casting and erection.

D. The Design-Builder shall check the elevations and alignment of the structure at every stage of construction, and must maintain a record of all these checks and of all adjustments and corrections made. All surveying shall be performed at a time that will minimize the influence of temperature. Corrections by shimming shall be done only when reviewed by NYSDOT and approved by the Engineer of Record.

E. For precast segmental construction using short line forming techniques, precision surveying systems shall be provided so that levels and horizontal alignment are measured to an accuracy of 0.001 feet. For all other types of segmental construction, surveying shall be provided to an accuracy of 0.01 feet.

F. For precast segmental construction using match-cast segments, careful checks of both
measurements and computations of geometry shall be made by the Design-Builder before moving segments from their casting position. Computed coordinates of all sections cast shall be completed before casting a new segment. In addition to the computed as-built casting curves for vertical and horizontal deflections, a cumulative twist curve shall be computed using the measured cross slopes of the individual units as a check on the extrapolated deflections. In computing set up elevations in the match-cast process, priority shall be given to correcting twist errors by proper counter-rotation. The segment in the match cast position shall not be subjected to a stress-inducing twist.

Placing Concrete

A. Concrete shall not be deposited into forms until the entire set up of the forms, reinforcement, ducts and anchorage has been thoroughly inspected. The placing of concrete will not be permitted until it is demonstrated that the rate of producing and placing concrete is sufficient to complete the proposed placement and finishing operations within the Design-Builder's scheduled time, that experienced concrete finishers are available where required for finish work and all necessary finishing tools and that all required equipment are on hand at the site of the work and are in satisfactory condition for use.

B. Special care shall be taken to plan the sequence of placing concrete so as to assure that voids do not occur within the concrete in areas where air is likely to be entrapped within the forms or in areas where flow of the plastic concrete is constrained by embedded items.

C. Placing equipment shall be of a size and design that will permit the placing of concrete within the limits set out in the standard specifications. Placing equipment shall be cleaned as necessary at the end of each operation or work day and, just prior to reuse, shall again be checked and cleaned of hardened concrete and foreign materials.

D. Construction joints within a segment will be permitted only at locations shown on the plans or at other locations as may be proposed by the Design-Builder on shop drawings and approved by the Engineer of Record.

Tolerances

The following tolerances shall apply to the fabrication of precast elements:

<table>
<thead>
<tr>
<th>(1) Precast Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of web</td>
</tr>
<tr>
<td>Depth of bottom slab</td>
</tr>
<tr>
<td>Depth of top slab</td>
</tr>
<tr>
<td>Overall depth of segment</td>
</tr>
<tr>
<td>Overall width of segment</td>
</tr>
<tr>
<td>Length of segment (not cumulative)</td>
</tr>
<tr>
<td>Diaphragm dimensions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2) Precast Box Pier Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (Individual Element)</td>
</tr>
</tbody>
</table>
(2) Precast Box Pier Segments

<table>
<thead>
<tr>
<th>Width and Breath (Individual Element)</th>
<th>± 1/4 inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (Wall)</td>
<td>± 1/4 inch</td>
</tr>
</tbody>
</table>

(3) All Fabricated Segments

<table>
<thead>
<tr>
<th>Ends (deviation from a plane per 20 ft with or depth)</th>
<th>± 1/4 inch per 20 ft not to exceed ½ inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Surface (deviation from a plane at any location)</td>
<td>± 0.025 in/ft not to exceed a total of 1/4 inch</td>
</tr>
</tbody>
</table>

Dimensions from segment to segment shall be adjusted so as to compensate for any deviations within a single segment so that the overall dimensions of the completed structure will conform to the dimensions shown on the plans.

Repairs

Repair minor breakage, spalling, or honeycomb (not over 1 inch deep) by a method approved by the Engineer of Record. Major breakage, spalling, or honeycomb in excess of 1 inch deep is subject to the Engineer of Record’s structural review. If found to be satisfactory, repair these areas using a method approved by the Engineer of Record. Do not perform surface finishing or repairs on the matching joint surfaces of precast segments until after final erection of the segment, except as herein noted. If more than 20%, but less than 40% of the total contact surface of all shear keys in any single web is broken, spalled or honeycombed, grind the damaged areas to produce a cylindrical depression into sound concrete to a depth and width approximately equal to the shear key dimensions. Complete necessary repairs to shear keys damaged at the casting site prior to shipping the segment to the erection site. After erection of the segments adjacent to the damaged keys and prior to erection of additional segments, carefully pack the voids left by the depressions with an epoxy mortar as approved by the Engineer of Record. With the Engineer of Record’s approval, an alternate method of repair may be used. The segment will be considered unacceptable for use if more than 40% of the total contact surface of all shear keys in any single web is broken, spalled or honeycombed. Use an Engineer of Record approved method for repairing damaged alignment keys located in the top and bottom slabs. The Engineer of Record will consider a segment unsatisfactory for use if more than 50% of the total contact surface of all alignment keys in any element of the slab (wing overhang, central portion between webs, etc.) is broken, spalled or honeycombed. Remove and dispose segments found to be unsatisfactory and not repairable after structural review and cast a new segment at no expense to the Department.

Removal of Forms

A. Forms shall remain in-place until the concrete has reached the compressive strength specified for form removal and until the transverse tendons in the top slab have been stressed to at least 50 percent of the final post-tensioning force required for these tendons. The compressive strength of the concrete shall be determined from the test cylinders cast by the Design-Build in accordance with AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing AASHTO T-22 from concrete representative of that used to cast the segment. The Design-Build shall cure test cylinders in the same manner as the segment and test cylinders.
them in accordance with AASHTO T-23.
B. Care shall be exercised in removing the forms to prevent spalling and chipping of the concrete.
C. Prior to moving a segment from its as-cast position, erection marks identifying its location in the structure and order in time erection sequence shall be affixed to the inside of the segment.

Curing Concrete

Curing shall be accomplished in accordance with the requirements of the PCI Manual 116, *Manual for Quality Control for Plants and Production of Structural Precast Concrete Products*, Fourth Edition, and the Standard Specifications as supplemented by the following additional requirements, which permit steam curing:

A. Concrete curing shall be in accordance with PCI 116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
B. Steam curing shall be done in a suitable enclosure to contain the live steam or heat. The enclosure shall totally enclose both the segment being cast and the segment being cast against and any rigid appendages thereto.
C. To prevent moisture loss on exposed surfaces during the pre-steaming period, members shall be covered with polyethylene coated burlap as soon as the concrete can be covered without marring the surface or the exposed surfaces shall be kept wet by fog spray or wet blankets.
D. During the waiting period the temperature in the enclosure shall not be less than 50° F.
E. The steam cycle may be initiated when the last portion of the concrete placed has reached 500 psi as indicated by a penetrometer test on a sample from which coarse aggregate was removed.
F. The Design-Builder shall provide temperature recording devices that will provide an accurate continuous permanent record of the curing temperature, a minimum of two temperature recording devices per casting setup will be required for checking temperature.
G. The steam curing cycle shall include a gradual heating and cooling period during which the rate of change in temperature shall not exceed 40°F per hour. The maximum temperature inside the enclosure shall not exceed 160°F after attaining the desired strength, the temperature within the curing enclosure shall be decreased at an average rate not exceeding 40°F per hour until the inside temperature is within 20°F of the outside ambient temperature.
H. Concrete test cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.

Finishing Concrete

A. Finishing of precast segments shall be done at the casting yard.
B. Minor breakage, spalling or honeycomb (not over one inch deep) shall be repaired by a method reviewed by NYSDOT if they determine that the structural or other functions of the segment will not be impaired. For cast-in-place construction, breakage, spalling or honeycomb on any mating surface of an in-place segment otherwise found acceptable, shall be repaired prior to casting the next segment. For precast segments, no surface finishing or repairs shall be performed on the matching joint surface until after final erection of the segment.
C. The Design-Builder shall submit for any breakage, spalling, or honeycomb more than one inch deep a proposed repair procedure. Structural justification may be required by NYSDOT for any repair which requires a submittal. Development of each repair procedure shall attempt to restore the local state of stress to that which would have existed if the repair had not been required.

Finish Roadway Surface

A. As soon as the concrete has been placed and vibrated in a section of sufficient width to permit working, the surface shall be leveled, struck off and screeded, carrying a slight excess of concrete ahead of the screed to insure filling at low spots. The screed shall be designed rigid enough to hold true to shape and shall have sufficient adjustments to provide for the required camber. A vibrating screed may be used if heavy enough to prevent undue distortion.

B. The longitudinal screed shall be moved across the concrete with a saw-like motion while its ends rest on the upper surface of a form that has been set to grade or on the adjacent finished slab, the surface of the concrete shall be screeded a sufficient number of times, and at such intervals to produce a uniform surface, true to grade and free of voids and then shall receive a broomed finish while the concrete is still plastic.

C. The screeded surface shall be worked to a smooth finish with a long handled wood or metal float of the proper size or hand floated from bridges over the slab.

Precast Segment Handling

A. Care shall be exercised in the handling of segments to prevent damage to them. Special care shall be used to prevent damage to prestressing steel installed in a unit that is left projecting because it is to be threaded into another unit later. Handling shall be done only by using the devices shown on the shop drawings for this purpose. Superstructure segments shall remain in a deck upright position.

B. Lifting devices incorporated into any segment shall be adequate to distribute the handling and erection stresses so as to not damage the segment.

C. Prior to shipment, each segment shall be thoroughly inspected for damage. No repairs of minor spalls or chipped areas on the joint surfaces shall be made until after erection of the segment. Upon arrival at the bridge site, each segment shall again be inspected. If any damage has occurred during shipment that in the judgment of the Engineer of Record will impair the structural or other function of the segment, such damage shall be cause for rejection of the segment.

D. Firm support during storage shall be provided and the segments shall be fully secured against shifting during transport. The storage area of the segments shall be of suitable stability to prevent differential settlement of the segment supports during the entire period of storage. Segments shall not be moved from the casting area until all curing, strength, repairs, and appropriate stressing requirements have been attained.

11.3.2 ERECTION

A. The Design-Builder shall be fully responsible for design, fabrication, assembly and operation of all equipment to be used for handling and erecting segments.

B. Erection of segments shall not begin until the required shop drawings and calculations have been reviewed by NYSDOT. No extra payment will be made to the Design-Builder for any cost incurred in modifying the permanent structure due to temporary loadings induced by the Design-Builder's handling and erection equipment or his erection scheme.
C. Elevations and alignment of segments shall be carefully measured during each stage of erection with instruments capable of providing the degree of accuracy necessary to assure that erection tolerances are met. Any deviation from the table of elevations and alignment prepared by the Design-Builder shall be corrected so as to prevent accumulation of deviations using a method submitted by the Design-Builder and reviewed by NYSDOT.

D. Precast segments shall not be erected until they have reached the age of 28 days and have obtained the minimum specified strength.

E. Erection of precast segments by the cantilever method will be permitted only when the substrate temperatures of the mating surfaces are between 40°F and 95°F. Upon review by NYSDOT, an artificial environment may be provided to maintain the substrate temperature within the permissible limits by creating an enclosure heated by circulating warm air or by radiant heaters. Localized heating shall be avoided and the heat shall be provided in a manner that prevents surface temperatures greater than 95°F during the epoxy hardening period. Direct flame heating of concrete will not be permitted.

F. The alignment and elevations of the cantilevers shall be checked by the Design-Builder and NYSDOT, independently, within one hour of sunrise on each day that segments are to be erected. The measurements made by the Design-Builder and NYSDOT shall agree to within ¼ inch.

G. Any deviation from the theoretical alignments (line, elevation, or cross-slope) shall be corrected by a method proposed by the Design-Builder and reviewed by NYSDOT and the Engineer of Record prior to its implementation. The Design-Builder shall immediately propose corrective actions upon determination that a deviation has or is developing. Review by NYSDOT shall not relieve the Design-Builder from the responsibility for the accuracy and adequacy of the work.

H. The following tolerances shall apply to the erection of superstructure segments:

1. The maximum differential between outside face of adjacent segments in the erected position shall not exceed 3/16 inch.
2. Transversely, the angular deviation from the theoretical slope difference between two successive segment joints shall not exceed 0.001 radians.
3. Longitudinally, the angular deviation from the theoretical slope change between two successive segments shall not exceed 0.003 radians.
4. The difference in roadway elevation at the connection of two adjacent segments measured perpendicular to the deck surface and across closure joints shall be no greater than 1/8 inch. If the Design-Builder fails to meet this tolerance, he shall grind and regroove the deck surface to meet the tolerance. All correction work shall be at the Design-Builder’s expense.

I. Superstructure pier segments shall be placed within 0.25 inch of the theoretical elevation adjusted for long-term deformations. The segment shall be within 0.125 inch of the defined line and station. The survey marks shall indicate a longitudinal slope or cross slope variation of not more than 0.005 ft. in 10 ft.

J. The alignment of the first cantilever segment beyond each closure pour is critical. The Design-Builder shall submit the proposed setup data for the survey rivets of each of the main span bridge segments. The submitted information shall include detailed calculations including proposed correction for minor geometry variations. The closure pours are not intended to be a correction for the source of deviations in behavior from predicted values.

K. Each of these segments shall be surveyed within one hour of sunrise to verify that the approved setup has been obtained prior to placement of concrete in the closure pour.
The survey markers shall indicate that each segment is within the following tolerances.

- **Transverse Slope**: +/-0.005 ft. in 10 ft
- **Longitudinal Slope**: +/-0.003 ft. in 10 ft
- **Twist**: +/-0.002 ft. in 10 ft
- **Line Control**: +/-0.004 ft. in 10 ft

L. Dimensions from segment to segment shall be adjusted so as to compensate for any deviations within a single segment so that the overall dimensions of the completed structure will conform to the dimensions shown on the plans. Deviations exceeding the erection tolerances listed above which are discovered during the match-casting operation shall be corrected at the casting site before the matched-casting are separated.

11.3.3 FORMS

The design and engineering of the forms, as well as their construction shall be the responsibility of the Design-Builder. All exposed surfaces of each element at the structure shall be formed with materials which will produce a similar surface texture, color and appearance for all concrete surfaces. Forms shall be inspected by NYSDOT prior to beginning of casting operations. Worn, damaged, or otherwise unacceptable forms shall be repaired before the casting of any segment begins. Any element cast in forms unacceptable to NYSDOT will be subject to rejection.

Where sections of forms are to be joined, a maximum off set of 1/16 inch for flat surfaces and 1/8 inch for corners and bends will be permitted.

11.3.4 REINFORCEMENT AND PRESTRESSING STRANDS

Reinforcing steel shall be stored and placed in accordance with the provision of the standard specifications and as modified herein.

Reinforcing steel shall be fabricated and placed in accordance with the shop drawings and as required herein. No reinforcing steel shall be cut and removed to permit proper alignment of tendon ducts or other embedded items. Any bar that cannot be fabricated to clear a post-tensioning tendon shall be replaced by additional bars with adequate lap lengths using a method proposed by the Design-Builder and reviewed by NYSDOT. Unless otherwise specified, reinforcement shall be fabricated and placed in accordance with ACI 117, Section 2 – Materials and the NYSDOT Bridge Manual.

As long as the total number of bars specified is maintained, a reasonable tolerance in spacing individual bars is ± 1 inch, except where openings, inserts, embedded items, etc., might require some additional shifting of bars.

Duct shall be rigidly supported at the proper location in the forms by ties to reinforcing steel. Polyethylene duct for longitudinal or transverse post-tensioning in the flanges shall be supported at intervals not to exceed 2 feet. Polyethylene duct in webs for longitudinal post-tensioning shall be tied to stirrups at intervals not the exceed 2 feet.

During concrete placement for precast segments, mandrels shall be used as stiffeners in each duct and shall extend throughout the length of the segment being cast and at least 2 feet into the corresponding duct of the previously cast segment. The mandrels shall be of sufficient
rigidity to maintain the duct geometry within ½ inch tolerance within the top flange, 1 inch in webs, and within 1/8 inch tolerance at the segment joints. Low point grout vents shall be provided for ducts of continuous longitudinal tendons or for ducts of web tendon in areas where freezing weather can be anticipated. Low point vents shall remain open until grouting is started. Ducts which act to change the alignment of tendons shall be marked so that proper positioning is assured prior to casting and can be verified after casting. The Design-Builder shall indicate on the shop drawings his method of marking and position. The Design-Builder shall submit to NYSDOT for review, the method he proposed to use to align ducts passing through cast-in-place concrete into precast units.
SP 12. WIND TUNNEL TESTS

12.1 PRELIMINARY DESIGN SERVICES

During the preliminary design phase, the Design-Builder shall undertake the following wind studies:

A. Meteorological Site Analysis;
B. Initial Design Review;
C. Preliminary Sectional Model Tests; and
D. Cable Vibrations.

12.1.1 METEOROLOGICAL/SITE ANALYSIS

In order to assess the effect of the local terrain on the wind conditions at the site and to determine the appropriate design wind speeds for the bridge, the Design-Builder shall undertake the following:

A. Visit the site to assess the local terrain, impacts on the local wind conditions and to determine if there are any special considerations relating to the site that should be addressed by the test program.
B. Obtain and analyze the historic wind data from relevant meteorological station(s).
C. Collect supplemental wind measurements at the bridge site to be used to establish correlation with data from the meteorological station(s).
D. Carry out an analysis (computer modeling) of the probability and magnitude of hurricane force winds occurring at the site.
E. Combine the topographic data with the wind data (both normal and hurricane winds) to determine the recommended design wind speeds for the construction stages and for the completed bridge.

12.1.2 INITIAL DESIGN REVIEW

As the preliminary design evolves, the Design-Builder shall undertake an initial design review and provide aerodynamic input on how alternative deck cross-sections and tower designs will perform in the wind for the new eastbound structure as well as the new eastbound structure together with the new westbound structure. The requirements for the design development of the new westbound structure are stated in Part 3 Project Requirements Section 1 - General.

The design review shall include recommendations on what deck cross-section shall be tested.

Preliminary Sectional Model Tests

This phase of the study shall include preliminary sectional model tests to examine the vertical and torsional motions of the bridge deck. Three configurations shall be tested, as follows:

A. The deck without railings and barriers representing construction stages;
B. The deck with railings and barriers for the completed bridge; and
C. The deck with railings and barriers and a typical traffic pattern.

The tests shall be conducted in smooth flow conditions representative of those at the bridge site in order to determine the aerodynamic characteristics and any tendency to instability. Smooth
flow tests shall be used to investigate the potential for vortex shedding induced response as well as lower bound estimate of the onset of any aeroelastic instability. Smooth flow tests shall be used to estimate the wind force coefficients on the completed structure as well as the sensitivity to turbulence of any instabilities identified in the smooth flow tests. Critical wind speeds for instability shall be established.

Should the stability and/or response characteristics prove not to be satisfactory, modifications to the aerodynamic cross-sections should be made.

Cable Vibrations

Using the latest available research, the latest available testing, and the latest available analytical techniques, the preliminary wind studies shall include an evaluation for wind-induced cable vibrations caused by coupled wind and rain effects, vortex shedding and wake galloping. The study shall include recommended methods to suppress or mitigate vibrations. Additional requirements for suppressing stay-cable vibrations are outlined in the special provision "Stay Cables Vibration Suppression System".

12.2 FINAL DESIGN SERVICES

During the final design phase, the Design-Builder shall undertake the following wind studies:

A. Static and Dynamic Sectional Model Tests;
B. Buffeting Analysis;
C. Aeroelastic Model Tests - Construction Stages; and
D. Aeroelastic Model Tests - Completed Bridge.

12.2.1 STATIC AND DYNAMIC SECTIONAL MODEL TESTS

Detailed Sectional Model Tests

This phase of the study shall include a comprehensive series of sectional model tests on the final design of the deck. Update the model(s) used in the preliminary tests and conduct detailed sectional model tests to examine the vertical and torsional dynamic motions of the bridge. It is expected that the models will be constructed to a scale of approximately 1:60. A single test series will involve testing as a minimum at 11 angles of inclination, -5 degrees to +5 degrees in 1.0 degrees increments. In the primary test series, the damping shall be set at a conservative value and smooth flow simulated. These parameters shall be referred to as the benchmark conditions. Several test series shall be performed to examine the influence of damping, and the torsional to vertical frequency ratio. Then the effect of turbulence on the stability of the section will be measured.

The test program shall provide as a minimum the following:

A. Test the section for the benchmark conditions for 11 angles of attack;
B. Adjust the benchmark conditions by increasing the damping to the probable maximum value and test for 5 angles of attack;
C. Adjust the benchmark conditions by lowering the frequency ratio and test for 2 angles of attack;
D. For benchmark conditions, introduce turbulence into the wind flow and test for 1 angle of attack; and
E. If unacceptable levels of vortex shedding are found at this point, additional tests to examine refinements to the deck cross-section shall be carried out.

Measurement of Time-Averaged Force Coefficients

After the stability of the section has been confirmed, measurements shall be carried out for the time-averaged vertical and horizontal wind forces and pitching moments on the bridge deck model in order to determine the mean wind load coefficients. The tests shall be conducted in smooth flow wind for 11 angles of inclination, -10 degrees to +10 degrees in 2 degrees increments. Three configurations shall be tested, as follows:

A. The deck without railings and barriers representing construction stages;
B. The deck with railings and barriers for the completed bridge; and
C. The deck with railings and barriers and a typical traffic pattern. Some measurements shall be included in turbulent flow.

Buffeting Analysis

The following tasks shall be undertaken in order to determine the wind loads acting on the bridge deck and towers:

A. Based on buffeting theory and using the static force coefficients determined from the sectional model tests, wind loads acting on the bridge shall be estimated during construction as well as in its completed state. Two construction stages shall be examined. Typically, the stage prior to connecting to the temporary tiedown and the stage prior to closure with the side span shall be evaluated. Effective wind load distributions shall be provided for the design wind speeds for each of the two construction stages, the completed bridge with and without traffic and any other critical conditions that are identified. Approximately the ten lowest modes of vibration shall be considered.
B. Review the design of the towers to assess their susceptibility to unstable aerodynamic behavior and also to provide estimated wind loads.

Aeroelastic Model Study-Construction Stages

In order to investigate the wind loads during construction, the aeroelastic model study shall be performed during the following construction stages:

A. Partially completed bridge deck (Eastbound Bridge);
B. Free-standing tower (Eastbound Bridge);
C. Eastbound Bridge complete, existing bridge demolished.

12.2.1.1.1 Partially Completed Bridge Deck

A. Examine the aeroelastic stability and measure the responses of the bridge during erection at the two most critical construction stages. The critical stages will be selected on the basis of the dynamic analysis, sectional model results and the buffeting analysis described above.
B. An aeroelastic model of the bridge shall be designed and constructed. Typically a scale of 1:200 is used. The model shall be capable of representing two erection stages including any temporary supports or construction equipment that might be used.
C. The pertinent elastic properties of the deck and tower shall be scaled down and incorporated in the structural components (spines) of the model. The correct mass and geometry of the deck and tower shall be represented by segmented sections attached to the spines. The geometric portions of the model shall be constructed of wood, plastic and/or metal, bearing in mind durability, weight and maintenance of model accuracy. Initially, the sources of damping shall be minimized in the model, and if necessary, damping could be later increased to represent full scale. The main cable stiffnesses shall be correctly scaled and the cable ends, cable drag and mass be brought up to the properly scaled values by attaching specially proportioned weights at intervals along their length.

D. The aeroelastic model shall be instrumented with strain gages at the base and deck levels of the tower and accelerometers at the top of the tower. Displacement transducers shall be used to measure the horizontal, vertical and torsional deflections of the deck.

E. The model shall be tested in a properly scaled simulation of the natural turbulent wind, critical wind speeds, vortex shedding and turbulent response shall be measured for the construction stages.

F. Each model configuration shall be tested for a series of wind speeds covering the design range and beyond. The effects of the wind normal to the span and from other directions shall be investigated. Tests shall be carried out to assess the impact of changes in the turbulence levels.

G. The mean, root mean square, and peak vertical and horizontal deflections of the deck shall be measured for each test direction and the corresponding bending and torsional moments of the tower obtained.

H. The meteorological wind data shall be combined with the wind tunnel data to derive the effective design wind load distributions. These effective wind load distributions shall incorporate the effects of the dynamic excitation of the bridges in its various modes of vibration.

12.2.1.1.2 Tests on a Free Standing Tower

One of the tower models constructed for the Construction Stages tests shall be modified and used for these tests by removing the deck.

A. During the tests, the base shears normal and parallel to the span and corresponding moments shall be measured in each leg. In addition, accelerations at the top of the tower shall be measured normal and parallel to the span. The tests shall be done for wind azimuths from 0 degrees through 90 degrees with 0 degrees being normal to the span. The tests shall be carried out on the completed tower as well as on the tower modeled in its most critical interim stage.

B. Supplementary tests shall be carried out in low turbulence flow to check the vortex shedding response.

C. The test data shall be used to derive the recommended wind forces for structural design and to provide predictions of the tower's dynamic response.

Aeroelastic Model Tests - Completed Bridge

In order to confirm the response of the bridge in its completed form, confirm and refine the findings of the sectional model tests and assess three-dimensional and topographic effects, the following tasks shall be undertaken:
A. The test model assembled for the investigation of the construction stages shall be expanded to represent the completed bridge.
B. The force and displacement measurements on tower and deck outlined for the construction stages shall be duplicated with the complete center span modeled.
C. The test program in terms of wind speeds, wind direction and turbulence levels shall be as outlined for the tests on the construction stages. The test program shall account for interference effects associated with surrounding buildings and structures on wind loadings and possible vibration. Interference effects shall be evaluated for each stage of construction as part of the local terrain studies. The test program shall account for the influence of the adjacent existing bridge when the Eastbound Bridge is completed, the absence of the existing bridge when it is demolished, and the adjacent Westbound Bridge after it is constructed.

12.3 COMMUNICATIONS

Interim information shall be made available as the preliminary and final design wind studies evolve. Typically, this would include a summary report following the completion of the following:

A. Meteorological/Site Analysis;
B. Initial Design Review;
C. Preliminary Section Model Tests;
D. Final Static and Dynamic Sectional Model Tests a Buffeting Analysis; and
E. Aeroelastic Model Tests.

Two final reports shall also be prepared, one at the completion of the preliminary design phase wind studies and the other at the completion of the final design phase wind studies. The final reports shall provide a complete review of the studies including modeling principles, test methods, test results, analysis and recommendations.

To assist in describing the wind tunnel tests and their results, a video tape recording the key aspects of the preliminary design and final design tests shall be produced at the completion of the final design phase wind studies. The video shall be edited and be of professional quality to be used in presentations.

The Design-Builder shall maintain a close contact with NYSDOT throughout the course of the wind studies via telephone and email and make provisions for a minimum of five (5) design review meetings as outlined below:

1. Meeting #1; At NYSDOT’s office upon completion of the Initial Design Review to discuss the initial assessments on the deck cross-section and towers and discuss design modifications, if necessary.
2. Meeting #2; At the wind laboratories during the preliminary sectional model tests to review the initial results and discuss design modifications, if necessary.
3. Meeting #3; At the wind laboratories during the final sectional model tests to review the model and its instrumentation and confirm the test program.
4. Meeting #4; At the wind laboratories during the aeroelastic tests to review the model and its instrumentation and confirm the test program.
5. Meeting #5; At NYSDOT’s office to make a presentation of the complete test program and its results.
SP 13. WATER QUALITY MONITORING (TURBIDITY)

13.1 SCOPE

This work shall consist of field sampling, testing and documenting the turbidity levels of Newtown Creek during all in-water work, including discharge activities (if applicable), throughout the duration of the contract.

Due to the presence of contaminants in the sediments of Newtown Creek and the creek’s listing as a Federal Superfund Site, the Design-Builder shall conduct all operations to avoid or minimize disturbances to the creek bottom.

This specification provides a method to verify that the conditions of the New York State Department of Environmental Conservation SPDES Permit, 401 Water Quality Permit, and the requirements of the United States Environmental Protection Agency are met with respect to monitoring for turbidity.

The Design-Builder shall conduct activities in compliance with the State Pollution Discharge Elimination System Permit (SPDES) and the conditions outlined in the 401 Water Quality Certificate. In the event there are conflicts between this specification and the applicable permits, the permit stipulations shall apply. In the event that the permits do not stipulate specific turbidity monitoring action levels, USEPA requirements typically stipulate that the differential turbidity levels, taken upstream and downstream from the source, shall not exceed 28 NTU’s (Nephelometric Turbidity Units).

All costs associated with any delays due to failure to meet the SPDES Permit, 401 Water Quality Certificate conditions or obtain timely and valid analytical results shall be borne by the Design-Builder.

The materials shall be appropriate and sufficient to complete the activities as described herein.

The type of turbidimeter shall be a factory standardized unit with permanent calibration features and it shall be meet the official standards of the USEPA. The Design-Builder shall make a turbidimeter available for use as requested by the Engineer.

13.2 CONSTRUCTION DETAILS

1. In-Stream Turbidity Monitoring

The Design-Builder shall monitor turbidity during all in-water work activities, particularly during pier demolition and construction of cofferdams, caissons, and the temporary barge docking platforms. Upstream and downstream measurements at any dewatering discharge points will also be required.

The frequency of testing shall be in accordance with the permit requirements, but no less than twice per day (once in the am and once in the pm).

Additional tests will be required whenever there is; a significant change in the
Design-Builder’s operations, an observed increase in the turbidity of the creek water, water discharge operations, or AOBE.

Test results will be made available to the Engineer as soon as practicable, but no later than one hour after the test. However, if the turbidity levels exceed the limits set forth, the Engineer shall be notified immediately.

As a component of the Water Quality Monitoring for turbidity, the Design-Builder shall keep a daily log or journal which references the weather conditions, date, time, location and results of the turbidity tests throughout the duration of the contract. The Design-Builder shall make the log available to the Engineer during the term of project and shall provide the original log or journal to the Engineer at the conclusion of the project.

2. Locations For Monitoring Turbidity

Unless specifically stated otherwise in the permits, the Design-Builder will monitor the in-water turbidity with a turbidimeter by sampling within 30 meters upstream and 30 meters downstream from the limits of the in-water work and wastewater discharge points. The Design-Builder shall obtain measurements at a depth of 1 meter from the bottom of the creek. The upstream and downstream tests are considered one sample set (one event).

3. Turbidity Monitoring Action Levels

If the turbidity levels exceed the limits set forth by the SPDES permit, WQC Permit, or USEPA requirements, then all in-water work activities and water discharges (if applicable) shall cease. The Design-Builder shall evaluate the situation and make corrective measures to the satisfaction of the Engineer.
SP 14. HANDLING, TESTING, TREATMENT/TRANSPORT AND DISPOSAL OF CONTAMINATED DEWATERING FLUIDS

14.1 SCOPE

This work shall consist of the handling, sampling and analysis, and onsite treatment and discharge or offsite disposal of potentially contaminated liquids generated by the dewatering of excavations. The Design-Builder shall assume that all groundwater within the project area is contaminated until testing demonstrates otherwise. The Design-Builder shall handle all contaminated liquids in a responsible manner to protect site personnel, the public, and the environment in accordance with all applicable federal, state and local laws and regulations, the applicable permits, and NYSDOT requirements.

The Design-Builder has the option to manage contaminated water by either off-site disposal at a permitted facility, or on-site treatment and discharge to a publically owned sewer or closest surface water body (Newtown Creek). The Department will provide the Design-Builder with an approved NYSDEC SPDES Permit for treatment of dewatering fluids and discharge to Newtown Creek for dewatering operations in Queens. The Design-Builder is responsible for obtaining additional or modified dewatering permits as necessary at no additional cost to the Department.

A NYCDEP Sewer Discharge Permit would be required if the Design-Builder elects to discharge to the public sewer system. Treatment on-site will require a detailed Water Quality Management Plan (WQMP) to insure the discharged effluent meets water quality standards.

The Design-Builder shall supply all equipment, material, labor and all incidentals required to document, handle/pump, store, sample, analyze, and either treat for discharge or dispose of, all contaminated fluids for the duration of the project.

14.2 MATERIALS

Contaminated liquids shall be placed and stored in liquid tight, suitable containers. If offsite disposal is performed, the Design-Builder shall assure that the waste hauler's appropriate choice of vehicles and operating practices shall prevent spillage or leakage of contaminated material from occurring en route. A description of all proposed vehicles will be included in the WQMP.

Regulations

The Design-Builder shall ensure that all operations associated with the handling, sampling, analyzing, loading, transportation, and treatment or offsite disposal of contaminated liquids are in compliance with all applicable Federal, State, and local regulations, including New York State Department of Environmental Conservation (NYSDEC) and the New York City Department of Environmental Protection (NYCDEP) regulations. The applicable regulations may include, but are not limited to the most recent editions of:

1. 6 NYCRR 364 -Waste Transporter Permits.
2. 6 NYCRR Part 703 -Surface Water and Groundwater Quality Standards and
Groundwater Effluent Limitations

3. NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) No. 1.1.1.

4. Water Quality Certification requirements for water discharge as per the NYSDEC SPDES (State Pollutant Discharge Elimination System) Permit.

5. NYCDEP, Bureau of Wastewater Treatment - Limitations for Effluent to Sanitary of Combined Sewers

6. Other local restrictions on transportation, treatment and discharge of waste waters.

7. Posted weight limitations on roads and bridges.

Definitions

1. Contaminated Liquid: liquid generated by dewatering activities within the project limits that exhibits contaminant concentrations in excess of NYSDEC or NYCDEP effluent limitations as stipulated in applicable discharge permits. All dewatered fluids generated by land-based dewatering will be considered contaminated until sample analysis results demonstrate otherwise.

2. Contaminated Liquid Disposal
   a. On-Site Treatment: All liquids handled on-site that will be treated and discharged to the city sewers or surface waters must meet all applicable NYCDEP or NYSDEC Effluent limitations. The existing SPDES Permit to be provided to the Design-Builder for dewatering in Queens contains NYSDEC effluent limitations for discharge to Newtown Creek.
   b. Off-Site Disposal: The liquids generated on this project that are classified as contaminated and cannot be discharged on-site for any reason, must be properly transported and disposed of at a permitted off-site waste disposal facility.

14.3 CONSTRUCTION DETAILS

A. Submissions, Notifications and Permits

1. Water Quality Management Plan

The Design-Builder shall submit copies of a Water Quality Management Plan (WQMP) to the Engineer for review and approval at least 30 days prior to commencing any handling of dewatering fluids. The Design-Builder may not commence this work until the WQMP is approved. The WQMP shall include, at a minimum, the following elements:
a. The Design-Builder’s detailed procedures for safely handling and properly disposing of contaminated water (including wastewater from the decontamination areas) and any other contaminated liquids generated on site. These procedures will be specified in detail.

b. Location and design of the Design-Builder’s on-site staging areas for temporarily holding of contaminated liquids.

c. Identification of the Design-Builder’s proposed waste transporter(s), including a commitment letter(s) from properly licensed and insured hauler/transporter(s). This information shall include:

1. Name and EPA identification number
2. Address
3. Name of responsible contact for the hauler
4. Telephone number for the contact
5. List of types and sizes of all transport vehicles and equipment used.
6. A description of proposed vehicle type, transportation methods and procedures for hauling contaminated water
7. Any and all necessary permit authorizations for transporting contaminated water
8. Previous experience in performing the type of work specified herein.

d. Information on the Design-Builder’s proposed disposal facility for disposal of contaminated water. Information shall include the following items:

1. General Information:
   a. Facility name and EPA identification number.
   b. Facility location.
   c. Name of responsible contact for the facility.
   d. Telephone number for contact.
   e. Unit of measure utilized at facility for costing purposes.

2. A listing of all permits, licenses, letters of approval, and other authorizations to operate, which are currently held and valid for the proposed facility as they pertain to receipt and management of wastewater derived from this Contract.

3. Letters from the intended facilities stating that the Facility has agreed to accept the wastewater is authorized to accept such wastewater under the laws of the State of residence; has the required capacity to treat and dispose of the waste; and will provide or assure the ultimate disposal method indicated on the Waste Manifest.

e. The names, address, and telephone number of the contact for the Design-Builder’s proposed chemical test laboratory. The laboratory must be ELAP certified.
f. The name and experience of the Design-Builder's sampling technician.

g. The Design-Builder's procedure for safely collecting, pumping, handling and storing contaminated water (including wastewater from the decontamination areas) and other contaminated liquids. Safeguards to prevent and/or collect spillage/leakage of contaminated liquids must be addressed.

h. The procedure for monitoring/sampling/analyzing and controlling wastewater discharges to city sewers and/or Newtown Creek as permitted by NYCDEP and NYSDEC.

i. The proposed water treatment equipment and processing method. The Design-Builder shall provide the operating parameters of the system. The allowable loading rates, sequencing, storage volume and discharge method must be identified. The Design-Builder shall certify that the treatment system is sized and designed for the project needs.

j. A quality control /quality assurance plan for water quality sampling, testing, and process control of the on-site treatment. The name and experience of the proposed water treatment operator.

4. NYSDEC Notification

At least 10 days prior to beginning work, provide the Engineer and NYSDEC with the anticipated scheduled dates and work locations for dewatering of excavations.

5. Permits

The Department will provide the Design-Builder with an approved NYSDEC SPDES Permit for treatment of dewatering fluids and discharge to Newtown Creek for dewatering operations in Queens. The Design-Builder is responsible for obtaining additional or modified dewatering permits as necessary at no additional cost to the Department.

B. General

All work performed under this item shall follow the prescribed measures pertaining to working with potentially hazardous materials as specified in OSHA Regulation 1910.

C. Collection, Sampling, Handling and Storage

The Design-Builder shall properly handle/pump, transfer, and store all contaminated liquids produced from project excavation and decontamination activities. The wastewater generated by on-site decontamination activities (equipment and materials) and any other remediation activities shall be captured, collected and transferred for sampling and treatment or disposal.

All contaminated liquids must be transferred to storage containers, tankers, or on-site storage tanks. The Design-Builder shall provide sufficient storage containers to contain
the necessary volume of dewatering fluid generated by daily work activities, until which time the water can be sampled, analyzed and either treated and discharged, or disposed of at an off-site treatment facility. The proposed storage capacity shall be large enough so that daily dewatering operations are not delayed. Storage containers shall be waterproof and may be stationary or mobile. For any on-site storage, label any containers and tanks with the identity of the contents and its generation date. Inspect stored materials at least weekly for any leakage and/or deterioration and immediately implement any needed corrective actions. Tankers shall be watertight and meet EPA waste transporter requirements. All temporary storage tanks erected on-site shall use an impermeable membrane and have sufficient storage and freeboard to contain the anticipated liquid generated during extraction and be protected from the elements by a suitable cover for the duration of storage. The method of transfer shall be detailed in the WQMP.

D. Off-Site Disposal or On-Site Treatment

The Design-Builder shall mitigate/manage the contaminated liquids by either off-site disposal or onsite treatment and discharge as permitted by NYSDEC and/or NYCDEP. The Design-Builder shall specify the method(s) via the WQMP submission. Any changes to the mitigation method(s) shall be approved by the Department Engineer in charge through re-submission of the WQMP. The following requirements shall be met for each method of mitigation:

1. Option A: On-Site Treatment and Discharge

   a. General

   The Department will provide the Design-Builder with an approved NYSDEC SPDES Permit for treatment of dewatering fluids and discharge to Newtown Creek for dewatering operations in Queens. The Design-Builder is responsible for obtaining additional or modified dewatering permits as necessary at no additional cost to the Department. A NYCDEP Sewer Discharge Permit will be required if the Design-Builder elects to discharge to the public sewer system.

   All sediment and spent media generated during the treatment process shall be handled as contaminated material per NYSDOT Standard Item 205.

   The Design-Builder shall be held responsible for any and all actions necessary to remedy situations involving materials/liquids spilled on-site. This cleanup, containment and proper disposal of wastes shall be accomplished at the Design-Builder’s sole cost and expense, and to the satisfaction of the Engineer.

   The Design-Builder shall not combine contaminated materials/liquids from other projects with materials/liquids from this project site.

   b. Treatment

   The Design-Builder shall design and operate a water treatment system of sufficient capacity and proper type to remove contaminates from the captured
project water and achieve applicable discharge permit requirements. The system shall be designed to impound the effluent prior to discharge to Newtown Creek if permitted by NYSDEC or to the city sewer if allowed by NYCDEP. The impounded water shall be tested in accordance with the discharge permit.

c. Testing

The chemical analysis shall be performed by a laboratory certified by the New York State Department of Health Environmental Laboratory Approval Program as technically acceptable. The laboratory selected by the Design-Builder shall be named in the WQMP.

The sampling method and frequency of the effluent water shall be in accordance with applicable permit requirements.

The chemical analysis is required on a priority turn around schedule. The chemical analysis shall be done by a laboratory within 24 hours of receipt of the samples. The laboratory results shall be available to the Engineer as soon as practical. The Engineer shall review and approve prior to discharge the effluent, as applicable.

d. Discharge

The Design-Builder shall comply with all standards, limitations and stipulations of appropriate discharge permits.

2. Option B: Off-Site Disposal

a. Sampling and Testing

The Design-Builder shall sample the waste fluids in the storage containers in accordance with the following procedures and the NYSDEC/NYCDEP regulations. The quality of the sampling program and all data generated shall be the responsibility of the Design-Builder. The Design-Builder shall furnish personnel, equipment, and instruments necessary for the implementation of the sampling program. The Design-Builder must inform the Engineer at least three days in advance of when all sampling activities will take place, so that the Engineer may observe sampling activities or collect Quality Assurance (QA) samples.

All sample containers shall be marked and identified with legible sample labels and shall indicate the project name, sample location and/or container, the sample number, the date and the time of sampling, preservatives utilized and other information that may be useful in determining the character of the sample.

The Design-Builder shall maintain a Chain of Custody log book for all samples. The Design-Builder shall provide the Engineer access to it at all times. He shall submit monthly summaries to the Engineer and the original
book in good condition at the completion of the Work. The following information at a minimum shall be recorded in the log:

a. Sample Identification Number
b. Sample Location
c. Field Observations
d. Any Field Parameters such as pH, Temperature, and Specific Conductivity if measured
e. Sample Type
f. Analyses
g. Date/Time Collection
h. Collector's Name
i. Sample Procedures, Equipment Utilized, and daily calibration data,

All equipment involved in field sampling activities shall be decontaminated prior to sampling, after each sample collection, and before demobilization from the sample area.

The number and frequency of samples to characterize wastewater for offsite disposal shall be based on the requirements of the receiving facility, but shall include at least one representative composite sample from each discrete wastewater point as directed and at the discretion of the Engineer. One quality assurance sample shall be collected by the Design-Builder for every 5 samples. The Engineer reserves the right to collect duplicate samples.

The Design-Builder shall be responsible for transporting the samples to the designated laboratory, within the same day they are taken, under chain of custody documentation, stored with the appropriate preservative, and transferred in the appropriate containers on ice.

3. Analysis

The chemical analysis shall be performed by a laboratory certified by the New York State Department of Health Environmental Laboratory Approval Program as technically acceptable. The laboratory selected by the Design-Builder shall be named in the WQMP.

The chemical analysis is required on a priority around schedule. The chemical analysis shall be done by a laboratory within 24 hours of receipt of the samples. The laboratory results shall be available to the Design-Builder within 48 hours from when the samples were taken.

Testing regiment shall be performed as required by the disposal facility or as required by the discharge permit.

4. Notification of Test Results

The Design-Builder shall provide the laboratory test results to the Engineer, prior to shipment of any liquid waste.
a. **Transport**

The Design-Builder shall only use the transporter(s) identified in the WQMP for the performance of work. Any substitutions and/or additional transporters must have written approval from the Engineer, prior to working. There shall be no additional cost to the NYSDOT for obtaining and submitting other transporters for approval and for use of such substitutions.

The Design-Builder shall be responsible for acquiring any transportation permits, manifests and related items and/or services, required for transporting contaminated material to an approved off-site disposal facility. The project site access, travel routes, clearances, weight restrictions must be investigated by the Design-Builder prior to shipment. The Design-Builder shall coordinate the schedule for truck arrival and waste deliveries to the disposal site as necessary.

The Design-Builder shall organize, prepare and maintain the material shipment record/ manifests and any/all land disposal restriction notifications required by federal regulations, the State of New York and the state where the treatment/disposal facility is located.

The Design-Builder shall arrange for the prompt transport of all liquid waste from the project area. Any collected waste water shall be disposed of within 45 days after liquid is generated.

The Design-Builder shall inspect all vehicles leaving the project site to eliminate contaminated materials adhering to the wheels or undercarriage.

The Design-Builder shall be held responsible for any and all actions necessary to remedy situations involving materials/liquids spilled in transit and of mud and dust tracked off-site. This cleanup, containment and proper disposal of wastes shall be accomplished at the Design-Builder's sole cost and expense.

The Design-Builder shall ensure that tanker trucks are sealed to protect against tampering or alternate usage not compatible to hauling contaminated materials.

The Design-Builder shall not combine contaminated materials/ liquids from other projects with materials/ liquids from this project site. Likewise, materials/ liquids from this project shall not be combined with materials/liquids from other projects, unless specifically permitted by the responsible regulatory agency (ies).

The Design-Builder shall coordinate manifesting, placarding of shipments, and vehicle decontamination. All quantities shall be measured and recorded upon arrival at the disposal facility (ies).

b. **Disposal**
The Design-Builder shall use only the treatment, disposal, and recovery facility (ies) identified in his WQMP for the performance of the work. Substitutions or additions shall not be permitted without prior written approval from the Engineer, and if approved, shall be at no extra cost to the NYSDOT.

The Design-Builder shall be responsible for acceptance of the materials at an approved treatment, disposal, or recovery facility for ensuring that the facility is properly permitted to accept the stated material, and that the facility provides the stated treatment and/or services.

The Engineer reserves the right to contact and visit the disposal facility and regulatory agencies to verify the agreement to accept the stated material and to verify any other information provided. This does not in any way relieve the Design-Builder of his responsibilities under this Contract.

In the event that the identified and approved facility ceases to accept the stated materials or the facility ceases operations, it is the Design-Builder's responsibility to locate an alternate approved and permitted facility (ies) for accepting materials. The Design-Builder is responsible for making the necessary arrangements to utilize the facility (ies), and the alternative facility (ies) must be approved in writing by the Engineer in the same manner and with the same requirements as for the original facility (ies). This shall be done with no extra cost or delay to the NYSDOT.

For wastewater determined by testing to be contaminated, the Design-Builder will be required to submit to the Engineer for review a completed manifest 3 days prior to shipment. The Design-Builder shall obtain manifest forms and complete the shipment manifest records and land disposal restriction forms as required by the appropriate regulatory agencies. The Design-Builder shall provide the signed disposal facility manifest receipt copy and copies of quantities received records to the Engineer within three (3) business days after notification of receipt at the disposal facility. Any manifest discrepancies shall be reported immediately to the Engineer and be resolved by the Design-Builder to the satisfaction of the Engineer. The Engineer shall notify the appropriate environmental agencies, such as NYSDEC, of the manifest problem and the ultimate resolution of the problem.

In accordance with the contract, all materials shall be treated/disposed of within 45 days of extraction/collection.

For contaminated waste waters that do not require a manifest, the Design-Builder must obtain the copies of records from the receiving facility, verifying the quantities received.

**SP 15. CRITICAL PATH METHOD SCHEDULE**

**15.1 DESCRIPTION**

The schedule submitted in accordance with DB Section 108-1.2 shall consist of preparing, maintaining and submitting a Progress Schedule using the Critical Path Method on Primavera P6 software, or newer release, which demonstrates complete fulfillment of all work including...
engineering, construction and administration of the Contract. All work to prepare, and maintain the Progress Schedule shall be performed using the scheduling software application provided by the Department on network servers and accessed through the Internet with Department provided user accounts. The Design-Builder shall regularly revise and update the Progress Schedule, and use it in planning, coordinating, and performing all work. Schedule activities shall accurately depict the entire scope of work to be performed to complete the project including, but not limited to, all work to be performed by the Design-Builder, consultants, subcontractors, fabricators, suppliers, the Department, and others, contributing to the project.

15.2 DEFINITIONS

Activity - A discrete, identifiable task or event that usually has an expected duration, has a definable Start Date and/or Finish Date, and can be used to plan, schedule, and monitor a project.

Activity, Controlling - The first incomplete activity on the critical path.

Activity, Critical - An activity on the critical path.

Actual Start date - At the activity level, the Actual Start date represents the point in time that meaningful work actually started on an activity.

Actual Finish date - At the activity level, the Actual Finish date represents the point in time that work actually ended on an activity (Note: in some applications areas, the activity is considered “finished” when work is “substantially complete.”); at the project level, the Actual Finish date represents the point in time that the Design-Builder completes all work on the project and it is accepted by the Project Manager.

Baseline Progress Schedule @ Award - The Progress Schedule submitted by the Design-Builder and accepted by the Department that shows the plan to complete the construction contract work. The Baseline Progress Schedule @ Award represents the Design-Builder’s plan at the time of contract Award for completing the Project.

Completion Date, Contract - The date specified in the DB Agreement for completion of the project or a revised date resulting from properly executed time extensions.

Completion Date, Scheduled - The date forecasted by the Progress Schedule for the completion of the Project.

Constraint - A schedule restriction imposed on the Start or Finish date(s) of an activity that modifies or overrides an activity’s relationships.

Progress Schedule Delay - An event, action, or other factor that delays the critical path of the Progress Schedule and extends the time needed for completion of the construction project.

Contemporaneous Period Analysis Method – A technique for evaluating schedule delays or time savings. The analysis period for the purpose of these provisions shall be monthly in each regular progress update to the schedule.

Design-Builder Start Work date – The actual date the Design-Builder starts work, which is entered as a Start milestone activity in the schedule. No work, other than that required for the Proposal, may start until after the contract is awarded by the Office of State Comptroller, and the Design-Builder has received a Notice to Proceed.

Critical Path – The critical activities shall be those activities being on the longest path. In a project network diagram, the series of activities which determines the earliest completion of the project.
Critical Path Method (CPM) – A network analysis technique used to predict project duration by analyzing which sequence of activities (which path) has the least amount of scheduling flexibility (the least amount of float). A scheduling technique utilizing activities, durations, and interrelationships/dependencies (logic), such that all activities are interrelated with logic ties from the beginning of the project to the completion of the project.

Data Date – The date entered in the Project Details, in the Dates tab, which is used as the starting point to calculate the schedule. For the Baseline Progress Schedule @ Award submission the Data Date shall be the Notice To Proceed Date; for Weekly Progress Schedule submissions, the Data Date shall be the date up to which the Design-Builder is reporting progress (generally the last work day for the week, and for Weekly Status Reports the Data Date shall be the Saturday of that week). Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."

Deliverable – Any measurable, tangible, verifiable outcome, result, or item that must be produced to complete a project or part of a project. Often used more narrowly in reference to an external deliverable, this is a deliverable that is subject to approval by the Department.

Duration, Original - The original estimated number of work days (not including holidays or other non-working periods) in which the work task associated with the activity is expected to be performed. (The number of calendar days may be different based on the calendar assigned to the activity.) For certain activities such as concrete curing, or others approved by the Project Manager, the calendar shall reflect no non-work days.

Duration, Remaining - The estimated time, expressed in work days (not including holidays or other non-working periods), needed to complete an activity that has started but has not finished.

Early Dates – The earliest date an activity can start or finish based upon logic and durations. Calculated by the software application when scheduling the project.

Enterprise Project Management Database (EPMD) – The P6 database of construction project Progress Schedules.

Final Baseline Progress Schedule @ Award - The original plan against which the Design-Builder’s progress is measured. The Final Baseline Progress Schedule @ Award represents the original plan at the award of the contract, of what is expected to happen. Once the Final Baseline Progress Schedule @ Award is accepted by the Project Manager it is saved and used as a basis to compare against Progress Schedules Updates.

Float Suppression - Utilization of zero free float constraints which allows an activity to start as late as possible by using all its’ available free float. This technique allows activities to appear more critical than if the activity’s total float was based on early dates. Assigning zero free float prevents true sharing of total float between Department and the Design-Builder. Utilization of overly generous activity durations and overly restrictive calendar non-working periods are also considered to cause float suppression.

Float, Free - The amount an activity can slip without delaying the immediate successor activities. Free Float is the property of an activity and not the network path.

Float, Total - The amount of time an activity (or chain of activities) can be delayed from its early start without delaying the contract completion date. Total Float is calculated and reported for each activity in a network, however, Total Float is an attribute of a network path and not associated with any one specific activity along that path.

Fragnet – A subdivision of a project network diagram usually representing some portion of the
Global data – Data classified by Oracle Primavera software as Global, including Project Codes, Global Activity Codes, Global Calendars, Resource Calendars, Global Filters, Resources, Global Reports, User Defined Fields and Unit of Measure.

Initial Baseline Schedule – The CPM schedule submission provided by the Design-Builder as part of their final proposal that reflects the key major elements of their design concept and approach along with the key construction major facility deliverables and sequence of operations.

Key Plans - Key Plans are graphic representations made by the Design-Builder’s project Scheduler on paper copies of the appropriate contract plan sheets that reflect the Design-Builder’s planned breakdown of the project for scheduling purposes to efficiently communicate the Design-Builder’s activity coding scheme to State scheduling staff. The key plans prepared by the Design-Builder shall clearly define the boundaries of the work for each designated Area, the operations contained in various Stages of work, and work in the Work Zone Traffic Control (WZTC) Phases. The alphanumeric codes on the key plans shall match the code values for the activity code "Area", “Stage”, and “WZTC Phase” in the Progress Schedule.

Late Dates – The latest an activity can start or finish without delaying the day of completion.

Letting Date – The date the bids are opened and there is an announcement by the Department of an apparent low bidder.

Longest Path - The sequence of activities through the Progress Schedule network that establishes the Scheduled Completion Date

Look-Ahead Schedule – Commonly a one or two week time segment generated from the accepted Progress Schedule that forecasts the work planned for the one or two week period following the Data Date, and includes any major materials to be delivered and any lane closings or anticipated shifts in WZTC.

Milestone – An activity with zero duration that typically represents a significant event, usually the beginning and end of the project, milestones set forth in the contract proposal, design phases, construction stages, a major work package, or the contract interim time-related clauses.

Narrative Report - A descriptive report submitted with each Progress Schedule.

Open End - The condition that exists when an activity has either no predecessor or no successor, or when an activity’s only predecessor relationship is a finish-to-finish relationship or only successor relationship is a start-to-start relationship.

Predecessor - An activity that is defined by Schedule logic to precede another activity. A predecessor may control the Start Date or Finish Date of its successor.

Progress Schedule – A general Primavera P6 Schedule as defined by this Specification.

Progress Schedule Update – Changes to the Progress Schedule that reflect the status of activities that have commenced or have been completed, including the following items: (a) Actual Start date and or Actual Finish date as appropriate; (b) Remaining Duration for activities commenced and not complete; and (c) Suspend or Resume dates for activities commenced and not complete.

Progress Schedule Revision – Revisions to the Progress Schedule ensure it accurately reflects the current means and methods of how the project is anticipated to progress, including modifications made to any of the following items: (a) changes in logic connections between activities; (b) changes in constraints; (c) changes to activity descriptions; (d) activity additions or...
deletions; (e) changes in activity code assignments; (f) changes in activity production rates; and (g) changes in calendar assignments.

**Project Scheduler** – The person that is responsible for developing and maintaining the Progress Schedule.

**Projects Planned Start Date** – The date entered in the Project Details, in the Dates tab, that reflects the Design-Builder’s planned start of work (based on contract requirements, and reasonable expectation for a Notice to Proceed) at the time of the contract letting.

**Projects Must Finish By Date** – A date constraint entered in the Project Details, in the Dates tab, that reflects the Contract Completion Date set in the Contract Documents or through a formal contract extension of time.

**Recovery Schedule** – A schedule depicting the plan for recovery of significant time lost on the project. This separate CPM schedule submission shall provide the resolution and include appropriate changes in network logic, calendar adjustments, or resource assignments.

**Relationships** - The interdependence among activities. Relationships link an activity to its predecessors and successors. Relationships are defined as:

- **Finish to Start** - The successor activity can start only when the current activity finishes.

- **Finish to Finish** – The finish of the successor activity depends on the finish of the current activity.

- **Start to Start** – The start of the successor activity depends on the start of the current activity.

- **Start to Finish** – The successor activity cannot finish until the current activity starts.

**Scheduling/Leveling Report** – The report generated by the software application when a user “Schedules” the project. It documents the settings used when scheduling the project, along with project statistics, errors/warnings, scheduling/leveling results, exceptions, etc.

**State Business Days** – Monday through Friday, with the exception of State Holidays.

**Substantial Completion** – The point at which the Project, or Section thereof, is complete, such that all items or Work, as described in Contract Document, Part 3 – Project Requirements, have been completed in accordance with the Contract Requirements and Approved by the Department’s Project Manager.

**Successor** - An activity that is defined by Schedule logic to succeed another activity. The Start Date or Finish Date of a successor may be controlled by its predecessor.

**Time Impact Analysis** - A technique to demonstrate the comparison of a time impact of a Progress Schedule revision prior to a change in the Contract work, against the current accepted Progress Schedule. Also known as a “What-If” analysis. A Time Impact Analysis is used to evaluate proposed changes to future work activities in the schedule.

**Weekly Status Report** – The report generated weekly from the updated Progress Schedule in an electronic Adobe Acrobat PDF format that reflects a Data Date for that Progress Schedule Update period. The report shall be formatted to fit ANSI Size D paper (610 mm x 914 mm) (24 inch x 36 inch), listing all work activities from the data date to contract completion, using the NYSDOT Status Report Layout, sorted by Early Start Date, Total Float in increasing order, showing the Activity ID, Activity Description, Original Duration, Remaining Duration, Total Float, Early Start date, Early Finish date, Start date, Finish date and Calendar ID.
Work Breakdown Structure (WBS) - A deliverable-oriented grouping of project elements, which organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of project components or work packages.

Work Package - A deliverable at the lowest level of the work breakdown structure. A work package contains activities.

Work Day - A calendar day scheduled for active prosecution of contract work by the Design-Builder or the Design-Builder’s representative.

15.3 CONSTRUCTION DETAILS

A. Project Scheduler:

The Design-Builder shall designate an individual, entitled the Project Scheduler, who will develop and maintain the progress schedule. The Project Scheduler shall be present at the Prestart Schedule Meeting, prepared to discuss, in detail, the proposed sequence of work and methods of operation, and how that information will be communicated through the Progress Schedule. The Project Scheduler shall attend all meetings, or receive meeting minutes that outline schedule related issues of those meetings, which may affect the CPM schedule, including but not limited to those between the Design-Builder and their consultants, subcontractors and between the Design-Builder and the Department. The Project Scheduler shall be knowledgeable of the status of all aspects of the work throughout the length of the Contract, including but not limited to: original contract work, additional work, new work, and changed conditions of work.

B. Scheduling Software:

The State will provide Primavera P6 software licenses, or newer release, for use by the Design-Builder to develop and maintain their Progress Schedules, and the Project Manager to review the schedules submitted by the Design-Builder. The Design-Builder shall be responsible for entering into a service contract for the duration of this contract with a Third Party Hosting Service, that is authorized by Oracle Primavera to host the Primavera P6 software licenses, to make Primavera P6 available on internet accessible servers for use by the Design-Builder team, and the Department’s design and construction staff. Appropriate Department personnel, Consultants, and Design-Builder’s staff shall have access to these schedules on the Third Party Hosting Service’s Enterprise Project Management Database (EPMD). The Department will provide a configured P6 release 6.2 database to the Third Party Hosting Service to load to their servers. The Department will determine the location to store the project schedule files on the EPMD, and will provide the Design-Builder the naming convention for all progress schedule submissions.

All access rights within the Third Party Hosting Service Primavera P6 database will be created and maintained by the Department. The Department will be the sole entity to establish and modify the EPS structure, the OBS Structure, Project Codes, Global Activity Codes, Global Calendars, User Defined Fields, Cost Accounts, Security Profiles, Admin Categories, and Admin Preferences.

The Design-Builder shall submit Request for Access forms to the Department’s Project Manager for each proposed Primavera user to obtain the User ID’s and Passwords for access to software.
and data on the Third Party Hosting Services network servers. The form can be downloaded from the following web page https://www.nysdot.gov/main/business-center/contractors/construction-division/primavera, or can be provided by the Project Manager. These forms may be submitted any time following the Department's release of the Request For Proposals. The Department will process these requests and should generally provide the User ID’s and Passwords within two weeks of receipt by the Project Manager. Upon approval and authorization by the Project Manager and the Office of Construction, required User ID’s and passwords will be provided to the Design-Builder (for the Project Scheduler plus other persons approved by the project Manager) to obtain secure Internet access to the Primavera software and project schedule data. If the contract is not awarded to this firm, the firm’s access to this project will be removed. Department provided User Ids and Passwords are assigned to specific individuals and shall not be shared with any other users. The Department will provide Design- Builders submitting final proposals access to Primavera P6 on the Department’s network servers for the development of the Initial Baseline Progress Schedule until award of the contract to the successful firm.

The Department will provide the Design-Builder either a Preliminary Schedule or a project schedule template for the Design-Builder’s use in developing their Progress Schedule. The Design-Builder shall develop, update, and revise the Progress Schedules using Primavera P6 software that has been loaded on the Third Party Hosting Services network servers and the Design-Builder shall store all Progress Schedule files on the Third Party Hosting Service network servers. The Department will not “Import” or accept Progress Schedule files from any other computer system, or re-import schedules that have been exported from the Third Party Hosting Service P6 database.

<table>
<thead>
<tr>
<th>TABLE 1 – SCHEDULE FILENAME CONVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Progress Schedules</strong></td>
</tr>
<tr>
<td>Initial Baseline Progress Schedule</td>
</tr>
<tr>
<td>Baseline Progress Schedule @ Award</td>
</tr>
<tr>
<td>Final Baseline Progress Schedule @ Award</td>
</tr>
<tr>
<td>Week #1 Progress Schedule Submission</td>
</tr>
<tr>
<td>Week #2 Progress Schedule Submission</td>
</tr>
<tr>
<td>As-Built Progress Schedule (Last Progress Schedule)</td>
</tr>
<tr>
<td>1st Time Impact Analysis</td>
</tr>
<tr>
<td>1st Recovery Schedule</td>
</tr>
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</table>
The Third Party Hosting Service shall be responsible for assuring the Primavera software and schedule data on their servers will generally be available for the Design-Builder and Department staff use at all times unless system maintenance (i.e. backups, upgrades, etc) is being performed. System maintenance shall generally be conducted over short time periods between the hours of 10 PM – 6AM, Monday - Friday and on weekends. The Third Party Hosting Service shall be responsible for performing regular backup of data contained in the EPMD, and upon approval of the Department shall make every effort to restore the latest historical copy of schedule submissions in the event of any data failure of the EPMD. The Design-Builder shall Export copies of project progress schedules, recovery schedules, TIA schedules, after data modifications have been made as their backup of these submissions. In the event that authorized users cannot access the software from 6AM to 10PM Monday through Friday, the Third Party Hosting Service shall provide written notification to the NYSDOT Project Manager.

Project schedules are developed from the Design-Builder’s knowledge of the project, and the means and methods represented in those schedules are based on the Design-Builder’s understanding of the contract documents, and the Design-Builder’s past experience, which are unique to the Design-Builder. Schedule activity data and logic are therefore the intellectual property of the Design-Builder and will not be made available to other Design-Builders. All other schedule data, and all Enterprise data residing on the network servers, are the sole property of the Department.

**C. Prestart Schedule Meeting:**

The Design-Builder shall contact the Department’s Project Manager but no later than two (2) State Business Days following contract award to schedule a Prestart Schedule Meeting. The purpose of this meeting will be to discuss essential matters pertaining to the satisfactory scheduling of project activities, and to resolve any known questions regarding interpretation of the contract requirements for this work.

The Project Scheduler shall be prepared to discuss the following:

1. The proposed hierarchal Work Breakdown Structure (WBS) for the Progress Schedules.
2. The proposed project calendars.
3. The proposed project activity codes, and various code values for each activity code.
4. Specifics of any contract Time-Related Clauses (A+B Bidding, Incentive/Disincentive, Liquidated Damages, Lane Rental, etc.);
5. The Design-Builder’s schedule methodology to be employed, proposed work sequence and any proposed deviations from the contract plans with respect to Staging or Work Zone Traffic Control phasing.
6. Copies of the Key Plans shall be provided at the meeting.
7. The factors that the Design-Builder determines to control the completion of the project and any milestone activity completion dates contained therein.
8. The Project Scheduler shall provide an outline for the content of the Narrative report for
future Progress Schedule submissions.

9. Schedule submission protocol for Progress Schedule submissions.

The Design-Builder shall submit to the Project Manager for review one week prior to the Schedule Meeting a copy of the Key Plans, a print out of the proposed Work Breakdown Structure, a print out of each of the proposed project Calendars showing the Work days versus non-work days and hours per day, and a list of the Code Values for each Project Activity Code proposed to be used in the schedules.

The Project Manager will be available to answer questions regarding scheduling, including: the availability of Department supplied electronic file(s) containing sample project schedule information, sample progress schedule narratives, Special Notes for CPM Scheduling, and required standard format for CPM Progress Schedules for contract work. The Design-Builder shall schedule meetings as necessary with the Project Manager to discuss schedule development and resolve schedule issues, until the Final Baseline Progress Schedule @ Award is accepted by the Project Manager.

The Design-Builder shall submit their Initial Baseline Progress Schedule that demonstrates how the Project Scheduler’s proposed alphanumeric coding structure and the activity identification system for labeling work activities in the CPM progress schedule will conform to the detailed requirements of this specification. The review and comment by the Project Manager of the sample schedule should assist the Project Scheduler in assuring the first submittal of the Baseline Progress Schedule @ Award will be in general conformance with the requirements of the specification and other contract requirements, and that major rework of the Baseline Progress Schedule @ Award will not be required. This submittal may be made anytime following the contract award. Critical items for this review should include but are not limited to: the proposed WBS for subsequent progress schedules; the proposed project Calendars; project Planned Start date; project Must Finish By date; major milestone activities (i.e. - Award, Notice to Proceed, Design-Builder’s First Day of Design Work, Design-Builder’s First Day of Construction Work, Design-Builder’s Last Day of Design Work, Design-Builder’s Last Day of Construction Work, Substant Completion, contract Completion Date); and between one hundred to two hundred summary activities for the major work deliverables of the contract (i.e. – Design approach span 1, Design main span, design approach span 2, construct approach span 1, construct main span, construct approach span 2, etc) that have assigned Activity Ids, Activity Descriptions, Activity Durations, Predecessors, Successors, and Activity Relationships. These summary activities will be broken down into, or supplemented with, individual work activities for the Baseline Progress Schedule submission. To the extent practicable, the Initial Baseline Progress Schedule should include administrative and procurement activities to be accomplished during the contract; planned submittal, review, and approval dates for key shop drawings, working drawings, fabrication drawings, and Design-Builder supplied plans, procedures, and specifications.

The submission of the Initial Baseline Progress Schedule (from the Design-Builder’s final Proposal) shall be accompanied by a written Narrative that provides details of the Calendar assignments of work days versus non-working days, outlines the sequence of planned operations to complete the project work, and provides the proposed Activity Codes and Code values to be assigned to activities in future submissions of project progress schedules. The Project Manager will review the logic diagram, coding structure, activity identification system, and Narrative; and provide comments for required changes by the Project Scheduler for implementation in the submission of the Baseline Progress Schedule @ Award. The Project
Manager will provide written comments on major deficiencies within five (5) State Business Days of receipt.

The Department shall review Initial Baseline Progress Schedules solely for the purposes of evaluating the prospective Design-Builder’s proposal, their ability to communicate their plan for progressing the contract work, and their knowledge and experience in following the requirements of these contract provisions with respect to CPM schedule format and content.

**D. Progress Schedule:**

1. **General**

   In addition to the attributes of the Progress Schedule provisions as set forth in §108-01, the Design-Builder shall prepare, furnish, and maintain a computer-generated Progress Schedule using the Critical Path Method (CPM) utilizing Primavera scheduling software on the Third Party Hosting Service network servers. The CPM Progress Schedule shall be prepared based on the principles defined by the latest issue of the Construction Planning & Scheduling Manual published by the Associated General Contractors of America, except where superseded by the contract documents such as the CPM Special Notes and these provisions.

   The Design-Builder and the Department shall use the Progress Schedule to manage the work, including but not limited to the activities of the Design-Builder, subconsultants, subcontractors, fabricators, the Department, other involved State agencies and authorities, other entities such as utilities and municipalities, and all other relevant parties.

   No physical field work other than installation of the Engineer’s Field Office, mobilization, field measurements, and survey and stakeout will be permitted to start until the complete Baseline Progress Schedule @ Award has been approved by the Department’s Project Manager.

   The Design-Builder will be the sole entity allowed to physically modify the following data within the progress schedule: activity IDs; activity descriptions; activity durations; relationships between activities; successors and predecessors, actual start and actual finish dates of activities; planned start and planned finish dates of activities; and activity resources (with the exception that activities assigned resources labeled to reflect Department personnel may be changed to reflect specific individuals, or job roles, within the Department).

   The Department may modify certain data associated with the progress schedule to ensure conformance to the Department’s Enterprise Project Management standard schedule format. This means that the Department may: create additional layouts, filters and reports; create and edit additional user defined custom data fields; assign Project Codes; add and assign additional project Activity Codes; add and assign additional Cost Account Codes; add and assign additional Resource Codes; enter data in Notebook tabs; modify calendar ID’s (although not the calendar itself); etc; that do not alter the established activities or schedule logic of the Design-Builder. The Project Manager shall communicate to the Project Scheduler the types and scope of changes planned to be made to the progress schedules prior to the implementation of those changes. The Design-Builder shall not delete or modify any schedule data entered by the Department without prior approval by the Project Manager. The schedule data added by the Department shall be incorporated into future schedule submissions of the Design-Builder.

   The Design-Builder shall develop the Progress Schedule using, to the maximum extent practicable, the Global Activity Codes (DOT GLOBAL) identified in the Department’s Primavera enterprise solution. Any schedule “Layouts”, “Filters” and “Report” formats that the Design-Builder
Builder develops for the various Progress Schedules submissions to the Project Manager shall be saved and made available to all other users of the project schedule with a name that includes the contract D#.

The Department may make copies of the progress schedules to perform what-if type analysis, which may involve any type of modification to those copies of the schedules.

The purpose of the Progress Schedule, and scheduling provisions in the contract, shall be to:

- Ensure that the Design-Builder and the Department have a detailed plan and resources to complete the project in accordance with contract time requirements;
- Provide a means of monitoring the progress of work;
- Aid in communication and coordination of activities among all affected parties;
- Analyze the effect of changed conditions on any milestone dates or on the contract completion date;
- Analyze the effect of change orders for extra work or deductions, and unanticipated delays, on the contract completion date;
- Establish a standard methodology for time adjustment analysis based on the principles of the Critical Path Method of scheduling, to analyze delays and resolve construction disputes concerning time;
- Determine appropriate extensions or reductions of Contract Time.
- Provide a means to verify costs that the Design-Builder is entitled to under the contract terms, following the Payment Breakdown Structure (PBS), through reports generated from the cost and resource loaded schedule that reflect the physical percentage of work that has been completed.

In scheduling and executing the work, the Design-Builder shall:

a) Sequence the work commensurate with the Design-Builder’s abilities, resources and the contract documents. The scheduling of activities is the responsibility of the Design-Builder.

b) Ensure that Progress Schedules prepared by the Project Scheduler for submission to the Department are in compliance with the Contract. The intent should be that Schedule submissions and accompanying Narratives are timely, complete, accurate, and in compliance with the Contract.

c) Communicate all Contract changes, and decisions or actions taken by the Design-Builder and all subconsultants, subcontractors, fabricators, etc, that effect the Progress Schedule to the Project Scheduler in a timely manner to allow appropriate development, maintenance, and update of the Progress Schedule.

d) Include all work contained in the Contract and all work directed in writing by the Project Manager. Work activities directed by the Project Manager to be added to the Contract shall be included in the next Weekly Progress Schedule submission.

e) Assure that Progress Schedule Updates reflect the actual dates that work activities started and completed in the field.
f) Break a schedule activity into multiple activities to reflect a discontinuity in the work if a work activity is suspended in the field and restarted at a later date, and the break between when the work was suspended to when it was resumed is significant compared to the original activity duration.

g) Ensure the Progress Schedule contains all work constraints and Milestones defined in the Contract.

h) Schedule the work using such procedures and staging or phasing as required by the Contract. Work designated as part of separate stages may be performed concurrently with other stages where allowed by the Contract or where approved by the Department.

Failure by the Design-Builder to include any element of work required by the contract in the accepted progress schedule does not relieve the Design-Builder from its responsibility to perform such work.

Should the Design-Builder choose to show activities in the schedule that reflects their plan of work prior to the contract award, the Department does not incur any liability and such work being performed between the bid date and the contract award date shall be considered at risk work.

Errors or omissions on schedules shall not relieve the Design-Builder from finishing all work within the time limit specified for completion of the contract.

If the Design-Builder fails to comply with the provisions of this Special Provision, the Department’s Project Manager may suspend payment for any contract work.

2. Baseline Progress Schedule @ Award

a) The Design-Builder shall ensure the schedule accurately reflects the proposed approach to accomplish the work outlined in the Contract documents and conforms to all requirements of this specification. The complete Baseline Progress Schedule shall show all the planned activities for the design and construction work in the Contract and shall indicate the planned dates for which the work begins and is complete and all lanes opened to traffic. The Baseline Progress Schedule shall also show design activities including, but not limited to, the various stages of design, design checks, design reviews and the submission dates of checked designs. The first submittal of the Baseline Progress Schedule ten days following the Notice To Proceed shall reflect detailed activities for a minimum of the first year of contract work, and for the remaining contract duration activities can be more of a summary level within each WBS node. The second submittal of the Baseline Progress Schedule shall be submitted within 30 days following the Notice To Proceed and shall reflect detailed activities for the entire contract duration.

b) The schedule shall define a complete logical plan that can realistically be accomplished, to execute the work defined in the Contract.

c) The schedule shall comply with the work constraints and milestones defined in the Contract as well as all other contractual terms and conditions. The schedule shall be consistent in all respects with the specific interim Time-Related Contract Provisions, and any order of work requirements of the contract documents. The schedule shall meet all interim milestone dates and shall not extend beyond the contract completion date. This submission shall reflect the Design-Builder’s plan at the time of contract award, and prior to the start of any work. No negative float is allowed in the Baseline Progress Schedule @ Award submission.
d) Detailed Schedule Requirements - As a minimum, the Design-Builder shall address the following in the Baseline Progress Schedule:

i) Defining Project details and defaults – Within the Dates tab, the “Planned Start” shall be the date the Department received all Final Proposals, the “Data Date” shall be the date of Contract Award, the “Must Finish By” date shall be the contract Completion Date. Within the Settings tab, define the Critical Activities as the “Longest Path”. The Project Scheduler role does not have security privileges to change this data in the project Details tab, so requests for changes to this data needs to be forwarded to the CPMSchedulingSection@dot.state.ny.us; include in your request the contract Dnumber and the Project ID.

ii) Sufficient activities shall be included to assure that there is adequate planning for the entire project. The appropriate number of activities will be largely dependent upon the nature, size, and complexity of the project. In addition to all design and site construction activities, network activities shall include: activities necessary to depict the procurement/submittal process including shop drawings and sample submittals; the fabrication and delivery of key and long-lead procurement elements; testing of materials, plants, and equipment; settlement or surcharge periods activities; sampling and testing period activities; cure periods; activities related to temporary structures or systems; activities assigned to subcontractors, fabricators, or suppliers; erection and removal of falsework and shoring; major traffic stage switches; activities assigned to the Department and other involved State agencies and authorities, including final inspection; activities to perform punch list work; and activities assigned to other entities such as utilities, municipalities, County government/agencies, and other adjacent contractors. The schedule shall indicate intended submittal dates, and depict the review and approval periods as defined in the Contract Documents for Department review or review by the Design Builder’s QC/QA Engineers.

The following activities shall be incorporated into the Progress Schedule:

<table>
<thead>
<tr>
<th>Activity ID</th>
<th>Activity Description</th>
<th>Duration (Min)</th>
<th>Follows</th>
<th>Logic Tie</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0001</td>
<td>Final Proposal Due Date</td>
<td>0 - Start Milestone</td>
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<td>Best &amp; Final Offer discussions</td>
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<td>M0004</td>
<td>Proposal Best Value Announced</td>
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<td>0003</td>
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<td>0005</td>
<td>DB Federal Authorization</td>
<td>1 State Business Day</td>
<td>M0004</td>
<td></td>
<td>NYSDOT</td>
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<tr>
<td>0006</td>
<td>Submit Proof of Insurance</td>
<td>1 State Business Day</td>
<td>M0001</td>
<td>SS</td>
<td>Design-Builder</td>
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<tr>
<td>Activity ID</td>
<td>Activity Description</td>
<td>Duration (Min)</td>
<td>Follows</td>
<td>Logic Tie</td>
<td>Responsible Party</td>
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<td>Contract Award Process</td>
<td>30 State Business Days</td>
<td>0003</td>
<td>FS</td>
<td>NYSDOT</td>
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<td>M0025</td>
<td>OSC Contract Award Date</td>
<td>0 - Finish Milestone</td>
<td>0007, 0010</td>
<td>FF</td>
<td>NYS State Comptroller</td>
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<td>M0025, 0006</td>
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<td>FS</td>
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<td>M0030</td>
<td>FS</td>
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<td>0040</td>
<td>Prepare/Submit Safety &amp; Health Plan</td>
<td>Minimum 1 Work Day</td>
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<td>SS</td>
<td>Design-Builder</td>
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<td>0045</td>
<td>Approve Safety &amp; Health Plan</td>
<td>20 State Business Days</td>
<td>00040</td>
<td>FS</td>
<td>NYSDOT</td>
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<td>M0050</td>
<td>Design-Builder’s First Day of Design Work</td>
<td>0 - Start Milestone</td>
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<td>Design-Builder</td>
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<td>0060</td>
<td>Prepare/Submit Baseline Progress Schedule</td>
<td>10 State Business Days</td>
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<td>FS</td>
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<td>Review Baseline Progress</td>
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<td>Accept Baseline Progress</td>
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<td>Others</td>
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<td>Logic Tie</td>
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<td>Design-Builder</td>
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<tr>
<td>09500</td>
<td>Demobilization</td>
<td>10 Work Days</td>
<td>09400</td>
<td>FS</td>
<td>Design-Builder</td>
</tr>
<tr>
<td>M9600</td>
<td>Construction Completion Date</td>
<td>0 - Finish Milestone</td>
<td>09500</td>
<td>FF</td>
<td>Design-Builder</td>
</tr>
<tr>
<td>M9700</td>
<td>Regional Director Recommendation for Final Acceptance</td>
<td>0 - Finish Milestone (20 Day Lag)</td>
<td>M9600</td>
<td>FF</td>
<td>NYSDOT</td>
</tr>
<tr>
<td>M9800</td>
<td>Final Acceptance by the Deputy Chief Engineer Construction</td>
<td>0 - Finish Milestone (5 Day Lag)</td>
<td>M9700</td>
<td>FF</td>
<td>NYSDOT</td>
</tr>
<tr>
<td>M9900</td>
<td>Final Payment</td>
<td>0 - Finish Milestone</td>
<td>M9800</td>
<td>FF</td>
<td>NYSDOT</td>
</tr>
<tr>
<td>M9999</td>
<td>Final Agreement</td>
<td>0 - Finish Milestone</td>
<td>M9900</td>
<td>FF</td>
<td>NYSDOT</td>
</tr>
</tbody>
</table>

Note 1 – Acceptance Date shall not exceed 40 State Business Days from Notice of Award.

The Logic Tie shown shall be used as a relationship to the predecessor activities contained in the column named Follows.

iii) Work Breakdown Structure (WBS) - A multi level hierarchal WBS shall be incorporated. The levels (nodes) shall include, but not be limited to:

Level 1 - is the project level;

Level 2 - shall have four nodes; DESIGN, PRECONSTRUCTION, CONSTRUCTION, and POST CONSTRUCTION;

Level 3 - the node for Design activities shall have sub nodes for each construction deliverable; PRECONSTRUCTION activities shall have at least two sub nodes; SHOP DRAWINGS, and PROCUREMENT/FABRICATION;

- The node for CONSTRUCTION activities shall have sub nodes for each construction Deliverable (shall match the payment breakdown structure);
- The node for POST CONSTRUCTION activities requires no sub nodes.

Level 4 - The nodes for Deliverables of construction activities should include sub nodes for the various elements of work (i.e. substructure can be broken into various components);
iv) **Activity ID** - Include a unique identification number for each activity. Activity ID numbers shall not be changed, or reassigned.

v) **Activity Name** - Clearly and uniquely define each activity name with a description of the work that is readily identifiable to inspection staff and the progress of each activity can be measured. Each Activity shall have a narrative description consisting at a minimum of a verb or work function (i.e. form, pour, excavate, etc), an object (i.e. slab, footing, wall, etc), and a location (i.e. STA, bridge or retaining wall number, street, etc). The work related to each Activity shall be limited to one Area of the contract, one Stage of the contract, one WZTC Phase of the contract, and one Responsible Party of the contract.

vi) **Milestone Type Activities** - Include activities for all contract milestones that define significant contractual events such as Contract Award, Notice to Proceed, Design-Builders First Day of Work, Substantial Completion, Design-Builders Last Day of Work, Contract Completion, and coordination points with outside entities such as utilities, State agencies, Authorities, municipalities, Time-Related Contract Provisions, etc. Other milestones shall include Design 25% Complete, Design 50% Complete, Design 75% Complete, and Design Complete. All milestone activities in the schedule shall be assigned the standard Global calendar named “NYSDOT Milestone/Curing 365 Day / 8 hour”, this calendar should also be assigned to any activities for concrete curing.

- The Contract Award milestone shall have a primary constraint of “Finish On” and the date of Contract signature by the State Comptroller,
- The Contract Completion milestone shall have a primary constraint of “Finish on or before” and the contract Completion Date.
- The Design-Builders Start Work” Start milestone activity, that will eventually reflect the actual date the Design-Builders started work authorized under the contract.

All maintenance type work, such as maintaining temporary concrete barrier or rodent control, shall be reflected in the schedule with Start and Finish milestone type activities and a Level of Effort activity, not task dependant activities.

vii) **Activity Durations** – Define the Original Duration of each activity in units of whole work days, except for activities of less than one day duration which should be shown in units of tenths of a day. Except submittal/procurement activities, durations shall not exceed 15 work days unless approved by the Project Manager. Durations for submittal reviews shall meet the requirements set forth in the contract documents. If requested by the Project Manager, the Design-Builders shall justify the reasonableness of planned activity time durations. Task Dependent activities shall not have zero durations.

viii) **Production Rates** – The Design-Builders shall furnish production rates for each task dependent activity in the schedule, these shall be entered in the Notebook tab of the activity details under the Production Rate notebook topic. If requested by the Department’s Project Manager, the Design-Builders shall furnish other information needed to justify the reasonableness of activity durations.

ix) **Activity Relationships** - Clearly assign predecessors and successors relationships to each activity, and assign appropriate logic ties between activities (Finish to Start, Start to Start, Finish to Finish, etc). Do not have any open ended activities, with the exception of the first activity and last activity in the schedule. An activity may only appear once as a predecessor or successor to another specific activity, but may be
assigned as a predecessor or successor to many different activities. Do not include inappropriate logic ties with Milestone activities (For a finish milestone activity: a predecessor shall only be assigned a Finish to Finish logic tie, a successor shall only be assigned a Finish to Start or Finish to Finish logic tie. For a start milestone: a predecessor shall only be assigned a Finish to Start or Start to Start logic tie, a successor shall only be assigned with a Start to Start logic tie). Lag time may not exceed 10 days. The Design-Builder shall not use negative Lag times.

x) The Design-Builder shall assign the “Contract Award Date” activity as a predecessor to any Review and Approval type activities to be performed by Department staff.

xi) **Activity Constraint Dates** – The Design-Builder shall not have any constrained activities, with the exception of contractual dates, unless the NYSDOT Project Manager accepts such constraints in writing. Milestone activities shall be included for the Contract Award which shall have a primary constraint of “Finish On” and the date of contract signature by the State Comptroller, and for the Contract Completion which shall have a primary constraint of “Finish on or before” and the contract completion date indicated in the contract documents. Only contractual/owner-designated constraints are allowed unless specifically authorized by this specification or the Project Manager.

xii) **Activity Dates** – With the exception of contract Milestone dates, “Actual Start” and “Actual Finish” dates and “Planned Start” and “Planned Finish” dates, activity dates shall be calculated by the project scheduler tool within the Primavera software. No Actual Start or Actual Finish dates shall be entered in the Baseline Progress Schedule @ Award, with the exception of activities that were completed prior to the Contract Award.

xiii) **Calendars** - Use clearly defined calendars that account for expected seasonal weather conditions (including winter shutdown periods) and environmental permit requirements, for the planning and scheduling of activities. Do not incorporate an activity with a description of “Winter Shutdown” that requires constraints. Provide the work days per week, holidays, the number of shifts per day, and the number of hours per shift by using the Calendar modifier in the P6 software. Incorporate any seasonal restrictions to the work within calendars assigned to activities.

- Global calendars used in the progress schedule shall be those established by the Department. There are only two Global Calendars developed and maintained by the Department for use by Design-Builder’s, they are the following:
  - NYSDOT Milestone/Curing 365 Day / 8 hour
  - State Business Days, 5 Day Work Week w/State Holidays, Field Changes desired for these calendars shall be forwarded to CPMSchedulingSection@dot.state.ny.us, and if appropriate these changes will be performed by the Office of Construction system admin staff. This will be accomplished by making a copy of the existing Global calendar, then the new calendar will be renamed and modified as necessary.
- Calendars related to specific resources (i.e., a specific person or piece of equipment) shall be established as Resource Calendars, with the Calendar name clearly identifying the resource.
- All other calendars developed by a Design-Builder shall be established as Project Calendars, with the calendar name including the contract D# and describing the function (i.e., D260000 - Asphalt Calendar, D260000 - Concrete Calendar, D260000 - Landscape Calendar, D260000 - Painting Calendar, D260000 – Design-Builder’s 5 Day/8 Hour Workweek). All work activities of the Design-Builder shall be assigned to Project Calendars.
Activities for shop drawing reviews and other approvals by Department personnel shall be assigned the Department’s standard Global – “State Business Day, 5 Day Work Week w/State Holidays, Field” Calendar that reflects all holidays observed by the State.

The Baseline Progress Schedule can not include a calendar that reflects any workers working more than 8 hours in any one calendar day or more than 5 days in any one week. (§102-10 LABOR AND EMPLOYMENT) Following the contract award the Design-Builder can add additional calendars in their next Weekly Progress Schedule submission based on an approved overtime dispensation.

d) Clearly define significant interaction points between the Design-Builder, the Department, and other entities including but not limited to: Federal, State and local agencies/authorities; and utilities. All activities of the Department, utility companies, adjacent contracts, and other entities that affect progress and influence any contract required dates including durations shall be shown in the schedule. This includes dates related to all Permits or Agreements. The schedule shall give special consideration to sensitive areas such as road closures and parklands and shall indicate any time frames when work is restricted in these sensitive areas as outlined in the permits issued by the regulatory agencies, and provided in the contract documents.

e) Activity Resources - The Design-Builder will generally not be required to assign labor resources in the Resource Dictionary, or assign them to schedule activities. The Design-Builder is required to enter material (pay item) resources in the Resource Dictionary and assign these resources to appropriate activities to enable the schedule to be cost loaded. The Design-Builder is required to enter the major equipment resources to the appropriate activities in the schedule, these shall include pile drivers, large cranes, asphalt paving equipment, and concrete finishing machines.

It shall be the Design-Builder’s responsibility to assure the activity logic in the schedule properly reflects their resource limitations. If the Design-Builder anticipates multiple crews for the same schedule activity, these resources shall be documented in the schedule narrative. As an activity can have only one responsible party, no activity shall involve multiple crews comprised of the Design-Builder and a subcontractor, or multiple subcontractors. The Design-Builder shall complete the Resource loading of the activities for the first year of the contract duration within the Baseline Progress Schedule submission, the resource loading of activities for the second year of contract work shall be submitted no later than 60 calendar days following the Notice To Proceed, all remaining activities shall be resource loaded no later than 90 calendar days following the Notice to Proceed.

f) Activity Costs – The Design-Builder shall enter the appropriate units, costs and cost accounts to material resources assigned to activities in the schedule to enable a report to be generated from the regular Progress Schedule submissions that reflects the amount that the Design-Builder is requesting payment. The report shall be based on the physical percentage of work completed within the reporting period, and must comply with the cost percentages allowed for the PBS deliverables in the Design-Build contract. The Design-Builder may propose and alternate method of cost loading the schedule to the Department Project Manager for consideration.

g) Activity Codes – The Design-Builder shall include a well-defined activity coding structure that allows activities to be sorted and filtered. Activity Codes shall be developed and assigned as needed by the Project Manager to facilitate the use and
analysis of the schedule.

- No Global Activity Codes shall be incorporated in any progress schedule submission to the Project Manager except those established by the Department.
- The Design-Builder shall assign the appropriate activity code values to each activity in the progress schedule for the following Global Activity Codes that are in the Department’s enterprise database:
  1) RESPONSIBLE PARTY (DOT GLOBAL)
  2) STAGE (DOT GLOBAL)
  3) AREA (DOT GLOBAL)
  4) TYPE OF WORK (DOT GLOBAL)
  6) CHANGED (ADDED/DELETED) WORK (DOT GLOBAL)
  7) TIME Related Clauses (DOT GLOBAL)
  8) DELAY (DOT GLOBAL)

- Additional Activity Codes developed for specific projects shall be established as Project Activity Codes. As a minimum this shall include the following:
  1) SUBCONTRACTOR

xviii) **Activity Code Values** – Each Activity Code shall be broken down into various Activity Code Values that are then assigned to activities. For example, the Activity Code “Stage” shall include a hierarchal arrangement of Activity Code Values as shown below in Figure 2:
xix) **Activity Code Assignments** - For each activity, within the activity details the Design-Builder shall assign Activity Code values to identify the “Responsible Party” (i.e. – Design-Builder, NYSDOT, Utility Co, Municipality) for the work to be performed (one and only one responsible party shall be assigned to each activity), the “Stage” of the contract for the work that will be performed, the “Area” where the work is to be performed, the “WZTC Phase”, and the Type of Work (i.e. - Procurement, Paving, Embankment, Excavation, Electrical, Signing, etc). For activities included in work governed by time-related contract provisions, the appropriate “Time Related” activity code shall be utilized. For activities included in work added and/or changed within an Order-On-Contract, the appropriate “Added/Changed Work” code shall be utilized. For all work activities performed by the Design-Builder or subcontractors/fabricators/providers, “Contractor” shall be designated as the Responsible Party. If the Design-Builder wants a separate activity code to enable sorting the activities of subcontractors, fabricators, or suppliers a separate “Subcontractor” code shall be utilized.

xx) **Interim Milestone Dates with Liquidated Damages and Special Time-Related Contract Provisions** (i.e. – A+B Bidding, Incentive/Disincentive provisions, Lane Rental) – Each time-related contract provision in the contract shall be represented in the progress schedule by having a start and finish milestone, with appropriate predecessors and successors assigned to all schedule activities considered part of that time-related contract provision work including the start and finish milestone activities. The Start milestone for the time-related contract work shall have predecessors and/or date constraints assigned that include those defined in the contract documents, and the Finish milestone for the time-related contract work shall have successors and/or date constraints assigned that include those defined in the contract documents. All schedule activities associated with each specific time-
related contract provision shall be assigned to a separate node within the project WBS and the WBS node description shall be labeled accordingly, in addition these activities shall be assigned the appropriate Time-Related Clauses (DOT GLOBAL) activity code value. A Level Of Effort activity shall be used for each time related contract provision (i.e - “Incentive 1 Duration” or “B Clock 1 Duration”), this activity shall have the Start Milestone as a predecessor with a SS relationship and the Finish Milestone as a successor with a FF relationship and the duration of this activity shall be calculated when the project is scheduled.

xxi) Narrative - Include a narrative in Microsoft Word and/or Adobe Acrobat format that describes:
- The Design-Builder’s general approach to construct the work outlined in the baseline schedule. Address the reasons for the sequencing of work and describe any resource limitations, potential conflicts, and other salient items that may affect the schedule and how they may be resolved.
- If not provided in the contract plans, or if modified by the Design-Builder, provide copies of the appropriate contract plan sheets marked up as Key Plans, to correlate values on the contract plans (for Area of Work, Stage of Work, and WZTC Phase) to the Design-Builder’s planned breakdown of the project (i.e- Activity Codes, Activity Descriptions) for scheduling purposes.
- The justification(s) for each activity with a duration exceeding 15 work days.
- The reason for any lags assigned to any activities.
- The justification(s) for Design-Builder imposed activity constraints proposed in the schedule.
- A list of calendars which have been used in the schedule, along with the general reason for their use.
- The project critical path and challenges that may arise associated with the critical path.
- Anticipated coordination issues related to work activities by other entities, that require additional information from or action by the Project Manager.
- Appendix 1 to the narrative shall be the “Schedule Log” report created when the project was scheduled.
- Appendix 2 to the narrative shall be an electronic schedule plot (Adobe Acrobat format) using the Global Layout named “Baseline Schedule submission”, with activities sorted by Start Date in asc ending order, Grouping of activities by WBS, and only the “Longest Path” filter applied. This plot shall provide a clear critical path from the Data Date to the last activity in the schedule.

xxii) List of Submittals – The Design-Builder shall submit with the Progress Schedule a list of all Submittals (i.e. – design plans, project specification, shop drawings, required permits, erection/demolition plans, Heath and Safety Plan, etc.) generated from the Baseline Progress Schedule for review and approval by the Project Manager. The Design-Builder shall use a Filter to limit the schedule activities shown in the report to only the prepare/submit, and review/approve activities related to submittals. The report shall be in Adobe PDF format and transmitted to the Project Manager by email. This list shall be revised and updated weekly with each schedule submission.

xxiii) Project Report – The Design-Builder shall create a custom report consistent with the requirements in the RFP for the Payment Breakdown Structure (PBS) that can be run from P6 that applies a filter to the Progress Schedule to reflect the work
completed within a progress period for which they are seeking contract payment

e) Schedule Submission

i) Within the timeframe indicated in Table 2 column 1, submit one electronic copy of the Baseline Progress Schedule @ Award in a Critical Path Method (CPM) format for the Department Project Manager’s review and acceptance.

Table 2
(in State Business Days)

<table>
<thead>
<tr>
<th>Time frame from receipt of Notice of Award to Submission of Complete Baseline Schedule (Column 1)</th>
<th>Time frame for Project Manager's Review (Column 2)</th>
<th>Time frame from Notice of Award to acceptance by the Project Manager not to exceed (Column 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

ii) The Project Manager will review the schedule and return it, accept it with comments, or reject it within the timeframes indicated in Table 2 column 2, following the date of receipt of the Design-Builder’s submission.

iii) If the schedule is returned with comments, the Design-Builder shall address all comments and revise the schedule as necessary. The Design-Builder shall complete the Final Baseline Progress Schedule @ Award and obtain the acceptance of the Project Manager within the timeframe required in Table 2 column 3.

iv) If the schedule is accepted by the Project Manager without any comments, the Design-Builder shall copy the schedule and rename it for submission as the Final Baseline Progress Schedule @ Award.

v) In no way does the Baseline Progress Schedule modify the contract documents.

vi) The Design-Builder shall assign appropriate Activity Codes and provide custom Layouts, Filters, and/or report formats necessary to allow the Project Manager to generate a report from the each Progress Schedule submission of all submittals required under the contract (i.e., shop drawings, required permits, erection/demolition plans, etc). The list shall show scheduled submission date, review date, and acceptance date for each submittal and identify the earliest activity affected by each of these submittals. This list shall be generated from each Progress Schedule submission until all such activities are completed.

3. Final Baseline Progress Schedule @ Award

a) If the Baseline Progress Schedule @ Award is returned to the Design-Builder with comments, the Design-Builder shall make a copy of the schedule and rename it as the Final Baseline Progress Schedule @ Award with comments addressed and revisions made as necessary. The Design-Builder shall complete the Final Baseline Progress Schedule @ Award and obtain acceptance of the Project Manager within the timeframe required in column 3 of Table 2, or within one week of the Design-Builder’s receipt of the final comments by the Project Manager, whichever is sooner.

b) The Project Manager will review the schedule and return it, accepted or with comments,
within 5 State Business days following the date of receipt of the Design-Builder’s submission.

c) The Final Baseline Progress Schedule @ Award must be “accepted” or “accepted as noted” by the Project Manager prior to the Department evaluating any Design-Builder disputes associated with time impacts. This does not preclude the Design-Builder from submitting a dispute while the schedule is being reviewed for acceptance.

4. Weekly Progress Schedule Submissions.

a) First Weekly Progress Schedule Submission – Within three State Business Days following acceptance of the Final Baseline Progress Schedule @ Award or the closing date for the first month’s contract payment period whichever is later, the Design-Builder shall perform a Progress Schedule Update to reflect the status of all activities where work was performed in the time period between the start of work and acceptance of the Final Baseline Progress Schedule @ Award. This shall include actual dates entered in the Actual Start and Actual Finish columns, and Remaining Duration for activities where work has commenced but is not complete, in addition the Design-Builder shall incorporate any Progress Schedule Revisions that reflect any changes in how future work activities are to be completed.

b) Subsequent Weekly Progress Schedule Submissions - On a weekly basis, the Design-Builder shall submit a copy of the current Progress Schedule that includes all Progress Schedule Revisions and Progress Schedule Updates to reflect the actual and planned prosecution and progress of the contract work. Progress Schedule Updates shall reflect the status of activities that have commenced or have been completed, including the following items: (a) actual dates in activity Actual Start and Actual Finish columns as appropriate; (b) actual Remaining Duration for activities commenced and not complete; and (c) actual activity Suspend or Resume dates for activities commenced and not complete. Progress Schedule Revisions reflect modifications made to activities in the current project baseline schedule in any of the following items: (a) activity Original Duration; (b) changes in logic connections between activities; (c) changes in Constraints; (d) changes to Activity Descriptions; (e) activity additions or deletions; (f) changes in Activity Code assignments; (g) changes in Calendar assignments, (h) Productivity Rates. All "Out of Sequence" activities noted in the scheduling log shall be corrected to reflect the current construction operations.

When preparing a formal submission of the progress schedule, the Design-Builder shall make a copy of the current Progress Schedule and name it according to the file naming convention provided by the Department in Table 1.

c) Additional Schedule Requirements - In addition to the schedule requirements detailed for the submission of the Baseline Progress Schedule @ Award, the following shall be provided by the Design-Builder:

i) Data Date - the “Data Date” shall be the date the Project Scheduler last edits the schedule prior to submission to the Project Manager (generally the last day of the month). The Project Scheduler shall enter the Data Date through the Schedule (F9) tool.

ii) Activity Status Tab -
   a. Durations – the Original Duration shall not be changed without prior written justification by the Design-Builder, and written approval by the Project
Manager. The Design-Builder shall edit the Remaining Duration to reflect progress made on work activities, and shall not use Duration %. If a proposed change to Original Duration is due to additional or changed work to the contract the Design-Builder shall instead add an activity to reflect this additional work, and assign the appropriate Activity Code. The Design-Builder shall not use zero durations for Task Dependant activities.

b. Started and Finished dates – for each activity where work was begun during the month, the Design-Builder shall check the box adjacent to Started and enter the date the work began. For each activity where work was completed during the month, the Design-Builder shall check the box adjacent to Finished and enter the date the work was completed.

c. Suspended work – The first time that work has been suspended on a schedule activity, the Design-Builder shall enter the Suspend and Resume fields within the Project Details under the Status tab. For any subsequent suspensions of work to that activity the Design-Builder shall break that activity into two or more activities to accurately reflect the suspension and resumption of work dates in the field, and to more accurately reflect the relationship to other work activities.

iii) Calendars – To change a project calendar for activities scheduled in the future, the Design-Builder shall copy the calendar and use a revised name that includes a reference to which Weekly Update the change was incorporated (i.e. - D260000 - Concrete Calendar should be revised to D260000 – 2 - Concrete Calendar to reflect the 2nd Weekly Update when the change was made to the calendar). The reason for the change in the calendar shall be documented in the Narrative.

iv) Notebook Tab –
   a. Delays - For any activities on the critical path that are delayed during this monthly reporting period, the Design-Builder shall enter the dates the activity was delayed and the reason for such delay in the Notebook tab of that activity.

b. Production Rates – For any activities where the work to be performed is similar in nature to work already performed on the same project and that the Production Rate for the work to be performed is different than the actual Production Rate for work already performed the Project Manager may require the Design-Builder to adjust the Duration for the work to be performed to reflect the more appropriate Production Rate.

c. Suspended work – The first time that work has been suspended on a schedule activity, the Design-Builder shall enter the Suspend and Resume fields within the Project Details under the Status tab. For any subsequent suspensions of work to that activity the Design-Builder shall break that activity into two or more activities to accurately reflect the suspension and resumption of work dates in the field, and to more accurately reflect the relationship to other work activities.

v) Deleted work – If work has been deleted the corresponding work activities in the schedule shall be deleted. The Design-Builder shall not just zero the activity duration since the calendar assigned to the zero duration activity shall still affect the logic of future work activities.

d) Weekly Progress Schedule Narrative - For each Weekly Progress Schedule submission, the Design-Builder shall submit a narrative in Microsoft Word, or Adobe Acrobat format that includes, but is not limited to: (The narrative may be an annotated copy of the Claim Digger Report that includes the information below.)
   i) The contract D number, project name, project location, and name of Prime Design-Builder.
   ii) Contract Award Date, current contract Completion Date, and scheduled completion of all project work.
   iii) Any contact Interim Milestone dates (I/D, B-Clock, LD, etc), and scheduled Start and Finish dates for those Milestone activities.
   iv) List all activities on the Critical Path (include Activity ID’s and Activity Descriptions) where work was delayed during the one month period prior to the Data Date, and for
each such activity provide detailed information including:

- the events that caused the delay.
- the party(s) responsible for the delay event(s).
- the number of days the activity has been delayed (negative float).
- the activities in the construction schedule affected by the events.
- the reasonable steps needed to minimize the impact of the delay, and which party needs to take the action(s).

v) List any other problems experienced during this Progress Schedule submission period, the party responsible for the problems, and the Design-Builder’s intentions to resolve the problems.

vi) List all activities for procurement of long lead time materials that are behind schedule and the reason(s) why.

vii) For major work items describe the differences between the actual work performed and the work planned for the period as represented in the preceding Progress Schedule submission, including explanations for the deviations.

viii) For all suspended work activities that could otherwise logically be progressed, identify the responsible party prohibiting the progression of the work, as well as the detailed reasons why.

ix) Description of any changes to the critical path since the last Monthly Progress Schedule submission and the impacts of such changes.

x) List of all added or deleted activities included in this Monthly Progress Schedule submission, and the reason(s) for and the impact(s) of such changes.

xi) List all changes in activity Original Durations, the justification for such change(s), and the impact(s) of such changes.

xii) List all changes in relationships between activities included in this Progress Schedule submission, and the reason(s) for and the impact(s) of such changes.

xiii) List any addition or deletion of activity or project constraints, and the reason(s) for and the impact(s) of such changes.

xiv) List all changes to the project calendars, and the reason(s) for and the impact(s) of such changes.

xv) The major work elements, as defined in the WBS, to be accomplished during the next monthly work period.

xvi) Any potential problems that are anticipated for the next monthly work period and the proposed solutions to such problems. Identify potential problems or risks that either the Department or Design-Builder may be potentially responsible for. Explain what action the responsible party (i.e. - Department or Design-Builder) needs to take and the date by which time the action needs to taken to avoid the problem.

xvii) Any planned acceleration of activities that the Design-Builder anticipates to undertake within the next monthly work period that either the Department directed, or that the Design-Builder believes is necessary.

xviii) The following appendix in Adobe Acrobat PDF file format, formatted to fit ANSI Size E paper (34 inch x 44 inch) (863 mm x 1117 mm) paper, printed with Landscape orientation, shall be included with the narrative as a separate file.

- APPENDIX 1 – A listing of all work activities as of the data date, using the NYSDOT Appendix 1 activity layout, sorted by Finish date, Total Float in increasing order, showing the Activity ID, Activity Name, Original Duration, Remaining Duration, Actual Duration, Total Float, Early Start date, Start date, Finish date, Late Finish date, and Calendar ID. The grouping of activities shall be by WBS. The Gantt Chart shall clearly indicate all activities in the schedule. Graphical representations shall be shown at a suitable scale to be legible and
readable.

xx) The following appendix in Adobe Acrobat PDF file format, formatted to fit ANSI Size B (Ledger) paper (11 inch x 17 inch) (279 mm x 431 mm) paper, printed with Landscape orientation, shall be included with the narrative as separate files.

- APPENDIX 2 – A listing of all work activities as of the data date, using the NYSDOT Appendix 1 activity layout, sorted by Finish date, Total Float in increasing order, showing the Activity ID, Activity Name, Original Duration, Total Float, Start date, Finish date. There shall be no Grouping of activities, and the global Filter for Longest Path shall be applied. The Gantt Chart shall clearly indicate the project critical (longest) path, with logic lines. Graphical representations shall be shown at a suitable scale to be legible and readable.

xxi) The following appendix in Adobe Acrobat PDF file format, formatted to fit standard ANSI A (Letter) size paper (8.5 inch x 12 inch) (215 mm x 279 mm) paper, printed with portrait orientation, shall be included with the narrative as a separate file.

- APPENDIX 3 – A complete Scheduling/Leveling Report file generated by the Department’s Primavera scheduling software application which includes the Schedule Settings, Statistics, Errors, Warnings, Scheduling/Leveling Results, Exceptions, Activities with unsatisfied constraints, Activities with unsatisfied relationships, and Activities with external dates. The statistics shall include, # of Activities, # of Activities Not Started, # of Activities In Progress, # of Activities Completed, # of Activity Relationships, and # of Activities with Constraints. Total number of activities on the critical path, percent complete, activities without predecessors, activities without successors, and activities out of sequence.

e) For any contract time extension requests the Design-Builder shall include: a Time Impact Analysis (TIA) for any changes to the schedule for future work for such issues as Added Work, VECP, or Changed Conditions; and a Delay Analysis that documents all delays from the Contract Award to the current date that is based on critical path delays that occurred when comparing subsequent Monthly Progress Schedule submissions and the supporting delay documentation in the Monthly Schedule Narratives.

f) Schedule Submission - The Design-Builder shall submit the Weekly Progress Schedule to the Project Manager at the end of each week. The schedule submission to the Project Manager shall be made within three (3) State Business Days of the Data Date (last day of the week), whether or not the Project Manager has accepted the previous Weekly Progress Schedule submission. Schedule submittals will only be considered complete when all documents and data have been provided.

Immediately prior to submitting the schedule the Project Scheduler shall “Schedule” the project, when scheduling the project the Scheduling Options shown in Figure 3 shall be used unless approval to vary from these settings is given by the Project Manager. The Project Scheduler shall use the same Scheduling Options for all Progress Schedule submittals for the duration of the contract, unless directed otherwise by the Project Manager.
g) Schedule Submission Method - The Design-Builder shall submit the schedule to the Project Manager electronically for review and acceptance. The filename shall conform to the requirements of Table 1. The Project Scheduler can change the Project ID and Name through the WBS at the top node, as they do not have privileges to edit data through the Project Details tab. The Design-Builder’s submission shall be documented by an E-mail to the Project Manager, with a copy to CPMSchedulingSection@dot.state.ny.us and all appropriate project participants, that the project schedule on the network is ready for review. The Design-Builder’s E-mail to the Project Manager shall also consist of the following:

i) The subject of the E-mail shall include the Region #, contract D number, the Project Name, the Progress Schedule’s Project ID, and Design-Builder company name. (i.e. – Region 8, D260000, Rehabilitation of Main Street viaduct, D260000-1UD2, ABC Contractors)

ii) The E-mail message shall include the name of the Project Manager, the current anticipated Finish date of the last activity in the project schedule, a statement as to how that date compares to the current Contract Completion Date, and the name of the Department’s Area Construction Supervisor.

iii) Electronic files of all Narrative Reports and required attachments associated with the schedule shall be submitted by the Design-Builder in Adobe Acrobat format.
5. **As-Built Progress Schedule.** The Design-Builder shall submit the As-Built Progress Schedule with Actual Start and Actual Finish dates for all activities, within ten (10) State Business Days following final acceptance of work by the Regional Director.

6. **Look-Ahead Schedule.**

Except during winter shutdown periods the Design-Builder shall prepare a Look-ahead Schedule as either a plotted report from the current progress schedule, or as a narrative report, and provide it to the Project Manager on a weekly basis, or if approved by the Project Manager on a mutually agreed upon interval. The Look-ahead schedule shall include work activities planned for the next one or two week period, as determined by the Project Manager, and shall include, but is not limited to: anticipated lane closures, road closures and detours, environmental issues, and utility issues. The Project Manager will provide the Project Scheduler with guidelines for determining the begin dates and end dates for the one or two week reporting periods, along with the how the plotted schedule report or narrative report shall be formatted.

The Department generally uses this Look-ahead schedule to facilitate communication with other Federal or State agencies, local municipalities, utility companies, railroads, emergency service providers, public news media and other affected parties.

E. **Progress Schedule Review and Analysis:**

1. **Immediate Rejection of Progress Schedule Submissions.**

The following deficiencies in a Design-Builder’s progress schedule submission shall be grounds for the immediate rejection by the Project Manager, without further review, analysis and/or comments.

   a) Failure of the Project Scheduler to “schedule” the project, as of the data date.

   b) Failure to attach a copy of the complete Scheduling/Leveling Report (SCHEDLOG.TXT file generated by Primavera software application).

   c) Any activities without predecessors, or activities without successors, appearing in the Scheduling/Leveling Report with the exception of the first and last activity in the schedule.

   d) Any activity constraints appearing in the Scheduling/Leveling Report that have not been approved in writing by the EICDepartment, or that are not specifically allowed by this specification.

   e) Any Activities with Actual Dates > Data Date appearing in the Scheduling/Leveling Report.

   f) Any Milestone Activities with invalid relationships appearing in the Scheduling/Leveling Report.

   g) Failure to have a clearly defined Critical Path from the Data date to the last activity in
the schedule, using the Longest Path method. This would reflect logic errors in the project schedule.

h) Failure to attach the schedule Narrative and required appendices.

i) Failure to correct any “Out-Of-Sequence” activities.

If any of these deficiencies are found, the Design-Builder’s submission shall be considered deficient, and Project Manager will notify the Design-Builder immediately by return E-mail of the rejection of the schedule submittal.

2. Schedule Analysis Method.

Events, actions, and progress that cause delays or gains to the Progress Schedule will be analyzed solely by the "Contemporaneous Period Analysis" method.

3. Project Progress Meetings.

One topic of the regular weekly progress meetings held by the Project Manager and attended by the Design-Builder shall be a review of the Weekly Status Report generated from the Progress Schedule. The Design-Builder shall be represented by their design, construction and Project Scheduler personnel. The Project Scheduler shall bring a copy of the printed plot of the current Weekly Status Report to the progress meeting, the report shall show the current anticipated schedule for all remaining work with the critical path activities highlighted.

a) The review of the Status Report serves as the forum to discuss project progress and delays, suggested remedies, necessary Progress Schedule revisions, coordination requirements, change orders, potential Design-Builder time extension requests, and other relevant issues. If contract work is falling behind the Progress Schedule, the responsible party (i.e.- Design-Builder or Department) shall be ready to discuss what measures it will take in the next thirty (30) days to put the work back on schedule so as to meet the contract Completion Date specified in the contract.

b) Items of discussion will include, but are not limited to: project progress; schedule progress; near term and long-term schedule issues, including RFIs, Shop Drawing submittals, permit work, utility relocations, mitigation work; project issues and risks; proposed solutions; and any relevant technical issues that are schedule related.

c) At the meeting the Project Scheduler shall compile an action item list that describes who is responsible for existing or pending issues and the date by which the issue needs to be resolved to avoid delays. The Design-Builder shall forward a copy of the action item list to the Project Manager within 2 business days following the meeting.

4. Department Review and Acceptance of Progress Schedules.

The Project Manager will review the Weekly Progress Schedule submissions and will prepare a written response (Progress Schedule Review Report) to the Design-Builder’s submission within five (5) State Business Days following receipt of the Design-Builder’s complete schedule submission. The Project Manager will either “accept” the schedule, “accept as noted”, or “reject” the schedule for re-submittal by the Design-Builder.

If the Progress Schedule submission is not in compliance with contract requirements, the
Project Manager may reject the submittal and shall forward any comments and requests for schedule revisions to the Project Scheduler with a copy to the Design-Builder. The Project Scheduler shall address all comments in writing and/or make the requested revisions, and resubmit the revised schedule within three (3) State Business days of the Project Manager’s reply. If the Project Manager determines the revised submission still does not meet the contract requirements, any further revisions required thereafter shall also be submitted for acceptance within (3) business days of the request for revisions by the Project Manager.

For schedules that are “accepted as noted” the Project Manager shall forward any comments, or requests for revisions, to the Design-Builder. The Project Scheduler shall address all comments in writing and/or make the requested revisions as part of the next scheduled Progress Schedule submission.

The Project Scheduler shall make adjustments to the Progress Schedule in accordance with the Project Manager’s comments and resubmit copies for review consistent with the requirements of this section.

The Project Manager, by accepting the progress Schedule, does not agree that the Progress Schedule is reasonable or that by following the Progress Schedule the Design-Builder can complete the work in a timely manner. If, after a Progress Schedule has been accepted by the Project Manager, either the Design-Builder or the Project Manager discover that any aspect of the Schedule is on error, or something significant has been omitted, the Design-Builder shall correct the Progress Schedule in the next Progress Schedule submission and describe this revision in the Narrative report.

Acceptance of progress schedules by the Project Manager shall not be construed to imply approval of any particular construction methods or sequence of construction or to relieve the Design-Builder from its responsibility to provide sufficient materials, equipment and labor to guarantee the completion of the contract in accordance with the contract documents.

Acceptance of the progress schedule by the Project Manager does not attest to the validity of assumptions, activities, relationships, sequences, resource allocations, or any other aspect of the progress schedule. Within the contractual constraints, the Design-Builder is solely responsible for the planning and execution of the work.

Acceptance of the progress schedule by the Project Manager shall not be construed to modify or amend the contract agreement or the date of completion therein. Completion dates can only be modified or amended by standard contractual means, through an official HC-250b Request For Extension of Completion Date.

If any resources are included in the Progress Schedule, it is not intended that the Project Manager, by accepting the schedule should use the Design-Builder’s resource data for anything other than determining the reasonableness of achieving the Design-Builder’s production rates. Resources included with the accepted CPM schedule shall not be misconstrued as a cost benchmark for the performance of planned or actual work.

Once the progress schedule has been accepted, the Design-Builder shall not deviate from it without first notifying the Project Manager in writing.

Upon receipt from the Design-Builder of the corrected schedule, a new review period by the
Project Manager of five (5) State Business days will begin.

F. Changes to Progress Schedule due to Added/Deleted/Changed Work:

1. Changes to the contract. In the event a notice of a change to the contract is received, the appropriate changes to the progress schedule shall be made, as necessary, to incorporate the anticipated added/deleted/changed work and the Design-Builder shall notify the Project Manager in writing within 10 (ten) calendar days if there is any effect of such change to the schedule. The reasons for these revisions must be succinct, comprehensive, and factual to merit consideration. Change to the contract includes, but is not limited to, extra work, Agreed Prices, Orders on Contracts, Suspensions of Work Directed by the Project Manager, Changed Condition, and Value Engineering Change Proposals. Added, deleted and/or extra work associated with Orders On Contract shall be reflected in the next Monthly Progress Schedule Submission in anticipation of and prior to the date in which the work physically takes place without regard to the dates when the actual Order On Contract was approved. The effect of the change to the contract on the projects Critical Path shall be stated. Extra work or additional work that does not affect the controlling operation on the critical path will not be considered as the basis for a time extension. All schedule activities effected by added, deleted or changed work that is included in a signed Order-On-Contract, Field Change Order, or Authorization of Extra Work (with the exception of minor quantity changes that do not impact contract milestones), or work activities performed by the Design-Builder at risk in anticipation of such Department approval, shall be assigned the appropriate Activity Code (Added/Changed Work) and Code Value (sequentially numbered) to denote which “Changed Contract Work” order number correlates to those activities of work.

2. Time Impact Analysis.

For each request of an adjustment of contract time due to an anticipated change to future work in the Progress Schedule, when the Design-Builder or Project Manager consider that an anticipated or approved change to the contract may impact the critical path and contract progress by more than a calendar month, the Design-Builder shall submit a Time Impact Analysis (TIA). The TIA shall be submitted as part of any Order on Contract (Change Order) and/or VECP if the critical path changes by more than a calendar month.

The TIA shall be based on a revised Progress Schedule and shall be submitted as an electronic file (using Microsoft Word for the narrative) containing:

a) The TIA shall illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate.

b) The analysis shall use the accepted Monthly Progress Schedule that has a data date closest to and prior to the event as the “Current Baseline”, this shall then be compared against the “What-if Project Plan Baseline” for the purpose of the TIA.

c) If the Project Manager determines that the accepted schedule used does not appropriately represent the conditions prior to the event, the accepted schedule shall be updated to the day before the event being analyzed.

d) The TIA shall include an impacted schedule (“What-if Project Plan Baseline”) developed from incorporating the actual or anticipated event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing
activities.

e) If the impact schedule shows that incorporating the event negatively modifies the critical path and scheduled completion date of the accepted schedule, and the Project Manager accepts the impacted schedule, the difference between scheduled completion dates of the two schedules shall be equal to the proposed adjustment of contract time.

f) The Project Manager may construct and utilize an appropriate project schedule or use another recognized method to determine adjustments in contract time until the Design-Builder provides the TIA.

g) The Design-Builder shall submit a TIA within fifteen (15) State Business Days of receiving a written request for a TIA from the Project Manager.

h) The Design-Builder shall allow the Project Manager ten (10) State Business Days after receipt to accept or reject the submitted TIA. All accepted TIA schedule changes shall be included in the next Monthly Progress Schedule submission.

i) If a TIA submitted by the Design-Builder is rejected by the Project Manager, the Design-Builder shall meet with the Project Manager to discuss and resolve issues related to the TIA. If agreement is not reached, the Design-Builder will give notice in conformance with §104-06 Notice & Recordkeeping, and submit in accordance within the provisions in §105-14.E “Required Content of Dispute Submissions”.

j) The Design-Builder shall only show actual as-built work, not unapproved changes related to the TIA, in subsequent Monthly Progress Schedules submissions. If agreement is reached at a later date, approved TIA schedule changes shall be included in the next Monthly Progress Schedule submission.

k) Request for a contract time extension will not be processed until the receipt and approval of a Time Impact Analysis.

G. Failure to Submit Progress Schedules and/or Recovery Schedules:

l) If the Design-Builder fails to comply with the provisions of this Special Provision, the Department’s Project Manager may suspend payment for any contract work.

1) If the Design-Builder’s Progress Schedule submission is rejected due to any deficiency noted in paragraph E.1(a) through (i), it shall be considered an incomplete submission and therefore substantially deficient.

2) If the Design-Builder’s revised Progress Schedule submission does not address the written comments provided by the Project Manager, and does not include a written explanation with a reasonable rational for not addressing those comments, the submission shall be considered deficient.

H. Recovery Schedule

1) If the latest completion time for any work on the current Progress Schedule results in an activity being delayed ten percent or more of the time beyond the required Contract
duration or any specified Milestone duration, as adjusted if appropriate, the Project Manager may require the Design-Builder to submit a Recovery Schedule and written description of the plan to recover all lost time and maintain the required Completion Date or specified Interim Milestone Date(s).

2) With the Recovery Schedule the Design-Builder shall include revised calendars, activity Production Rates, and/or revised activity logic along with a narrative that identifies how time will be recovered.

The submission may be supplemented with a request for a Contract Time Extension. The Design-Builder shall provide a reasonable plan for accomplishing the work of the contract within the current completion date, or to the requested contract extension date. The Project Manager will use the Recovery Schedule to evaluate time extensions, with or without charges.

J. Float

During the course of contract execution, Total Float generated due to the efficiencies of either party (State or Design-Builder) will be considered project Float that is not for the sole use of the party generating the float; rather it is a shared commodity to be reasonably used by either party. Any party assigned activity responsibility within the schedule has the full use of the project Float until it is depleted.

Design shall be considered complete when all Design related documents been completed and accepted by the Department including all calculations, specifications, records of design quality control reviews and procedures, any substandard features as a result of the design, and resolution of any non-conformance reports.

1. SP108A-3 PROGRESS CHECK POINTS AND PAYMENT
2. Specified Progress Schedule submissions shall be considered Progress Check Points.

The cost of preparing, revising and updating the CPM Progress Schedule and meeting all other requirements of this specification (including costs of the Third Party Hosting Service) shall be included in the project costs.
SP 16. MATERIALS APPROVAL PROCEDURES FOR DESIGN-BUILD PROJECTS

All Materials used in the Design-Build work shall meet the quality requirements described in the Contract Documents. The use of Standard Specifications and Approved List (AL) materials are expected for commonly available products for incorporation into the Work. Additionally, existing NYSDOT Special Specifications that include material requirements may also be used in the Work.

If the Design-Builder deviates from Contract Documents, Standard Specifications, or existing Special Specifications, the Design-Builder shall develop Design Plans, Project Specifications and Work Plans that define materials and procedures to complete the Work. The Design-Builder shall progress acceptance of materials and sources, proving durability through tests and evaluations as appropriate, prior to use in the Work. The Design-Builder shall document the sources of supply and kinds of materials that will be used in the work as soon as they are known.

As part of the Design requirements of DB Section 111, the Department will review and accept materials proposed for use as follows:

Products that are not presently on the AL but claim to meet specification requirements shall be evaluated by the Department prior to use. The Department will perform the necessary testing according to the existing material requirements for the products as defined in Section 700 of the NYSDOT Standard Specifications or any Special Specification requirements. A request for inclusion on the AL shall be made by the manufacturer / supplier. The required submittal information for AL consideration can be found at:

https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau/approved-list-submission

When products are proposed for which NYSDOT does not have Standard or Special Specifications, or where proven materials may be used in non-traditional applications, materials evaluations will be progressed based on review of technical details, performance histories, and/or physical testing. The Design-Builder will provide this information to prove the expected performance and durability of these unique materials before they can be used in the Work. Submissions shall include:

General Information

- Product Name
- General Description
- Purpose/Justification
- Manufacturer
- Supplier

Technical Details (Specifications)

- Materials (Include composition and MSDS sheets)
Construction Details
- Testing, Inspection and Acceptance (identify standards like AASHTO or ASTM)
- Maintenance requirements and frequencies that may apply for the intended application

Performance History
- Test Results (including test methods for durability, strength, appearance, etc)
- Previous Uses (describing who, where, when, documented performance)

The evaluation of materials will depend on the uniqueness of the proposed materials, critical nature of the application, and detailed information provided. Evaluations will consist of the following:

- Materials deemed less critical will likely be accepted based on literature review only. Use of these materials can begin at any time.

- Materials deemed more critical will require both literature review and physical testing by the Department. Physical testing will commence only after literature review determines the material has a likely chance of meeting all performance criteria defined in the Design-Builder’s Special Specifications. Conditional acceptance will be made upon completion of the literature review that will allow use of these materials prior to completion of physical testing. However, failure of materials during physical testing will result in a NCR for any materials incorporated into the Work.

The Design-Builder shall consider the uniqueness of the proposed materials, critical nature of the application, and detail of information provided for an evaluation. Additionally, The Design-Builder shall consider the duration of the evaluation required to reasonably progress all sampling, transportation, preparation, testing, and evaluation of results as defined in the material requirements for an item. The Department will, when possible, perform AASHTO and/or ASTM tests of the materials for acceptance purposes. When the Department does not have the capabilities to evaluate materials, testing labs may be hired for testing as needed.

Use of any materials prior to acceptance by the Department shall be at the Design-Builder’s risk. After acceptance, materials shall conform to specification requirements and subject to all QC/QA actions and Department verification.

Once in Construction, the Design-Builder is responsible for QC/QA of all materials while the Department is responsible to verify the quality of all materials. The Department will progress sampling and testing for verification of materials according the established Quality Control Plan developed for the project.

SP 17. BEARING TESTING REQUIREMENTS

17.1 DISC-DESIGN STRUCTURAL BRIDGE BEARINGS (716-06)

The inspection, sampling and testing of disc-design structural bridge bearings follows the procedures outlined in Materials Procedure 84-2 (Quality Assurance Inspection for 716.06.01, Disc-Design Structural Bridge Bearings 716.07.01 Pot-Design Structural Bridge Bearings) [to be referred to as MP84-2], and are performed on a lot by lot basis. The requirements for these bearings are listed in the NYS DOT Standard Specifications, Construction and Materials,
Polyether Urethane Structural Element: The physical properties of the polyether urethane shall conform to the requirements ASTM D2240, ASTM D412 and ASTM D395 as listed in Table 716-06-1 (see NYS Spec Book / 716-06).

Steel Plates: Conform to the requirements of the steel designated on the Contract Plans and applicable provisions of the NYS Steel Construction Manual (see Spec Book / 716-06).

Stainless Steel: Stainless steel shall conform to the requirements of ASTM A167 or ASTM A240, Type 304. Refer to NYS Spec Book (716-06).

Polytetrafluoroethylene (PTFE) Sheet and Strip: Finished PTFE sheet and strip shall conform to the physical requirements of ASTM D638M and ASTM D792 as listed in Table 716-06-2 (see NYS Spec Book / 716-06).

Welding Procedure: All welding shall conform to, and all welders shall be qualified in accordance with the requirements of the NYS Steel Construction Manual.

Compression Strain: Requirements and test conditions are outlined in the NYS Spec Book (716-06).

Sliding Coefficient of Friction: For all guided and non-guided expansion type disc-design bearings, the bearing manufacturer will test one production bearing per lot (see NYS Spec Book / 716-06).

Rotation Test: The bearing manufacturer will test one production bearing per lot. Evaluation criteria are listed in the NYS Spec Book (716-06).
17.2 POT-DESIGN STRUCTURAL BRIDGE BEARINGS (716-07)

The inspection, sampling and testing of pot-design structural bridge bearings follows the procedures outlined in Materials Procedure 84-2 (Quality Assurance Inspection Procedure for 716.06.01 Disc-Design Structural Bridge Bearings 716.07.01 Pot-Design Structural Bridge Bearings) [to be referred to as MP84-2], and are performed on a lot by lot basis. The requirements for these bearings are listed in the NYS DOT Standard Specifications, Construction and Materials, English Units, Office of Engineering, May 1, 2008, as amended, (to be referred to as NYS Spec Book).

**Elastomeric Rotational Element:** The tensile properties of the neoprene and natural rubber elements shall conform to ASTM D412, ASTM D573 and ASTM D2240. These neoprene and natural rubber elements shall also conform to ASTM and AASHTO requirements as listed in Table 716-07-1 (NYS Spec Book / 716-07) [ASTM D2000, Line Call Out M2BC517A14B34, ASTM D2000, Line Call Out M4AA517A13B33, AASHTO Standard Specifications for Bridge Section 2.25.2, Materials 50 Durometer Hardness].

**Steel:** All steel will conform to the requirements of the steel designated on the Contract Plans and applicable provisions of the NYS Steel Construction Manual (refer to NYS Spec Book / 716-07).

**Stainless Steel:** Stainless steel shall conform to the requirements of ASTM A167 or ASTM A240, Type 304. Refer to NYS Spec Book / 716-07.

**Polytetrafluoroethylene (PTFE) Sheet and Strip:** Finished PTFE sheet and strip shall conform to the physical requirements of ASTM D638M and D792 as listed in Table 716-07-2 (refer to NYS Spec Book / 716-07).

**Welding Procedure:** All welding shall conform to, and all welders shall be qualified in accordance with the requirements of the NYS Construction Manual.

**Sliding Coefficient of Friction:** For all guided and non-guided expansion type pot-design bearings, the bearing manufacturer will test one production bearing per lot (see NYS Spec Book / 716-07).

**Rotation Test:** The bearing manufacturer will test one production bearing per lot. Evaluation criteria are listed in the NYS Spec Book (716-07).
17.3 STEEL LAMINATED ELASTOMERIC BRIDGE BEARINGS (716-11) AND ELASTOMERIC BRIDGE BEARINGS WITH EXTERNAL LOAD PLATES (716-12)

The inspection, sampling and testing of elastomeric bridge bearings follows the procedures outlined in Materials Method No.: NY 23 M (to be referred to as MM23), and are performed on a lot by lot basis. The requirements for these bearings are listed in the NYS DOT Standard Specifications, Construction and Materials, English Units, Office of Engineering, May 1, 2008, as amended, (to be referred to as NYS Spec Book).

Elastomeric Material: The physical properties of the cured elastomeric compound shall meet the requirements of ASTM D412 (see Table 716-10-1, NYS Spec Book / 716-11 and 716-12).

Manufacturer must certify that the elastomeric compound passes Grade 3 Low-Temperature Brittleness as determined by ASTM D746 – Brittleness Temperature of Plastics and Elastomers by Impact, Procedure B.

Internal Steel Plates (shims): Conform to the requirements of ASTM A36M, ASTM 1008/A 1008/M or ASTM 1011/A 1011/M (Grade 33, 36 and 40).

External Load Bearing Plates and Steel Backing Plates: External load plates shall conform to the requirements of ASTM A36M and to the requirements of the Steel Construction Manual (SCM).

Welding Procedure: The bearing manufacturer shall submit a Welding Procedure to the Deputy Chief Engineer Structures (DCES) for each welding process to be used in the manufacture of the bearings. No welding shall be performed until the manufacturer receives an approved Welding Procedure.

Bearing Tolerances: The finished elastomeric bearings shall conform to the design dimensions, with the tolerances listed in Table 716-10-1 (NYS Spec Book / 716-11 and 716-12).

Compression / Deflection: Test conditions are outlined in the NYS Spec Book (716-11 and 716-12).

Adhesion: Visual inspection as outlined in NYS Spec Book (716-11 and 716-12).
SP 18. LIQUIDATED DAMAGES AND EARLY COMPLETION BONUS

18.1 LIQUIDATED DAMAGES

A. Lane Closure Periods

The public is subject to detriment and inconvenience when full use of infrastructure cannot be maintained during the construction of the Project. Therefore, liquidated damages will be assessed against the Design-Builder under the circumstances specified below.

The Design-Builder shall be subject to payment reduction(s) for work zone traffic control non-conformance in accordance with DB Section 109-7.2 for:

- each lane closure period on the BQE mainline or ramps greater than the total number of lane closure periods proposed in Form SCD.
- each lane closure period on Meeker Avenue and Vandervoort Avenue greater than the total number of lane closure periods proposed by the successful Proposer in Form SCD.

In addition, if a lane closure on the BQE mainline extends beyond the hours permitted by the Contract Documents (See Part 3 – Project Requirements for Draft Lane Closure Stipulations) the Design-Builder shall pay liquidated damages:

- in the amount of $12,000 per 10 minute increment for a lane closure that extends more than 1 minute up to 30 minutes beyond the hours permitted.
- in the amount of $36,000 for a lane closure that extends more than 30 minutes up to one hour beyond the hours permitted, in addition to the liquidated damages assessed for the previous 30 minute delay.
- in the amount of $135,000 per hour if a lane closure extends beyond one hour past the hours permitted, in addition to the liquidated damages assessed for the previous hour delay.

If a lane closure on a local street extends beyond the hours permitted by the Contract Documents (See Part 3 – Project Requirements for Draft Lane Closure Stipulations) the Design-Builder shall be subject to payment reduction(s) for work zone traffic control non-conformance in accordance with DB Section 109-7.2.

B. Interim Completion Milestone

Due to the cost the Department incurs to inspect and maintain the existing bridge, and due to operational inefficiencies, which are both an inconvenience to the traveling public, liquidated damages will be assessed due to a delay in having the new bridge open to traffic and all traffic permanently transferred onto the new Eastbound Structure, with no further lane closures on the new Eastbound Structure. Therefore, the Design-Builder shall pay liquidated damages in the amount of $60,000.00 per day for failure to achieve the Interim Completion Milestone by the Interim Completion Milestone Date. The Interim Completion Milestone Date will be established based on the proposed duration provided by the successful Proposer in Form SCD and described in Part 1 – DB Agreement, Article 2.2 – Interim Completion Milestone Date. This liquidated damage shall be in lieu of the liquidated damages described in DB § 108-5 – Liquidated Damages.

C. Project Completion
Time is an essential element of the Contract, and it is important that the Work be pursued vigorously to completion. Therefore, the Design-Builder shall pay liquidated damages in the amount of $150,000.00 per day for failure to achieve Project Completion by the Project Completion Date. The Project Completion Date will be established based on the proposed duration provided by the successful Proposer in Form SCD and described in Part 1 – DB Agreement, Article 2.4 – Project Completion Date. This liquidated damage shall be in lieu of the liquidated damages described in DB § 108-5 – Liquidated Damages.

18.2 EARLY COMPLETION BONUS

An Early Completion Bonus will be paid to the Design-Builder in the amount of $60,000.00 per day (25 days maximum) for the number of days that all traffic is permanently transferred onto the new Eastbound Structure, with no further lane closures on the new Eastbound Structure, earlier than the Interim Completion Milestone Date. The Interim Completion Milestone Date will be established based on the proposed duration provided by the successful Proposer in Form SCD and described in Part 1 – DB Agreement, Article 2.2 – Interim Completion Milestone Date.

In addition, an Early Completion Bonus will be paid to the Design-Builder in the amount of $150,000.00 (25 day maximum) per day for the number of days Project Completion is achieved earlier than the Project Completion Date. The Project Completion Date will be established based on the proposed duration provided by the successful Proposer in Form SCD and described in Part 1 – DB Agreement, Article 2.4 – Project Completion Date.
SP 19.  TRAINING REQUIREMENTS

SPECIAL PROVISION

19.1 TO BE PROVIDED IN THE FINAL RFP.

19.1 INTRODUCTION

A primary purpose of the Department’s Training Programs is to train and upgrade minorities, women and economically disadvantaged persons in the engineering and construction industries. Accordingly, every effort (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield the targeted groups) shall be made by the Design-Builder to enroll minority, women and the economically disadvantaged to the extent that such persons are available within a reasonable area of recruitment. The Design-Builder will be responsible for demonstrating the steps that have been taken in pursuance thereof, prior to determination as to whether the Design-Builder is in compliance with this Training Special Provision.

The Design-Builder shall provide on-the-job training aimed at developing full competence in the job classification involved for Construction Inspection services, Highway/Bridge Design services, and Construction trades per the guidelines provided in the following documents:

- NYSDOT Specification Item 691.03 – (Apprenticeship) Training Requirements
- NYSDOT Engineer’s Instruction EI-06-018 – for Item 691.03—20 Training Requirements
- NYSDOT Consultant Instruction CI 11-06 – Trainees for Construction Inspection
- NYSDOT Consultant Engineer’s Training Catalog

19.2 TRAINING PROGRAM

The Design-Builder shall develop a training program to be submitted to the Department and FHWA for their review and approval. The minimum length and type of training for each classification will be as established in the training program. The training program shall outline a schedule that is reasonable to meet the training obligations of the Design-Builder and to assist in qualifying the training participant toward proficiency in the classification concerned by the end of the training period.

The number of trainees shall be distributed among the work classifications on the basis of the Design-Builder’s needs. The resources reported in 1.1 will be utilized as a guide to determine the proposed number to be trained in each selected classification, their estimated salaries; staffing and training program as applicable

The Design-Builder is to ensure that all training participant’s credentials are reviewed and approved by the Department before the commencement of the respective training.

19.3 ADDITIONAL REQUIREMENTS

Additional requirements include the following:

- The Department has in place an outreach program for this project to assist in recruitment and training. The Design-Builder shall participate in this program and provide support to the Department.
• The Design-Builder shall advise employees and applicants for employment of available training programs and entrance requirements for each.

• The Design-Builder shall periodically review the training and promotion potential of minority group and women employees and shall encourage eligible employees to apply for such training and promotion.

• The Design-Builder must demonstrate their best efforts and evidence good faith in hiring trainees for positions in the classifications in which they have completed training.

• The Design-Builder shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

• The Design-Builder shall provide for the maintenance of records and furnish periodic reports documenting the trainee(s) performance under this Training Special Provision.

• Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

• No employee shall be employed as a trainee in a classification in which they have successfully completed a training program or in a classification in which they have been employed.

• This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether or not a member of a minority group.