SUPPLEMENTAL SPECIFICATION
SECTION 510A – PRESTRESSED CONCRETE

510.01A DESCRIPTION. This work shall consist of manufacturing, transporting, and erecting precast prestressed concrete members.

510.02A MATERIALS. Materials shall meet the requirements of the following Subsections:

Portland Cement..701.02
High Early Strength Portland Cement..701.04
Blended Silica Fume Cement..701.06
Tar Emulsion..702.05
Fine Aggregate for Concrete..704.01
Coarse Aggregate for Concrete..704.02
Mortar, Type I..707.01
Mortar, Type IV..707.03
Asphalt-Treated Felt..707.08
PVC Waterstop..707.10
Bar Reinforcement..713.01
Prestressing Reinforcement..713.06
Structural Steel..714.01-714.05
Concrete Curing Materials..725.01
Air-Entraining Admixtures..725.02(b)
Retarding Admixture..725.02(c)
Water-Reducing Admixture..725.02(f)
Water-Reducing and Retarding Admixture..725.02(g)
Water-Reducing, High Range Admixture..725.02(h)
Water-Reducing, High Range,
and Retarding Admixture..725.02(i)
Accelerating Admixture..725.02(j)
Water-Reducing and Accelerating Admixture..725.02(k)
Mineral Admixture..725.03
Silica Fume Admixture..725.03(b)
Ground Granulated Blast-Furnace Slag(GGBFS)..725.03(c)
Polystyrene Insulation Board..735.01
Blanket Insulation Material..735.02
Pipe Insulation..740.08
Water..745.01

510.03A GENERAL FABRICATION REQUIREMENTS.

(a) General. The manufacture of the prestressed units shall be in accordance with PCI MNL-116 *Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products* and PCI MNL 135-00 *Tolerance Manual for Precast and Prestressed Concrete Construction*, except as modified in this Section.

(b) Qualification. The prestressed members shall be manufactured in a plant that has been certified by the Prestressed Concrete Institute under its Plant Certification Program for prestressed concrete.

(c) Quality Control. The fabricator shall demonstrate a level of quality control testing that satisfies the Agency as to its ability and commitment to produce concrete to the requirements of this Section. A satisfactory program of quality control shall include gradation and moisture determinations of the aggregates, as well as slump, air content, and strength determinations of the concrete. These tests shall be performed at regular and suitable intervals and actively used to maintain the quality of the concrete within the specified requirements.

510.04A DESIGN AND DRAWINGS. The fabricator shall submit working drawings in accordance with Subsection 105.03. In addition to the requirements in Subsection 105.03, the following shall be included:

(a) The dimensions of the sections to be fabricated.

(b) The concrete mix design, including but not limited to the following:

(1) Batch weights specifying dry or saturated surface dry.

(2) Material names and sources.

(3) Aggregate properties and date tested.

(4) Chemical and physical properties of cementitious material.

(5) Admixture names and sources.

(6) Lab data that shall include, but not be limited to:

a. Slump.

b. Air Content.

c. Temperature.

d. Ratio of Water/Cementitious Material.

e. Cylinder breaks for 3, 7 and 28 days cured in the same manner as the piece to be fabricated.

f. 56 day Rapid Chloride Ion Permeability – AASHTO T 277 test data. The information shall include the individual results from testing 3 specimens, but no specimen shall exceed the maximum set forth in 510.05A (b)(6).

g. Alkali-Silica Reactivity (ASR) – AASHTO T 303 test data from both fine and coarse aggregates. **Testing shall be performed by a CCRL qualified laboratory.**

(1) Alkali-Silica Reactivity (ASR) – If potentially reactive aggregates are to be used in a mix design, then proposed mitigation method(s) and test results must be provided. The AASHTO T 303 test must be run again with the proposed mitigation method(s) and using the proposed job cementitious material proportioning. The proposed mitigation method(s) shall reduce expansion to below 0.10%.

If an existing mix design is submitted, then acceptable test results within a 12 month period will be allowed as a substitution to the required submittal of lab test results. However, if a change in any material source has occurred, then new lab test data will be required.

(c) The sources and properties of the materials proposed for use.

(d) The methods of prestressing, including certified calibration charts for all jack and gauge combinations.

(e) Tensioning calculations for prestress strands that include gauge pressure, elongations, and movement of anchorage abutments.

(f) The method and sequence of strand detensioning.

(g) The placement of reinforcing steel and prestress strands.

(h) The type of surface finish, defining how the finish will be obtained.

(i) The curing method, detailing sequence and duration.

(j) The grouting procedure.

(k) The design of the lifting attachments.

(l) Transportation, handling, and storage details.

(m) The installation procedure.

(n) Description of Quality Control procedures.

All design details shall be in accordance with the AASHTO *Standard Specifications for Highway Bridges.*

As soon as practical after award of the Contract, the fabricator shall submit data, working drawings and calculations as a complete package, allowing a minimum of four weeks for review and response.

510.05A CONCRETE.

(a) Batch plant equipment, materials, and batching procedures shall conform to the following provisions of Section 501A:

501.04A	BATCHING, paragraphs 1 and 3 only.
501.04A(b)	Testing Laboratory.
501.04A(c)	Bins and Scales.
501.04A(d)	Accuracy of Plant Batching.
501.04A(e)	Storage and Proportioning of Materials.
501.05A	MIXING AND DELIVERY, for plants not located in the State, the Agency has the option of waiving the requirements of Part (a)(4) and Part (c), paragraphs 1 and 3 only.

(b) Concrete for prestressed members shall conform to the following:

(1) Compressive strength at 28 days, as determined in accordance with AASHTO T 22, of not less than 35 MPa (5000 pounds per square inch). When a 28 day test result, as defined in this Section or in the Contract, is below the specified strength, all concrete represented by that test shall be unacceptable for the requirements of this Section. The Engineer reserves the right to reject all members that were made from this concrete.

(2) The cementitious material content in the mix design shall be between 363 and 475 kg/m³ (611 and 800 pounds per cubic yard) of concrete.

(3) The percent of air entrainment shall be 7 percent with a tolerance of +/- 2 percent, as tested in accordance with AASHTO T 152.

(4) The temperature of the concrete at the time of placement shall be between 10 and 29 °C (50 and 85 °F), as tested in accordance with AASHTO T 309.

(5) The maximum water-cementitious material ratio shall be 0.44. When a water-reducing, high range admixture (AASHTO M 194, Type F or Type G) has been included in the approved mix design, the concrete shall not demonstrate segregation at the proposed slump.

(6) The maximum allowed rapid chloride ion coulomb permeability result as tested per AASHTO T 277 is 2000, tested at 56 days from the date specimens were cast.

(7) The maximum allowable mortar bar expansion when tested per AASHTO T 303 (with proposed mitigation method(s), as described previously, if required) shall be 0.10%.

(c) The proposed concrete mix design, including performance history and all requests for variance from the material requirements of these Specifications, shall be submitted for approval as part of Subsection 510.04A. The Structural Concrete Engineer may require a minimum of 8 weeks for testing and approval of the mix design.

(d) Any admixture containing calcium chloride shall not be used. Type II, Type III or Blended Silica Fume portland cement may be used. Only one type of cement and only one source of that type shall be used for the prestressed units required for any one structure.

510.06A INSPECTION. Materials furnished and the work performed under Section 510A shall be inspected by the Agency. The inspector shall have the authority to reject any material or work that does not meet the requirements of these Specifications. Advance notification of at least two weeks must be provided by the fabricator to the Agency's Engineer and the Structural Concrete Engineer concerning the proposed intention to commence work. A minimum of five working days notification must be provided to the Structural Concrete Engineer by the fabricator to confirm the fabrication start date.

Prior to shipment of any members, the Materials and Research Engineer must have approved all applicable material certifications required in accordance with Subsection 700.02.

510.07A PRESTRESSING. Prestressing shall be accomplished by the pre-tensioning method.

The fabricator shall provide all equipment necessary for the prestressing operations. Prestressing shall be done with approved jacking equipment. Hydraulic jacks shall be equipped with pressure gauges or other indicating devices. The combination of jack and pressure gauge, or other tensioning system, shall be accompanied by a certified calibration chart showing the relationship between the gauge reading and force in the ram for both ascending and descending movements of the ram. The calibration date of each combination jack and gauge or indicating device shall be within the 12-month period immediately prior to the start of work.

If other types of jacks are used, calibrated proving rings or other devices shall be furnished so that the jacking force may be accurately determined.

Suitable precautions shall be taken by the fabricator to prevent accidents due to breaking of the prestressing steel or slippage of the grips during prestressing operations.

The tensioning operation shall proceed until the calculated gauge reading has been reached. The elongation of each strand shall then be measured. If the measured elongation differs from the theoretical by more than 5 percent, the tensioning operation shall be stopped, and the cause of the discrepancy determined prior to continuing.

Immediately after tensioning, the final position of each strand shall be marked for the purpose of checking possible strand relaxation.

510.08A FABRICATION.

(a) Forming Members. Side forms shall be supported without the use of ties or spreaders within the body of the member. Any defects or damage due to form work, stripping, or handling may be cause for rejection. Forms for interior voids or holes in the members shall be constructed of a material that will adequately resist breakage or deformation during concrete placement and that will not materially increase the mass (weight) of the members. Interior void forms shall be accurately positioned as shown on the Plans and secured to prevent displacement during concrete placement. All voids shall be adequately vented to prevent damage to the members during curing. Each void shall contain a suitably located drain hole. Holes or cutouts for anchoring devices, diaphragm connections, openings for connection rods, recesses for grout holes for railing bolts, and any other related details shown on the Plans shall be provided for in the members. Where diaphragm dowels do not pass through the member, the dowels may be attached by use of an approved anchorage embedded in the concrete member.

(b) Placing Transverse Conduits and Tendons. Each tendon to be post-tensioned shall be encased in an approved conduit. Unless otherwise shown on the Plans, the ratio of cross-sectional area of the tendon to be encased to the interior cross-sectional area of the conduit shall not exceed 0.4, except when a steel bar is used as a tendon, the inside diameter of the conduit shall be at least 10 mm (3/8 inch) greater than the diameter of the bar. Conduit that has been crushed or has opened seams shall not be used.

The conduit shall be rigidly constructed, completely sealed, accurately placed, and securely fastened to maintain the desired profile during concreting. No conduit shall be located more than 6 mm (1/4 inch) from the position shown on the Plans. Bundling of conduits will not be permitted.

(c) Placing Prestress Strands. Prestress strands shall be accurately placed in position to achieve the center of gravity of the steel as shown on the approved shop drawings. Prestress strands shall be protected against corrosion and be free of nicks, kinks, dirt, rust, oil, grease, and other deleterious substances.

(d) Bar Reinforcement. Bar reinforcement shall be furnished and installed in conformance with Subsections 507.03, 507.04, 507.05 and 507.07.

(e) Pre-Tensioning. The prestress strands shall be stressed by jacking in accordance with Subsection 510.07A, and in the presence of an Agency representative. The jacking force exerted and the elongation produced shall be recorded. Several units may be cast and stressed at one time in a continuous line. Sufficient space shall be maintained between the ends of the units to permit access for cutting strands after the concrete has attained the required strength.

(f) Thermal Effects. For abutment anchorage set-ups where the strands are anchored to abutments that are independent from the form, thermal adjustments shall be made if the ambient temperature at the time of tensioning differs by more than 15 °C (25 °F) from the concrete temperature prior to placement and if the net force differential is greater than 2.5%. Consideration shall be given to partial bed length usage and adjustments made when the net effect on the length of the bed used exceeds the allowable. The thermal coefficient of steel shall be taken as 12 x 10□□/°C (6.5 x 10-□/°F).

(g) Placing Concrete. Concrete shall not be deposited in the forms until the Agency representative has approved placement of the reinforcement, conduits, anchorages, and prestressing strand. The concrete shall be vibrated internally, externally, or a combination thereof to the required consolidation. The vibrating shall be done with care and in such a manner that:

(1) Concrete is uniformly consolidated.

(2) Displacement of reinforcement, conduit, voids and prestressing strand is avoided.

(3) Acceptable finish surfaces are produced.

(h) De-tensioning. No stress shall be transferred to the concrete until 80 percent of the design compressive strength (f'c) has been attained. The compressive strength shall be determined by cylinders tested in accordance with Subsection 510.09A. The prestressing strands shall be released in the de-tensioning pattern detailed on the shop drawing. If de-tensioning is accomplished by single strand release, each strand shall be cut by gradually heating the strand at both ends of the member simultaneously. A minimum length of 125 mm (5 inches) of strand shall be heated to prevent any shock or snap when the strand is finally severed. Each strand shall be cut at all spaces between members cast continuously, before starting de-tensioning on the following strand in sequence.

(i) Dimensional Tolerances. All tolerances shall be in accordance with PCI MNL – 116 *Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products* and PCI MNL 135-00 *Tolerance Manual for Precast and Prestressed Concrete Construction*, unless otherwise noted in the Contract Documents or as approved by the Engineer. Camber shall be measured as soon as possible after detensioning and at approximately the same time for each product piece. Camber shall be noted for process monitoring/consistency of production.

(j) Dimensional Tolerances for Prestress Deck Panel.

(1)	Depth of panel:	+6, -3 mm (+1/4, -1/8 inch)
(2)	Width of panel:	+/- 6 mm (+/- ¼ inch)
(3)	Length of panel:	+/- 6 mm (+/- ¼ inch)
(4)	Squareness:	12 mm (1/2 inch) maximum (measured along diagonals)
(5)	Vertical position of strand group:	+0, -3 mm (+0, -1/8 inch) (measured from bottom of panel)
(6)	Vertical position of individual strands:	+/-3 mm (+/- 1/8 inch)
(7)	Horizontal Strand Position:	+/- 6 mm (+/- 1/4 inch)
(8)	Strand projection:	+/- 12 mm (+/- ½ inch)
(9)	Bowing:	+/- 3 mm (+/- 1/8 inch)
(10)	Dunnage:	+/- 150 mm (+/- 6 inches)
(11)	Warping:	5 mm per meter (1/16 inch per foot) (of distance from nearest adjacent corner)
(12)	Finish of strands:	100 mm (4 inches) minimum extension beyond ends of panel

(k) Repairs/Patching. Projecting strands shall be torch cut unless otherwise specified on the Plans. If strands are required to be recessed, the recess shall be thoroughly cleaned and patched with Mortar, Type IV. The mortar shall be wet cured for three days or as specified by the manufacturer. Units that contain minor defects caused by manufacture or handling may be repaired at the manufacturing site. Minor defects are defined as holes, honeycombing or spalls, which are 150 mm (6 inches) or less in diameter, that do not penetrate deeper than 25 mm (1 inch) into the concrete. Surface voids or "bugholes" that are less than 16 mm (5/8 inch) in diameter and less than 6 mm (1/4 inch) deep need not be repaired. Repairs shall be made using an overhead and vertical concrete repair material satisfactory to the Engineer. The repair material shall be cured as specified by the manufacturer. Repairs shall be approved by the Engineer.

(l) Cracking. Cracks less than 0.25 mm (0.01 inch) in width shall be sealed by a method approved by the Engineer. Cracks in excess of 0.25 mm (0.01 inch) may be cause for rejection. At the Engineer's discretion, cracked members shall be repaired or replaced at the Contractor's expense. De-tensioning procedures causing web splitting or other member cracking shall be revised before de-tensioning the next bed.

(m) Deck Panel Rejection Criteria.

(1) Any crack transverse or diagonal to strand pattern and crossing more than one strand.

(2) Any crack parallel to a strand and longer than 33% of the panel length.

(3) Cracks shorter than 33% of the panel length and present at more than 12% of the total number of strands in the panel.

(4) Voids or honeycombed areas with exposed strands.

(n) Welding. All welding shall conform to the requirements of Subsection 506.10.

510.09A CONCRETE TESTING.

(a) General. Prestressed members shall be manufactured in a plant, which maintains a quality control laboratory complete with equipment for measuring the properties of fresh and hardened concrete. As a minimum, the laboratory shall be equipped with a compression testing machine, curing room or chamber, apparatus for measuring slump and air entrainment, and a complete set of aggregate sieves. The compression testing machine shall be calibrated yearly by an independent laboratory using equipment that is certified by the National Institute of Standards and Technology. The testing machine shall be power operated and capable of applying the load continuously rather than intermittently, and without shock.

(b) Testing of Compressive Strength. Specimens shall be standard cylinders made by the fabricator in accordance with AASHTO T 23. Fabrication of test specimens shall be witnessed by an Agency representative. Molds for forming test specimens shall conform to AASHTO M 205 and shall be supplied by the fabricator. For each bed of pre-tensioned members, the fabricator shall make for the Agency the following minimum number of specimens:

(1) Six specimens to determine strength prior to de-tensioning. These specimens shall be cured from the time of casting, under the same conditions as the concrete in the work.

(2) Four specimens to determine compliance with the 28-day strength requirement. The specimens shall be cured under the same conditions as the member from the time of casting until the member is removed from the form. At that time, the specimens shall be moved to storage where curing shall continue under standard conditions in accordance with AASHTO T 23. These specimens shall be retained by the fabricator for testing by the Agency.

The average of the compressive strengths of two specimens shall constitute a test result. Specimens shall be tested either at the Agency's Materials and Research Section laboratory, or at the manufacturer's plant laboratory. An Agency representative will witness all tests. Unless otherwise specified, de-tensioning shall only be permitted after two successive specimens have been tested and the average strength of these specimens is equal to or greater than the strength required in the Contract for de-tensioning.

If the average strength of specimens from a member does not reach the 28-day design strength within 28 days, the member shall be rejected.

510.10A CURING.

(a) General. All curing methods shall be subject to the Engineer's approval. Where the fabricator elects to cure by method(s) other than low pressure steam or radiant heat as described below, the fabricator shall submit with the shop drawings complete details of the proposed method(s) for approval.

The fabricator shall provide one automatic temperature recorder for every 30 m (100 feet) of casting bed. The recorder shall continuously record curing temperature for the entire curing period. Temperature sensors shall be carefully placed within the curing enclosure to ensure that ambient temperatures are measured at typical locations. Recorder accuracy shall be certified at least once every 12 months, and the certificate displayed with the recorder. Calibration and certification shall be performed by either the manufacturer, the supplier, or an independent laboratory. Random temperature checks of each recorder may be made by an Agency representative. Each recorder chart shall indicate the casting bed, date of casting, time of start and finish of record, and the mark number of prestressed units being cured. At the completion of the curing period, the recorder charts shall be given to the Agency representative. Temperatures recorded on the charts shall be used to determine whether the prestressed units have been cured in accordance with the specifications and the approved shop drawings.

Curing by the approved method shall continue uninterrupted until the start of de-tensioning operations. De-tensioning shall be accomplished immediately after the steam curing or heat curing has been discontinued.

(b) Curing with Low-Pressure Steam or Radiant Heat.

(1) Immediately upon completing placement of the concrete of each unit, an enclosure shall be placed over the casting bed. this enclosure shall be suitable for containing the live steam or heat. The fabricator shall make these covers available for inspection prior to casting.

(2) When low pressure steam methods are used for curing, precautions shall be taken to prevent live steam from being directed on the concrete or forms in such a way as to cause localized high temperatures.

(3) When radiant heat is used for accelerated curing, all exposed concrete surfaces shall be covered with plastic sheeting. Radiant heat may be applied by means of a circulation pipe containing steam, hot oil or hot water, or by electric heating elements.

(4) The concrete shall be allowed to attain its initial set before commencing accelerated curing. This waiting period shall not exceed four hours from time of placement for concrete with no retarder added, or eight hours from the time of placement for concrete with retarder. During this initial curing period, while waiting for the initial set to take place, the temperature within the enclosure shall be maintained between 10 and 27 °C (50 and 80 °F).

(5) During the initial application of heat or steam, the ambient air temperature within the enclosure shall increase at a rate not exceeding 20 °C (40 °F) per hour until the maximum curing temperature is reached. The maximum curing temperature shall not exceed 71 °C (160 °F). The selected curing range shall be as approved on the working plans. The maximum temperature shall be held until the concrete has reached a minimum of 80 percent of f'c, unless otherwise specified in the Contract.

510.11A HANDLING. Handling and installation of prestressed members shall be performed with members in an up-right position and with points of support and direction of reactions in approximately the same locations as designated for the final position of the members in the structures. The Contractor must receive authorization from the Agency prior to shipment or erection of any members.

Care shall be taken during storage, hoisting, and handling of the precast units to prevent cracking or damage. Units damaged by improper storing or handling shall be replaced at the Contractor's expense.

510.12A INSTALLATION.

(a) Prestressed Concrete Members.

(1) Methods, Equipment and Erection. Cranes, lifting devices, and other equipment for all prestressed concrete member erection shall be of adequate design and capacity to safely erect, align and secure all members and components in their final positions without damage. The Contractor is solely responsible for the methods and equipment employed for the erection of the prestressed concrete member.

The Contractor shall submit an erection plan for the methods and sequence of prestressed concrete member erection, the temporary bracing, and the equipment to be used for the erection. The erection plan shall include the necessary computations to indicate the magnitude of stress in the segments during erection and to demonstrate that all of the erection equipment has adequate capacity for the work to be performed. The erection plan shall contain provisions for all stages of construction, including temporary stoppages.

The prestressed concrete members may be used for support of equipment prior to placement of the deck only with written permission of the Engineer. The proposed use of the prestressed members for support of equipment shall be detailed in the erection plan.

The erection plan submitted by the Contractor shall be prepared and stamped by a Professional Engineer. Three sets of the erection plan shall be submitted to the Construction Engineer a minimum of two weeks prior to the erection of Prestressed members. Drawings shall conform to ISO Designation A-1 or A-4 (8 1/2 × 11 inches or 36 × 22 inches) in size and shall have appropriate scale and detail, and shall convey sufficient information for successful prosecution and inspection of the proposed work. A title block shall be provided in the lower right hand corner and shall include the following:

Town(s) in which project is located
Project name and number
Route number and location information
Prime contractor and fabricator's name and address
Sheet title or identification of details shown
Name of supervisor in charge
Detailer's and checker's name
Date
Sheet number of.

Submittal of the erection plan is for the Agency's information only, and shall in no way be construed as approval of the proposed method of erection. Unless otherwise directed by the Engineer, the Contractor shall follow the erection plan as submitted.

(2) Initial Post-tensioning. Initial post-tensioning shall not commence until 24 hours after the last prestressed unit has been placed. The Contractor shall insert post-tensioning strand in the conduits and pull to 13.3 kN (3.0 kips) tension.

(3) Grout. Grout shall be placed according to the requirements of Subsection 510.13A.

(4) Fairing Surface. This work shall consist of placing grout between precast members as required for fairing out any unevenness between adjacent units. Mortar, Type IV shall be used. Placement shall be at the same time mortar is placed to fill shear keys between members and in accordance with Subsection 510.13A.

The mortar shall be placed to the thickness necessary to eliminate unevenness, forming a smooth surface from the higher beam edges to the lower surface. The finished surface shall be feathered smoothly and be free of depressions or sharp edges.

(5) Final Post-tensioning. Strands shall be tensioned in accordance with the requirements of Subsection 510.14A.

(b) Prestressed Deck Panels.

(1) Panels shall be installed as shown on the Plans. The temporary supports shall be attached to the top of the flange of the girder with an adhesive, approved by the Engineer, in accordance with the manufacturer's recommendations. The temporary supports shall be cut in the field to the required height after the blocking depth has been determined.

(2) Panels shall not be used to support heavy loads, such as additional deck panels, until the top slab is cast and cured. Construction loads on individual panels shall be uniformly applied and shall not exceed an average loading of approximately 2000 Pa (40 pounds per square foot).

(3) After the panels have been placed on temporary supports, the area under the ends of the panels and over the girder flanges up to the bottom of the panels shall be completely filled with Concrete, High Performance Class AA (or other material, as specified on the Plans). Temporary support/grout dams for precast deck panels shall consist of continuous, high density, expanded polystyrene strips (grout dam) with a minimal compressive strength of 380 Pa (55 psi). If leveling screws are used, a 27.2 kg per cubic meter (1.7 pounds per cubic foot) polyethylene foam shall be used as a grout dam. The concrete shall be wet cured until a minimum of 85 percent of f'c is attained by the average strength of two field cured cylinders prior to placement of the cast-in-place deck. If leveling screws are used, they shall be completely removed and the holes filled with grout prior to the placement of deck concrete.

(4) Prior to placing the deck concrete, laitance or other contaminates that would interfere with full bond to the panels shall be removed by an approved method.

510.13A GROUT.

(a) Grout used to fill shear keys, leveling screw voids, transverse tie anchor recesses, dowel holes, and for fairing joints shall be Mortar, Type IV and shall be an approved grout as listed in the Approved Products List. Additional aggregates shall not be added to the material during field mixing.

The Contractor shall submit a grouting procedure proposal to the Engineer including a premix name brand for approval.

For testing, 6 neat 50 mm (two inch) cubes shall be molded and cured in accordance with AASHTO T 106 (ASTM C 109). The average compressive strength of 3 cubes at 3 days shall be a minimum of 7 MPa (1000 psi) and a minimum of 35 MPa (5000 psi) in 28 days.

(b) The surface to be grouted shall be thoroughly cleaned, wetted, and free of all standing water.

The grout shall be mixed using a mechanical mixer, according to the manufacturer's recommendations and shall be readily pourable so that it completely fills the shape of the shear keys or holes, depending on the product being installed. The placement of the grout for each shear key shall be continuous. The grouting of each shear key shall be completed in its entirety within a single working day.

The Contractor has the option to use ready mixed mortar for the grouting process. However, the maximum quantity that can be delivered in a single load is one cubic meter (1.25 cubic yard), which must be delivered and placed within the time limits set by the manufacturer.

(c) All exposed grout shall be cured for a period of not less than three days by the wetted burlap method in accordance with Section 501A. Curing shall commence as soon as practical after grout placement. During this curing period, the Contractor shall not apply any additional post-tensioning force.

510.14A TRANSVERSE POST-TENSIONING. Transverse post-tensioning strands shall not be bonded to the concrete. Post-tensioning strands shall be protected against corrosion as specified in the Contract.

Post-tensioning of strands shall not commence until a minimum compressive strength of 10 MPa (1500 psi) in the grout has been attained and the grout has cured for three days.

Strands shall be stressed in the following sequence: Before grouting, the strands shall be pulled with a maximum force of 13.3 kN (3.0 kips). After the grout has attained required strength and proper cure time is complete, the strands shall be pulled to a final 133.4 kN (30.0 kips) tension. The sequence shall begin by pulling the inner-most strands first, then proceeding symmetrically towards the members ends. The inner strands shall be rechecked to ensure the strands have 133.4 kN (30.0 kips) tension. In the case where the Plans call for top and bottom strands, the sequence shall be followed using an initial pull of 66.7 kN (15.0 kips), top and bottom, followed by a sequence using a final (total) pull of 133.4 kN (30.0 kips) tension.

510.15A METHOD OF MEASUREMENT. The quantities of Prestressed Concrete Box Beams, Voided Slabs, and Girders to be measured for payment will be the number of meters (linear feet) of the types and sizes of prestressed concrete members used in the complete and accepted work.

The quantity of Grouting Shear Keys to be measured for payment will be the number of meters (linear feet) of grouted shear keys in the complete and accepted work.

Prestressed deck panels and concrete support beds for the panels will not be separately measured for payment, but will be considered within the volume measurement limits for payment of superstructure concrete.

510.16A BASIS OF PAYMENT. The accepted quantities of Prestressed Concrete Box Beams, Voided Slabs, and Girders will be paid for at the Contract unit price per meter (linear foot) for the types and sizes of prestressed concrete members specified. Payment will be full compensation for detailing, fabricating, repairing, quality control testing, transporting, handling, and installing the materials specified, including the concrete, reinforcement, prestressing steel, transverse ties, enclosures for prestressing steel, anchorages, mortar, anchor rods, any other material contained within or attached to the members, for furnishing and implementing the erection plan, and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

The accepted quantity of Grouting Shear Keys will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for providing all materials and performing the work specified herein, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Any other grouting work, such as fairing out unevenness between adjacent units and filling leveling screw holes, transverse anchor recesses, and dowel holes, is considered incidental to the work for prestressed concrete members.

Payment will be made under:

Pay Item		Pay Unit
510.21	Prestressed Concrete Box Beams	METER (LINEAR FOOT)
510.22	Prestressed Concrete Voided Slabs	METER (LINEAR FOOT)
510.23	Prestressed Concrete Girders	METER (LINEAR FOOT)
510.24	Grouting Shear Keys	METER (LINEAR FOOT)