SECTION 8 - PRECAST PORTLAND CEMENT CONCRETE, REINFORCED AND PRESTRESSED

1.0 DESCRIPTION

This section details the manufacture, delivery, storage and erection of precast reinforced concrete members, and precast prestressed concrete members.

2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications, or publications:

- ASTM C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C 260/C 260M, Air-Entraining Admixtures for Concrete
- ASTM C 494/C 494M, Chemical Admixtures for Concrete
- CSA A23.3-17C:19, Temperature of Freshly Mixed Hydraulic-Cement Concrete
- CSA A23.1:19, Concrete Materials and Methods of Concrete Construction
- CSA A23.2:19, Methods of Test and Standards of Practice for Concrete
- CSA A23.3, Code Design of Concrete Structures
- CSA A23.4-16, Precast Concrete - Materials and Construction
- CSA A251, Qualification Code for Manufacturers of Architectural and Structural Precast Concrete
- CSA S6, Design of Highway Bridges
- CSA S269-1, Concrete Falsework and Formwork
- Division 5, Section 7, Cast-in-Place Concrete
- PCI Manual for Quality Control for Plants and Production of Prestressed Concrete Products
- Division 5, Section 18: Cast in Place High Performance Concrete

3.0 SUBMISSIONS

3.1 Shop Drawings. At least four (4) weeks prior to the proposed commencement of manufacture, the Contractor shall submit the shop drawings directly to the Engineer, Highway Construction Services (HCS), and Structural Engineering for review and approval. Drawings shall be stamped by a Professional Engineer registered to practice in Nova Scotia. Fabrication shall not proceed until approval of the shop drawings from the Department is received. Approval of the shop drawings by the Department will not relieve the Contractor of the responsibility for correctness of dimensions, size of components and the details of manufacture. As per CSA A23.3 Clause 5, the shop drawings shall include, but not limited to:

- The size and location of all structural elements, reinforcement, and prestressing tendons.
- Provision for dimensional changes resulting from prestress, creep, shrinkage, and temperature.
- Locations and details of expansion or contraction joints, and permissible locations and details for construction joints.
- Magnitude and location of prestressing forces.
- The specified strength of concrete in various parts of the structure at stated ages or stages of construction, as well as nominal maximum size aggregate.
- The required cover.
- Identification of the applicable reinforcing steel Standard and the specified type and grade of reinforcement.
- The anchorage length and location, and length of lap splices.
- Type and location of welded splices and mechanical connections of reinforcement.
- Type and grade of prestressing steel.
- Identification of protective coatings for reinforcement, prestressing tendons, and hardware.

Additionally, in accordance with CSA A23.4-16 requirements:

- Shop and installation drawings shall show the layout and general arrangement of the precast concrete elements, their location in the building or structure, their relation to adjacent materials, the connections, and the joint and sealing details, if within the scope of work.
- Shop and setting drawings showing the location of hardware supplied by the precast concrete manufacturer to be installed by the general contractor.

- Shop and installation drawings that detail the dimensions and shape of individual elements, masses, reinforcement, finishes, special handling instructions, stressing information, and individual mark numbers. Such drawings shall also show special embedments (e.g., plant and installation hardware and fastening details, such as reglets, cut-outs, and pipe sleeves and openings) required by other trades. Shop drawings for individual elements shall contain enough views and sections to ensure clear interpretation by workers, including, information on special materials, the concrete mix, finishes (including wet finishing), and special tolerances)

3.2 Erection Procedure. At least four (4) weeks prior to the commencement of erection of the members, the Contractor shall submit to the Engineer, Highway Construction Services (HCS), and Structural Engineering details of erection procedures including lifting methods. This shall include the relevant requirements listed in Section 3.1 of this specification as well as any additional details required for member erection.

3.3 Concrete Mix Design. The mix design shall be submitted in accordance with Division 5, Section 7, or Division 5 Section 18 for High Performance Concrete, at least four (4) weeks prior to member manufacture to the Engineer, Highway Construction Services (HCS), and Structural Engineering. Precast concrete girders shall be constructed using high performance concrete (HPC) in accordance with the requirements of Division 5, Section 18, of the Standard Specification.

3.4 Certification. The Manufacturer shall be certified through the Canadian Precast Concrete Quality Assurance (CPCQA) Certification Program or be certified through the CSA Prequalification Program for Precast Concrete prior to the time of tender. Proof of this certification shall be provided to the Engineer, Highway Construction Services (HCS), and Structural Engineering by the Contractor prior to award of the contract.

3.5 Quality Control. The Manufacturer is responsible for quality control and shall implement a Quality Control Plan for all phases of the element manufacture. Quality control testing shall be conducted by the Manufacturer and quality assurance verification will be conducted by the Department.

Manufacturers shall have the following certifications:

- Technicians providing Quality Control on Department projects shall have a CCIL (QF+QL) Concrete Certification or an ACI Level 1 Concrete Certification.
- The laboratory conducting testing shall be CCIL certified meeting the requirements of CSA A283 or be certified through the Canadian Precast Concrete Quality Assurance (CPCQA) Certification Program.

For generic precast products (catch basins, pipe, culverts, arches, retaining walls, etc.) which are manufactured for stock, the Manufacturer shall provide copies of the Quality Control records before the products are approved for delivery to the site.

For precast elements manufactured for a specific project, the Manufacturer shall submit a project specific Quality Control plan to the Department at least four (4) weeks prior to commencement of manufacturing.

As a minimum, the Quality Control Plan shall include inspection and testing of all items referenced in this section of the Standard Specification and additional items referenced in the Special Provisions. Typical items contained in the Quality Control Plan would include:

- Concrete mixture design.
- Mill certificate information from prestressing wire and reinforcing steel.
- Shop drawings for each element showing dimensions, tolerances for the completed element, concrete cover, and pretensioning stress.
- Records of detensioning.
- Frequency of plastic and hardened concrete tests
- Plastic and hardened concrete test results (slump, temperature, total air content, mass density, compressive strength, air void parameters, chloride ion penetrability).
- Curing procedures.
- Finishing and repairs procedures.
- Storage procedures.
- Delivery procedures where the manufacturer is responsible for delivery.
- Certificate of accuracy for all scales or measuring devices used during the production of concrete, including batch scales, verified by a qualified technician employed by an authorized Scale Manufacturer or Company.

- List of Certified technicians as well as proof of certification.
- Proof of Laboratory Certification.

Quality Control information shall be clearly presented on daily report forms and the manufacturer's quality control representative shall sign and date all items checked or tested. Depending on the size of the project, weekly or monthly summary reports may be required, and the frequency of reporting shall be stipulated in the Quality Control Plan. The qualifications of the manufacturer's quality control representative shall be included in the Quality Control Plan.

Each individual element shall be legibly marked with a unique identification number or code and the date of manufacture. The number and the date of manufacture must remain legible until the element is installed on the project. All applicable reports for the element shall reference this identification mark.

4.0 MATERIALS

4.1 Concrete. Concrete shall conform to the provision of Division 5, Section 7, or Section 18, of these specifications except as varied herein. The Manufacturer is responsible to provide a mix design meeting the minimum 28-day compressive strength as indicated on the drawings.

4.2 Reinforcing Steel. Reinforcing steel and supports shall conform to Division 5, Section 5 of the Standard Specifications.

4.3 Prestressing Strand. Prestressing strand shall consist of seven wires having a center wire and six outside wires, conforming to the latest edition of CSA G279.2. Prestressing strand shall be stabilized having a nominal diameter of 12.7 mm and ultimate tensile strength of 1860 MPa, unless otherwise specified. Prestressing strand shall be furnished either in coils, or on reels and shall be tagged to provide the following information: strand type, manufacturer, length, reel number, modulus of elasticity and ultimate strength. Each reel shall be accompanied by a stress-strain curve.

All prestressing strands must be clean and free from deleterious materials which may prevent bond between the strand and concrete. In cases where a bond breaker is required, the debonding material provided shall be in accordance with the approved shop drawings. All casting beds shall be covered with a non-absorbent, waxed paper or an approved equivalent to prevent form release agents from contaminating the prestressing strand. Prestressing strand having kinks, nicks, bends, or other defects shall not be used.

In accordance with CSA A23.4-16 Clause 28.2.5.8.2, stressing records shall include the following information applicable to a particular operation:

- Date of tensioning.
- Casting bed identification.
- Description, identification, and number of elements.
- Manufacturer, size, type, and ultimate strength of tendon.
- Sequence of stressing (and detensioning, if critical).
- Straight or draped tendons (possible compensations and possible stressing from either end).
- Identification of jacking equipment.
- Corrections for tendon slippage (including splices), anticipated abutment movement, thermal effects, etc.
- Required total load per tendon.
- Initial tension.
- Anticipated pressure for each tendon or for each group of tendons stressed in one operation.
- Anticipated elongation for each different jacking load.
- Actual elongation or actual force measurement, depending on which operation is chosen for checking. Force measurement for multiple tendon stressing may be determined with strain gauges.
- For stressing of draped tendons:
    - Sequence
    - Date and description
- Any unanticipated problems encountered during tensioning (e.g., wire breakage, excessive slippage, restressing, or other factors that can have influence on the net stress)

4.4 Inserts. The Manufacturer shall supply and install all inserts in the member, as shown on the approved shop drawings. This item shall include lifting and handling devices as well as anchors for hold-down devices.

4.5 Lifting Devices. Lifting devices for the members shall be submitted with the shop drawings for approval by the Department.

5.0 CONSTRUCTION METHODS

5.1 Manufacture of the precast or prestressed concrete members shall be in accordance with CSA A23.4-16. “Precast Concrete Materials and Construction”.

5.2 Manufacturing Restriction. Between October 31 and April 1, or when the air temperature is at or below 5°C or if there is a probability of it falling below 5°C within 24 hours, girders and all concrete shall be manufactured and protected in suitable enclosures or shelters to maintain an air temperature above 5°C.

5.3 Notification. The Contractor shall notify the Department 48 hours before any phase of the member manufacturing is commenced.

5.4 Dimension Tolerances. Dimensions shall be in accordance with CSA A23.4-16, Section 12.

5.5 Prestressed Members

5.5.1 Pretensioning. The prestressing strand shall be accurately held in position and stressed by jacks. If multiple strands are tensioned simultaneously, provision shall be made to include the same initial stress in each. Strands shall be tensioned to the initial tension as indicated on the approved shop drawings prior to final stressing. The variation from the specified prestress force shall not be more than 5% on the parallel strand and 7% on the draped strand. The elongation of strand shall be adjusted for the effect of temperature variations if the temperature of the steel at the time it is stressed differs by more than 15°C from the time of placement of the concrete. After three days, a minimum of three strands shall be inspected. If any strand shows significant movement then the remaining strands will be restressed.

One splice will be permitted providing that no splice falls within the girder. The strand to be spliced shall have the same lay or direction of twist. If strand splices are used elongations must be adjusted to account for slippage at the splice.

Rotation of a jacking ram shall be limited to not more than one revolution per 30 m of exposed tendon. Welding of strand shall not be permitted.

5.5.2 Detensioning. Detensioning shall not proceed until the concrete in the member has achieved the required release strength. In accordance with CSA A23.4-16 Clause 23.2.1.2 and 23.2.1.3, the strength of elements at time of transfer of prestress and stripping shall be determined by test test specimens cured under temperature and moisture conditions that simulate as closely as possible to the conditions under which the concrete in the precast forms is cured. Additionally, the required strength of concrete at transfer of prestress and stripping shall be documented in the shop drawings.

Detensioning shall meet the requirements of CSA A23.4-16 Section 28.2.6.

For no-slump concrete products, detensioning shall meet the requirements of CSA A23.4-16 Section 28.2.7.2.

In single strand detensioning, the strand shall be gradually released by heat-cutting, using a low oxygen flame or by jacking.

5.6 Concrete Placing. Concrete shall not be placed without the approval of the Department or its representative. Concrete placing methods and equipment shall meet the requirements of CSA A23.4-16 Section 21.2., as well as this specification. Concrete placing methods and equipment shall be such that the concrete is conveyed and deposited at the required consistency without segregation or affecting the specified qualities of the concrete. The top surface of the members shall be free of laitance and finished in accordance with the specification for the type of element cast.

5.7 Concrete Curing. As per the requirements of CSA A23.4-16 Section 23.2.2, curing of non-accelerated concretes shall conform to the following:

- Concrete Exposure Classes C-3, C-4, A-3, A-4, F-2, R-1, R-2, R-3, N-CF, and S-3 normal concretes, as described in CSA A23.1:19, curing shall continue for 3 days at greater than or equal to 10°C or for the time necessary to attain 40% of the specified strength.
- Concrete Exposure Classes C-1, C-2, A-1, A-2, F-1, S-1, and S-2 normal concretes, as described in CSA A23.1:19, curing shall continue for 7 days greater than or equal to 10°C or for the time necessary to attain 70% of the specified strength.

- Concrete Exposure Classes C-XL, A-XL normal concretes, as described in CSA A23.1:19, wet curing shall continue for 7 days greater than or equal to 10°C and for the time necessary to attain 70% of the specified strength.

High Performance Concrete (HPC) shall be cured using water or steam. All other concrete shall be cured in accordance with Division 5, Section 7. Side forms may be removed when the concrete strength reaches the release strength as specified in the approved construction drawings, however, water or steam curing must continue until release strength is achieved.

5.7.1 Water Curing. Water shall be clean and free from any materials which may cause discolouration or other harmful effects to the concrete. The members shall be maintained at the point of casting in an approved manner, designed to keep the units continuously wet and at a minimum temperature of 10°C. Water curing shall be continued until the required release strength is obtained. If tarpaulins are used to enclose girders, they must be clean and free from holes. Tarpaulins shall remain over the member until the specified release strength is obtained.

5.7.2 Steam Curing. The members shall be maintained at the point of casting in an approved manner. The initial application of steam shall not commence until after initial set of the concrete. Steam shall not be discharged directly onto the concrete, forms, or test test specimens. The ambient temperature within the enclosure shall be increased at a uniform rate not exceeding 20°C/hr. The maximum curing temperature shall not exceed 70°C. When release strength is reached, the ambient temperature shall be decreased at a maximum rate of 15°C/hr and shall be monitored until the concrete is not more than 20°C above the ambient temperature. The time-temperature relationship shall be recorded throughout the curing period.

5.7.3 Temperature Monitoring. In accordance with CSA A23.4-16 Clause 23.2.3.6, temperature of concrete during the curing period shall be monitored by one or more of the following means:

- Devices, such as expendable thermometers or thermocouples, cast into the concrete; or
- For surface measurements, temporary measuring devices placed against the concrete surface under a temporary cover of heavy insulation.

Automatic temperature recordation of the concrete shall occur with the time interval between readings to not exceed 15 minutes.

For standard products, if the correlation between the enclosure temperature and temperatures within the concrete is determined and documented, temperatures may be measured within the enclosure but the temperature within the concrete shall govern the cycle, if approved by the Department.

If steam curing is used, the governing maximum temperature shall be achieved within the core of the concrete elements in accordance with CSA A23.4-16 Clause 23.2.3.5.

5.8 Final Finish. Members shall be finished as indicated on shop drawings. Members shall be repaired and finished in suitable enclosures or shelters where the ambient temperature is maintained above 10°C and cured at this temperature for at least 24 hours. Surfaces of members specified to receive sack rub finish (sacking) shall be water jetted at a pressure which will not damage the concrete but will expose air pockets. The member surface shall be sack rubbed finished in accordance with CSA A23.1:19 Section 7.10.4.4. Sacking materials can be cured with a curing compound approved by the Department.

5.9 Prestressed Girder Ends. At the ends of prestressed girders which are to be cast in concrete, the prestressing strand shall be burned or cut off flush with the end of the girder and the strand shall be coated with a corrosion inhibitor. At the ends of girders which are not to be cast in concrete the strand shall be removed to a depth of 25 mm. All depressions left shall be filled with epoxy. All slag and rough concrete shall be ground off prior to the application of two coats of asphaltic material over the entire surface of the girder ends.

5.10 Acceptance. All members shall be inspected and accepted by the Department's representative prior to shipment.

5.11 Repairs. Repair work shall be performed in accordance with CSA A23.4-16, Section 33, and Sections 5.11.1 and 5.11.2 of this specification. Repairs of minor defects are referred to as cosmetic repairs, while extensive defects are considered structural.

5.11.1 Cosmetic Repair. Repair of defects and damage to precast members shall be performed with materials in a manner that will restore the specified quality of the product and shall meet the requirements of CSA A23.4-16 Section

33.2 as well as any modifications below. Any damage not determined to be a structural repair in accordance with Section 5.11.2. shall be considered a cosmetic repair.

When the defect in a prestressed girder end is less than 15 mm, no repair is required, and the beam will be coated with the standard end coating. When the defect exceeds 15 mm it shall be considered a structural repair. Any damaged areas exposed to view as well as any sections identified by the Department or its representative shall be repaired.

Where it is necessary to fill surface voids in vertical concrete surfaces or under top forms, these shall be sack-rubbed in accordance with CSA A23.1:19 Clause 7.10.4.4.

5.11.2 Structural Repairs. No repairs of a structural nature shall be undertaken until the Department has evaluated the damage. A defect or damage will be considered structural when:

- Main reinforcement or prestressing strand are exposed.
- Connection hardware anchorage is exposed.
- Any cracking in member bearing areas.
- Any cracking extending from one face of the element through to the opposite face.
- Cracks larger than 0.3 mm extending longer than 100 mm.
- Cracks larger than 0.2 mm in an area of tensile stress.

When an element is considered to have structural damage, repair procedures may include; grinding, epoxy coatings and epoxy injection. If epoxy is used it must be approved by the Department. Repair procedures shall include the requirements of CSA A23.4-16 Clause 33.2.6. Additional repair methods such as dry packing, pressure grouting, or injection of epoxy under pressure or by vacuum shall be approved by the department prior to repair.

If a load test is required after repairs, it shall be done in accordance with CSA A23.3 Section 20.3.

5.12 Identification, Handling and Storage. Members shall be identified by stencilling or painting as indicated on approved shop drawings. In addition, each member shall be identified by a direction marker to aid in placement. No member shall be lifted by using pickup points other than those indicated on the drawings or as approved by the Department. Prestressed girders shall be supported at a distance from the ends of the girder, not exceeding 1.5 times the depth of the member. Members shall be stored in a way to meet the requirements of CSA A23.4-16 Section 30.

5.13 Transportation and Delivery. Members shall not be shipped until the concrete has reached the compressive strength specified by the designer for shipping. Compressive strengths will be determined by obtaining the average strength of two test test specimens cured with the member. Members shall be loaded and delivered in an approved manner which ensures the members are not subject to stresses they are not designed for. Damage incurred during transportation, handling, and erection shall be the responsibility of the Contractor and shall be repaired to the satisfaction of the Department.

5.14 Erection of Members. Members stored on site shall be supported on properly constructed blocking, until they are placed in the structure. All members shall be erected by the Contractor in accordance with the approved erection drawing and CSA A23.4-16 Section 32.

6.0 QUALITY CONTROL / QUALITY ASSURANCE

6.1 General. Quality assurance shall be conducted by the Department or its representative.

The frequency and extent of inspection will be outlined on a project by project basis. Quality assurance shall include verification of the Quality Control Plan (which shall meet the requirements of Section 3.5 of this specification), and records submitted by the Manufacturer as well as access to all phases of member production including:

- Prestressing operations, where applicable,
- Installation of reinforcing steel and support, inserts,
- Aggregate testing,
- Concrete production, placement and curing,
- Detensioning operations, where applicable,
- Finishing of members,
- Dimensions and tolerances,
- Handling and storage, and

- Transportation and delivery.

Quality Assurance representative(s) will oversee Quality Control operations performed by the Manufacturer and may perform duplicate testing for tests such as slump, air content, temperature, compressive strength, etc. to verify accuracy. A concrete placement report shall be made for each day(s) production, if applicable. The placement reports shall be sent to the Engineer and HCS within 24 hours of concrete placement.

Concrete shall be sampled and tested at the point of discharge, prior to placing into forms without discharging the first 10% as per the requirements of CSA A23.4-16 Clause 19.1. If the primary source of mixing is with a truck mixer, then sampling after 10% discharge shall be permitted.

The Manufacturer shall cast a minimum of six (6) test specimens, two (2) of which are for the Manufacturer and four (4) of which are for the Quality Assurance representative. The two (2) test specimens cast for the Manufacturer shall be tested for compressive strength 28 days after casting by the Manufacturer. Two (2) test specimens cast for the Quality Assurance representative shall be tested for compressive strength 28 days after casting by the Quality Assurance representative, unless otherwise directed by the Engineer, and the other two (2) test specimens cast for the Quality Assurance representative shall only be tested if requested by the Engineer for appeal purposes. The Manufacturer will cast additional test specimens as required for release and stripping strength, and the testing listed below. A concrete placement and compressive strength report shall be completed and reported to the Engineer the same working day as the test.

Concrete shall also be randomly tested for Microscopical Determination of Air Void Content and Parameters of the Air-Void System in Hardened Concrete (ASTM C457) and Electrical Indication of Concrete Ability to Resist Chloride Ion Penetration (CSA A23.2-23C:19). The frequency of these tests shall be one (1) test for every 75 m^3 of the project, unless otherwise specified by the Engineer. The test result shall represent the 75 m^3 or fraction thereof in its entirety. The Quality Assurance representative will determine when the sampling is to take place, while the Manufacturer is responsible for sample preparation. This testing will be completed by the Quality Assurance representative. For every sample taken, an additional specimen for both Chloride Ion Penetrability and Air Void Parameters of Hardened Concrete shall be cast and only be tested if requested by the Engineer for an appeal. The testing shall be performed at the following days after casting:

- Air Void Parameters of Hardened Concrete (ASTM C457) – 7 days after casting.
- Chloride Ion Penetrability (CSA A23.2-23C:19) – 91 days after casting.

All tests listed above are to be reported within 24 hours of completing the test.

Aggregate used in the production of beams shall be sampled and tested by the Department or it's representative at a frequency of one (1) per beam. For panels the test frequency shall be once per week while production is ongoing. This aggregate is to undergo Sieve Analysis of Coarse and Fine Aggregate testing in accordance with CSA A23.2-2A:19. The results of this test shall be reported to the Engineer within 24 hours of completing the test.

6.2 Prestressed Girder Fabrication. The Department's Quality Assurance representative will verify the following during Girder production:

- Prior to concrete placement:
  - Location of hold-down, lifting points, prestressing strand, and reinforcing steel for each girder.
  - All cables are properly stressed.
  - All corrective actions are completed.
- During concrete placement:
  - Ensure that four (6), 28-day compressive strength test specimens are cast by the Manufacturer (two for the Manufacturer, four for the Department) for each girder.
  - Minimum two (2) test specimens are cast by the Manufacturer to verify release strength of each girder.
  - Minimum two (2) test specimens are cast by the Manufacturer to verify stripping strength of each girder.
- After Concrete Placement:
  - Verify release strength before permitting detensioning of prestressing strands.
  - Determine the camber of each girder.
  - Inspect each girder for defects when the Manufacturer declares it ready for shipment. If defects are present, they shall be reported to the Manufacturer and the Engineer. Once repairs have been completed, they shall be inspected again by the Department Representative.
  - Verify shipment strength prior to transport.

A stressing report shall be developed for each production bed, and a Measurement of Prestressed Girder report shall be made for each girder. Both reports shall be submitted to the Engineer and HCS within 24 hours of completion.

7.0 METHOD OF MEASUREMENT

8.0 BASIS OF PAYMENT

8.1 General. Payment will be at the contract unit bid price for Reinforced Precast Concrete Members including Prestressed Concrete Girders. This price shall be full compensation for all labour, materials, plant and services necessary to manufacture, deliver and erect the members in the final position, as shown on the shop drawings, in accordance with this specification and the project special provisions.

8.1.1 Unit Price Adjustments (Penalty/Bonus). If a concrete member fails to meet the durability requirements of this specification and contract documents, the member may be subject to a unit price adjustment, strengthening, or full replacement, as decided by the Engineer.

8.1.2 Compressive Strength Adjustment. The unit price adjustment for compressive strength testing shall be as defined in Division 5, Section 7 of the Department's Standard Specification.

8.1.3 Air Void Parameters of Hardened Concrete **Adjustment.** The unit price adjustment for Hardened Air Void Systems (ASTM C457) testing shall be as defined in Division 5, Section 7 of the Department's Standard Specification, with the following adjustments. The testing frequency and the quantity of concrete the test represent shall be as defined in Section 6.1 of this specification.

8.1.4 Resistance to Chloride Ion Penetration Adjustment. The unit price adjustment for Resistance to Chloride Ion Penetration (CSA A23.2-23C:19) testing shall be as defined in Division 5, Section 7 of the Department's Standard Specification, with the following adjustments. The testing frequency and the quantity of concrete the test represent shall be as defined in Section 6.1 of this specification.

8.1.5 Appeals. Appeal criteria and procedures for the tests listed in this section shall be as defined in Division 5, Section 7 of the Department's Standard Specification.

8.2 Partial Payment. Where members are not delivered to the job site but are delivered to a temporary storage site on property owned or leased by the Department with the prior approval of the Engineer, partial payment for the fabrication and delivery of the members may be made, which payment will be the lesser of the Manufacturers invoice price less 15% or the tender amount less 15%. Payment will only be made at the Contractors request.

9.0 WARRANTY