# CONSTRUCTION SPECIFICATION FOR STEEL REINFORCEMENT FOR CONCRETE

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905.01 SCOPE

This specification covers the requirements for the placing of steel reinforcement and mechanical connectors for concrete structures.
905.02 REFERENCES

This specification refers to the following standards, specifications or publications:

**Ontario Provincial Standard Specifications, Construction:**

OPSS 909  Prestressed Concrete - Precast Members  
OPSS 910  Prestressed Concrete - Cast-in-Place

**Ontario Provincial Standard Specifications, Material:**

OPSS 1440  Steel Reinforcement for Concrete  
OPSS 1442  Epoxy Coated Steel Reinforcement for Concrete  
OPSS 1443  Organic Coatings for Steel Reinforcement

**Canadian Standard Association Standards:**

G279-M1982 - Steel for Prestressed Concrete Tendons  
W59-M1989 - Welded Steel Construction - Metal-Arc Welding  
W186-M1990 - Welding of Reinforcing Bars in Reinforced Concrete Construction

**Reinforcing Steel Institute of Canada:**

Reinforcing Steel Manual of Standard Practice - 1992

**American Society for Testing and Materials Standards:**

A53-90b - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless  
D2239-89 - Polyethylene - PE, Plastic Pipe - SIDR-PR Based on Controlled Inside Diameter  
D3350-84 - Polyethylene Plastic Pipe and Fittings Materials

**Others:**

Concrete Reinforcing Steel Institute - Voluntary Certification Program for Fusion-Bonded Epoxy Coating Applicator Plants

905.03 DEFINITIONS

For the purposes of this specification, the following definitions apply:

**Bridge:** means a highway, railway, rail transit or pedestrian bridge, bridge components and accessories such as retaining walls, barrier walls and approach slabs.

**Day:** means calendar day unless otherwise specified.

**Deviator Duct:** means a length of steel pipe placed in deviation blocks or deviation diaphragms to provide a means of changing direction of external tendons.
**Local Zone:** means the region immediately surrounding each anchorage device represented by a prism with a width and height equal to the maximum anchorage plate dimension plus the edge cover recommended by the manufacturer and with a depth equal to the width.

**Mechanical Connection:** means a joining of two reinforcing steel bars or post tensioning tendons by means of a mechanical connector.

**Mechanical Connector - Post-Tensioning:** means a mechanical device that is used to join post tensioning tendons.

**Mechanical Connector - Reinforcing Steel Bars:** means a mechanical device that is used to join two butting reinforcing steel bars and refers to one of the following connector types:

  a. **Filled Sleeve Type** - A mechanical connector consisting of a metal or grout filled sleeve relying on the resistance between the grooves inside the sleeve and on the reinforcing steel bar and the hardened filler material.

  b. **Sleeve Swaged Coupler Type:** A mechanical connector consisting of a seamless steel sleeve applied over the ends of the reinforcing steel bars and swaged to the bars by means of a hydraulic press.

  c. **Threaded Coupler Type:** A mechanical connector consisting of a steel sleeve with internal threads that match tapered or straight threads cut on reinforcing steel bars.

  d. **Hot Rolled Thread Bar Coupler Type:** A mechanical connector consisting of a steel sleeve with internal deformations that match the continuously rolled-in pattern of thread-like deformations formed along the entire length of a reinforcing steel bar.

  e. **Forged Bar Coupler Type:** A mechanical connector similar to the Threaded Coupler Type that has the end of the reinforcing steel bar enlarged by forging prior to cutting the threads.

  f. **Form Saver Type** - A mechanical connector of type c., d. or e. above that incorporates a flanged steel element that can be bolted or nailed to the formwork and avoids the necessity of cutting holes in the forms to facilitate subsequent joining.

**Post-tensioning:** means a method of prestressing in which tendons are stressed after the concrete has reached a predetermined strength.

**Prestressing Tendon:** means a high strength steel element consisting of one or more wires, strands or bars used to impart prestress to the concrete.

**Proposal:** means a Contractor’s submission of changes, when engineering design is required, affecting the original design.

**Reinforcing Steel Bars:** means deformed steel bars used in the reinforcing of concrete and includes splice bars.

**Slip:** means the increase in elongation in the mechanical connection measured at a bar stress of 20 MPa after the mechanical connection is loaded to a bar stress of 240 MPa and then unloaded to a bar stress of 20 MPa.

**Splice Bar:** means a reinforcing steel bar that is further manufactured, other than by solely cutting threads, to be compatible with a specific mechanical connector.
Splice - Prestressing Tendon: means a connection of one prestressing tendon to another by means of a mechanical connector.

Splice - Reinforcing Steel: means a connection of one reinforcing steel bar or splice bar to another by lapping, welding, mechanical couplings or other means or the lap between sheets or rolls of welded wire fabric.

Stamped: means that "permission to construct" has been given by the Owner and "Reviewed, Permission to Construct Granted" is so stamped on the drawings.

Steel Reinforcement: is a general term which includes reinforcing steel bars, splice bars, welded steel wire fabric and prestressing tendons.

Steel Wire Fabric: means a wire mesh fabricated by means of welding the crossing joints, available in rolls or flat sheets.

Swaged: means to apply circumferential pressure to a sleeve surrounding a bar to deform the sleeve sufficiently to achieve bearing between the deformed sleeve and the deformations on the bar.

Tensile Strength: means the stress at which the reinforcing steel bar or the tendon fails under tensile testing.

Yield Strength: means the maximum tensile stress which a material is capable of sustaining.

905.04 SUBMISSION AND DESIGN REQUIREMENTS

905.04.01 Submissions

905.04.01.01 Certification of Manufacturer

At least three weeks prior to fabrication, a statement from the manufacturer certifying that their plant meets the minimum quality criteria set forth by the Concrete Reinforcing Steel Institute - Voluntary Certification Program for Fusion-Bonded Epoxy Coating Applicator Plants shall be submitted to the Contract Administrator.

905.04.01.02 Mechanical Connectors for Post Tension Tendons

At least three weeks prior to commencement of the work, test reports from the manufacturer certifying the connectors have met the specified fatigue requirements shall be submitted to the Contract Administrator.

905.04.01.03 Mill Certificates for Prestressing Steel

At least three weeks prior to commencement of the work, two copies of the mill certificate for each lot or part lot of prestressing steel shall be submitted to the Contract Administrator.

905.04.02 Submission of Working Drawings

905.04.02.01 Reinforcing Steel Bar Placing Drawings

When not included in the Contract by the Owner, the Contractor shall prepare and submit to the Contract Administrator, three complete sets of placing drawings and reinforcing steel schedules, at least four weeks before the commencement of the installation of the reinforcement. These drawings shall include: quantity, bar size, grade, mark number including coating designation, location and spacing for all reinforcing steel bars.
905.04.02.02  Reinforcing Steel Schedule

Three weeks prior to commencement of placing reinforcing steel, six copies of the reinforcing steel bar schedule shall be submitted to the Contract Administrator. When bar marks are shown on the contract drawings, they shall be used in the schedule.

Reinforcing steel bar schedules shall include: quantity, bar size, grade, coated or uncoated, length and bending dimensions.

905.04.02.03  Prestressed Concrete - Precast Members

Submission of proposals and shop drawings for prestressed concrete-precast members shall conform to OPSS 909.

905.04.02.04  Prestressed Concrete - Cast-In-Place Concrete

Submission of post-tensioning drawings and stressing details for prestressed concrete - cast-in-place concrete shall conform to OPSS 910. Drawings shall include the detailing of reinforcement in the local zone as required by the anchorage supplier.

905.04.02.05  Welding Details

Six copies of complete details of all welding shall be submitted to the Contract Administrator, three weeks before commencement of the welding of the reinforcing bars. The details shall include materials, procedures, bars to be welded, location and type of weld. Details of tack welds shall be included. Details shall be designed to prevent notching effects in the bars.

Providing the details on the working drawings conform to the Owner's requirements, two copies will be returned to the Contractor stamped "Reviewed. Permission to construct granted".

905.04.02.06  Prestressing Steel

The Contract Administrator shall be notified when prestressing steel is available for sampling.

Samples selected by the Contract Administrator shall be properly labelled by the Contractor for submission, at least three weeks in advance of anticipated use, to the Owner's laboratory or as directed by the Contract Administrator.

Two copies of the stress-strain curves representative of the lots to be used shall be submitted to the Contract Administrator together with the mill certificates detailed in OPSS 1440.

905.04.03  Mechanical Connections

The proposal for the mechanical connection shall be submitted to the Contract Administrator four weeks prior to commencement of the work and shall contain the following information:

a. The type or series identification of the connector.

b. The grade and size of the reinforcement to be joined by the connector.

c. A copy of the manufacturer's catalogue giving complete data on the connector material and installation procedures.
905.05    MATERIALS

905.05.01    Steel Reinforcement

Steel reinforcement shall conform to OPSS 1440.

Reinforcing steel bars installed in bridges, culverts and headwalls shall be 400W.

Reinforcing steel bars to be welded and installed in other structure types, shall be type W.

Epoxy coated bars shall conform to OPSS 1442.

905.05.02    Ducts

Ducts for prestressing steel shall be formed from bright steel corrugated sheaths or polyethylene sheaths. The sheaths including joints shall be watertight under an internal pressure of 350 kPa and chemically non-reactive with concrete, tendons or grout.

All sheaths shall be provided with suitable devices for the injection and discharge of grout after prestressing. Air vents shall be provided at all high points on the tendon sheaths that are continuous over more than one span. Air vents and drainage vents shall be provided at other specified locations.

Internal ducts shall be mortar tight, and capable of withstanding concrete pressures without excessive deformation or permitting the entrance of cement paste during the placing of concrete. The ducts shall have sufficient rigidity to maintain the required profile between points of supports.

905.05.02.01    Steel Sheaths

Rigid steel sheaths shall have a wall thickness of at least 0.60 mm and shall be capable of being bent to an inside radius of 9 m without damage. Semi-rigid steel sheaths shall have a wall thickness of at least 0.25 mm and shall be capable of being bent to an inside radius of 3.50 m without distress.

905.05.02.02    Polyethylene Sheaths

Corrugated polyethylene sheath used as internal duct or smooth, rigid pipe used as external duct shall be high-density polyethylene, conforming to the material requirements of ASTM D 3350. Each section of polyethylene duct shall be watertight. Internal duct shall have a white coating on the outside, or shall be white material with ultra violet stabilizers added. Rigid pipe shall be manufactured in conformance with ASTM D 2239. Material thickness shall be as follows:

a. Corrugated, internal polyethylene duct
   1.25 mm ± 0.25 mm

b. Smooth, external polyethylene duct shall have an external diameter to wall thickness ratio of 21 or less.

905.05.02.03    Deviator Ducts

Deviator ducts for post-tensioning tendons shall be made of galvanized steel pipe conforming to ASTM Standard A53. The pipe shall be Type E, grade B with a minimum wall thickness of 3 mm. The pipe shall be bent to the tendon alignment. Field bending will not be permitted.
905.05.03 Anchorages

When tested in an unbonded condition, anchorages for post-tensioning shall develop at least 95% of the ultimate strength of the tendons, without exceeding the anticipated set. After tensioning and seating, anchorages shall be capable of sustaining applied loads without slippage, distortion or other changes which could result in loss of prestress.

The dimensions and details of anchorages, including any reinforcement required to resist tensile, bursting and anchorage bearing stresses within the local zone, shall be based on the specified strength of the tendon and the specified strength of the concrete at transfer.

905.05.04 Mechanical Connections

905.05.04.01 General

Mechanical connections will only be permitted where shown on the contract drawings.

905.05.04.02 Post-Tensioning Tendons

When tested in an unbonded condition, mechanical connections for post-tensioning tendons shall develop at least 100% of the ultimate strength of the tendons, without exceeding the anticipated set.

The mechanical connection shall withstand, without failure, two million cycles of stress through a range of 245 MPa for plain bars and 195 MPa for strands and ribbed bars. The upper limit of the range shall be 70% of the nominal tensile strength.

905.05.04.03 Reinforcing Steel Bars

The mechanical connections shall be qualified by tests made on sample splices in conformance to section 905.07.

The mechanical connections shall develop in tension or compression, as required, at least 125% of the specified yield strength of the bars joined.

The slip in the mechanical connection shall not exceed 0.10 mm measured between the gauge points located clear of the splice sleeve.

Splice bars shall be supplied by the manufacturer of the associated mechanical connector.

Mechanical connectors and splice bars shall be coated in conformance with OPSS 1442 when the contract specifies coating.

905.05.05 Mechanical Connectors

905.05.05.01 Post Tensioning Tendons

Mechanical connectors shall be supplied by the manufacturer of the prestressing system.

905.05.05.02 Reinforcing Steel Bars

Mechanical connectors shall be of an approved type and design and may be the form saver type, the filled sleeve type, the sleeve swaged coupler type, the threaded coupler type, the hot rolled thread bar coupler type or the forged bar coupler type.
The form saver type shall only be used at construction joints.

When a coupler type is specified in the contract only the specified coupler type shall be used for that application.

905.05.06 Associated Hardware

Only hardware including spacers and support devices, approved by the Owner shall be used with steel reinforcement. All supports or support systems shall be capable of withstanding the loads to be placed on them. Except for tie wire, all embedded hardware within 50 mm of exposed faces, shall be coated with an acceptable material or be of an acceptable non-metallic material.

The tie wire shall be annealed wire 2.6 mm in diameter and when used with coated steel reinforcement, shall be coated.

Bar chairs for supporting epoxy-coated reinforcing steel shall be non-metallic and shall be so manufactured that their use shall not damage the epoxy coating. Concrete chairs shall not be used to support coated bars.

905.05.07 Patching Material for Epoxy Coated Reinforcing Steel Bars

The patching material for epoxy coated reinforcing steel bars and mechanical connectors shall conform to OPSS 1443.

905.05.08 Polyethylene Sheeting

Polyethylene sheeting, used for protection purposes shall be opaque and have a minimum thickness of 150 μm.

905.07 CONSTRUCTION

905.07.01 General

All reinforcement and accessories shall be kept clean of all mud, oil and other deleterious materials and stored clear of ground contact.

905.07.02 Reinforcing Steel Bars, Coated Reinforcing Steel Bars, Splice Bars, and Coated Splice Bars

905.07.02.01 Handling, Storage and Protection of Coated Bars

Unprotected on-site storage shall not exceed 30 days, and total on-site storage time shall not exceed 120 days.

When protection is required, bars shall be covered with opaque polyethylene sheeting or other equivalent protective material. For stacked bundles, the protective covering shall be draped over the sides of the bundles around the perimeter of the stack. The covering shall be adequately secured, with provisions for adequate air circulation around the bars to prevent condensation under the protective covering.

The bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in the bundles.
Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.

When the exposure time is expected to exceed or exceeds 30 days, exposed bars installed in the structure, including bars partially embedded in concrete, shall be protected from the elements by covering with opaque polyethylene sheeting or equivalent protective material. The protection shall be adequately supported and secured in place.

This protection shall be maintained until its removal is required for preparation for subsequent concrete placement.

905.07.02.02 Placing

Reinforcing steel bars shall be accurately placed in the positions shown in the contract and held in the correct location during the operations of placing and consolidating concrete.

Bars shall be tied at least at every fourth intersection. The maximum untied length of any bar shall be 1 m.

For slab-on-girder type decks, the top layer of deck reinforcement shall be tied to the shear studs or shear stirrups on each girder at approximately 1.5 m centres.

Spacers for spirals shall be equally spaced around the spiral and shall be such that the specified pitch of the spiral is maintained.

Reinforcement shall be placed in conformance with the tolerances given in Table I. The tolerances listed include fabrication tolerances.

905.07.02.03 Surface Condition of Steel Reinforcement

Steel reinforcement at the time the concrete is placed shall be free from mud, oil or other contaminants that adversely affect bonding strength. Steel reinforcement with rust, mill scale or a combination of both will be acceptable provided the minimum physical properties including height of deformations and mass, of a wire brushed test specimen, are not less than the applicable specification requirements. Loose scale shall be removed.

905.07.02.04 Cutting

The cutting of reinforcing steel bars and splice bars by oxyacetylene torch may be carried out only where permitted in writing by the Contract Administrator. The cutting of epoxy coated steel bars by oxyacetylene torch is prohibited. Coated bars shall be cut only where specified in the Contract or authorized by the Contract Administrator. Repairs to coatings shall conform to the requirements specified for repairs to damaged epoxy coating.

905.07.02.05 Bending

Field bending of reinforcing steel bars will not be permitted except where specified in the Contract or authorized by the Contract Administrator.

When epoxy coated reinforcing steel bars are re-bent or straightened in the field the area of the bend shall be inspected and damaged areas repaired.
905.07.02.06 Welding

Welding including tack welding, will not be permitted except as shown in the Contract or as shown on the welding details submitted to the Contract Administrator.

The welding of reinforcing steel bars shall conform to CSA Standard W186 and shall be performed by companies certified by the Canadian Welding Bureau in conformance with CSA Standard W186.

Welding will not be permitted within 3 metres of any prestressing steel. Grounding welding equipment to prestressing steel or sheath will not be permitted.

Except for spirals, welding of epoxy coated reinforcing bars will not be permitted.

The welding of splices for epoxy coated reinforcing bar spirals shall be of the direct butt-splice type with no more than one splice per 15 metres of bar. The splice welds shall be ground flush with the bars deformations and cleaned of deleterious material prior to application of the patching material. The patching shall be done in conformance with the requirements specified for repairs to damaged epoxy coating.

The welding of prestressing steel will not be permitted.

905.07.02.07 Splicing

Welded splices shall develop 100% of the tensile strength of the bar.

Splices for reinforcing steel other than spirals shall be made where shown on the drawings.

End anchorage of column spiral reinforcement shall be provided either by one and one half extra turns of spiral bar at each end of the spiral, one end embedded in the footing and the other end in the component supported above or by a 90° bend around a longitudinal reinforcing bar plus an extension of at least 24 bar diameters into the core of the column.

Splicing of spiral reinforcing bars by means of a non-welded splice shall be made only where shown on the drawings. Non-welded splices shall be effected by mechanical connections or anchoring the ends of the spiral bars by means of a 90° bend around a longitudinal reinforcing bar with extensions of at least 24 bar diameters into the core of the column.

905.07.02.08 Repairs to Damaged Epoxy Coating

905.07.02.08.01 General

Bars with coating damage greater than 1% of the surface area in any one metre length of bar shall be rejected.

Bars with coating damage to 1% or less of their surface area shall have all damaged areas of the coating repaired.

Repairs to damaged epoxy coating shall conform to OPSS 1442 with material conforming to OPSS 1443.

Repairs shall not be done when the temperature of the bar or ambient air is 5°C or less, or when moisture is present on the bar.
905.07.02.08.02 Pre-installation

Prior to installation, the Contract Administrator will inspect the epoxy coated reinforcement to identify bars to be rejected or repaired.

All bars and accessories with damaged portions of coating, including bare portions of bar, shall be repaired.

905.07.02.08.03 Post-installation

After coated reinforcing steel has been installed at the intended position within the work, the Contract Administrator will inspect the steel for visible signs of damage, and will determine if bars with coatings damaged during or after installation shall be replaced or repaired.

All repairs to the coating of reinforcing steel and accessories shall be completed at least 12 h before permission to place concrete will be given. Repairs should be performed immediately after the damage occurs, and shall be done before rusting begins. If any rust is present it shall be completely removed before the patching material is applied.

905.07.03 Mechanical Connections

905.07.03.01 Reinforcing Steel Bars and Splice Bars

All procedures and equipment for mechanical connections shall conform to the manufacturer's recommendations.

Ends of reinforcing bars to be joined shall be cut nominally square.

Connector sleeves shall have the clear cover as specified for the reinforcing steel in that location.

Stirrups, ties and other reinforcement shall be adjusted or relocated if necessary to provide the required clear cover to the reinforcement.

Threads cut on the ends of the reinforcing steel bars shall match the internal threads in the connector.

The joint between the epoxy coated reinforcing steel bars or splice bars and the mechanical connector shall be sealed with the application of the epoxy kit in conformance with OPSS 1443.

905.07.03.02 Reinforcing Steel Bars - Qualification of Mechanical Splicing

905.07.03.02.01 General

Except for the filled sleeve type and sleeve swaged coupler type the procedures and operators will be qualified by inspection of the initial job site installation of the connectors incorporated in the work.

905.07.03.02.02 Filled Sleeve Type and Sleeve Swaged Coupler Type

Procedures to be used for making mechanical connections in reinforcing bars and operators employed to make these connections shall be qualified by tests performed by the Contractor on sample connections of the type to be used, before making connections in the work.

Each operator qualification test and each procedure qualification test for the mechanical connection shall consist of two sample connections.
All sample connections shall be made on the largest reinforcing bar size to be joined by the procedure or operator being tested.

Each operator qualified to make a mechanical connection to join reinforcing bars of a given size shall be considered also qualified for smaller sizes.

An operator qualification test and procedure test shall be performed for each mechanical connection position and for each procedure that the operator is expected to use in the work.

The Contractor may have operator and procedure qualification tests performed simultaneously.

Mechanical connection procedures and operators may be approved by the Contract Administrator, based upon approval of previous tests performed on appropriate sample connections.

Completed sample connections shall be at least 1050 mm long with the splice at mid-length.

The sample connections shall be made and tested by the Contractor in the presence of the Contract Administrator or his authorized representative or the Contractor shall arrange testing by an independent test laboratory.

905.07.03.03 Reinforcing Steel Bars - Job Control Tests

When mechanical connections are used, the Contractor shall perform job control tests. A job control test shall consist of the physical testing of three sample connections for each lot of 150, or fraction thereof, of each mechanical connector type used in the work. The samples shall be made at the job site. The test shall be performed on the largest bar size connected.

The bars joined shall be at least 500 mm long. The materials, position, location, equipment, and procedures as are being used to make connections in the reinforcing bars in the work shall be used when making the sample connections.

Sample connections shall be made and tested in the presence of the Contract Administrator or his authorized representative.

Sample connections shall be suitably identified with weatherproof markings prior to shipment to a testing laboratory.

For metal filled sleeve type and sleeve swaged coupler type mechanical connections, the Contract Administrator will designate when samples for job control tests are to be fabricated and will determine the limits of the lot represented by each test.

For threaded type mechanical connections, the reinforcing bars from which the control samples shall be fabricated will be selected on a random basis during the cutting of threads. The selected reinforcing bars of each lot shall be identified with weatherproof markings and shipped to the job site with the material they represent.

When the average of the results of tests made on the three sample connections or when more than one sample connections in any job control test fails to meet the requirements for the connections, all connections represented by that test will be rejected. Such rejection shall prevail unless the Contractor, at his expense, obtains and submits evidence acceptable to the Contract Administrator that the strength and quality of the connections in the work are acceptable.
905.07.04   Prestressing Steel, Sheaths and Anchorages

905.07.04.01   Surface Condition

All materials shall be clean and free of all rust, oil, dirt, scale and pitting. Prestressing steel may have a light oxide coating.

905.07.04.02   Placing

Prestressing steel, sheaths, anchorages, couplers and local zone reinforcing steel shall be accurately placed in the positions shown in the contract and held in the correct location during the operations of placing and compacting concrete.

The sheaths shall be secured at intervals not exceeding 1 m and shall meet the tolerances specified in Table I with the condition that a smooth profile shall be obtained. All joints in the sheath and between sheath and other hardware shall be protected against the entrance of laitance during concreting and against the entry of any deleterious material before, during and after concreting.

Prestressing steel, local zone reinforcing steel and anchorages shall be placed in conformance with the tolerances listed in Table I. The tolerances listed include fabrication tolerances.

Mechanical connections in strand or high strength bars will not be permitted in the work unless specified in the Contract.

Mechanical connections shall be installed in conformance with the recommendations of the manufacturer of the prestressing system used.

905.07.04.03   Welding

Welding of the prestressing tendon will not be permitted.

905.07.05   Repairs to Coated Associated Hardware

All damage due to handling shall be repaired to provide protection equivalent to the original coating.

905.08   QUALITY ASSURANCE

905.08.01   Sampling

905.08.01.01   Prestressing Steel

Samples of the prestressing steel shall be provided as follows:

a. For strand, 1 sample 1.0 m long from each reel,

b. For anchorages and connectors, samples will be selected by the Contract Administrator on a random basis.

905.08.01.02   Reinforcing Steel Bar

The sampling of reinforcing steel bar will be on a random basis.
905.08.02 Testing

905.08.02.01 Prestressing Steel

The testing of prestressing steel strand and bars will conform to CSA Standard G279.

905.08.02.02 Reinforcing Steel Bar

The testing of reinforcing steel bar will conform to CSA Standard G30 series listed in OPSS 1440.

Mill certificates for reinforcing steel bar stock may be examined at the fabricator’s plant.

905.08.03 Mechanical Connections

The torque will be checked on 5% of the splices. Formwork that will limit access to connectors for testing purposes shall not be placed until testing has been completed.

905.09 MEASUREMENT FOR PAYMENT

905.09.01 Reinforcing Steel Bars and Coated Reinforcing Steel Bars

905.09.01.01 Actual Measurement

The quantity in tonnes will be determined from the nominal mass in kilograms per metre as set out in the applicable CSA Standards.

For coated reinforcing steel, additions to, or deductions from, the theoretical mass per length of uncoated bar, will not be made.

905.09.01.02 Plan Quantity Measurement

Measurement of reinforcing steel is by Plan Quantity, as may be revised by Adjusted Plan Quantity, of the mass in tonnes. The mass is determined from the nominal masses in kilograms per metre as set out in the applicable CSA Standards.

For coated reinforcing steel, additions or deductions from the theoretical mass per length of uncoated bar, will not be made.

905.09.02 Mechanical Connections and Coated Mechanical Connections

905.09.02.01 Actual Measurement

Measurement is by the number of connections installed. The unit of measure is each.

905.09.02.02 Plan Quantity

Measurement is by Plan Quantity, as may be revised by Adjusted Plan Quantity of the number of connections installed. The unit of measure is each.
905.09.03  Splice Bars and Coated Splice Bars

905.09.03.01  Actual Measurement

Measurement is by the number of splice bars installed. The unit of measure is each.

905.09.03.02  Plan Quantity

Measurement is by Plan Quantity as may be revised by Adjusted Plan Quantity of the number of splice bars installed.

905.10  BASIS OF PAYMENT

905.10.01  Reinforcing Steel Bar - Item
Coated Reinforcing Steel Bar - Item

Payment at the contract price shall be full compensation for all labour, equipment and material to do the work, including steel wire fabric, when the steel wire fabric is not included in another tender item.

When the Contractor is required to supply placing drawings and/or reinforcing steel bar schedules, payment at the contract price shall include providing the placing drawings.

Payment for the supply of reinforcing steel at the work site shall be made in conformance with the General Conditions of Contract.

905.10.02  Mechanical Connections - Item
Coated Mechanical Connections - Item
Splice Bars - Item
Coated Splice Bars - Item

Payment at the contract price shall be full compensation for all labour, equipment and material to do the work.
### TABLE I

<table>
<thead>
<tr>
<th>TYPE</th>
<th>CAST-IN-PLACE CONCRETE</th>
<th>PRECAST CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REINFORCING STEEL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Principal Reinforcing Steel</td>
<td>± 20</td>
<td>± 10</td>
</tr>
<tr>
<td>b. Concrete Cast Against and Permanently Exposed to Earth</td>
<td>± 25</td>
<td></td>
</tr>
<tr>
<td>c. Stirrups in Webs</td>
<td>+ 5, - 3</td>
<td></td>
</tr>
<tr>
<td>d. Stirrups, Ties, Spirals</td>
<td>± 20</td>
<td>± 10</td>
</tr>
<tr>
<td>e. Deck Slab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top</td>
<td>± 20</td>
<td>± 15</td>
</tr>
<tr>
<td>Bottom</td>
<td>± 10</td>
<td>± 10</td>
</tr>
<tr>
<td>f. Remainder</td>
<td>± 30</td>
<td>± 30</td>
</tr>
<tr>
<td>g. Lateral spacing in slabs and walls</td>
<td>± 30 Note c</td>
<td>± 30 Note c</td>
</tr>
<tr>
<td>h. Longitudinal location of bends and ends of bar in continuous member</td>
<td>± 50</td>
<td>± 50</td>
</tr>
<tr>
<td>i. Longitudinal location of bends and ends of bar at discontinuous end</td>
<td>± 20</td>
<td>± 20</td>
</tr>
<tr>
<td><strong>PRESTRESSING STEEL AND SHEATHS</strong></td>
<td>Placing Accuracy Horizontal and Vertical</td>
<td></td>
</tr>
<tr>
<td>a. Pretensioning Tendons</td>
<td>± 5</td>
<td></td>
</tr>
<tr>
<td>b. Post Tensioning Sheaths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Longitudinal</td>
<td>± 15</td>
<td>± 10</td>
</tr>
<tr>
<td>(ii) Transverse</td>
<td>± 10</td>
<td>± 10</td>
</tr>
<tr>
<td>c. Anchorage</td>
<td>± 10</td>
<td>± 10</td>
</tr>
</tbody>
</table>

**Notes:** Notwithstanding the above tolerances:

a. The cover to the concrete surface shall not be reduced by more than one-third of the specified cover.

b. 1 The clear distance between bars shall not be less than one and one-half times the nominal diameter of the bar, one and one-half times the nominal size of the coarse aggregate, or 40 mm.

2 In two or more layers, the rebar shall be directly above one another and the clear distance between layers shall not be less than 25 mm.

3 The tolerances e. through f. do not apply to the lateral spacing of bars in slabs and walls.

c. The number of bars specified per metre width shall be placed in the metre width.