SECTION 910

STRUCTURAL STEEL

INDEX

910.01 SCOPE

This specification covers the requirements for the supply, fabrication, delivery and erection of structural steel for highway bridges including the design of all connections. The works shall be carried out in accordance with the latest version of CSA-S6 “Canadian Highway Bridge Design Code”.

910.02 DEFINITIONS

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

Bearing Contact Area - Two planes which are in contact or have a separation between them not exceeding 0.12mm.

Erection Diagrams - drawings showing the dimensional layout of the steel structure, from which shop details are made, and which correlate to the fabricator's piece markings with the location in the structure.

Flush - a profile of weld reinforcement in which there is a smooth gradual transition between base and weld metal involving grinding where necessary. Weld reinforcement not exceeding 1mm in height, may remain on each surface, unless the weld is part of a fraying surface when all reinforcement shall be removed.

Fracture Critical Member - a member, including attachments, in a single load path structure, which is subject to tensile stress and whose failure could lead to collapse of the structure.

Primary Tension Member - a member including attachments, which are subject to tension stress.

Proposal - a Contractor's submission of changes, when engineering design is required, affecting either the original design or shipping, as stipulated in this specification.

Smooth - a profile of weld reinforcement, in which the surface finish of weld reinforcement has a sufficiently smooth gradual transition, involving grinding where necessary. Weld reinforcement not exceeding the following limits, may remain on each surface:

For plate thicknesses $\leq$ 50mm, 2mm
For plate thicknesses > 50mm, 3mm

910.03 APPROVALS

910.03.01 General

Proposals by the Contractor, connection design, shop details, bolting procedure, welding procedures, erection diagrams, alternative design calculations, drawings and procedures shall bear the seal and signature of a Professional Engineer licensed in the Province of Newfoundland and Labrador.

Work affected by these proposals, details, designs, procedures and drawings shall not proceed until the Contractor receives an accepted copy of their submission(s).

Design shall be according to CSA S6.

Welding design shall be according to CSA W59 “Welded Steel Construction.”

Welding procedures shall be according to CSA W47.1 “Fusion Welding of Steel Company Certification” and CSA W59, except where modified by CSA S6 Clause A10.1.5.

Symbols for welding and non-destructive testing shall be according to CSA W59.

910.03.02 Shop Details and Welding Procedures

Four weeks before the commencement of fabrication, the Contractor shall submit to the Owner’s Representative for review, 1 paper copy and 1 electronic copy of shop details and welding procedures, which shall include the following:

a) All necessary specifications for the materials to be used.
b) The welding process to be used, the position of welding, filler metal, the proposed method of filling the welds, flux, shielding gas, if required, joint configurations, number and size of passes, preheat and interpass temperatures (if required) sequence of passes, current, rate of pass, electrode type, thickness or size, electrical stick-out and polarity and methods of storing consumables.
c) The methods that will be used for the preparation of the edges and measures which will be taken to control the effects of distortion, shrinkage and residual stresses.
d) The proposed methods and sequence of assembling, welding, welding repair and welding equipment which will be used. The approval of the above must be obtained before commencing the work.
e) Full detail dimensions and sizes of all component parts of the structure. These dimensions shall make allowance for changes in shape due to weld shrinkage,

camber, and any other effects that cause finished dimensions to differ from initial dimensions.

f) Erection marks.
g) Identification of areas requiring special surface treatment.
h) Identification of fracture-critical and primary tension members and component parts. Attachments having a length of more than 100mm in the direction of tension and welded to the tension zone of a fracture-critical or primary tension member shall be treated as part of that member.
i) Bolt installation requirements, including number of fitting up bolts required at each connection and oversize and slotted holes.
j) Identification of material and welds requiring non-destructive testing, including the limits of the weld undergoing testing and the frequency and type of testing.
k) Temporary welds.
l) Location of shop and field splices.

When all requirements are satisfied, one (1) accepted electronic copy of the above will be returned to the Contractor.

The Fabricator shall have a copy of the shop detail drawings and welding procedures at the manufacturing plant during fabrication available at all times.

910.03.03 Erection Diagrams and Procedures

4 weeks before commencement of erection, the Contractor shall submit to the Owner's Representative for review, 1 paper copy and 1 electronic copy of the erection diagrams, drawings and procedures, including lifting point locations and details of all temporary supports.

Erection diagrams and erection procedure drawings shall include at least the following:

a) Principal dimensions of the bridge
b) Erection marks
c) Sizes of all members
d) Field welding requirements, including identification of welds requiring non-destructive testing
e) Size and type of bolts
f) Bolt installation requirements, including the number of fitting up bolts required at each connection and identification of oversize and slotted holes.
g) Bracing during erection of structural steel.
h) Treatment at faying surfaces for joints designed as slip critical.

i) Written confirmation that the diagrams and drawings have been reviewed for quality assurance, safety and environmental requirements, and is in full accordance with the contract plans and specifications.

The Contractor shall have a clean copy of the erection diagrams and the erection procedure drawings and calculations at the site during erection available at all times.

Grouting materials, equipment and procedure shall be accepted by the Owner's Representative. The Contractor shall submit their grouting proposal to the Owner's Representative at least 2 weeks in advance of required use.

When all requirements are satisfied, 1 accepted electronic copy of the erection diagrams and procedures will be returned to the Contractor. Acceptance of all or any part of the proposal does NOT indemnify the Contractor from any consequences resulting from their proposal or any consequences related to the erection that were not covered in their proposal. Acceptance does not relieve the Contractor from any conditions specified in the Contract Documents.

Work is not to commence until acceptance of the proposal has been obtained from the Owner's Representative. The Contractor's Field Superintendent and Project Manager will be required to attend a pre-job meeting prior to commencement of any field work. The Contractor is required to follow the accepted erection plan and will be required to verify and sign off, after each stage of the erection procedure, that all requirements of that stage of the procedure have been satisfied.

The Erector shall provide to the Owner's Representative a detailed survey of the substructure including the location and top elevation (i.e. underside of bearing plates) of all bearing grout pads.

Shop drawings and calculations are to cover erection of all elements of the bridge. Shop drawings showing partial details or details of some elements but not all, and/or calculations that do not cover all elements of the erection process, will not be reviewed until all details have been submitted to the Owner's Representative. The Contractor shall have, and demonstrate, their own QA procedures for review of their proposal before submittal to the Department.

The Contractor shall ensure that all conflicts with utilities have been removed or mitigated and is responsible for obtaining all permits and all monetary and time costs related to complying with the requirements of the utility owners.

910.03.04 Mill Certificates, Samples and Tests

Prior to fabrication, 1 paper copy and 1 electronic copy of mill test reports for all materials, certifying that the material meets the contract requirements, shall be submitted to the Owner's Representative.

The Owner's Representative shall have the right to call for any additional samples, specimens and tests that are, in their opinion, necessary to secure the proper quality of material and work.

Paper Copies of the mill test certificates for all material to be used in the fabrication shall be available at all times for review at the fabricating plant during fabrication. The certificates shall show that the material is according to the Contract Documents.

If the material cannot be identified by mill test certifications, coupons shall be taken and tested and these test certificates shall be submitted to the Owner's Representative.

Steel with boron content exceeding 0.0008% shall not be permitted.

Where mill test certificates originate from a mill outside Canada or the United States of America, the Contractor shall have the information on the mill test certificate verified by testing by a certified Canadian laboratory to ensure grade compliance by testing the material to the specified material standards, including boron content. This laboratory shall be certified by an organization accredited by a Canadian or American accreditation body to comply with the requirements of ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories" for the specific tests or type of tests required by the material standard specified on the mill test certificate. The accreditation body shall be a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA). Preparation and collection of samples for testing shall be directed and witnessed by or completed by personnel employed by the testing laboratory A verification letter shall be provided by the testing laboratory and include laboratory accreditation documentation, applicable mill test reports, testing standards, date of verification testing, verification testing results, and declaration of compliance with the specified material reference standards. The results of verification testing shall meet all requirements of the specified material reference standard. The verification letter shall be signed by an authorized officer of the testing laboratory.

Re-classification of steel using a mill test report or mill test report verification testing data will not be permitted.

Proof that the bolts, nuts, and washers meet the chemical composition, mechanical properties, dimensions, workmanship, and head burst as required by ASTM F3125M "Standard Specification for Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, 830MPa and 1040 MPa Minimum Tensile Strength," ASTM A563M "Standard Specification for Carbon and Alloy Steel Nuts," or ASTM F 436M "Standard Specification for Hardened Steel Washers" shall be submitted to the Owner's Representative. Verification of the acceptability of assemblage of zinc-coated bolts, nuts, and washers delivered to the job site shall also be submitted to the Owner's Representative.

The Contractor shall submit to the Owner's Representative, at least two (2) weeks in advance of the steel fabrication, a letter certifying that the stud shear connectors conform.

For bolts supplied from a manufacturer outside Canada or the United States of America, the above information shall be verified by testing by a Canadian laboratory as outlined in the Mill Test Certificates clause.

During or after fabrication of the components, and prior to erection, the Owner's Representative, or a representative nominated by the Department, shall conduct an inspection to verify that the fabrication of components has been carried out in general conformance with the shop details, welding procedures, and Contract Documents, and issue to the Contractor written permission to proceed with the work.

910.04 MATERIALS

910.04.01 Steel

Structural steel shall conform to the requirements of CSA-G40.21 "Structural Quality Steels" and shall be as specified in the Contract documents. Structural steel shall be new and previously unused or unassembled.

910.04.02 Identification of Structural Steel

Identification of structural steel shall be in accordance with the provisions of CSA S16.1 "Limit States Design of Steel Structures." In addition, fracture critical and primary tension members shall be identified such that the pieces of each member are traceable to material test reports which indicate the required toughness properties.

910.04.03 High Strength Bolts, Nuts and Washers

High strength bolts shall be supplied with heavy hex nuts and one hardened washer per bolt. The bolts shall have dimensions conforming to CSA B18; with chemistry and mechanical properties conforming to ASTM A325M "Standard Specification for Structural

Bolts" or A490M "Standard Specification for High Strength Steel Bolts". The nuts shall be of heavy hex type conforming to CSA B18 suitable for use with ASTM A325M or A490M bolts of the type specified. Hardened washers shall conform to ASTM F436M, suitable for use with ASTM A325M or A490M bolts of the type specified. Bolts, nuts and washers shall be new and previously unused, and shall be shipped together as an assembly.

910.04.04 Electrodes

Electrodes shall conform to the latest edition of CSA W48.1-M, W48.3-M, W48.5-M and W48.6-M.

Filler metal shall be in accordance with Table 5-1, "Filler Metal Requirements for Exposed Bare Applications of CAN G40.21-M 350A, 350AT, 400A, 400AT, ASTM A242 and A588 Steels" of the CSA W59.

Deposited weld metal shall have a minimum Charpy Impact Energy as specified on the contract drawings.

910.04.05 Shear Connectors

Shear connectors shall be of a headed stud type in accordance with the requirements of Appendix "H" of CSA W59-M. Grade to be specified on the contract drawings.

910.04.06 Bearing Assemblies

The Contractor shall supply and install bearing assemblies as shown on the Contract Drawings or approved alternatives accepted by the Department.

Mill test reports and rotational capacity testing for fasteners shall be submitted to the Owner's Representative for review and acceptance 6 weeks prior to the commencement of erection, assembly or installation.

910.05 FABRICATION AND ERECTION

910.05.01 General

It is the Contractor's responsibility to ensure that the structure has sufficient capacity to sustain the stresses to which it will be subjected to during the erection procedure.

All fabrication shall confirm to the requirements of CSA S6 Clause A10.1.4.

Each member shall carry an erection mark for identification. Permanent marking shall be affixed in an area not exposed to view in the finished structure.

910.05.02 Welded Fabrication

910.05.02.01 General Requirements

All welding and all welding related items shall conform to the requirements of the following codes: CSA W59, ANSI/AASHTO/AWS D1.5 “Bridge Welding Code” and CSA S6 clause A10.1.5.

Qualification of welding procedures shall include weld metal and HAZ impact testing.

The fabrication weld metal requirements, base metal repairs, and repairs of weld in fracture critical and primary tension members hall be according to CSA S6 Clause 10.23.5.

Peening, when required, shall be subject to approval by the Owner’s Representative.

910.05.02.02 Qualifications of the Contractor

The company undertaking welded fabrication of bridge structures and components shall have documentation from the Canadian or American Institute of Steel Construction indicating the steel fabricator has been certified with the CISC or AISC.

The certification shall be as follows as required:

CISC Complex Steel Bridges or
AISC Advanced Steel Bridges

CISC Simple Steel Bridges, w/ fracture critical endorsement or
AISC Simple Steel Bridges, w/ fracture critical endorsement

CISC Simple Steel Bridges, w/o fracture critical endorsement or
AISC Simple Steel Bridges, w/o fracture critical endorsement

Certification shall be in effect prior to the beginning of the Work and shall be maintained throughout the period of manufacture.

910.05.02.03 Place of Fabrication

All fabrication shall be carried out in adequately covered and heated areas. The place of fabrication shall be accepted by the Owner’s Representative.

910.05.02.04 Web to Flange Fillet Welds

Where practical, web to flange fillet welds shall be made continuously by machine or automatic welding. Welds, when corrected, shall blend smoothly into the adjacent welds. When corrected by welding, a semi-automatic or manual process may be used.

910.05.02.05 Electrodes, Workmanship and Techniques

910.05.02.05.01 General

Electrodes, workmanship and techniques shall be in accordance with the provisions of CSA W59M.

910.05.02.05.02 Preparation of Material

The preparation of edges by oxygen cutting shall be done by machine whenever practical. Corner of oxygen cut girder flanges shall be chamfered 1.5 to 2.0 mm by grinding.

Plasma arc cutting shall only be done when accepted in writing by the Owner's Representative.

All cut edges which are not to be welded, shall have a roughness not greater than 1000 as defined by CSA B95 "Surface Texture Roughness, Waviness, and Lay." The provisions of CSA W59 shall also apply.

All surfaces and edges of materials to be welded shall be in accordance with the provisions of CSA W59.

910.05.02.05.03 Inspection and Repair of Planar Edge Discontinuities

Inspection and repair of planar edge discontinuities shall be in accordance with the provisions of CSA W59. For fracture critical and primary tension members, the requirements of the Owner's Representative shall apply.

910.05.02.05.04 Workmanship and Finish

Workmanship and finish shall be of the best modern general practice in bridge fabrication and construction.

Shearing, flame cutting and planing shall be done carefully and accurately.

Particular attention shall be paid to the neatness and uniformity of finish of all parts of the work exposed to view.

910.05.02.05.05 Storage of Material

Structural material, either plain or fabricated, shall be stored at the fabricating shop or elsewhere, above the ground upon platforms, skids, or other suitable supports, shall be kept free from dirt and other foreign matter and shall be protected as far as practicable from corrosion.

Long members shall be so supported as to prevent deflection.

910.05.02.05.06 Straightening Material

All steel, before being marked off or worked, must be flat and straight. If any flattening or straightening is necessary, it shall be done by methods that will not, in the Owner's Representative's opinion, injure the metal. Sharp kinks or bends in the material shall be cause for its rejection.

910.05.02.05.07 Re-Entrant Cuts

A fillet of not less than 20mm radius shall be provided at the junctions of all re-entrant cuts and the fillet shall be formed before the cuts are made.

910.05.02.05.08 Flame Cutting

Steel may be flame-cut, provided a smooth surface is secured by the use of a mechanical guide. Flame cutting by hand shall be done only when accepted by the Owner's Representative, and the surface shall be made smooth by planning, chipping or grinding.

910.05.02.05.09 Assembly

Assembly shall be in accordance with the provision of CSA W59.

In addition, the following requirements for bearing and intermediate stiffeners in plate girder and box girder bridges, shall apply:

a) Bearing stiffeners shall be vertical under full dead load.
b) Intermediate stiffeners may be either vertical or perpendicular to fabrication worklines, depending on the fabricators practice.

910.05.02.05.10 Temporary Welds

Temporary welds shall be in accordance with the provisions of CSA W59.

Temporary welds on fracture critical, primary tension members and flange material in compression shall not be used.

Extension bars, when attached to flanges, shall have the welds placed inside the joint, so that they can be welded over and fused into the final joint.

910.05.02.05.11 Groove Welds

For groove welds in butt joints, extension bars shall be used.

910.05.02.05.12 Tack Welds

Tack welds shall be in accordance with the provisions of CSA W59.

Tack welds shall not be used on fracture critical or primary tension members unless they are incorporated into the final weld.

910.05.02.05.13 Attachments

Attachments making use of tack welds which are not part of the welds shown in the contract, shall not be allowed on any portion of the girders.

910.05.02.05.14 Profile of Welds

Profile of welds shall be according to CSA W59.

910.05.02.05.15 Camber and Correction Of Shape

Webs shall be cut to the prescribed camber, with suitable allowance for shrinkage due to cutting and subsequent welding.

Mechanical means, or heat, may be used to correct the shape or straighten a welded member. If such a member is a fracture critical or primary tension member, the prior approval of the Owner's Representative is necessary. Welding corrections and repairs to fracture-critical and primary tension members shall be according to CSA S6 Clause 10.23.6.

Steel members subject to shape corrections or straightening shall be allowed to cool in still air.

910.05.02.05.16 Stress Relief - Heat Treatment

Temperature shall be recorded using thermo-couples or other accepted methods. A record of the heat treating operation, showing temperature and time data, shall be maintained and made available to the Owner's Representative upon request.

910.05.02.06 Obligations of The Contractor

Prior to commencement of welding, the Contractor shall make available to the Inspector, the Canadian Welding Bureau's transferable or non-transferable identification cards for each tacker, welder or welding operator, to be employed on the work. Such identification cards shall be currently valid and shall indicate the welding process and the positions which the personnel are qualified to weld.

910.05.02.07 Welding Repairs

Any section of weld that does not meet the acceptance standards shall be removed, rewelded, and re-examined.

Submissions of repair procedures shall be submitted to the Department a minimum of 14 days prior to commencement of work. Submissions shall comply with CWB accepted welding procedure specifications, data sheets and repair procedures, and shall be signed and sealed by a CWB certified Welding Engineer.

When making welding repairs to fracture-critical and primary tension members, the preheat requirements shall be according to CSA S6 Table 10.16. All repair procedures for these members and any others that are either listed as critical in CSA S6 clause 10.23.6.5 or are more severe than as described in CSA S6 Clause 10.23.6.4 will be submitted for approval to the Owner's Representative a minimum of 14 days prior to commencement of the work, and shall be according to CSA S6, Clause 10.23.6. Work on the repair shall not commence until the Owner's Representative has given written approval to proceed.

Non-critical repairs shall be as defined in CSA S6 Clause 10.23.6. All repair procedures for these members will be submitted for approval to the Owner's Representative a minimum of 14 days prior to commencement of the work. Work on the repair shall not commence until the Owner's Representative has given written approval to proceed.

910.05.02.08 Non-Destructive Testing of Fracture Critical Members

The Fabricator shall maintain documentation of all visual and non-destructive testing for review and confirmation by the Owner's Representative. Documentation shall be submitted to the Owner's Representative upon completion of the project.

910.05.02.09 Standards of Inspection, Certification and Acceptance

The standards of inspection and acceptance shall be in accordance with CSA W59.

Any independent organization undertaking welding testing shall be certified for testing bridges in conformance with CSA W178.1. The certification shall encompass at lest the following methods: radiographic, ultrasonic, and magnetic particle.

The independent organization's non-destructive testing technician undertaking non-destructive testing of welds under the Inspection and Testing subsection shall be certified for testing bridges in conformance with CSA W178.2. Certification shall be to either Level II or III for the methods used, as required by CGSB 48.9712 "Qualification and Certification of Nondestructive Testing Personnel."

910.05.03 Bolted Construction

910.05.03.01 General

This sub-section covers the requirements for bolted steel construction.

The design of bolted connections shall be performed by the Contractor. The design shall be in accordance with CSA S6 A10.1.6. Bolts shall be sufficiently long to exclude threads from the shear plane.

Dimensional and workmanship tolerances shall be according the CSA W59 and Annex A10.1 of CSA S6.

910.05.03.02 Assembly And Inspection

The assembly and inspection of joints, using ASTM A325M or A490M bolts, shall be in accordance with the provisions of CSA S6 and CSA W59.

910.05.03.03 Trial Assembly

All bolted splices shall be sub-punched or sub-drilled, put together in the shop and then reamed, unless put together and drilled from the solid. All shop trial assembly requirements shall be in accordance with CSA S6 clause A10.1.6.11.

910.05.03.04 Holes Drilled Using Numerically Controlled Machines

As an alternative to the trial assembly specified above, when numerically controlled machines have prepared bolt holes the requirements of CSA S6 clause A10.1.6.12 shall apply.

910.05.03.05 Bolt Holes

All holes for bolts shall be punched or drilled. Where the thickness of the metal does not exceed 16mm, the metal may be punched or drilled 2mm larger than the nominal diameter of the fastener. Where the thickness of metal exceeds 16mm, or wherever required under Subsection 910.05.03, all the holes shall be subpunched or subdrilled 5mm smaller and after assembling shall be reamed 2mm larger than the nominal diameter of the fastener or, alternatively, shall be drilled from the solid 2mm larger than the nominal diameter of the fastener. Holes in welded members shall not be made before the welding of such member is completely finished.

910.05.03.06 Punched Holes

The diameter of the die shall not exceed the diameter of the punch by more than 2mm. If any holes must be enlarged to admit the fasteners, they shall be reamed. Holes must be clean cut, without torn or ragged edges. Poor matching of holes will be cause for rejection.

910.05.03.07 Reamed or Drilled Holes

Reamed holes shall be cylindrical, perpendicular to the member, and not more than 2mm larger than the nominal diameter of the bolt. Whenever practicable, reamers shall be directed by mechanical means. Drilled holes shall be 2mm larger than the nominal diameter of the bolt. Burrs on the outside surfaces shall be removed. Reaming and drilling shall be done with twist drills.

If required by the Owner's Representative, assembled parts shall be taken apart for removal of burrs caused by drilling.

Connecting parts requiring reamed or drilled holes shall be assembled and securely held while being reamed or drilled and shall be match-marked before disassembling.

910.05.03.08 Holes for Field Connections

The holes of those field connections which are assembled in the shop shall be reamed while assembled.

910.05.04 Shop Assembly

The exact detailed method of assembly, including points of support, dimension checks, method of trimming to length, drilling and marking of splices, is to be to the procedure submitted as per the accepted shop drawings.

All field connections in girder members (flanges and webs) shall be assembled in the shop, and there have their subsize holes reamed to specified size while assembled. The assembly, including camber, alignment and accuracy of holes, shall be accepted by the Owner's Representative before reaming is commenced.

Surfaces of metal that will be in contact shall be cleaned before assembling. The parts of the member shall be assembled, well pinned and firmly drawn together with bolts, before reaming is commenced. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation. The member shall be free from twists and bends or other distortion.

Shop assembly of connections may be waived if the Contractor can demonstrate to the Owner's Representative a method of assuring accurate matching of connections in the field, and that they have had past experience. Any alternative method of matching field connections shall be subject to approval by the Owner's Representative.

In addition, the following requirements for bearing and intermediate stiffeners shall apply:

a. Bearing stiffeners shall be vertical under full dead load.

b. The bearing ends of bearing stiffeners shall be flush and square with the web and shall have at least 75 percent of this area in contact with the flanges. When bearing against a steel base or seat, all components shall fit within .010 inch (.025mm) for 75 percent of the projected area of the web and stiffeners and with no gap of 1/32 inch (0.80mm) for the remaining 25 percent of the projected area.

c. Intermediate stiffeners may be either vertical or perpendicular.

910.05.04.01 Drifting Of Holes

The drifting done during assembly shall be only such as to bring the parts into position and shall not be sufficient to enlarge the holes or distort the metal. If any holes must be enlarged to admit the fastener, they shall be reamed.

910.05.04.02 Match-Marking

Connecting parts assembled in the shop for the purpose of reaming holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished to the Owner's Representative.

910.05.05 Transportation and Delivery

910.05.05.01 General

The Contractor shall perform all work necessary to ensure safe delivery and storage at the site specified in the Contract.

Structural steel shall be so loaded for shipping that it may be transported and unloaded at its destination without being excessively stressed, deformed or otherwise damaged. Girders shall be transported with their webs in a vertical plane.

Structural steel, when stored, shall be stockpiled to avoid excessive stress deformation or other damage.

Not less than 7 days before any shipping begins, the Contractor shall provide the Owner's Representative with the delivery schedule.

910.05.05.02 Oversize-Overweight Restrictions

Vehicles loaded with structural steel which are oversize or overweight are not permitted on the highways except by special permit which shall be obtained by the Contractor.

It is the Contractor's responsibility to ensure delivery of structural steel to the job site is feasible.

910.05.06 Erection

910.05.06.01 General

Structural steel erection shall not commence until all aspects of Section 910.05.06 Inspection and Testing have been fulfilled to the satisfaction of the Owner's Representative. The Contractor shall notify the Owner's Representative, in writing, of the starting date at least 2 weeks prior to the commencement of field operations and work shall not be carried out until the Inspector is on the site.

Repairs to erected material will only be permitted when the procedure is accepted by the Owner's Representative.

Welding shall not be used to fill misplaced holes.

The Contractor shall not use any of the material intended for use in the finished structure for erection or temporary purposes unless such use is provided for on the plans or authorized by the Owner's Representative. Excessive hammering, pushing, pulling, twisting, bending and the like which will injure or distort the members will not be allowed. Surfaces to be in permanent contact shall be cleaned just prior to assembly.

The Contractor shall supply all materials, tools, equipment, plant and labour necessary for the erection of the steelwork. The Contractor shall erect the structural steel in accordance with the requirements of the latest edition of the A.A.S.H.T.O. Specifications.

910.05.06.02 Methods and Equipment

So that the Owner's Representative may verify that the proposed method of erection conforms to the requirements of these specifications, the Contractor shall, before starting the work of erection, furnish the Owner's Representative with erection procedure, erection drawings, together with complete calculations of stresses in the steelwork in the various stages of erection and shall inform the Owner's Representative fully as to the method of erection they propose to use. The whole of this information shall be submitted to the Owner's Representative at least 4 weeks before the work of erection is to commence and shall be stamped by a Professional Engineer who is registered or licensed to practice in the Province of Newfoundland and Labrador.

The Owner's Representative shall have the right to inspect all equipment to be used for the erection to satisfy themself that such equipment is of good quality, and they may forbid the use of any equipment that is, in their opinion, in any way faulty.

Under no condition may stresses occurring in the members of the structure exceed the basic allowable stresses, except with the express permission of the Owner's Representative.

Release of temporary supports or temporary members, etc. must be gradual, and under no circumstances will a sudden release be permissible.

The method of erection proposed to be used shall be subject to the acceptance of the Owner's Representative, but such approval shall not relieve the Contractor of any responsibility for the safety of the proposed method of work in full accordance with the Contract. The Contractor shall not start any erection operation before this acceptance is obtained.

910.05.06.03 Falsework

The design of falsework shall be in accordance with CSA S269.1 "Falsework and Formwork."

Falsework shall also conform to Section 907.

The Contractor shall furnish, construct, erect, maintain and subsequently remove and dispose of all falsework required for the erection of the work. Falsework will include all temporary supports and foundations and shall be properly designed and substantially constructed and maintained to sustain the loads which will come upon it. Falsework drawing(s) shall be stamped by a Professional Engineer registered or licensed to practice in the Province of Newfoundland and Labrador.

910.05.06.04 Handling and Storing Materials

Material delivered to the site shall be placed on skids above ground. It shall be kept clean and properly drained. Girders and beams shall be placed upright and shored. Long members shall be supported as to prevent injury from deflection.

910.05.06.05 Damaged Material

Material which is bent, kinked, twisted or otherwise damaged shall be immediately removed from the job site and replaced with equivalent new and undamaged material.

910.05.06.06 High Tensile Bolts

Each bolt shall be tightened to provide, when all the bolts in the joint are tight, at least the minimum bolt tension shown in Table A10.1.4 of CSA-S6.

Alternatively, the "turn-of-the-nut" method may be used for tightening bolts as specified in CSA S6 clause A10.1.6.7.

The Contractor shall submit to the Owner’s Representative a detailed description of the tightening method they propose to follow, and shall be subject to approval by the Owner’s Representative. Tightening by torque control shall not be utilized.

The proposed tightening procedure shall contain controls to prevent the "over tightening" of bolts.

910.05.06.07 Connections

At the time of erection all splice plates shall be free of all contamination such as burrs, drillings, oil, dirt and paint.

Any error in shop fabrication, or any deformation resulting from handling or transportation, which prevents the proper assembly and fitting of parts shall be reported to the Owner’s Representative.

910.05.06.08 Drilling and Grouting of Anchor Bolts

When the Contract includes drilling and grouting of anchor bolts, this work shall be performed as follows:

Holes shall be drilled in the concrete, and through reinforcing steel, where encountered, by means of a core drill. From the time of drilling and until the anchor bolts have been placed and grouted, the Contractor shall prevent the entry of water and any other foreign material into the holes.

The Contractor shall place the anchor bolts, supply all necessary materials, provide necessary heating, protection, and carry out all the work required to completely fill the space around the anchor bolts.

910.05.06.09 Field Assembly

The parts shall be accurately assembled as shown on the plans, and any match-marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken, or otherwise damaged. Hammering which would injure or distort the members is prohibited. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

Insofar as the cantilever method of erection is followed, the procedure shall be accepted by the Owner's Representative.

In all main girder field connections, 10% of the holes shall be filled with cylindrical erection pins before tightening high-strength bolts.

Cylindrical erection pins for use in shop-reamed holes shall be machined to a push fit so as to obtain an accurate matching of corresponding holes.

910.05.07 Inspection and Testing

910.05.07.01 Responsibility

It is the Contractor's responsibility to supply the material, execute, complete and maintain the works in strict accordance with the terms of the Contract. Inspection and testing of the materials and works by the Owner's Representative or their representative or that performed by the Contractor and reviewed by the Owner's Representative shall not be deemed to relieve the Contractor of any of their obligations.

910.05.07.02 Quality Control

Quality control shall be in accordance with CSA S6 clause A10.1.8. The acceptance standards of CSA W59 for dynamically loaded structures shall also apply.

In addition to quality control measures instituted by the Contractor, the Contractor shall be responsible for the quality control procedures specified throughout Specification 910.

A record for each component shall be kept to identify the material as to heat number, corresponding mill test certificate, and colour coding or other identifying markings.

910.05.07.03 Non-Destructive Testing and Inspection

Prior to commencement of fabrication the Contractor shall designate, by way of written notification to the Owner's Representative, an independent testing organisation to perform inspections and testing services. A certified non-destructive testing technician shall do the testing. Neither the technician nor the independent testing organization shall be changed without the approval of the Department. The inspections and testing services to be performed shall include:

(a) A full visual inspection of all components.
(a) All welds shall be visually inspected.
(b) Groove welding (splicing) of material for main girder members, other than splices shown on drawings, will not be permitted without express written consent of the Owner's Representative. In the event that such splices are allowed, they shall receive 100 percent radiographic or ultrasonic inspection.
(c) Web to flange fillet welds on main girder members shall be subject to magnetic particle inspection as follows:
    (1) Submerged arc welds 25 percent of length
    (2) Semiautomatic welds 50 percent of length
    (3) Manual welds 100 percent of length

(d) 25% of fillet welds for attaching gusset plates, diaphragm welds and bearing stiffeners shall be tested by magnetic particle inspection.
(e) Gusset plates and stiffeners for attaching diaphragm bracing shall be tested for 100% of the length of the mid-depth of the web to the tension flange.
(f) All transverse welds on tension flanges shall receive 100% magnetic particle inspection.

(g) Periodic inspections shall also be conducted to ensure:
    (1) Mill certificates and material identifications conform with the shop and contract drawings.
    (2) Fabrication procedures/methods conform to the Department's and project's specifications.
    (3) Weld procedures/methods conform with the Contractors weld procedures accepted for this project, the Department's and project's specifications and the requirements of CSA W59 and ANSI/AASHTO/AWS D11.5-88.

The independent testing organisation for performing the aforementioned tests shall be experienced in the type of inspection and non-destructive testing required and shall be subject to the approval of the Owner's Representative.

The independent testing organisation and the Department shall be given a minimum of 5 business days notice of when the work is ready for testing. Such notice shall include the type and quantity of work to be tested.

In the event that welding defects or deficiencies are found, either by the Department's representative or by the personnel designated to perform testing for the Contractor, then the Owner's Representative must be notified within 48 hours by the Contractor and a method of welding repair for correction of the deficiencies must be submitted in writing, for approval by the Owner's Representative. Upon approval of any proposed corrective measures the Contractor may proceed with the repair work, however, all repairs or corrective measures may be subject to 100% non-destructive testing and inspection, at the discretion of the Owner's Representative, and at the expense of the Contractor.

The personnel or organization performing non-destructive testing and inspection for the contractor shall keep a written record of all testing and inspection work performed, which shall include details of the item(s) inspected, type of inspection(s) performed, date, time and location where inspection was performed, and details of any items which did not conform with the shop or contract drawings or specifications.

The Contractor shall submit to the Owner's Representative, within one week of their execution, all inspection, testing/retesting results and records. In addition, from the time of commencement of fabrication, the Contractor shall ensure that the independent testing organisation submits to the Owner's Representative a weekly progress report describing work completed, and inspections and testing conducted, including results thereof, since the previously submitted progress report.

One week after all fabrication work is complete the Contractor's designated independent testing organisation shall submit to the Owner's Representative, in writing, certification that all inspection and testing required under the Department's Specification and the project's supplementary conditions have been performed and all items inspected, including those requiring repair or rework and re-inspection, fully conform to the shop and contract drawings as well as the Department and project specifications.

All components fabricated outside of Canada shall be shipped to a steel fabricator located in Canada that is:
1) CWB certified in accordance with CSA W47.1 to Division 1; and
2) Either CISC or AISC certified in the applicable category of steel bridges for re-inspection and testing.

The components shall be in a condition that facilitates all re-inspection and testing requirements. The re-inspection and testing shall take place at the Canadian shop and the Contractor shall also arrange for inspection by a CSA 178.2 Level III certified welding inspector accredited with W47.1/W59 to inspect:

- All components to ensure that they were undamaged during transportation; and
- Shop re-assembly of all components is required in accordance with 335.

Components shall not be shipped from the Canadian shop until all requirements have been met and the work has been reviewed and accepted. The Contractor shall have no claim against the Department resulting from delays caused by these requirements.

910.05.07.04 Inspection

The Contractor shall perform all inspection as outlined in Section 910.05.06. In all such inspections, the Contractor will be held strictly to the true intent and meaning of the specifications, drawings and other Contract Documents in regard to quality of materials, workmanship and diligent execution of the Contract. Any work done or materials used without supervision or inspection by the Owner's Representative may be ordered to be removed and replaced, at the Contractors' expense.

Inspection by the Owner's Representative may extend to all or any part of the works and to the preparation, fabrication, manufacture or erection of any or all the materials. The Owner's Representative or their representative shall be furnished by the Contractor with such information and facilities as is required to make a complete and detailed inspection and shall be allowed access to all parts and phases of the work. The Contractor shall supply electric power, scaffolding, protection from the weather, and free access for inspection and testing of material, to all aspects of the fabrication, delivery, and erection of the structural steel.

910.05.07.05 Owner's Representative

(a) A Owner's Representative will be assigned to the project to report to the Engineer on the progress of the works as a whole and the manner in which they are being performed, to secure adherence to the requirement of the Contract, to report on any failure by the Contractor to fulfil the requirements of the Contract and to direct the Contractor's attention to such failure.

(b) Testing Engineers and Inspectors may be appointed by the Engineer to fulfil duties similar to those of the Owner's Representative in connection with various aspects of the works and to carry out the testing of material and work.

(c) The Owner's Representative shall, within the limits of the written authorization given them by the Engineer, have authority to reject material or work that is not in conformity with the requirements of the Contract, but no representative of the Engineer shall have authority to revoke, alter, enlarge, relax or release any requirement of the Contract.

910.06 SURFACE PREPARATION AND COATINGS

The type of coating(s), the type of surface preparation, the method of application and drying or curing in addition to the measurement for and basis of payment shall be as defined in Section 921.

Surface touch up where necessary shall be done after the erection is complete and final.

910.07 CAMBER

Camber shall be as stated on the contract drawings.

910.08 MEASUREMENT FOR PAYMENT

Measurement for payment will be made on a lump sum basis for “Fabrication, Supply and Delivery” and “Erection.”

Measurement for payment will commence when the structural steel arrives on site and is accepted by the Owner’s Representative.

Measurement for payment will not be made for the provision of samples, specimens and testing including those tests required to be carried out in accordance with Section 910.05.06.

Measurement for payment for Surface Preparation and Coatings will be made in accordance with Section 921.

910.09 BASIS OF PAYMENT

910.09.01 Fabrication, Supply and Delivery

Payment at the contract price for "Fabrication, Supply and Delivery" in the Unit Price Table shall be full compensation for all labour, equipment, materials, plant and services to fabricate, test and inspect as outlined above, design services, supply, transport, deliver, handle and store the structural steel as outlined in this specification.

The basis of payment shall include full compensation for the provision of a storage site, the unloading, proper and orderly storage and identification of structural steel as outlined herein.

The Contractor shall bear all costs for the provision, preparation and testing of samples and specimens including those described in Section 910.05.06.

All costs, including inspection and testing, associated with the correction or repair of rejectable defects shall be the responsibility of the Contractor.

At the discretion of the Owner’s Representative, the Department may withhold a sum equal to 15% of the total lump sum price for the tender item "Fabrication, Supply and Delivery of Structural Steel", if the Contractor fails to comply with, or provide the documentation required under, Section 910.05.07. This sum may be withheld until such time as the Contractor, in the Owner’s Representative's opinion, meets the obligations set forth in the aforementioned specification.

The basis of payment shall include full compensation for the preparation of all proposals, shop details, bolting and welding design, bolting, welding and erection procedures, diagrams, calculations and drawings and submission of the same to the Owner's Representative for approval.

The costs and fees of the testing Engineer and other representatives of the Engineer shall be borne by the Department; with the exception of costs of re-inspection and retesting as associated with work not meeting these specifications, which shall be borne by the Contractor.

The basis of payment for Surface Preparation and Coatings will be made in accordance with Section 921.

The basis of payment for false work shall be in accordance with Section 907.

910.09.02 Other Inspection and Testing

If the Owner's Representative decides additional testing is necessary, the costs for electric power, scaffolding, protection from the weather and access for testing and inspection shall be included with the appropriate tender items and be borne by the Contractor.

The cost of the Engineer, their representative and all additional testing shall be borne by the Department unless due to rejectable defects or alternative design proposed by the Contractor; the cost of which will be borne by the Contractor.

910.09.03 Erection

Payment at the contract price for "Erection" in the Unit Price Table shall be full compensation for all labour, equipment, materials, plant and services to handle and erect the structural steel, site works required for erection, the drilling, setting and grouting of anchor bolts in addition to testing and inspection, all as outlined above.