SPECIFICATIONS FOR
ERECTION OF STRUCTURAL STEEL

1.0 DESCRIPTION

The Work shall consist of:

.1 Unloading and erecting structural steel components (e.g. girders, diaphragms, jacking beams, stiffeners, girder coverplating) as shown and described on the Drawings and in this Specification;

.2 Supplying and installing bearings, including grout pads (where applicable);

.3 Design, supply, fabrication, installation, maintenance and removal of temporary falsework (where applicable);

.4 Design, supply, delivery, installation, maintenance and removal of erection bracing, temporary wind bracing, lateral stability bracing, longitudinal ties and other temporary works for structural steel girders; and

.5 The quality control (QC) testing of all materials and the Work.

The Contractor shall not erect the structural steel girders until the substructure concrete has cured a minimum of seven days and achieved 80% of the 28 day specified concrete strength requirements.

2.0 REFERENCES AND RELATED SPECIFICATIONS

All reference standards and related specifications shall be current issue or latest revision at the date of tender advertisement.

2.1 Related Specifications

- Specifications for Supply and Fabrication of Structural Steel
- Specifications for Temporary Works

3.0 SUBMITTALS

The Contractor shall submit the following to the Engineer, in accordance with the Special Provisions:

.1 Girder Erection Procedure

A schedule and detailed plan clearly illustrating the method and sequence by which the Contractor proposes to unload and erect the structural steel girders. The girder erection procedure shall include detailed design notes and Shop Drawings that are sealed, signed and dated by a Professional Engineer, registered or licensed to practice in the Province of Manitoba necessary to describe the following and assume full responsibility that the design is being followed:

.1 Access to work, including earth berms, work bridges, or rock berms. The Professional Engineer shall confirm that the temporary works can fully support all loads during girder erection.

.2 Type and capacity of proposed equipment.

.3 Sequence of operation, including position of cranes, trucks with girders, and traffic accommodation.

.4 Detailed crane position and location, particularly adjacent to substructure elements, such as piers and abutment backwalls, with details of load distribution on wheels and outriggers throughout each lift. If the Engineer, approves the crane positioned on the structure during a portion of the work, details of crane position on the structure showing wheel loads and axle spacing of equipment moving on structure shall also be submitted.

.5 Loads and their position from crane wheels and outriggers during all positions of lifting when the crane(s) is on or adjacent to the structure.

.6 Details of temporary falsework, including proposed methods to be used to ensure stability and the required splice elevations and structure shape and details of release (if applicable).

.7 Method of providing temporary supports for stability.

.8 Details of lifting of girders, showing vertical forces at lifting points and on the lifting devices.

.9 Complete details of blocking for bearings where necessary to constrain movement due to horizontal forces and/or gravity effects.

.10 When applicable, complete details of longitudinal ties between the ends of girders at locations where the bridge will be made continuous. These ties shall be capable of resisting tension or compression that will develop due to temperature change, creep, and shrinkage. These shall be kept in place until the diaphragms have been installed and a majority of bridge deck concrete has been cast and reached specified strength.

.11 Grout Pad Construction, if applicable.

.12 Provide an “As Constructed” detailed survey of the substructure showing the following:

.1 Location and elevation of all bearing seats;

.2 Shim height at each bearing location, if applicable;

.3 Top of girder elevations at each bearing (and each splice location where applicable).

Safety and compliance with Manitoba Workplace Health and Safety Act and Regulations shall be integral to the girder erection procedure.

.2 Detailed design notes and Shop Drawings for the bearings that are stamped signed and dated by a Professional Engineer, registered or licensed to practice in the Province of Manitoba.

.3 Detailed design notes and Shop Drawings for proposed temporary works, including but not limited to: erection bracing, temporary wind bracing and lateral stability bracing for structural steel girders that are sealed signed and dated by a Professional Engineer, registered or licensed to practice in the Province of Manitoba.

4.0 MATERIALS

4.1 Bearings

The Contractor shall supply bearings in accordance with the requirements and details specified on the Drawings. Bearings must be approved as identified in MIT’s Approved Products List and shall be to the

satisfaction of the Engineer. Any bearings that are not in MIT's Approved Products List will be subject to approval by the Engineer.

4.2 High Strength Bolts, Nuts and Washers

The requirements of the Specifications for Supply and Fabrication of Structural Steel, Clause 4.2 shall apply.

4.3 Welding Consumables

The requirements of the Specifications for Supply and Fabrication of Structural Steel, Clause 4.4 shall apply.

5.0 CONSTRUCTION METHODS

5.1 General

The Contractor shall schedule, coordinate and sequence structural steel erection in cooperation with the delivery of the structural steel by the structural steel fabricator.

Any structural steel components that in the opinion of the Engineer have been damaged or otherwise rendered useless by the improper handling by the Contractor shall be replaced by the Contractor at his own expense.

If the structural steel components are stored on site, the requirements of the Specifications for Supply and Fabrication of Structural Steel, Clause 5.6 shall apply.

5.2 Bearing Areas

.1 Grout Pads

When shown on the Drawings or described in the Special Provisions, the Contractor shall construct grout pads using Sika 212 flowable grout or equivalent, accepted by the Engineer. Construction of grout pads shall be done by workers competent in this work.

Grouts shall be packaged in waterproof containers with the production date and shelf life of the material shown. It shall be mixed, placed, and cured in strict accordance with the Manufacturer's recommendations.

The method of forming and poring the grout shall be submitted to the Engineer for review and approval prior to the work being undertaken. Dry-pack methods of constructing grout pads will not be accepted.

When the daily minimum air temperature or the temperature of the girders, bearings, or substructure concrete in the immediate area of the grouting falls below 5°C, or when there is a probability of it falling below 5°C within 24 hours of grouting, the following provisions for cold weather grouting shall be implemented:

(a) Before grouting, adequate preheat shall be provided to raise the temperature of the adjacent areas of the girders, bearings, and substructure concrete to at least 10°C.

(b) Temperature of the grout during placing shall be between 10°C and 25°C.

(c) The grout pads (and girders where appropriate) shall be enclosed and kept at 15°C to 25°C for at least five days. The system of heating shall be designed to prevent excessive drying-out of the grout.

.2 Anchor Bolts

The Contractor shall remove all anchor bolt void forming materials prior to grouting. Any residues on the concrete surface, such as oils, grease, or other contaminants that can reduce bonding characteristics, shall be removed by sandblasting.

Anchor bolts shall be set accurately and grouted with non-shrink cement grout accepted by the Engineer. All methods and materials for setting anchor bolts and building bearing pads shall be submitted to the Engineer for review and acceptance. The location of the anchor bolts, in relation to the slotted holes in the expansion shoes, shall correspond with the temperature at the time of erection. The nuts on the anchor bolts, at the expansion ends of spans, shall be adjusted to permit free movement of the spans.

.3 Bearings

The Contractor shall accurately assemble and install the bearings as specified on the Drawings and as directed by the Engineer. The stainless steel surface of the bearings, the Teflon coated bearing pads and the machined surfaces of steel bearings that have been cast into the girders shall be protected from damage at all times. The plywood and polyethylene covers shall not be removed until immediately prior to the positioning of the bearings over the bearing seats.

When steel bearings are employed in conjunction with grout pockets in the substructure, the bearings shall be set accurately on galvanized steel shims, and grouted as detailed on the Drawings, after the girder erection has been completed. The shims must be located so that a minimum of 75 mm grout coverage is provided. When the grout pockets are not detailed, the bearing plates shall be set on the property finished bearing areas in exact position and shall have a full and even bearing on the concrete.

Where the design requires that the girders bear on neoprene pads placed directly on pier or abutment seat concrete, the Contractor shall supply and install shims cut from lead sheeting as determined by the Engineer to ensure full and uniform bearing.

Any bearings that in the opinion of the Engineer have been damaged or otherwise rendered unusable by improper storage or handling by the Contractor shall be replaced by the Contractor at his expense.

5.3 Erection of Structural Steel Girders

.1 General

Before taking possession and erecting the girders, the Contractor shall verify that the lengths of the girders, the layout of the substructure units, the elevations of the bearings seats, and the location of the anchor bolts are in accordance with the Drawings. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Engineer.

It is essential that the girders be erected with utmost attention being given to girder positioning, alignment, and elevation. The Contractor shall adjust girder position, bearing location, and bearing elevation in order to achieve as closely as possible the lines and grades shown on the Drawings. The Contractor shall minimize any differential camber (girder to girder), and the sweep of the girders by jacking, loading of girders, winching, or whatever means are necessary, and shall provide the necessary temporary attachments to hold the girders in position. The Engineer shall approve of all proposed methods of jacking, loading, winching, etc. prior to the work being undertaken.

Unloading and erection of the structural steel girders shall be under the direction of a Professional Engineer, registered or licensed to practice in the Province of Manitoba. The Professional Engineer shall be experienced in bridge girder erection and be present for all stages of the girder erection.

Loose timber blocking will not be permitted for use as temporary works for any aspect of girder erection.

It is the Contractor's responsibility to ascertain the actual weight of the girders.

.2 Equipment

All cranes, rigging and equipment shall be in good condition and properly maintained at all times during the period of the work. All cranes, rigging and equipment shall be of sufficient capacity to complete every stage of the erection works.
The Engineer shall, at his/her discretion, verify capacity and state of equipment provided and any equipment found not meeting the requirements for erection work shall be removed and replaced.
Slings and other lifting devices that will be in contact with structural steelwork shall be of a type which shall not damage shop primed or painted surfaces.

.3 Erection

The Engineer shall be notified in writing of the starting date at least two weeks prior to the commencement of field operations. Work shall not be carried out until the Engineer is on the site.

Components shall be lifted, placed, and maintained in position using appropriate lifting equipment, temporary bracing, guys, or stiffening devices so that the components are at no time overloaded, unstable, or unsafe. Additional permanent material may be provided, if approved by the Engineer, to ensure that the member capacities are not exceeded during erection. The additional material shall be shown in the erection diagram.

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

Unless otherwise approved by the Engineer, at least 50% of the holes in the joints shall be filled with drift pins or hand tightened bolts prior to removing the crane. At least 50% the bolts required in the flanges shall be installed. For roadway or railway overpass structures, drift pins shall not be left in place over traffic when the crane is removed.

For temporary fit ups, main girder splices and connections shall be aligned with drift pins and a sufficient number of fitting up bolts shall be installed to maintain the integrity of the connection.

The fitting up bolts may be the high strength bolts used in the installation. Drift pins shall be 1 mm larger in diameter than the required bolts. Excessive drifting that distorts the metal and enlarges the holes is not allowed. Reaming up to 2 mm over the nominal hole diameter is permitted, except for oversize or slotted holes.

Repairs to erected material will only be permitted after the repair procedure has been approved by the Engineer.

Filling of misplaced holes by welding is permitted only with the written approval of the Engineer.

Material intended for use in the finished structure shall not be used for erection or temporary purposes unless such use has been shown on the Shop Drawings, erection diagram, or authorized by the Engineer.

Hammering that will damage or distort the members is not permitted.

Surfaces that will be in permanent contact shall be cleaned immediately prior to assembly.

.4 Temporary Stresses

The Contractor shall assume full responsibility for ensuring that all bridge member and component stresses are within permissible limits at all stages of the construction work. The Contractor shall provide all necessary additional steel reinforcement, bracing or other measures required to ensure that the erection procedures do not overstress any temporary or permanent member or component at any stage of the Work.

.5 Alignment and Camber

The structural steel girders shall be erected to the proper alignment in plan and in elevation, taking into account the dead load camber shown on the Drawings. Members shall be aligned to the dimensional tolerances specified in CAN/CSA W59-M, but in no case, shall it deviate by more than 50 mm from the theoretical location.

Alignment shall be measured from survey lines joining the ends of any test length of a member.

.6 Temporary Bracing

The Contractor shall be responsible for the design, supply, installation and removal of all:

.1 erection bracing;

.2 temporary wind bracing;

.3 lateral stability bracing; and

.4 longitudinal ties

as may be required during and immediately following the erection of structural steel girders.

The bracing shall be designed and installed so that it will not interfere with the installation of steel diaphragms.

.7 Lifting Devices

After the Engineer has approved the erection positions of the girders, all lifting devices shall be removed to the satisfaction of the Engineer.

5.4 Connections

Holes made in the field shall be drilled or reamed. Shop reamed holes shall not be re-reamed in the field.

At the time of erection, all splice plates shall be free of loose mill scale, burrs, and all contamination such as drilling shavings, oil, dirt, and paint.

Surfaces to be in permanent contact shall be cleaned immediately prior to assembly.

Any error in shop fabrication or any deformation resulting from handling or transportation that prevents the proper assembly and fitting of parts, especially splices of main structural members, shall be reported

and the proposed method of correction shall be submitted to the Engineer. Corrective measures shall not commence until the submitted proposal is accepted by the Engineer.

5.5 Cantilever Erection

When members or components to be erected will be cantilevered, splices that support the cantilevering member or component shall be fully bolted before extending.

5.6 Attachments

The use of tack welds for securing temporary or permanent attachments that are not shown on submitted Shop Drawings, erection drawings or fabrication drawings shall not be permitted on any portion of girders or any other structural members.

5.7 Field Welding

The company undertaking field-welding shall be certified to Division 1 of CAN/CSA W47.1.

The requirements of the Specifications for Supply and Fabrication of Structural Steel, Clause 5.2 shall apply.

5.8 Bolted Construction

The requirements of the Specifications for Supply and Fabrication of Structural Steel, Clause 5.3 shall apply.

Bolt heads shall be located on the outside faces of exterior girder webs.

Bolt heads in field splices for box girders shall be located on the exterior surfaces.

5.9 Removal of Falsework and Site Clean-up

Upon completion of the erection and before final acceptance, the Contractor shall remove all temporary falsework. He shall remove all piling, excavated or surplus materials, rubbish and temporary supports, replace or renew any damaged fences, and restore in an acceptable manner all property damaged during the execution of the Work. Disposed of surplus materials shall be in a manner and at a location satisfactory to the Engineer.

The Contractor shall leave the bridge site, roadway and adjacent property in a neat restored and presentable condition, satisfactory to the Engineer. When requested by the Engineer, the Contractor shall provide written evidence that affected property owners and/or regulatory agencies have been satisfied.

5.10 Protection of Concrete Components

If the coating system is to be applied in the field, the substructure shall be protected during construction against rust-staining by water runoff until the structural steel has been coated.

6.0 QUALITY MANAGEMENT

After all of the structural steel has been erected, the Engineer and the Contractor shall conduct a final inspection to locate any damage or deficiencies. All visible damage or any deficiencies shall be repaired to the satisfaction of the Engineer before final approval.

7.0 METHOD OF MEASUREMENT

7.1 Structural Steel

The structural steel will be measured on a mass basis. The total mass in kilograms to be paid for will be computed on the basis of the net finished dimensions on the plans, deducting the mass of copes, cuts, clips and all open holes, except bolt holes. The mass of rolled shapes will be calculated using the nominal mass listed in recognized handbooks or as follows:

Material	Unit Mass (kg/m^3)
Structural Steel	7 850
Lead	11 320
Bronze	8 590

The mass of all paint, galvanizing material or other protective coatings, and all deposited weld metal used for either shop or field welding, will not be included in the mass of material to be paid for.

7.2 Bearings

The supply and installation of bearing units will be measured on a unit basis, and the number to be paid for will be the total number of bearings installed and accepted by the Engineer.

8.0 BASIS OF PAYMENT

8.1 Structural Steel

Erection of structural steel will be paid for at the Contract Unit Price per kilogram for "Erection of Structural Steel" measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

8.2 Bearings

Supply of bearings will be paid for at the Contract Unit Price for “Supply Bearings”, measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

Installation of bearings will be paid for at the Contract Unit Price for “Installation of Bridge Bearings”, measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.