a. Supplemental Specification Section 5, Reinforcing Steel

The following Supplemental Specification supersedes, in its entirety, the version contained in the Specifications for Bridge Construction - 2010.

SECTION 5 REINFORCING STEEL

5.1 General

This Specification is for the supply, fabrication, handling and placing of plain reinforcing steel, epoxy coated reinforcing steel, corrosion resistant reinforcing steel (CRR), and stainless reinforcing steel. All reinforcing steel shall be supplied and installed in the lengths and shapes shown on the Drawings. The bar lists shown are provided for estimating purposes only. No substitution of bars or changes to bar details will be permitted without prior approval of the Consultant.

5.2 Material Types

5.2.1 Plain Reinforcing Steel

Plain reinforcing steel shall be Grade 400, meeting the requirements of CSA Standard G30.18M.

5.2.2 Epoxy Coated Reinforcing Steel

Plain reinforcing steel meeting the requirements of Subsection 5.2.1 shall be used in the production of epoxy coated reinforcing steel.

Epoxy coated reinforcing steel shall be coated by a Manufacturer certified under the Concrete Reinforcing Steel Institute (CRSI) Voluntary Certification program for Fusion Bonded Epoxy Coating Applicator plants. Proof of certification shall be submitted to the Consultant prior to delivery of the material.

Epoxy coated reinforcing steel shall be prepared and coated in accordance with the requirements of Ontario Provincial Standard Specification OPSS 1442, Material Specification for Epoxy Coated Steel Reinforcement for Concrete, and the requirements contained herein.

The film thickness of the epoxy coating, after curing, shall be 175 Fm to 300 Fm (7 to 12 mils). The epoxy coating material shall conform to the requirements of OPSS 1443, Material Specification for Organic Coatings for Steel Reinforcement.

5.2.3 Corrosion Resistant Reinforcing Steel

Corrosion resistant reinforcing steel (CRR) shall consist of either low carbon/chromium reinforcing steel or stainless reinforcing steel.

Low carbon/chromium reinforcing steel shall meet the requirements of ASTM A1035. The minimum yield strength based on the 0.2% offset method shall be equal to 690 MPa.

Stainless reinforcing steel, if used, shall meet the requirements of Subsection 5.2.4, Stainless Reinforcing Steel.

Unless otherwise specified, only one type of CRR shall be supplied for use throughout the project.

5.2.4 Stainless Reinforcing Steel

Stainless reinforcing steel shall be of the following designations as defined by the Unified Numbering System (UNS):

- S31653
- S31603
- S31803
- S30400
- S32304

Stainless reinforcing steel shall meet the requirements of ASTM A276 and ASTM A955/A955M (including Annex 1.2 or 1.3). The minimum yield strength shall be 420 MPa.

Unless otherwise specified, only one type of stainless reinforcing steel shall be supplied for use throughout the project.

5.3 Material Production and Testing

Reinforcing steel shall be produced and tested in accordance with the applicable standard(s). Material manufacturer mill test certificates showing proof of compliance shall be submitted to the Consultant for review and acceptance prior to the placement of any reinforcing steel.

Mill test certificates shall be provided for each lot delivered to the site.

The following additional information, as applicable, shall be supplied for each lot of stainless reinforcing steel delivered to the site:

- Austenitic grades: Test results verifying compliance with ASTM A262, Practice E.
- Duplex grades: Test results verifying compliance with ASTM A923, Method A, by demonstrating an unaffected etched structure.

Stainless reinforcing steel shall be pickled to remove all mill scale and surface oxidation. Details of the Manufacturer's pickling process shall be included with the mill test certificate submissions.

5.4 Fabrication

All bars requiring bends shall be cold bent at the fabrication facility. Heating of bars to facilitate bending will not be permitted.

Bars shall be cut by shearing or with fluid cooled saws. Torch cutting will not be permitted. Bars showing evidence of torch cutting will be rejected.

Unless otherwise specified, all hooks and bends shall be fabricated using the pin diameters and dimensions recommended in The Reinforcing Steel Institute of Canada (RSIC) Manual of Standard Practice. Bars shall conform accurately to the dimensions shown on the Drawings, and be within the fabricating tolerances detailed in the RSIC Manual of Standard Practice.

Fabrication of epoxy coated reinforcing steel after application of the coating shall be in accordance with the requirements of Ontario Provincial Standard Specification OPSS 1442.

Fabrication of stainless reinforcing steel shall be carried out in such a manner that bar surfaces are not contaminated with deposits of iron or other non stainless steels; or suffer damage due to straightening or bending.

Reinforcing steel shall be fabricated without laminations or burrs.

5.5 Shipping, Handling and Storage

Reinforcing steel shall be covered and protected at all times during transportation.

Reinforcing steel of differing material types shall be stored separately. Bar tags identifying the

material type shall be clearly visible and shall be maintained in-place until installation of the material.

The Contractor shall store all reinforcing steel on platforms, skids, or other suitable means of support able to keep the material above the ground surface while protecting it from mechanical damage or deterioration.

Special care shall be taken when handling epoxy coated reinforcing steel to prevent damage to the epoxy coating. Epoxy coated reinforcing bars shall not be dropped or dragged, and shall be lifted with non-metallic slings. Protective measure shall be implemented to prevent bar to bar abrasion and excessive sagging of bundles.

On-site storage of epoxy coated reinforcing steel shall not exceed 120 days, and exposure to daylight shall not exceed 30 days. If the daylight exposure time is expected to exceed 30 days, the Contractor shall protect the reinforcing steel by covering with opaque polyethylene sheeting or equivalent protective material acceptable to the Consultant.

On-site storage of all other types of reinforcing steel shall not exceed 120 days unless protected with polyethylene sheeting or equivalent protective material acceptable to the Consultant.

The Contractor shall take all precautions necessary to prevent damage to the material during handling operations. Bundles shall be handled with spreaders and non-metallic slings, or by other methods acceptable to the Consultant. Damaged materials shall be replaced by the Contractor at his expense.

5.6 Placing and Fastening

Reinforcing steel incorporated into the work shall be free from loose rust, scale, dirt, paint, oil or other foreign materials.

Reinforcing steel shall be accurately placed in the positions shown on the Drawings, and shall be securely tied and chaired before placing the concrete. Bars shall be tied at all intersections except when the bar spacing is less than 250 mm in each direction; alternate intersections may be tied at these locations. Specified distances from forms shall be maintained by supports, spacers, or other means approved by the Consultant.

Reinforcing cover shall not be less than that specified on the Drawings. Supports used to prevent bars from contact with forms or for separation between layers of bars shall be of adequate strength, shape and dimension, and shall be approved for use by the Consultant. Supports shall be either plastic or precast concrete. Where additional reinforcing support bars are proposed by the Contractor, they shall be of the same material type and grade used in the work. Supports and spacers fabricated from alternate material types may be used upon approval by the Consultant.

Plastic bolster slab supports shall be Aztec Strong Back Slab/Beam Bolster PSBB manufactured by Dayton Superior, or approved equivalent. Bolster slab supports shall be staggered and configured to facilitate full concrete consolidation.

Precast concrete supports shall be used for all exposed faces of curbs, medians and barriers. Precast concrete supports shall be Total Bond Concrete Supports manufactured by Con Sys Inc., or approved equivalent. Precast concrete supports shall have the compressive strength, rapid chloride permeability, and air content meeting the specification requirements for the class of concrete being placed.

Except as noted herein, tie-wire shall be manufactured from the same material type as the reinforcing steel being tied. Plastic coated tie wire may be used where low carbon/chromium reinforcing steel is being placed. Where stainless reinforcing steel is being placed, tie-wire shall be stainless steel of any grade listed in Subsection 5.2.4.

Welding of reinforcing steel will not be permitted.

Field bending of reinforcing steel, regardless of circumstance, will not be permitted unless specified on the Drawings.

Field cutting of epoxy coated reinforcing steel shall be carried out only where necessary and approved by the Consultant. Cuts shall be made by shearing or saw cutting only. The epoxy coating on sheared or saw cut ends shall be patched in accordance with the specifications contained herein.

5.7 Splicing

Splicing of bars, unless shown on the Drawings or approved in writing by the Consultant, is prohibited.

Splices, where permitted, shall be staggered. For lapped splices, bars shall be placed in contact and wired together while maintaining the minimum required clear distance to other bars and the required minimum distance to the surface of the concrete.

5.8 Repair of Epoxy Coated Reinforcing Steel

The Contractor shall be responsible for the repair of all damage to epoxy coating up to the time the reinforcing steel is acceptably incorporated into the concrete. Where field cutting of the epoxy coated reinforcing steel is necessary and accepted by the Consultant, cutting shall be by shearing or saw cutting.

Repair of damaged coating and sheared or sawed ends shall be carried out using a two component epoxy coating patching material approved for use by the reinforcing steel Manufacturer.

Surface preparation and material application shall be completed in accordance with the patching material Manufacturer's written recommendations; the following requirements; and to the satisfaction of the Consultant. The areas to be repaired shall be cleaned by removing all surface contaminants and damaged coating before applying the patching material. Where rust is present, it shall be completely removed immediately prior to application of the patching material. The patching material shall be overlapped onto the original coating for a minimum distance of 25 mm or as recommended by the patching material Manufacturer. The dry film thickness of the patched areas shall be between 175 Fm and 300 Fm.

All costs associated with the repair of damaged epoxy coating will be considered incidental to the Work, and no separate or additional payment will be made.

5.9 Repair of Stainless Reinforcing Steel

Individual stainless steel reinforcing bars exhibiting any of the following defects shall be repaired or replaced at the Contractor’s expense:

- Any single area of iron contamination greater than 100 mm in length.
- Two or more areas of iron contamination greater than 50 mm in length.
- Frequent small occurrences of iron contamination along the full length of the bar.

Bars exhibiting excessive staining, as determined by the Consultant, shall have the contaminants identified by energy dispersive x-ray analysis (EDXA). Contaminant identification shall be carried out by the Contractor at his expense.

Methods proposed for the repair of stainless reinforcing steel bars shall be approved by the Department and Consultant prior to implementation.

Stainless reinforcing steel bars exhibiting signs of mechanical damage shall be replaced.

5.10 Measurement and Payment

5.10.1 Measurement

Steel reinforcing incorporated in the concrete will be measured in kilograms, based on the total computed mass for the size and length of bars as shown on the Drawings or accepted by the Consultant.

Any proposed substitution of imperial reinforcing steel for metric reinforcing steel must be reviewed and approved by the Consultant prior to the substitution taking place. The nominal cross sectional area of metric and imperial bar sizes used for evaluating substitutions will be in accordance with ASTM A1035, ASTM A955/A955M and CAN/CSA G30.18, respectively.

The mass for all reinforcing steel will be calculated as follows:

Metric Bar Designation	10M	15M	20M	25M	30M	35M	45M	55M
Imperial Bar Designation	4	5	6	8	9	11	14	18
Mass (kg/m)	0.785	1.570	2.355	3.925	5.495	7.850	11.775	19.625

5.10.2 Payment

5.10.2.1 Supply

Payment for the supply of reinforcing steel will be made at the unit prices bid per kilogram for “Plain Reinforcing Steel - Supply”, “Epoxy Coated Reinforcing Steel - Supply”, “Corrosion Resistant Reinforcing Steel - Supply” or “Stainless Reinforcing Steel - Supply”, as applicable, and will be full compensation for the supply and fabrication of reinforcing steel; delivery to the project site; and all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Consultant.

When stainless steel is supplied for use where CRR is specified, payment will be made at the unit price bid for “Corrosion Resistant Reinforcing Steel - Supply”. No separate or additional payment will be made.

Payment will be made for 90% of the unit price bid for material acceptably supplied and delivered to the site. Payment for the remainder of the unit price bid will be made as the materials are acceptably installed.

All costs associated with the handling and storage of reinforcing steel will be considered incidental to the Work, and no separate or additional payment will be made.

5.10.2.2 Placement

Payment for the installation of reinforcing steel will be made at the unit price bid per kilogram for “Reinforcing Steel - Place” for steel acceptably placed and remaining in the work, regardless of type; and will be full compensation for all labour, equipment, tools and incidental necessary to complete the Work to the satisfaction of the Consultant. No allowance will be made for tie-wire, chairs or other materials used for fastening the reinforcing steel in place.