MATERIAL SPECIFICATION FOR STEEL REINFORCEMENT FOR CONCRETE

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1440.01 SCOPE

This specification covers the requirements for all steel reinforcement used in concrete work.

1440.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

1440.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

1440.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

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

Ontario Provincial Standard Specifications, Construction

OPSS 905	Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

Designated Sources for Materials (DSM)
Structural Manual

CSA Standards

G30.18-09	Carbon Steel Bars for Concrete Reinforcement
G40.21-04 (R2009)	Structural Quality Steels
S6-14	Canadian Highway Bridge Design Code

ASTM International

A 82/A 82M-07	Steel Wire, Plain, for Concrete Reinforcement
A 185/A 185-07	Steel Welded Wire Reinforcement, Plain, for Concrete
A 276-10	Stainless Steel Bars and Shapes
A 416/A 416M-12a	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
A 421/A 421M-10	Uncoated Stress-Relieved Steel Wire for Prestressed Concrete
A 496/A 496M-07	Steel Wire, Deformed, for Concrete Reinforcement
A 497/A 497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete

A 722/A 722M-12	Uncoated High-Strength Steel Bars for Prestressing Concrete
A 955M/A 955M-12e1	Deformed and Plain Stainless Steel Bars for Concrete Reinforcement

International Organization for Standardization/International Electrotechnical Commission

ISO/IEC 17025:1999	General Requirements for the Competence of the Testing and Calibration Laboratories

Others

Reinforcing Steel Institute of Canada - Reinforcing Steel Manual of Standard Practice - 2004

1440.03 DEFINITIONS

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

Heat means a single operation of melting of steel, also called a melt.

Lot means a quantity of steel that can be identified. For each size designation of prestressing steel strand, a lot shall be reels or coils produced from one heat. For each nominal diameter of prestressing steel bar and for each size designation of reinforcing steel bar, a lot shall be all the supplied bars from one heat.

Prestressing Steel means as defined in OPSS 905.

Prestressing Steel Bar means a high strength alloy steel bar having a nominal diameter greater than 9 mm.

Reinforcing Steel Bars means as defined in OPSS 905.

Spacer means a rolled steel shape punched to form hooks that are bent over the spiral to maintain a specified pitch.

Spiral means continuously wound reinforcing steel in the form of a cylindrical helix.

Splice Bar means as defined in OPSS 905.

Stainless Steel Reinforcing Bars means as defined in OPSS 905.

Steel Reinforcement means as defined in OPSS 905.

Strand means as defined in OPSS 905.

1440.04 DESIGN AND SUBMISSION REQUIREMENTS

1440.04.01 Submission Requirements

1440.04.01.01 Mill Certificates for Reinforcing Steel Bars, Stainless Steel Reinforcing Bars, Splice Bars, and Stainless Steel Splice Bars

Two copies of the mill certificates for each lot shall be submitted to the Contract Administrator prior to shipment of reinforcing steel bars**,** stainless steel reinforcing bars, splice bars, and stainless steel splice bars. The certificates shall show that the material is as specified in the Contract Documents.

1440.04.02 Mill Certificates and Stress-Strain Curves for Prestressing Steel

Two copies of the mill certificates and stress-strain curves for each lot shall be submitted to the Contract Administrator prior to shipment of prestressing steel. The certificates shall show that the material is as specified in the Contract Documents.

When 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 Canadian laboratory. This laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply with the requirements of ISO/IEC DIS 17025 for the specific tests or type of tests required by the material standard specified on the mill test certificate. The mill test certificates shall be stamped with the name of the Canadian laboratory and appropriate wording stating that the material is in conformance with the specified Contract requirements. The stamp shall include the appropriate material specification number, testing date (i.e., yyyy-mm-dd), and the signature of an authorized officer of the Canadian laboratory.

1440.05 MATERIALS

1440.05.01 Reinforcing Steel Bars, Splice Bars, Tie Bars, Dowel Bars, Spirals, and Spacers

Reinforcing steel bars shall be according to CAN/CSA G30.18.

All reinforcing steel bars shall be Grade 400W according to CSA G30.18.

Plain steel wire for spirals shall be according to ASTM A 82. Deformed steel bars for spirals shall be according to CSA G30.18 type W. Steel spacers according to CAN/CSA G40.21, Grade 350 G shall be provided with the spirals.

1440.05.02 Stainless Steel Reinforcing Bars, Stainless Steel Splice Bars, Tie Bars, Dowel Bars, Spirals, Spacers, and Stainless Steel Mechanical Connectors

Stainless steel reinforcing bars and spirals shall be according to ASTM A 276 and ASTM A955M, minimum Grade 420.

Nominal dimensions, unit masses, and deformation requirements for metric bar sizes shall be according to CAN/CSA G30.18. Stainless spirals shall be provided with stainless spacers in conformance with ASTM A 276.

Stainless steel reinforcing bars, stainless steel spirals, stainless steel spiral spacers, and mechanical connectors shall be of a stainless steel type shown in Table 1.

Imperial and soft-converted metric bar size substitutions for metric bar sizes shall be permitted on a one-for-one basis without adjustment as shown in Table 2.

Other Imperial and soft-converted metric stainless steel reinforcing bar sizes may be substituted for metric bar sizes, subject to the following:

a) The area of substituted steel reinforcement for the concrete component per linear metre or per gross cross-section area, as applicable, shall not be less than that shown for the concrete component on the Contract Drawings; and,

b) The spacing of substituted steel reinforcement for the concrete component shall be according to CAN/CSA-S6 and the Structural Manual, Division 1.

Nominal cross-sectional areas of metric and imperial bar sizes used for determining substitutions shall be according to ASTM A 955M and CAN/CSA G30.18, respectively.

1440.05.03 Deformed Steel Wire

Deformed steel wire shall be according to ASTM A 496.

1440.05.04 Welded Smooth Steel Wire Fabric

Welded smooth steel wire fabric shall be according to ASTM A 185.

1440.05.05 Welded Deformed Steel Wire Fabric

Welded deformed steel wire fabric shall be according to ASTM A 497M.

1440.05.06 Prestressing Steel

Prestressing steel strand shall be weldless, low relaxation grade according to ASTM A 416M. Prestressing steel strand shall be certified by its manufacturer to bond to concrete of normal strength and consistency.

Prestressing steel wire shall be according to ASTM A 421M.

Prestressing steel bars shall be according to ASTM A 722M. The bars shall not be welded.

1440.07 PRODUCTION

1440.07.01 Manufacture of Reinforcing Steel Bars

The manufacture of reinforcing steel bars shall be by a manufacturer listed under "Mill" in the Designated Sources for Materials listing for Reinforcing Steel, Uncoated, Fabricators and Mills.

1440.07.02 Manufacture of Stainless Steel Reinforcing Bars

The manufacture of stainless steel reinforcing bars shall be by a manufacturer listed under “Mills” in the Designated Sources for Materials listing for Reinforcing Steel, Stainless, Mills and Fabricators.

1440.07.03 Fabrication of Reinforcing Steel Bar, Stainless Steel Reinforcing Bar, Splice Bar, and Stainless Steel Splice Bars

Bars shall be cold bent at the fabricator's shop.

The standard fabricating tolerances for all bars, straight or bent, shall be according to the Reinforcing Steel Manual of Standard Practice of the Reinforcing Steel Institute of Canada.

Fabrication of stainless steel reinforcing bars shall be so that the bar surfaces are not contaminated with deposits of iron or non-stainless steels, and the bar is not damaged by straightening from coil.

Fabrication of stainless steel reinforcing bars shall be by a fabricator listed under “Fabricators” in the Designated Sources for Materials listing for Reinforcing Steel, Stainless, Mills and Fabricators.

1440.07.04 Identification

1440.07.04.01 Prestressing Steel

All steel strand from each manufactured reel used and all high strength alloy bars used shall be assigned an individual lot number and shall be tagged with the lot number.

1440.07.04.02 Reinforcing Steel Bars, Stainless Steel Reinforcing Bars, Splice Bars, and Stainless Steel Splice Bars

All bars shall be shipped in bundles.

Each lot of reinforcing steel bars, stainless steel reinforcing bars, splice bars, and stainless steel splice bars shall be assigned an individual lot number and shall be tagged with the lot number.

In addition, tags for stainless steel reinforcing bars shall identify the manufacturer, stainless steel type and grade, and bar mark number, including stainless designation.

1440.08 QUALITY ASSURANCE

1440.08.01 Inspection and Testing

The Owner reserves the right to carry out inspections and tests at such times as the Owner may consider necessary to ensure that the materials supplied are according to this specification.

Materials failing to comply with the requirements of this specification shall be rejected.

The Owner's representative shall be permitted free entry to the manufacturing and fabrication plants, as well as the finished product storage and loading areas for inspection purposes.

TABLE 1
Type of Stainless Steel

Common or Trade Name	AISI Type	UNS Designation
Type 316 LN	316 LN	S31653
Type 2205 Duplex	2205	S31803

Note:

A. Condition/Finish: reinforcing stainless steel bars and shapes shall be hot rolled and pickled, or hot rolled and descaled to the required mechanical properties and dimensions.

TABLE 2
Size Conversions

Metric Bar Size	Imperial Bar Size	Bar Designation No.
15M	# 5	16
25M	# 8	25
35M	# 11	36

Appendix 1440-A, November 2016
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.