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| **Section Cover Page** |
|  **Section 03 20 00****2019-06-05 Concrete Reinforcing** |
| Refer to “Green Building Notes” page for additional guidance for projects following a sustainable rating system.Revise Green Building requirements if the Province has determined that the work of this Contract is not to attain a sustainable rating system certification. |

Use this Section to specify concrete reinforcement for large scope (e.g. more than $25,000) cast-in-place concrete work except:

.1 Concrete reinforcement for sidewalks, driveways, aprons, pads, curbs and gutters, specified in Section 32 13 13 - Concrete Paving, Curbs and Gutters.

.2 Concrete reinforcement for street light bases, car plug-in posts, guard posts, etc., specified in Section 32 17 10 - Road and Parking Appurtenances.

.3 Use Section 03 30 10 – Cast-in-Place Concrete (Short Form) for small scope cast-in-place concrete work.

Requirements for recycled material should still be specified even if this project is not pursuing LEED Certification.

This Master Specification Section contains:

.1 This Cover Sheet

.2 Green Building Notes

.3 Specification Section Text:

**1. General**

1.1 Related Work Specified in Other Sections

1.2 Reference Documents

1.3 Testing

1.4 Submittals

1.5 Quality Assurance

1.6 Delivery, Storage and Handling

**2. Products**

2.1 Reinforcement Materials

2.2 Fabrication

**3. Execution**

3.1 Field Bending

3.2 Placement Detailing

3.3 Placement

3.4 Field Touch-up

3.5 Cleaning

3.6 Schedule

**Green Building Notes:**

If the project is **not** designated to use a sustainable rating system it is still be prudent to leave in relevant green building requirements as part of an effort towards sustainability.

**Review and incorporate requirements from the following documents into the project:**

Section 1.0 “Sustainability” and “Appendix G – Green Building Standards” of the “Technical Design Requirements for Alberta Infrastructure Facilities”

<http://www.infrastructure.alberta.ca/doctype486/TechDesignRequirements.pdf>

**LEED Specific Documents (if required):**

LEED Project Delivery Process Manual

<http://www.infrastructure.alberta.ca/Content/docType486/Production/LEED_PD_Manual.pdf>

LEED Project Delivery Process Manual – Appendices

<http://www.infrastructure.alberta.ca/Content/docType486/Production/LEED_PD_Appendices.pdf>

All documents can be found on Infrastructure’s Technical Resource Centre, Guidelines and Standards page: <http://www.infrastructure.alberta.ca/992.htm>

1. General
	1. RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Section 03 05 05 – Concrete Testing and Inspection

.2 Section 03 30 00 – Cast-in-Place Concrete

.3 Section 03 30 10 – Cast-in-Place Concrete Short Form

.4 Section 31 62 13 – Cast-in-Place Concrete Piles

* 1. REFERENCES DOCUMENTS

*SPEC NOTE: Latest versions of the following standards to be used*

* + 1. American Concrete Institute (ACI):
			1. ACI SP-066(04) ACI Detailing Manual – 2004
		2. American Society for Testing and Materials (ASTM):
			1. ASTM A108-13 Standard Specification for Steel Bar, Carbon

 and Alloy, Cold-Finished

* + - 1. ASTM A276/A276M-17 Standard Specification for Stainless Steel

 Bars and Shapes

* + - 1. ASTM A767/A767M-16 Standard Specification for Zinc-Coated

 (Galvanized) Steel Bars for Concrete

 Reinforcement

* + - 1. ASTM A775/A775M-17 Standard Specification for Epoxy-Coated

 Steel Reinforcing Bars

* + - 1. ASTM A955/A955M-17a Standard Specification for Deformed and

 Plain Stainless-Steel Bars for Concrete

 Reinforcement

* + - 1. ASTM A970/A970M‑17 Standard Specification for Headed Steel

 Bars for Concrete Reinforcement

* + - 1. ASTM A1064/A1064M-17 Standard Specification for Carbon-Steel

 Wire and Welded Wire Reinforcement,

 Plain and Deformed, for Concrete

* + 1. Canada Green Building Council (CaGBC):
			1. LEED Canada 2009 Rating System LEED Canada for New Construction and Major Renovations. LEED Canada for Core and Shell Development. Website: [www.cagbc.org](http://www.cagbc.org)
		2. Canadian Standards Association (CSA):
			1. CSA A23.1‑14 Concrete Materials and Methods of Concrete Construction
			2. CSA A23.3-14 Design of Concrete Structures
			3. CSA G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement
			4. CSA G40.21-13 Structural Quality Steels
			5. CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel
			6. CSA W55.3-08 (R2013) Certification of Companies for Resistance Welding of Steel and Aluminum
			7. CSA W59-13 Welded Steel Construction (Metal Arc Welding)
			8. CSA W178.1-14 Certification of Welding Inspection Organizations
			9. CSA W178.2-14 Certification of Welding Inspectors
			10. CSA W186-M1990 (R2016) Welding of Reinforcing Bars in Reinforced Concrete Construction
		3. International Organization for Standardization (ISO):

.1 ISO/IEC 17025:2017 General Requirements for the Competence

of Testing and Calibration Laboratories

* + 1. Reinforcing Steel Institute of Canada (RSIC):
			1. Reinforcing Steel Manual of Standard Practice.
	1. TESTING
		1. As per Section 03 05 05 – Concrete Testing and Inspection.
	2. SUBMITTALS
		1. Shop Drawings:
			1. Submit shop drawings including placing of reinforcement in accordance with Division 01.
			2. Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, location and length of reinforcement splices, location of mechanical and welded splices if approved by the Consultant, with identifying code marks to permit correct placement without reference to structural drawings. [Indicate sizes, spacings, and locations of chairs, bolsters, spacers, and hangers.] Prepare reinforcement drawings in accordance with [Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada] [ACI SP-066].
			3. Detail lap lengths and bar development lengths to CSA A23.3. Provide Class B tension lap splices unless otherwise indicated or stipulated by the Standard.
		2. Sustainable Design Submittals:
			1. LEED Submittals: submit LEED submittal forms for Credits MR 4 in accordance with Section 01 35 18 LEED Requirements and the following:
				1. Documentation identifying quantity by weight of recycled content in steel reinforcing if content is over 25% and to be claimed as such toward LEED credits.
			2. LEED Submittals: submit LEED submittal forms for Credits MR 5 in accordance with Section 01 35 18 LEED Requirements and the following:
				1. Regional Materials: provide evidence that project incorporates required percentage [20] [30] % of regional materials/products, showing their cost, distances from extraction to manufacture and manufacture to project site, and total cost of materials for project.
	3. QUALITY ASSURANCE
		1. Provide the Province, upon request, with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, [minimum [4] [ ] weeks prior to commencing reinforcing work].
			1. Where mill tests reports originate from a mill outside Canada or the United States of America, the Contractor shall have mill test reports verified by a certified laboratory in Canada by testing the material to the specified material standard, including boron content. The testing laboratory shall be certified to ISO/IEC 17025 by an organization accredited by the Standards Council of Canada for the tests required. Samples for testing shall be collected by personnel employed by the certified laboratory. A verification letter shall be provided by the certified laboratory that includes at a minimum, the applicable mill test reports, testing standards, date of verification testing, and declaration of material compliance with Contract requirements. The verification letter shall be signed by an authorized officer of the certified laboratory.
		2. Inform the Province, upon request, of proposed source of material to be supplied.
		3. Qualify procedures and personnel according to the following:
			1. Welders shall be qualified by Canadian Welding Bureau for classification of work being performed.

.2 The fabricator shall be certified to CSA W47.1, Division 1 or 2.1.

.3 Perform welding inspection to CSA W178.

.4 Resistance welding: to CSA W55.3.

.5 Fusion welding: to CSA W59.

* 1. DELIVERY, STORAGE AND HANDLING
		1. Deliver, store and handle reinforcing steel, welded wire fabric and accessories in manner that prevents contamination which reduces bond, and damage to fabricated forms.
		2. Protect reinforcement from rust, dirt, grease, form oil and other bond-breaking substances.
		3. Waste Management and Disposal:
			1. Separate waste materials for [reuse] [and] [recycling] in accordance with Section 01 74 19 – Waste Management and Disposal.
1. Products
	1. REINFORCEMENT MATERIALS
		1. [Provide materials with minimum 25% recycled content.]
		2. Steel reinforcing bars shall be deformed, except spirals, load‑transfer dowels, and welded wire reinforcement, which may be plain. Reinforcing bars shall be grades, types of steel, and sizes required by the Contract Documents.
		3. Reinforcing Steel: billet steel, grade [300] [400], deformed bars to CSA G30.18, unless indicated otherwise; [Plain] [Galvanized] [Epoxy coated] finish.
		4. Reinforcing Steel: weldable low alloy steel deformed bars to CSA G30.18.
		5. Stainless Steel Reinforcing: to ASTM A276/A267M and ASTM A955/A955M
		6. Zinc‑coated (galvanized) reinforcing bars shall conform to ASTM A767/A767M and other requirements as specified in the Contract Documents. Coating damage incurred during shipment, handling, and placing of galvanized rebar shall be repaired in accordance with ASTM A780/A780M. Damaged areas shall not exceed 2 percent of surface area in each linear metre of each bar or bar shall not be used.
		7. Plain Round Bars: to CSA G40.21.
		8. Epoxy‑coated reinforcing bars shall conform to ASTM A775/A775M and other requirements as specified in the Contract Documents. Coating damage incurred during shipment, handling, and placing of epoxy‑coated rebar shall be repaired in accordance ASTM A775/A775M. Damaged areas shall not exceed 2 percent of surface area in each linear metre of each bar or bar shall not be used. Fading of coating color shall not be cause of rejection of epoxy‑coated reinforcing bars.
		9. Headed reinforcing bars shall conform to ASTM A970/A970M including Annex A1, and other specified requirements.
		10. Chairs, Bolsters, Bar Supports and Spacers: to CSA A23.1.
		11. Mechanical Splices: subject to the Consultant’s approval. Mechanical splices for galvanized reinforcing bars shall be galvanized or coated with dielectric material.
		12. Welded Wire Reinforcement, plain and deformed: to ASTM A1064/A1064M, boron content shall not exceed 0.0008%. The spacing of welded intersection in the direction of principal reinforcement shall not exceed:
			1. 300 mm for plain welded wire reinforcement
			2. 400 mm for deformed welded wire reinforcement
		13. Tie Wire: 1.5 mm diameter annealed wire.
		14. Shear Stud-Rail Systems:
			1. Shear studs: Standard mild steel studs meeting requirements for ASTM A108, Grades 1010 through 1020 and weldable in accordance with CSA W59:

.1 Minimum Tensile Strength: [ ]

.2 Minimum Yield Stress: [ ]

.3 Minimum Elongation: [ ]

 .2 Rails: Standard low carbon steel:

 .1 Minimum Tensile Strength: [ ]

 .2 Minimum Yield Strength: [ ]

 .3 Minimum Elongation: [ ]

.12 Shear Connectors: Premanufactured, two-part high load shear dowel and sleeve connector system designed to allow for lateral movement and rotation, and longitudinal movement.

* 1. FABRICATION
		1. Fabricate reinforcing steel in accordance with CSA A23.1, ACI SP-066[, and] [Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada].
		2. Obtain the Consultant’s approval for locations of reinforcement splices other than those shown on placing drawings.
		3. Upon approval of the Consultant, weld reinforcement in accordance with CSA W186.
		4. Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
		5. Bundle and transport epoxy coated reinforcement in accordance with ASTM A775/A775M.
		6. Fabricate within the following tolerances:
			1. Sheared Length: +/- 25 mm
			2. Stirrups, Ties and Spirals: +/- 10 mm
			3. Other Bends: +/- 25 mm
		7. Locate reinforcing splices not shown on drawings at points of minimum stress.

.8 Fabrication of Galvanized Reinforcement:

 .1 Fabricate galvanized reinforcement in accordance with ASTM A767/A767M.

.2 Handle galvanized reinforcement with care. Use padded contact areas on all systems for handling galvanized bars at all times, including, but not limited to, during fabrication, transportation, and placement.

.3 Galvanize all steel supports, including support bars, to be used in conjunction with galvanized reinforcement.

.4 The silicon content shall be either less than 0.04% or 0.15 to 0.25% inclusive when steel is to be galvanized.

1. Execution
	1. FIELD BENDING
		1. Do not field bend or field weld reinforcement except where indicated or authorized by the Consultant.
		2. When field bending is authorized, bending procedure shall conform to the Standard.
		3. Replace bars which develop cracks or splits.
	2. PLACEMENT DETAILING
		1. Conform to CSA A23.1 and CSA A23.3 for hooks, bends, laps, and similar details not specifically shown.
		2. For support bars not shown on drawings, use the sizes and spacing for applications as follows:
			1. Slab Top Reinforcing (10M): 10M bars spaced at [1000] mm o.c. maximum.
			2. Slab Top Reinforcing (15M and larger): [15] [ ]M bars spaced at 1200 mm o.c. maximum.
			3. Slab Bottom Reinforcing: 15M bars spaced at 1200 mm o.c. maximum.
			4. Beam Stirrups: 15M bar in each corner.
		3. Reinforce slab and wall openings, unless otherwise shown, as follows:
			1. Openings with greatest dimension of 600 mm or less: four 15M diagonal bars, 900 mm longer than greatest opening dimension.
			2. Openings with greatest dimension larger than 600 mm: two 15M bars on each side, top and bottom, 1500 mm longer than greatest opening dimension.
			3. Reinforce circular openings as square.
		4. Secure chairs for reinforcing in place located at 1200 mm o.c. maximum.
		5. Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars or welded wire fabric around wall and grade beam corners.
		6. Cover electrical conduit, ductwork or piping buried in slabs with 600 mm wide strip of 102 x 102 x MW13.3 x MW13.3 welded wire fabric. If principal slab reinforcement is placed above conduit then place 600 mm strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork, or piping.
	3. PLACEMENT
		1. Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1. Chair slab reinforcing not further apart than 1.2 m in either direction.
		2. Place, support and secure reinforcement against displacement. Do not deviate from required position.
		3. Do not displace or damage vapour barrier. Repair and reposition vapour barrier as required.
		4. Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
		5. Position of reinforcing shall take precedence over position of conduit or piping.
		6. Prior to placing concrete, obtain the Consultant’s approval of reinforcing material and placement.
		7. Ensure reinforcement location is maintained to provide required concrete cover to reinforcement during placement of concrete.
		8. Place reinforcing steel in [                    ], [                    ] [, and] [                  ] to provide concrete cover for [      ] hour fire endurance, as required by the Alberta Building Code.
		9. Protect [epoxy] [and] [paint] coated portions of bars with covering during transportation and handling.
		10. Place reinforcing steel to provide concrete cover as follows:

|  |  |
| --- | --- |
| Item | Cover [mm] |
| Beam Stirrups | [40] [         ] |
| Supported Slabs and Joists | [20] [         ] |
| Column Ties | [40] [         ] |
| Interior Walls  | [25] [         ] |
| Walls Exposed to weather or backfill | [50] [         ] |
| Footings and concrete formed against earth | [75] [         ] |
| Slabs on Fill | [50] [         ] |

* + 1. .Maintain alignment as follows:

|  |  |
| --- | --- |
| Item | Tolerance Plus or Minus [mm] |
| Slabs | [5] [        ] |
| Other Structural Members  | [10] [        ] |
| Rebar bends and Ends | [50] [        ] |

* 1. FIELD TOUCH-UP
		1. Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.
	2. CLEANING
		1. Ensure concrete reinforcing is clean and free from oil and deleterious matter.
		2. Remove all loose scale, loose rust, and other deleterious matter from surfaces of reinforcing.
	3. SCHEDULE

|  |  |
| --- | --- |
| Location | Reinforcement |
| Foundation walls, foundation framing members, and slabs-on-grade | Deformed bars and wire fabric, galvanized finish. Chairs, bolsters bar supports and spacers, non-corrosive finish or construction |
| Superstructure framing members | Deformed bars, unfinished |
| Parking structure framing members | Deformed bars, epoxy coated finish. |

end of section