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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 01 11 00 – Summary of Work.
- .2      Section 01 29 00 – Payment Procedures.
- .3      Section 01 33 00 – Submittal Procedures.
- .4      Section 03 20 00 – Concrete Reinforcing.
- .5      Section 03 30 00 – Cast-in-Place Concrete.
- .6      Section 03 30 10 – Concrete Cleaning and Repair.

**1.2               REFERENCES**

- .1      Canadian Standards Association (CSA International)
  - .1      CSA A23.1/A23.2-09 (R2014 or latest edition), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2      CSA-O86S1-05 (or latest edition), Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
  - .3      CSA O121-08 (R2013 or latest edition), Douglas Fir Plywood.
  - .4      CSA O151-09 (R2014 or latest edition), Canadian Softwood Plywood.
  - .5      CSA O153-M1980 (R2003 or latest edition), Poplar Plywood.
  - .6      CAN/CSA-O325.0-92 (R2003 or latest edition), Construction Sheathing.
  - .7      CSA O437 Series-93 (R2006 or latest edition), Standards for OSB and Waferboard.
  - .8      CSA S269.1-1975 (R2003 or latest edition), Falsework for Construction Purposes.
  - .9      CAN/CSA-S269.1-M92 (R2003 or latest edition), Concrete Formwork, National Standard of Canada

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Shop Drawings:
  - .1      Upon request, submit to Departmental Representative for review four (4) sets of formwork and falsework shop drawings, in accordance with Section 01 33 00, at least four (4) weeks prior to erection. All such drawings to be stamped and signed by a Professional Departmental Representative registered in the Province of Nova Scotia.
  - .2      Clearly indicate method and schedule of construction, materials, arrangement of joints, ties, shores, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings.

- .3 Product Data/Samples:
  - .1 Provide product data and samples for form ties.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Formwork lumber: plywood and wood formwork materials to CSA A23.1
- .2 Falsework materials: to CSA S269.1
- .3 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal, 15 to 14 mm<sup>2</sup>/s at 40DC, flash-point minimum 150DC, and open cup.
- .4 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. When forms are removed, no metal will be less than 75 mm from the surface of the concrete.

## **Part 3 Execution**

### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines and levels before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1
- .3 Line forms with material only as approved by Departmental Representative.
- .4 Construct falsework in accordance with CSA S269.1
- .5 Align form joints and make watertight. Keep form joints to minimum.
- .6 Use 25 mm chamfer strips on external corners.
- .7 Clean formwork in accordance with CSA A23.1, before placing concrete.
- .8 Leave formwork in place for at least seven days, exclusive for days when temperature falls below 50C, unless otherwise directed by Departmental Representative.
- .9 Re-use of formwork and falsework subject to requirements of CSA A23.1
- .10 All holes from form ties and rods to be plugged with mortar to requirements of CSA A23.1. When forms are removed, no metal will be less than 75 mm from the surface of the concrete.

**END OF SECTION**

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**Part 1            General**

**1.1            DESCRIPTION**

- .1        The Work shall consist of supplying, delivery, handling, storing and placing of galvanized steel reinforcement, including all bar supports and accessories, as shown on the drawings and in accordance with the provisions of this section.

**1.2            RELATED REQUIREMENTS**

- .1        Section 01 11 00 – Summary of Work.
- .2        Section 01 29 00 – Payment Procedures.
- .3        Section 01 33 00 – Submittal Procedures.
- .4        Section 03 10 00 – Concrete Forming and Accessories.
- .5        Section 03 30 00 – Concrete Reinforcing.
- .6        Section 05 50 51 – Custom Metal Fabrication.

**1.3            REFERENCES**

- .1        American Concrete Institute (ACI)
  - .1        SP-66-04 (or latest edition), ACI Detailing Manual 2004.
- .2        ASTM International
  - .1        ASTM A82/A82M-07 (or latest edition), Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2        ASTM A143/A143M-07 (or latest edition), Standard Practice for Safeguarding against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3        ASTM A185/A185M-07 (or latest edition), Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .4        ASTM A775/A775M-07b (or latest edition), Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3        CSA International
  - .1        CSA A23.1/A23.2-09 (R2014 or latest edition), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2        CAN/CSA-A23.3-14 (or latest edition), Design of Concrete Structures.
  - .3        CSA-G30.18-09 (R2014 or latest edition), Carbon Steel Bars for Concrete Reinforcement.
  - .4        CAN/CSA G40.20-04/G40.21-04 (R2009 or latest edition), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

- .5 CAN/CSA-G164-M92 (R2003 or latest edition) - Hot Dip Galvanizing of Irregularly Shaped Articles.
- .6 CSA W186-M1990 (R2012 or latest edition), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC-2004 (or latest edition), Reinforcing Steel Manual of Standard Practice.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 The Contractor shall submit the following to the Departmental Representative:
  - .1 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.
  - .2 Upon request, inform of proposed source of material to be supplied.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle reinforcing and 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.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Reinforcing Steel: billet steel, grade 400w, deformed bars to CAN/CSA-G30.18, unless indicated otherwise; Galvanized coated finish.
- .2 Galvanizing of Non-Prestressed Reinforcement: to CAN/CSA-G164.
- .3 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m<sup>2</sup> to CSA G164.
- .4 Cold-Drawn Annealed Steel Wire Ties: to CSA-G30.3.
- .5 Chairs, Bolsters, Bar Supports and Spacers: to CSA A23.1.
- .6 Mechanical Splices: subject to Departmental Representative's approval.
- .7 All bar accessories in deck slab and walls shall be a type approved by the Departmental Representative and shall be non-rusting. They shall be made from precast concrete or in the case of steel, Type 316 stainless steel or hot-dip galvanized steel.

#### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA A23.1, ACI 315, and Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.

- .2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .3 Fabricate within the following tolerances:
  - .1 Sheared Length: +/- 25mm
  - .2 Stirrups, Ties and Spirals: +/- 10 mm
  - .3 Other Bends: +/- 25 mm

### **Part 3 Execution**

#### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

#### **3.2 PLACING REINFORCEMENT**

- .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 Prior to placing concrete, obtain Department Representative's approval of reinforcing material and placement.
- .4 Place reinforcing steel to provide minimum 75 mm concrete cover.
- .5 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.
- .6 Ensure concrete reinforcing is clean and free from oil and deleterious matter.
- .7 Remove all loose scale, loose rust and other deleterious matter from surfaces of reinforcing.

**END OF SECTION**

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**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 01 11 00 – Summary of Work.
- .2      Section 01 29 00 – Payment Procedures.
- .3      Section 01 33 00 – Submittal Procedures.
- .4      Section 03 10 00 – Concrete Forming and Accessories.
- .5      Section 03 20 00 – Concrete Reinforcing.

**1.2               REFERENCES**

- .1      ASTM International
  - .1      ASTM C260/C260M-10a (or latest edition), Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2      ASTM C309-07 (or latest edition), Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3      ASTM C494/C494M-10a (or latest edition), Standard Specification for Chemical Admixtures for Concrete.
  - .4      ASTM C1017/C1017M-07 (or latest edition), Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5      ASTM D412-06ae2 (or latest edition), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .6      ASTM D624-00 (2007 or latest edition), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .7      ASTM D1751-04 (2008 or latest edition), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .8      ASTM D1752-04a (2008 or latest edition), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2      CSA International
  - .1      CSA A23.1/A23.2-09 (R2014 or latest edition), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2      CSA A283-06 (R2011 or latest edition), Qualification Code for Concrete Testing Laboratories.
  - .3      CSA A3000-13 (or latest edition), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

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### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Shop Drawings:
  - .1 Upon request, submit shop drawings and erection drawings for formwork and falsework. All such drawings to be stamped and signed by a Professional Engineer registered in the Province of Nova Scotia.
  - .2 Upon request, submit placement drawings for reinforcing steel.
  - .3 Upon request, submit placement drawings for miscellaneous items.
- .2 Product Data/Samples:
  - .1 Provide technical data and/or samples for curing compounds for winter, evaporation retardant and finishing aids, expansion joint materials /sealants, grouts.
- .3 Certificates:
  - .1 Minimum four weeks prior to starting concrete work submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
    - .1 Portland cement.
    - .2 Admixtures.
  - .2 Provide certification that plant, equipment, and materials to be used in concrete work comply with requirements of CSA A23.1
  - .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1
  - .4 Provide certification that concrete will not include alkali reactivity aggregates.
- .4 Methodology:
  - .1 Submit methodology for cold weather concreting.
  - .2 Submit methodology for concrete placement operations.
  - .3 Submit methodology for concrete deck finishing operations.
  - .4 Submit methodology for supporting reinforcing steel.
- .5 Test Results:
  - .1 Provide design mix tests results.

### **1.4 STORAGE OF MATERIALS**

- .1 Store all materials to prevent contamination or deterioration, whether at the plant or at the job site.
- .2 Store cement in watertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment whether at the plant or at the job site.
- .3 Prevent stored liquid admixtures and compounds from freezing and powdered admixtures and compounds from absorbing moisture.

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**1.5 SOURCE SAMPLING**

- .1 At least 4 weeks prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling.

**1.6 READY-MIX CONCRETE SUPPLY**

- .1 Provide, with each load of concrete delivered to site, duplicate delivery slips containing following:
  - .1 Name of ready-mix batch plant.
  - .2 Serial number of ticket.
  - .3 Date and truck number.
  - .4 Project identification.
  - .5 Class of concrete or mix.
  - .6 Amount of concrete in cubic metres.
  - .7 Time of loading or first mixing of aggregate, cement and water.
  - .8 Time of discharge of concrete.
  - .9 Admixtures added at plant.
  - .10 Amount of water added at plant.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregates: to CSA A23.1, for Class "C-1" exposure.
- .2 Portland Cement: to CSA A5, normal type 10.
- .3 Water: to CSA A23.1
- .4 Admixtures:
  - .1 Air entraining admixtures: to CSA A23.5
  - .2 Chemical admixtures: to CSA A23.5 and ASTM C494
  - .3 Pozzolanic mineral admixtures: to CSA A23.5
- .5 Non-shrink grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.
- .6 Curing compound: To ASTM-C309-M81 and CSA A23.1-M94 (or latest editions) type 1, 1D, or 2.
- .7 Remoulded joint fillers:
  - .1 Bituminous impregnated fibre board: to ASTM D1751 (latest edition), non-extruding resilient type.
- .8 Joint sealer: self-levelling, two component sealant capable of remaining resilient over temperatures ranging from - 25° C to 35° C. Material will be capable of an elongation of



300%, have tensile recovery of 90% ASTM D412-75 (or latest edition), hardness of 25-35 Shore A and have a high bond strength to the concrete faces.

## 2.2 CONCRETE MIXES

- .1 Prior to starting concrete work, submit to the Departmental Representative the proposed mix design(s) for approval. Mix design(s) to be in accordance with Alternative 1 of Table 11 in CSA A23.1-94 (or latest edition). Comply with additional requirements of CSA A23.1-94 (or latest edition), Section 15 for concrete placed near sea water.
- .2 Use concrete mix designed to produce air entrained concrete meeting the following requirements:
  - .1 Cement to be normal Portland cement, Type 10.
  - .2 Minimum compressive strength at 28 days: 45 MPA.
  - .3 Exposure: Class C-1.
  - .4 Maximum aggregate size to CSA A23.1-M94 (or latest edition) table 2, Group 1, 20 mm sieve size.
  - .5 Minimum cement content 390 kg/m<sup>3</sup>.
  - .6 Air content: 6 to 8%.
  - .7 Maximum water/cement ratio to be 0.40.
  - .8 Slump at time and point of discharge 20 to 80 mm. Where the nature of the work requires larger slumps, they are to be obtained by the use of admixtures rather than increasing the water content. The use of such admixtures and the increase in slump to be approved by the Departmental Representative prior to implementation in the work.
  - .9 Modify concrete mix to the approval of the Departmental Representative to accommodate pumping.
  - .10 Admixtures to the approval of the Departmental Representative and the recommendation of the manufacturer. Admixtures must be dispersed separately into mixing water.
- .3 Do not use calcium chloride or compounds containing calcium chloride.
- .4 Weigh aggregates, cement, water and admixtures separately when batching. Inspect and test scales for accuracy as directed. Accuracy to be such that successive quantities can be measured to within one percent of desired amounts. Test certificates to be submitted to Departmental Representative upon request.
- .5 Where seven day strength is less than 70% of specified 28 day strength, provide additional protection curing and make changes to mix proportions to the satisfaction of the Departmental Representative.
- .6 Provide certification that plant, equipment and all materials to be used in concrete comply with the requirements of CSA A23.1-94 (or latest edition).
- .7 Provide certification from independent testing and inspection company that mix proportions selected will produce concrete of specified quality and can be effectively placed and finished for all work under this contract.

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**Part 3            Execution**

**3.1                GENERAL**

- .1      Obtain Departmental Representative's approval before placing concrete. Provide 24 hours notice of intended placement.
- .2      Place, consolidate, finish, cure and protect concrete to CSA A23.1-94 (or latest edition) except where specified otherwise.
- .3      Prior to placing of concrete, obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4      Comply with additional requirements of CSA A23.1-94 (or latest edition) Section 15 except where specified otherwise, for concrete exposed to seawater environment.
- .5      Do not commence placing concrete until Departmental Representative has inspected/reviewed forms, inserts, dowels, reinforcing steel, joints; conveying, spreading, consolidation, finishing, curing and protective methods.
- .6      Ensure that reinforcement and anchorage are not disturbed during placing.
- .7      Maintain accurate records of placed concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8      Do not place load(s) upon new concrete until Departmental Representative is satisfied that the Contractor has carried out all calculations and tests necessary to confirm that the load(s) will not cause damage or create a safety hazard. Calculations and tests to be stamped by a Professional Departmental Representative registered in the Province of Nova Scotia.
- .9      Comply with additional requirements of CSA A23.1-94 (or latest edition), Clause 15, for concrete exposed to seawater environments during placement and curing.

**3.2                REINFORCING STEEL**

- .1      Place new reinforcing steel according to Section 03 20 00.
- .2      Provide 75 mm minimum cover for all reinforcing steel unless indicated otherwise on drawings.

**3.3                FORMWORK**

- .1      Verify field dimensions to determine applicable sizes of formwork.
- .2      Design and construct form work to allow adequately for proper placement and consolidation while conforming with shape and dimensions shown on plans.
- .3      Formwork design will include closures at both top and bottom of form, and all necessary hardware to support the forms.
- .4      Upon request, submit drawings for review by the Departmental Representative, at least 3 weeks before placement of concrete. Drawings, will show formwork details and illustrate dimensions, method of placing of concrete, connections and support.

- .5 Strip formwork after minimum 5 days. This condition might be waived only if an alternative method to curing and preventing alternate wetting and drying is provided, to the satisfaction of the Departmental Representative. This condition will be waived if the forms are left permanently in place, where approved by the Departmental Representative.

### **3.4 PLACEMENT OF CONCRETE**

- .1 Place and consolidate concrete to CSA A23.1-94 (or latest edition).
- .2 If allowed by Departmental Representative, pump concrete to following requirements:
  - .1 Arrange equipment so that no vibrations result which might damage freshly placed concrete.
  - .2 Where concrete is conveyed and placed by mechanically applied pressure, provide suitable equipment.
  - .3 Operate pump so that concrete, without air pockets, is produced.
  - .4 When pumping is discontinued and concrete remaining in pipe line is to be used, void pipe line in a manner that prevents contamination of concrete or separation of ingredients.
- .3 Concrete will be deposited in all cases as neatly as practicable, directly in its final position, and will not be caused to flow in a manner to permit or cause segregation.
- .4 Each layer of concrete will be vibrated and tamped with an appropriate vibrator as allowed by the Departmental Representative. The concrete must be compacted to the maximum practicable density, free of air pockets, and until it is in complete contact with the reinforcement and formwork.

### **3.5 INSERTS**

- .1 Set galvanized sleeves and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 X 100 mm not indicated on drawings must be approved by Departmental Representative.
- .2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Departmental Representative before placing of concrete.
- .3 Galvanized items embedded in concrete will be completely separated from reinforcing steel.
- .4 Anchor bolts:
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 With Departmental Representative's concurrence, grout anchor bolts in pre-formed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used.
  - .3 Protect anchor bolt holes from water accumulations.
  - .4 Set bolts and fill holes with non-shrink epoxy grout.

- .5 Anchor bolts for base plates will be set to allow at least 25 mm of grout under the base plates.

### **3.6 PROTECTION AND CURING**

- .1 Provide protection and curing in accordance with CSA A23.1. Concrete shall be wet cured.
- .2 Protect concrete with windproof shelter to allow free circulation of inside air around fresh concrete. Do not let walls of shelter touch formwork and provide sufficient space for removal of formwork.
- .3 Supply approved heating equipment to maintain inside air at following temperatures:
  - .1 For an initial seven days, at not less than 10° C nor more than 25° C at surfaces.
  - .2 At not less than 10° C for an additional 4 consecutive days or for the time necessary to attain 70% of the specified 28-day compressive strength of the concrete,
  - .3 Reduce temperature near end of curing period at rate not exceeding 20° C per day.
  - .4 Do not overheat.
- .4 Keep concrete surfaces continuously moist during protection stage and allow concrete to dry before removal of protection.
- .5 Freshly deposited concrete will be protected from premature drying and cold temperatures, will be maintained without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete. It will be protected from harmful effects of sunshine, drying winds, cold weather, running or surface water and mechanical shock.
- .6 Wood floating, broom finishing, placing of burlap and inspection of concrete to be done from transverse bridges of rigid construction free from wobbles and springing under use, unless other methods have been submitted and accepted.

### **3.7 FINISHING**

- .1 Finish concrete in accordance with CSA A23.1-94 (or latest edition).
- .2 Grind off fins, nibs and other raised protuberances with an approved hand stone.
- .3 When concrete has hardened sufficiently, give deck surface a uniform finish free from porous spots, irregularities, depressions, small pockets or rough spots using a power float leaving a rough spiral finish with one pass of the float.
- .4 Following use of power float, provide coarse broom finish using steel wire or stiff, coarse, fibre broom. Use broom in a transverse ridges satisfactory to Departmental Representative. Brooming will be delayed until concrete is sufficiently hard to retain ridges.
- .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise detailed.

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**3.8 JOINT FILLERS**

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .2 Locate and form separation joint as indicated. Install joint filler.
- .3 Unless indicated otherwise, use 25 mm thick joint filler to separate deck slabs and extend joint filler from bottom of slab to within 25 mm of finished concrete surface.

**3.9 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by Testing Laboratory designated by the Departmental Representative in accordance with CSA A23.1-94 (or latest edition).
- .2 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 If tests do not meet requirements of the Departmental Representative, take such measures as indicated in CSA A23.1-94 and CSA A23.2-94 (or latest editions).
- .4 Arrange and pay for inspection and testing when necessary for production control to meet requirements.
- .5 Inspection and testing by Departmental Representative will not augment Contractor's quality control or relieve him of contractual responsibility.

**3.10 DEFECTIVE WORK**

- .1 Concrete is defective when:
  - .1 Failing to meet any requirement of this specification.
  - .2 Concrete contains honeycombing or embedded debris.
  - .3 28-day strength in any area is less than 95% of specified minimum.
- .2 Repair or remove and replace defective work as directed by the Departmental Representative.
- .3 Take corrective measures as directed by the Departmental Representative to prevent occurrence of further defective concrete.

**END OF SECTION**

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**Part 1            General**

**1.1                DESCRIPTION**

- .1    The work generally consists of:
  - .1      Pressure Wash Cleaning of all concrete surfaces.
  - .2      Sandblasting of heavily oil or grease stained concrete surfaces.
  - .3      Repair and restoring concrete walls sections by pinning and crack filling.
  - .4      Replacement of concrete embedded corroded steel rungs.
  - .5      Painting of concrete floors and walls.

**1.2                RELATED REQUIREMENTS**

- .1    Section 01 11 00 – Summary of Work.
- .2    Section 01 29 00 – Payment Procedures.
- .3    Section 01 33 00 – Submittal Procedures.

**1.3                REFERENCES**

- .1    Canadian Standards Association (CSA International)
  - .1      CSA A23.1/A23.2-09 (R2014 or latest edition), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2    International Concrete Repair Institute (ICRI) Technical Guideline No. 310.1R, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
- .3    Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.
- .4    OPSS 929 Abrasive Blast Cleaning-Concrete Construction.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop Drawings:
  - .1      Upon request, submit shop drawings showing details and methodology of pinning displaced and fractured concrete wall.
  - .2      Upon request, submit shop drawings showing details and methodology of placement of anchor bolts.
  - .3      Product data sheets and installation procedures for the proposed concrete repair mortar and concrete.
  - .4      Submit before commencing the manufacturer's data sheets on the coating system describing the following:
    - .1          Recommended maximum dry film thickness for each coating layer.
    - .2          Mixing and thinning directions.

- .3 Acceptable humidity level and temperature range for application.
- .4 Minimum acceptable recoat time period for temperature ranges.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Water
  - .1 Water used for high pressure water wash shall be clean, fresh and free from oil, acid, alkali organic matter or other deleterious substance.
- .2 Abrasive Material
  - .1 Blast abrasive material shall be free of corrosion producing contaminants and oil. The type of blast abrasive material, hardness and grit size shall be such so as to achieve a clean surface profile, onto which the paint system is to be applied. The final prepared surface is to be compatible with the requirements of the paint system to be used.
- .3 Bonding Agent
  - .1 A two-component, epoxy-resin bonding system for application to Portland cement concrete, which are able to cure under humid conditions and bond to damp surfaces, and comply with the AASHTO M 235 (ASTM C 881).
  - .2 Type V - For use in load bearing applications- for bonding freshly mixed concrete to hardened concrete.
  - .3 Grade 1 - Low viscosity (0-2.0 Pa)
  - .4 Class B - For use between 40 and 60°F. The class of bonding agent is to conform to the temperature at time of application.
- .4 Repair Grout and Mortar
  - .1 Material to be used shall be polyurethane resins for active cracks and epoxy resins for passive cracks.
  - .2 Polyurethane and epoxy grout shall prevent water penetration and shall have a flow ability to fill the crack at least 80% of the depth.
  - .3 Polyurethane shall be 100% solids.
  - .4 Epoxy resins shall be moisture insensitive and 100% solids.
- .5 High Strength Patching Mortar
  - .1 The high strength mortar patching compound shall be a one component, add water only, hydraulic cement based, polymer modified and silica-fume enhanced, fibre-reinforced mortar suitable for form and pour applications.
    - .1 Minimum Physical Requirements:
    - .2 Compressive Strength
      - @ 3 Days 24-28 MPa
      - @ 7 Days 28-32 MPa
      - @ 28 Days 34-38 MPa

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|    |                             |                        |
|----|-----------------------------|------------------------|
| .3 | Modulus of Rupture          | 7.5-9.5 MPa            |
| .4 | Slant Shear Strength        | 16.5 - 18.5 MPa        |
| .5 | Bond Strength with Concrete | >1.4 MPa               |
| .6 | Rapid Chloride Permeability | < 980 Coulombs         |
| .7 | Salt Scaling                | 0.08 g/cm <sup>2</sup> |
| .8 | Freeze/Thaw Durability      | < 1% weight loss       |

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.6 Concrete Paint

- .1 An application of protective coating is to be sprayed on all concrete surfaces as identified on the drawings.
- .2 A single component water based acrylic elastomeric coating is to be applied with a minimum of 2 coats.
- .3 Each of two coats shall have a minimum 175um (7mis) dry film thickness. The elasticity @ 21 degrees Celsius shall exceed 150%.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Obtain Department Representative's approval before placing concrete repairs and coating concrete surface. Provide 24 hours notice of intended placement.

**3.2 CONSTRUCTION METHODS**

- .1 All concrete surfaces are to be power washed debris and remove any loose material and light surface coatings. The high pressure wash is to loosen any delaminated surfaces.
- .2 If surface coating, oil or grease stains remain, abrasive blasting or grinding shall be used to clean surfaces.
- .3 The contractor shall remove all dust, spent water and debris in a manner that will not result in any material being deposited in the water way or on the surrounding area. The contractor shall supply appropriate protection barriers or other approved means of containing all contaminants.
- .4 After cleaning the contractor shall inspect all areas of unsound concrete to be repaired and relay the repair location information to the Department Representative. Upon approval of the Department Representative, the contractor shall proceed with the repairs.
- .5 The contractor shall remove all unsound concrete by cutting, chipping or other approved methods. The Contractor shall take care not to damage any reinforcing intended to remain in place.
- .6 Any damage caused by the contractor to any portion not intended to be repaired shall be repaired, at the contractor expense, to the satisfaction of the Departmental Representative.
- .7 Any exposed reinforcing that shows signs of rust shall be sand blasted clean.



- .8 Prior to placing the repair mortar or concrete, the contractor shall thoroughly clean the existing concrete surface and apply the bonding agent as recommended by the repair concrete or mortar manufacturer.
- .9 The contractor shall then immediately apply the repair mortar to restore the surface to the original profile.
- .10 The Contractor shall place the repair mortar to match the existing profile and cross section to within 5 mm of original surface or to the satisfaction of the Public Works Representative.
- .11 In the case where there are complete fractures through the concrete section, displacement steel pins shall be epoxied 300 mm into each of broken section every 300 mm along the break.
- .12 Curing shall be in accordance with the manufacturer's instructions.
- .13 The Surfaces to be sealed and painted shall be cleaned thoroughly of rust, scale, dirt, oil, grease, and all other foreign substances
- .14 All the concrete surfaces, after having been cleaned and primed, shall be painted with two complete coats of paint,
- .15 Painting shall not be done in damp or foggy weather or at any time when the temperature of the concrete is below 5 degree C. Paint shall not be applied on damp surfaces. Spraying machines will be allowed.
- .16 All painting shall be done in a neat and workmanlike manner following the manufacturer's recommendations. The field coat of paint shall be applied so that a dry film thickness of 175 um is obtained. No portion of the paint film shall be less than this the thickness recommended by the Paint Manufacturer.
- .17 The Contractor shall ensure that the other surfaces are not damaged or disfigured by Paint.

### **3.3 QUALITY CONTROL**

- .1 Concrete repair mortar, paint application or other material that is not stored, handled, prepared, placed or cured in accordance with the manufacturer's instructions shall be rejected by the Department Representative. This decision shall be considered final with the Contractor correcting the work at his own expense.

**END OF SECTION**