

**RETURN BIDS TO:**  
**RETOURNER LES SOUMISSIONS À:**  
Public Works and Government Services Canada  
ATB Place North Tower  
10025 Jasper Ave./10025 ave. Jasper  
5th floor/5e étage  
Edmonton  
Alberta  
T5J 1S6  
Bid Fax: (780) 497-3510

**SOLICITATION AMENDMENT**  
**MODIFICATION DE L'INVITATION**

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

**Comments - Commentaires**

**Vendor/Firm Name and Address**  
**Raison sociale et adresse du**  
**fournisseur/de l'entrepreneur**

**Issuing Office - Bureau de distribution**  
Public Works and Government Services Canada  
ATB Place North Tower  
10025 Jasper Ave./10025 ave Jasper  
5th floor/5e étage  
Edmonton  
Alberta  
T5J 1S6

<b>Title - Sujet</b> Water and Wastewater System Upgrade	
<b>Solicitation No. - N° de l'invitation</b> EW038-152316/A	<b>Amendment No. - N° modif.</b> 004
<b>Client Reference No. - N° de référence du client</b> parks EW038-152316	<b>Date</b> 2015-05-06
<b>GETS Reference No. - N° de référence de SEAG</b> PW-\$PWU-909-10414	
<b>File No. - N° de dossier</b> PWU-4-37295 (909)	<b>CCC No./N° CCC - FMS No./N° VME</b>
<b>Solicitation Closes - L'invitation prend fin</b> <b>at - à 02:00 PM</b> <b>on - le 2015-05-13</b>	<b>Time Zone</b> Fuseau horaire Mountain Daylight Saving Time MDT
<b>F.O.B. - F.A.B.</b> <b>Plant-Usine:</b> <input type="checkbox"/> <b>Destination:</b> <input checked="" type="checkbox"/> <b>Other-Autre:</b> <input type="checkbox"/>	
<b>Address Enquiries to: - Adresser toutes questions à:</b> Mayhew (RPC), Sylvia	<b>Buyer Id - Id de l'acheteur</b> pwu909
<b>Telephone No. - N° de téléphone</b> (780) 497-3645 ( )	<b>FAX No. - N° de FAX</b> (780) 497-3510
<b>Destination - of Goods, Services, and Construction:</b> <b>Destination - des biens, services et construction:</b> Department of Public Works and Government Services Canada See Hererin	

**Instructions: See Herein**

**Instructions: Voir aux présentes**

<b>Delivery Required - Livraison exigée</b>	<b>Delivery Offered - Livraison proposée</b>
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<b>Signature</b>	<b>Date</b>

Solicitation No. - N° de l'invitation

EW038-152316/A

Client Ref. No. - N° de réf. du client

parks EW038-152316

Amd. No. - N° de la modif.

004

File No. - N° du dossier

PWU-4-37295

Buyer ID - Id de l'acheteur

pwu909

CCC No./N° CCC - FMS No/ N° VME

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The Amendment is raised to extend the Bid Closing Date and to include Addendum #3 as follows:

BID CLOSING DATE EXTENSION:

Delete: May 11, 2015

**Insert: May 13, 2015**

ADD: Addendum # 3. Refer to the pdf document attached.

End of Amendment

## Addendum #3

### Questions

Q1: Please provide a specification for the concrete mix for both the concrete influent pads and the sewage dump chutes.

A1: Replace Specifications Table of Contents with the attached revised Table of Contents and insert the attached Specification Sections:

Section 03 10 00 – Concrete Formwork and Falsework

Section 03 20 00 – Concrete Reinforcement

Section 03 30 00 – Cast-In-Place Concrete

Q2: In regard to the 300mm dia. concrete columns shown just outside of the precast pump station barrels on drawings ADM\_02\_P\_301 and AST\_02\_P\_301, at what depth do these columns terminate?

A2: Delete the concrete columns in the referenced drawings. The backfill to be installed under forcemains and couplings in areas excavated for the lift station installations at both locations shall be unshrinkable fill installed to a minimum width of 600 mm (at least 300 mm to each side from the centerline of the forcemain), from undisturbed soil of the excavation to the underside of the bedding material.

Q3: On drawing DET\_00\_C\_402, there are three layers of base shown under the sewage dump chutes: two 150mm thick layers of crushed rock followed by a 150mm thick layer of compacted subgrade above. Was this in fact the intent or was it meant to be compacted subgrade on the bottom followed by two layers of crushed rock on top?

A3: Refer to drawing DET\_00\_C\_402 Details 2 and 3. For traffic load bearing area, i.e., the concrete pad with 5% slope to the wheel stops, the base layers shall be, from bottom to top, 150 mm prepared subgrade compacted to 100% SPMDD, followed by 2 layers of 150 mm of Granular Base as described in Specification 32 11 23, Section 2.9, compacted to a minimum of 100% SPD. For the sewage dump chute area, i.e., the 4:1 slope area, base layers shall be, from bottom to top, 2 layers of 150 mm prepared subgrade compacted to 100% SPMDD, followed by a layer of common fill (refer to Specification 31 23 10, Section 2.1.1) compacted to 100% SPMDD. Prepared areas shall be proof rolled in the presence of the Departmental Representative for identification of loose or soft spots, which would need to be re-excavated and re-compacted.

Q4: Bid item 12 reads: "Repair of Asphalt Trails". Where are these asphalt trails located?

A4: Refer to the Table presented in Specification 33 33 13, Section 1.1.9 and Drawing AST\_04\_C\_101 for asphalt repair locations.

Q5: The specification reference for bid item 12, Repair of Asphalt Trails, is for Rip Rap. Please advise.

A5: Refer to the Combined Price Form - Revision Two. Delete the specification reference for bid item 12 and replace with specification reference 32 12 16.

Q6: Drawing ADM\_02\_P\_301, shows the electric blower heater and its pipe (150-VNT-P201). Typically, this pipe is made of PVC however it appears that the pipe in this project, because of the P-201 code, is carbon steel. Please clarify the material this pipe is made of.

A6: All piping, including blower heater and vent piping in both stations shall be steel and shall be epoxy coated. Refer to Specification 22 13 29.16, Sections 2.12 and 2.13.

Q7: Drawing ADM\_02\_P\_301 does not show an air release valve on the 100mm piping. Is one required? If so, please provide specifications for the air release valve.

A7: Manual three piece ball valves are indicated on the drawings at both lift stations. Refer to Specification 22 13 29.16 Section 2.12.1.4. No addition air valves are required.

Q8: One of our mechanical subcontractors was informed by a sales representative at Xylem that the blower heater (Flygt model 13-40-01-72) is no longer available. Please advise.

A8: Refer to Specification 22 13 29.16, Section 2.11: Replace all instances of "Flygt model 13-40 01 72" with "Dexon MDH3 Series or equivalent".

#### Clarifications

1. For all named equipment throughout the Tender Documents, note that "or equivalent" whether stated explicitly or not, is implied.
2. Refer to Specification 31 23 10, Section 2.1.1. Revise Section 2.1.1 to read as follows:

*Common fill: material from common excavation that is free from organics, deleterious materials and rocks larger than 100 mm. Material may consist of low to medium plastic clay or clay till, or granular material.*

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PART 1        GENERAL

1.1            Work Included

- .1        Forms and supporting falsework design.
- .2        Wood or steel forms for all cast-in-place concrete.
- .3        Tubular column forms.
- .4        Void forms.
- .5        Shoring, bracing and anchorage.
- .6        Taping of form joints for special finishes.
- .7        Form openings for other trades.
- .8        Supply and installation of concrete accessories.
- .9        Set anchor bolts, anchors, sleeves, frames and other items.
- .10       Clean erected formwork prior to concrete placement.
- .11       Remove forms and supporting falsework.
- .12       Reshoring.

1.2            Related Work

- .1        Section 03 20 00 - Concrete Reinforcement.
- .2        Section 03 30 00 - Cast-in-Place Concrete.

1.3            Reference Standards

- .1        ACI 347-07 "Guide to Formwork for Concrete".
- .2        Alberta Building Code 2006.
- .3        Alberta Occupational Health and Safety Code 2003.
- .4        CSA-A23.1-09, "Concrete Materials and Methods of Concrete Construction".
- .5        CSA-O141-05 (R2009), "Softwood Lumber".
- .6        CSA-O151-09, "Canadian Softwood Plywood".
- .7        CSA-O325-07, "Construction Sheathing".



- .8 CSA-S269.1-1975 (R2003), "Falsework for Construction Purposes".
- .9 CAN/CSA-S269.3-M92 (R2003), "Concrete Formwork".

#### 1.4 Design Standards

- .1 Design and detail formwork and supporting falsework in accordance with CSA-A23.1, CSA-S269.1, CAN/CSA-S269.3, ACI 347, and applicable construction safety regulations.
- .2 Where there is a conflict between the above-noted codes and standards, the most stringent requirements shall apply. The Engineer shall decide which requirement is the most stringent.
- .3 Use load combinations in accordance with the Alberta Building Code 2006.
- .4 Design formwork, falsework, and reshoring to carry all dead loads, lateral loads, concrete loads, and construction live loads, including placing equipment, until these loads can be supported by the structure.
- .5 All design shall be done by a Professional Structural Engineer, registered in the Province of Alberta.

#### 1.5 Quality Assurance

- .1 Construct and erect formwork and falsework in accordance with CSA-A23.1, CSA-S269.1, CAN/CSA-S269.3, ACI 347, and applicable construction safety regulations.
- .2 Provide a system of quality control and quality assurance to ensure that the minimum standards specified herein are attained.

#### 1.6 Shop Drawings

- .1 Submit shop drawings for formwork, falsework, and reshoring well in advance of the work in accordance with Division 01.
- .2 Shop drawings for formwork and falsework shall clearly indicate the following:
  - .1 Design loads and load combinations;
  - .2 Proposed construction methods and field adjustment of forms;
  - .3 Specifications for formwork materials and overall formwork scheme;
  - .4 Density of plastic concrete;
  - .5 Rate, sequence, and method of placing concrete;
  - .6 Concrete slump, concrete admixtures, and concrete temperature;
  - .7 Maximum member panel deflection;
  - .8 Mass of components of formwork to be erected;
  - .9 Location and details of construction joints;
  - .10 Compressive strength of concrete at formwork removal and application of construction loads.

- .3 Shop drawings for reshoring shall clearly indicate the following:
  - .1 Description of reshoring concept;
  - .2 Stripping schedule;
  - .3 Sequence of installing reshores;
  - .4 Formwork details relating to stripping and reshoring.
- .4 Shop drawings and design briefs are to bear the seal of a Professional Structural Engineer registered in the Province of Alberta.
- .5 Formwork, falsework, and reshoring are to be reviewed by the same Professional Structural Engineer prior to each concrete pour.
- .6 Professional Structural Engineer to report, in writing, that reviewed formwork, falsework, and reshoring are in accordance with the design prior to each concrete pour.
- .7 Shop drawing review by the Engineer is solely to ascertain conformance to the general design concept.
- .8 Responsibility for approval of detail design inherent in shop drawings rests with the Contractor and review by the Engineer shall not imply such approval.
- .9 Review shall not relieve the Contractor of his responsibility for errors or omissions in shop drawings or for proper completion of the Work in accordance with the Contract Documents.

## PART 2 PRODUCTS

### 2.1 Materials

- .1 For Exposed Surfaces: square-edged, smooth surfaced panels true in plane, free of holes, surface markings or defects.
- .2 For Unexposed Surfaces: square-edged plywood or other material suitable to retain concrete without leakage or distortion.
- .3 Wood Materials:
  - .1 Sheathing: CSA-O151 or CSA-O325, solid one side select sheathing - tight face grade. Sound, undamaged sheets with clean true edges.
  - .2 Lumber: conforming to CSA-O141.
  - .3 Nails, Spikes and Staples: galvanized or phosphatized.

### 2.2 Prefabricated Forms

- .1 Steel Type: minimum 1.6 mm steel thickness; well matched, tight fitting and adequately stiffened to support the weight of concrete without deflection detrimental to structural tolerance and appearance of finished concrete surface.
- .2 Tubular Column Type: round, spirally wound laminated fibre material, internally treated with release agent; sizes indicated on the Drawings.

- .3 Void Forms under Structural Slabs: 150 thick, low density closed-cell expanded polystyrene (EPS) designed to collapse under soil expansion; Dynavoid by Beaver Plastics, Geovoid by Plasti-Fab or approved equal. Use 10mm sheathing or hardboard between void form and concrete.

### 2.3 Accessories

- .1 Form Ties: suitable for water retaining structure construction. Removable or snap-off metal type with metal form spacers, adjustable length; minimum working strength of 13 kN. When assembled, free of defects that will leave metal closer than 40 mm from concrete surface. Cones shall be approximately 20 mm diameter and not larger than 40 mm. Use plastic cone snap type or screw type on exposed surface. Wire ties are not permitted.
- .2 Form Release Agent: colourless mineral oil which will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete. Form release agent shall be non-toxic.
- .3 Corner or Chamfer Fillets: extruded plastic or mill finish pine, 20 mm width, maximum possible lengths, mitre ends.
- .4 Sealing Tape: reinforced, self-adhesive polyvinyl-chloride.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Before starting this Work examine work done by others which affects this Work.
- .2 Rectify all conditions which would prejudice proper completion of this Work.
- .3 Commencement of Work implies acceptance of existing conditions.

### 3.2 Erection

- .1 Verify lines, levels and centers before proceeding with formwork. Ensure dimensions agree with the Drawings.
- .2 Construct formwork and falsework to meet design and regulatory requirements and to produce finished concrete conforming to surfaces, shapes, lines and dimensions indicated on the Drawings. Ensure visible lines of the curbs, walls and walks follow a smooth profile both vertically and horizontally.
- .3 Arrange and assemble formwork to permit removal without damage to concrete. Set shores supporting forms for beams, slabs and other horizontal members on wedges or other approved adjustable supports.
- .4 Do not weld formwork to steel superstructure.
- .5 Align joints and make watertight to prevent leakage of cement paste and disfiguration of concrete. Keep form joints to a minimum. Where joints are shown on Drawings, Contractor shall ensure that joint layout matches drawings. Tape form joints as necessary.

- .6 Do not use earth surfaces to form concrete without written approval of Engineer.
- .7 Arrange forms to allow removal without removal of principal shores where these are required to remain in place.
- .8 Obtain the Engineer's permission before framing openings in concrete slabs, beams and columns not shown on Drawings.
- .9 Provide falsework to ensure stability of formwork. Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.
- .10 Position form joints to suit any expressed lines required in exposed concrete. Arrange form board panels in a regular symmetrical pattern to the approval of the Engineer.
- .11 Provide 25 mm chamfer on all internal and external corners and edges of exposed concrete.
- .12 Form chases, slots, openings, drips and recesses as detailed on the Drawings.
- .13 Set screeds with top edge level to required elevations.
- .14 Check and re-adjust formwork to required lines and levels during placing of concrete.
- .15 If form sheathing is to be re-used, remove nails and clean surfaces in contact with concrete before re-using.
- .16 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- .17 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs and to provide uniform surface on exposed concrete.

### 3.3 Tolerances

- .1 Construct formwork, falsework and all supporting or bracing members to provide concrete with dimensions, lines and levels within tolerances specified in CSA-A23.1.
- .2 If tolerances are exceeded, remove, replace or modify placed concrete as directed by the Engineer at no cost to the Owner.
- .3 Provide for settlement, closure of joints and elastic shortening of forms and shoring. Camber slabs and beams as shown on the Drawings. Maintain beam depth and slab thickness from cambered surface.

### 3.4 Construction Joints

- .1 Locate joints not indicated on the Drawings so as to least impair the strength of the structure. Obtain the Engineer's approval before proceeding.

- .2 Construct joints in accordance with CSA-A23.1 and details shown on drawings. Provide waterstop for full length of joint.
- .3 Roughen surface of hardened concrete and thoroughly clean of any foreign matter and laitance. Wet surface with water and ensure forms are tight against face of hardened concrete. Epoxy bonding agent to be used where shown on Drawings or as indicated by the Engineer.

### 3.5 Inserts / Embedded Items / Openings

- .1 Provide formed openings where required for pipes, conduits, sleeves and other work to be embedded in and passing through concrete members.
- .2 Accurately locate and set in place items which are to be cast directly into concrete.
- .3 Coordinate Work of other Sections and cooperate with other trades involved in forming openings, slots, recesses, chases, and setting sleeves, bolts, anchors and other inserts.
- .4 Coordinate installation of concrete accessories specified in Section 03 25 00 - Concrete Accessories.
- .5 Set anchor bolts, sleeves and inserts accurately at the positions designated. Secure in position by means of wooden templates and ties to prevent shifting and floating during concrete placement.
- .6 Do not set anchor bolts, sleeves and inserts into placed concrete.
- .7 Core holes and grout anchor bolts for bearings.

### 3.6 Form Ties

- .1 Submit tie patterns form tie specifications to the Engineer for review prior to construction. Arrange ties in a uniform pattern; horizontally and vertically.
- .2 For exposed concrete fit ties with cones approximately 20 mm diameter and not longer than 40 mm. Coat ties with cup grease or other approved material if ties are to be removed. Loosen ties twenty four hours after concrete has been placed. Ensure sufficient numbers of ties remain to hold form in place. Cutting ties back from the face of the wall is not permitted.
- .3 For all non-exposed concrete, fill all holes left by withdrawal of rods or holes left by removal of tie ends with solid mortar as outlined in the concrete section.
- .4 Remove all cones from both interior and exterior concrete surfaces. If surface is to be sandblasted, leave cones in place until after sandblasting is complete. Fill cone holes with small amount of grey sealant to cover metal rod.
- .5 In water retaining structures or surfaces requiring waterproofing of removable ties; remove the rods and cones and fill the holes with hydraulic cement compound after applying a slurry coat of cement bonding agent on the water retention side. Approved products: Permaquik by Tremco, Krystol Plug by Kryton, or Xypex Patch and Plug by Xypex.

- .6 The holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with mortar after first being thoroughly wetted. For holes passing entirely through the wall a plunger-type pressure gun or other device shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is completely filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing entirely through the wall shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the wall shall be struck off flush with the surface.

### 3.7 Quality Control

- .1 Inspect and check complete formwork, falsework, shoring and bracing to ensure that the work is in accordance with formwork design and that supports, fastenings, wedges, ties and parts are secure.
- .2 Inform Engineer when formwork is complete and has been cleaned to allow for inspection. Engineer's inspection will be for verification that forms are clean and free from debris.
- .3 For all exposed concrete surfaces, do not patch formwork.
- .4 Allow the Engineer to inspect each section of formwork prior to reuse. Formwork may be re-used if approved by the Engineer.

### 3.8 Cleaning

- .1 Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings and debris from within the forms. Flush completely with water to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- .2 During cold weather, remove ice and snow from within the forms. Do not use de-icing salts. Do not use water to clean out completed forms unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

### 3.9 Preparation

- .1 Apply form release agent in accordance with the manufacturer's recommendations prior to placing reinforcing steel, anchoring devices and embedded parts. Any embedded item to be cast in concrete, on which form release agent has been applied, shall be thoroughly cleaned prior to placing concrete.
- .2 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by the agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing the concrete.
- .3 Do not apply form release agent where wood graining characteristics are required on finished concrete surfaces.

3.10 Form Removal

- .1 Notify Engineer prior to removing formwork.
- .2 The following Table is to be used as a guide for the removal of forms and supports:

	Minimum Period of Time	Minimum Concrete Strength (based on 28 Day Strength)
Beams and slabs	21 days	80%
Columns	3 days	70%
Walls and critical vertical faces	2 days	50%

- .3 Remove falsework progressively in accordance with regulatory requirements and ensure that no shock loads or imbalanced loads are imposed on the structure.
- .4 Loosen forms carefully. Do not apply tools to exposed concrete surfaces.
- .5 Leave forms loosely in place for protection until complete removal is approved by the Engineer.
- .6 Store removed forms for exposed architectural concrete in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .7 Removal of forms subject to approved on-going curing procedures.

3.11 Reshoring

- .1 Prepare a schedule of reshoring and submit to the Engineer for review.
- .2 Reshore structural members where required due to design requirements or construction conditions, or where subject to additional loads during construction.
- .3 Install reshoring as required to permit progressive construction.

END OF SECTION

PART 1      GENERAL

1.1      Work Included

- .1      Reinforcing steel bars, welded steel wire fabric, and fabricated steel bar or rod mats for cast-in-place concrete, complete with tie wire.
- .2      Support chairs, bolsters, bar supports, and spacers for reinforcing steel.
- .3      Special support chairs, spacers, bar supports, and bolsters for reinforcing where adjacent to architectural concrete surfaces.
- .4      All labour, materials, and equipment to supply and place the reinforcing steel shown on the drawings.

1.2      Related Work

- .1      Section 03 10 00 - Concrete Formwork and Falsework.
- .2      Section 03 30 00 - Cast-in-Place Concrete.

1.3      Referenced Standards

- .1      ACI Detailing Manual – 2004.
- .2      ACI 439.3R-07, “Types of Mechanical Splices for Reinforcing Bars”.
- .3      ASTM A 185/A 185M – 07, “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”.
- .4      ASTM A 497/A 497M – 07, “Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete”.
- .5      CAN/CSA-A23.1-04, “Concrete Materials and Methods of Concrete Construction”.
- .6      CAN/CSA-A23.3-04, “Design of Concrete Structures”.
- .7      CAN/CSA-G30.18-M92 (R2007), “Billet-Steel Bars for Concrete Reinforcement”.
- .8      CAN/CSA-G164-M92 (R2003), “Hot Dip Galvanizing of Irregularly Shaped Articles”.
- .9      CAN/CSA-W47.1-03, “Certification of Companies for Fusion Welding of Steel”.
- .10      CAN/CSA-W186-M1990 (R2007), “Welding of Reinforcing Bars in Reinforced Concrete Construction”.
- .11      Reinforcing Steel Institute of Canada, “Reinforcing Steel – Manual of Standard Practice, Fourth Canadian Edition 2004”.



1.4 Quality Control

- .1 Perform concrete reinforcing work in accordance with CSA-A23.1.
- .2 Perform welding of reinforcing steel in accordance with CSA-W186.
- .3 Provide a system of quality control to ensure that the minimum standards specified herein are attained.

1.5 Shop Drawings and Submittals

- .1 Submit bar lists and placing drawings in accordance with Division 1.
- .2 Placing drawings and details shall conform to the ACI Detailing Manual and RSIC Manual of Standard Practice.
- .3 Clearly indicate bar sizes, spacing, locations and quantities of reinforcing steel, mesh, chairs, spacers, and hangers.
- .4 Detail placement of reinforcing where special conditions occur. Congested areas such as openings, depressions, intersections of columns and beams, and column splices to be drawn at a larger scale to fully illustrate placing sequence.
- .5 Specify the placing sequences for reinforcement at the intersection of beams and slabs. Specify the placing sequence for reinforcement in flat and two-way slabs.
- .6 Show minimum clearances between reinforcing bars and the minimum concrete protection for reinforcement.
- .7 Locate bars relative to building grid lines which can be identified on the formwork.
- .8 Specify the location and embedment of dowels.
- .9 Design and detail lap lengths, bar development lengths, and splice lengths to CSA-A23.1 and CSA-A23.3, unless noted otherwise on the drawings.
- .10 Fabrication shall commence only after shop drawings have been reviewed by the Engineer, provided that the drawings require no resubmission.

1.6 Test Reports

- .1 If requested by Engineer, submit certified copies of mill test report of reinforcement supplied, indicating physical and chemical analysis.

1.7 Substitutions

- .1 Different size bars will be permitted only upon written approval of the Engineer.

1.8 Construction Review

- .1 Notice for inspection must be given to the Engineer 48 hours prior to actual concrete placing. Failure to give adequate notice may cause the Engineer to classify the work as defective.

- .2 Concrete shall not be cast until the reinforcement and its placement has been inspected by the Contractor's quality control representative.
- .3 Correct defects and irregularities to the satisfaction of the Engineer, at no cost to the Owner.
- .4 The Engineer's general review is undertaken to inform the Owner of the Contractor's performance, and in no way shall augment the Contractor's quality control procedure, or relieve the Contractor of contractual responsibility.

## PART 2 PRODUCTS

### 2.1 Reinforcing Materials

- .1 Reinforcing Steel: billet steel deformed bars to CSA-G30.18, Grade 400.
- .2 Weldable Reinforcing Steel: weldable low alloy deformed steel bars, conforming to CSA G30.18, Grade 400W.
- .3 Galvanized Reinforcing Steel: billet steel deformed bars to CSA-G30.18 and CSA-G164.
- .4 Welded Steel Wire Fabric: plain type, conforming to ASTM A 185/A 185M or deformed type, conforming to ASTM A 497/A 497M.
- .5 Tie Wire: minimum 1.6 mm cold-drawn annealed type.
- .6 Chairs, Bolsters, Bar Supports, Spacers: adequately sized for strength and support of reinforcing steel during construction.
- .7 Concrete Bricks: acceptable for support of bottom layer of bars in slabs on fill. Broken concrete blocks and wood supports not acceptable.
- .8 Mechanical Rebar Splices: conforming to CSA-A23.3 and ACI 439.3R-07, complete with temporary cap, sizes as shown on drawings; LENTON® rebar splices as manufactured by Erico Inc. or approved equal.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Before starting this work, examine work done by others which affects this work.
- .2 Notify the Engineer of any conditions which would prejudice proper completion of this work.
- .3 Commencement of work implies acceptance of existing conditions.

### 3.2 Fabrication

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1 and drawings.
- .2 Locate reinforcing splices not indicated on drawings at points of minimum stress.

- .3 Fabricate within the following tolerances:
  - .1 Sheared length:  $\pm 25$  mm.
  - .2 Depth of truss bars: plus 0, minus 10 mm.
  - .3 Stirrups, ties and spirals:  $\pm 10$  mm.
  - .4 Other bends:  $\pm 25$  mm.
- .4 Weld reinforcing bars in accordance with CSA-W186.
- .5 All bending shall be done cold with a suitable machine accurately producing all lengths, depths and radii shown on the bending details.
- .6 Bars shall not be bent or straightened in a manner that will injure the material, and any bars with kinks or bends not shown on the drawings shall not be used.
- .7 After initial fabrication, reinforcing steel shall not be rebent or straightened unless so indicated on the drawings.
- .8 Heating of reinforcing steel will not be permitted.

### 3.3

#### Installation

- .1 Place reinforcing steel in accordance with CSA-A23.1 and reviewed placing drawings. Chair slab reinforcing not further apart than 1.2 m in either direction.
- .2 Locate mechanical splices, if acceptable, as detailed on shop drawings.
- .3 When specifically requested, obtain Engineer's approval of reinforcing steel and position before placing concrete.
- .4 Reinforcement shall be free from loose rust, scale, grease, clay, or other coatings which will destroy or reduce concrete bond.
- .5 Concrete cover shall be as specified on the drawings, or if not specified, in accordance with CSA-A23.1.
- .6 Reinforcement shall be adequately secured in position by approved chairs, support bars, and spacers.
- .7 Reinforcement shall be tied with wire ties at bar intersections to ensure that displacement outside the allowable tolerances will not occur. Tack welding of bars is not permitted.
- .8 Necessary splices shall be lapped not less than 24 bar diameters unless noted otherwise, and be in accordance with CSA-A23.3.
- .9 Revise, reseal, and correct improperly positioned reinforcing prior to placing concrete to the satisfaction of the Engineer.
- .10 Provide horizontal "L" shaped corner bars of same cross-sectional area and spacing as horizontal bars around wall and grade beam corners, unless shown otherwise on drawings.

- .11 Provide 10M stirrup support bars in hooks or corners of beam stirrups unless shown otherwise on the drawings.
- .12 Provide 4 extra 15M diagonal corner bars around holes larger than 100 mm in floor slabs and walls, unless shown otherwise on the drawings. Corner bars to be 1.5 times the length of the shortest side of the hole or minimum of 750 mm long.
- .13 Provide 1-15M bar for each wall face at each side of hole for holes larger than 750 mm in walls, unless shown otherwise on the drawings.
- .14 Where toppings are placed on waterproof membranes or vapour barriers, prevent reinforcement or tie wire from contacting these items.
- .15 Do not drive or force reinforcement into fresh concrete.
- .16 Preassemble column and beam cages as necessary. Do not “spring” or bend ties and stirrups to place longitudinal reinforcement.

#### 3.4 Field Bending

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

#### 3.5 Welding Reinforcing Steel

- .1 Welding of reinforcing steel to plates or to other reinforcing steel shall be in accordance with CSA-W186.
- .2 The organization undertaking to weld under this section shall be certified by the Canadian Welding Bureau in accordance with CSA-W47.1.

END OF SECTION

PART 1      GENERAL

1.1      Work Included

- .1      All plain and reinforced cast-in-place concrete shown on drawings.
- .2      Repairing concrete imperfections.
- .3      Finishing formed concrete surfaces.

1.2      Related Work

- .1      Section 03 10 00 - Concrete Formwork and Falsework.
- .2      Section 03 20 00 - Concrete Reinforcement.

1.3      Referenced Standards

- .1      ASTM C 260-06, "Standard Specification for Air-Entraining Admixtures for Concrete".
- .2      ASTM C 494-08, "Standard Specification for Chemical Admixtures for Concrete".
- .3      ASTM C 1017-07, "Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete".
- .4      CSA-A23.1-09, "Concrete Materials and Methods of Concrete Construction".
- .5      CSA-A23.2-09, "Methods of Test and Standard Practices for Concrete".
- .6      CSA-A3001-08, "Cementitious Materials for Use in Concrete".

1.4      Quality Control

- .1      Cast-in-place concrete to conform to CSA-A23.1.
- .2      Testing shall conform to CSA-A23.2.
- .3      These standards shall be available in the Contractor's site office for the use of the Contractor, subtrades, and Engineer.
- .4      Provide a system of quality control to ensure that the minimum standards specified herein are attained.
- .5      Obtain acceptance of resultant concrete surface finish prior to placing or finishing subsequent concrete.

1.5      Submittals for Review

- .1      Submit concrete mix proportions in accordance with Division 01 and Table 5 in CSA-A23.1 Alternate 1.

- .2 At the request of the Engineer, submit a letter, signed and sealed by a Professional Engineer registered in the Province of Alberta, stating that all concrete supplied meets the project specifications and requirements of CSA-A23.1.
- .3 Submit proposed source of aggregates, including results of petrographic examination indicating petrographic number (PN) and ironstone content for each coarse aggregate proposed for use, which will include evidence that aggregates are not susceptible to alkali-aggregate reactions. Petrographic analysis shall be performed by an experience qualified petrographer of a CSA certified laboratory. The analysis of the aggregates shall be current and fully represent the material to be used in production. Sampling and testing shall have been done no more than ninety (90) days prior to concrete production. Refer to 2.1.5 for ironstone and coal/lignite limits.
- .4 Submit historical records of strength performance for proposed concrete mixes.

1.6 Inspection and Testing

- .1 The Contractor is responsible for Quality Control Testing as specified in Section 01 45 10 – Quality Assurance / Control.
- .2 An Independent Testing Agency appointed by the Engineer may perform additional required Quality Assurance Testing as specified in Section 01 45 10 - Quality Assurance / Control.
- .3 An Independent Survey firm appointed by the Engineer may perform additional required Quality Assurance Surveys as specified in Section 01 45 10 - Quality Assurance / Control.
- .4 Notify Engineer at least 24 hours before complete formwork and concrete reinforcement will be ready for inspection.
- .5 Allow ample time for inspection and corrective work, if required, before scheduling concrete placement.
- .6 Concrete sampling, inspection and testing is to be performed by a qualified testing laboratory or agency and paid by the Contractor.
- .7 Provide free access to all portions of work and cooperate with appointed firm.
- .8 Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of work.
- .9 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.
- .10 Notify Inspection and Testing Firm before placing concrete, in ample time to permit scheduling.
- .11 One (1) set of concrete test cylinders will be taken for every 50 to 100 m<sup>3</sup> or less of each class of concrete placed each day.

- .12 At least one (1) set of test cylinders will be taken daily for each class of concrete placed. Record atmospheric and concrete temperatures.

A set of test cylinders will consist of:

- .1 Three (3) cylinders, unless noted otherwise. One (1) cylinder will be tested at 7 days, and two (2) cylinders will be tested at 28 days.
  - .2 Four (4) cylinders for concrete with CSA exposure class S-2 or concrete defined as HVSCM-1. One (1) cylinder will be tested at 7 days, one cylinder will be tested at 28 days, and two cylinders will be tested at 56 days.
  - .3 One (1) additional test cylinder will be taken during cold weather concreting, and be cured on job site under the same conditions as concrete it represents.
- .13 One slump test and one air content test will be taken for each set of test cylinders taken.
- .14 Additional slump tests may be taken as necessary to verify quality of concrete.
- .15 Testing of concrete will be performed in accordance with CSA-A23.2. Test results will be issued to the Contractor and the Departmental Representative.
- .16 Pay costs for retesting required due to defective materials or workmanship.
- .17 Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

## 1.7

### Trial Batching

- .1 Prepare trial batches for each concrete mix that is defined as HVSCM-1 or HVSCM-2 in accordance with CSA-A23.1.
- .2 Trial batches to confirm workability, air content, finishability, setting time, temperature development, hardened air-void parameters, strength, and durability.
- .3 Trial batches and testing of trial batch cylinders shall be witnessed and certified by a Professional Engineer registered in the Province of Alberta.
- .4 Cast six (6) compression test cylinders for each trial mix. Test two cylinders at 7 days, two cylinders at 28 days, and two cylinders at 56 days.
- .5 Submit certified compression test, air content test, and hardened air-void test results to Engineer for review at least 4 weeks prior to the placing of any concrete in accordance with Division 01.
- .6 The initial testing required during trial batching shall be the responsibility of the concrete supplier and will not be paid by the Owner.

PART 2      PRODUCTS

2.1      Concrete Materials

- .1      Hydraulic cement: to CSA-A3001, Type GU, HS, MH, or LH.
- .2      Blended hydraulic cement: to CSA-A3001, Type GUb, HSb, MHb, or LHb.
- .3      Supplementary cementing materials: to CSA-A3001, Type F, CI, or CH flyash, or Type SF silica fume. A maximum of 25% SCM is permitted for concrete with exposure class C-1 and C-2 when exposed to freezing and thawing.
- .4      Water: to CSA-A23.1.
- .5      Aggregates: to CSA-A23.1. Coarse aggregates to be normal density. Ironstone content shall not exceed one percent (1.0%) for coarse aggregate and one point five percent (1.5%) for fine aggregate. Coal and lignite content shall not exceed 0.1% for coarse aggregate and 0.5% for fine aggregate.
- .6      Air entraining admixture: to ASTM C 260. Notwithstanding tabulated concrete properties in Section 2.2 below, air may be deleted for interior slab work.
- .7      Chemical admixtures: to ASTM C 494. Admixtures containing chlorides are not permitted.
- .8      Superplasticizers: to ASTM C 494 or ASTM C 1017.
- .9      Ensure that no aggregates are used which may undergo volume change due to alkali reactivity, moisture retention or other causes. Confirm suitability of aggregate with a petrographic analysis as directed by Engineer.

2.2      Concrete Mixes

- .1      Pay all costs for mix design. Submit design of a proven mix to Engineer for review.
- .2      Concrete mixes shall be designed to mitigate dry and plastic temperature and shrinkage cracks.
- .3      Do not change concrete mix without prior approval of Engineer. Should change in material source be proposed, submit new mix designs to be reviewed by Engineer.
- .4      Use accelerating admixtures in cold weather only when approved by Engineer. If approved, the use of admixtures will not relax cold weather placement requirements. Do not use calcium chloride.
- .5      Use set-retarding admixtures during hot weather only when approved by Engineer.
- .6      All admixtures are subject to the approval of the Engineer. List all proposed admixtures in mix design submission. Do not change or add admixtures to approved design mixes without Engineer's approval.



- .7 Concrete delivered to Site must be accompanied by a delivery slip in accordance with CAN/CSA-A23.1.
- .8 Provide concrete mixed in accordance with requirements of CAN/CSA-A23.1 to give the following properties:

Location	CSA Exposure Class	Cement Type	Minimum Compressive Strength (MPa)	Max w/c Ratio	Max Aggregate (mm)	Air Content (%)
Sewage Dump Chute, Benching, Influent Pad	A-3, S-3	HS	30 @ 28 Days	0.50	20	5-8

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Before starting this Work, examine work done by others which affects this Work.
- .2 Review any conditions which would prejudice proper completion of this Work.
- .3 Commencement of Work implies acceptance of existing conditions.

#### 3.2 Placing Concrete

- .1 Place concrete in accordance with requirements of CSA-A23.1 and as indicated on Drawings.
- .2 Immediately before concrete is placed, all forms shall be carefully inspected to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel is in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and all debris, snow, ice or other foreign material removed. Chemicals shall not be used to remove ice or hardened concrete from the forms. All forms shall be thoroughly soaked with water except in freezing weather.
- .3 Handling equipment shall be kept free from hardened concrete or foreign material, and cleaned at frequent intervals.
- .4 Ensure all anchors, seats, plates and other items to be cast into concrete are securely placed, and will not interfere with concrete placement.
- .5 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling or flowing. Vibrators shall not be used to move concrete. Under no circumstances shall the concrete which has partially hardened by deposited in the forms.
- .6 When concrete is started, it shall be carried on as a continuous operation until the placing of the section is completed. When shown on the Drawings, concrete shall be placed in the sections indicated and according to the sequence given.

- .7 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- .8 Ensure reinforcement, inserts, embedded parts, formed expansion and control joints are not disturbed during concrete placement.
- .9 Prepare set concrete by removing all laitance and loose materials and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations.
- .10 Vibrate concrete using the appropriate sized equipment as placing proceeds in strict accordance with CSA-A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.
- .11 Where placing operations would involve dropping the concrete more than 1.5 metres, it shall be placed through "canvas elephant trunks" or galvanized iron chutes. Concrete levels shall not be raised at a rate greater than that for which proper vibration may be affected.
- .12 The concrete surfaces shall be protected from rain until the final set occurs.
- .13 A minimum of 72 hours shall elapse between adjacent pours separated by construction joints or expansion joints.
- .14 Do not place concrete in the interior of a building if carbon dioxide producing equipment has been in operation inside the building during the 12 hours preceding the pour. Such equipment shall not be used during placing or for 24 hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases or drying from heaters.
- .15 Honeycomb or embedded debris in concrete is not acceptable.
- .16 Remove and replace defective concrete in accordance with Clause 3.16 of this Section.

### 3.3 Construction Joints

- .1 Joints not indicated on the Drawings shall be located so as to least impair the strength of the structure. The location of these joints shall be subject to the prior approval of the Engineer. Joints shall be in accordance with CSA-A23.1, or as indicated on Drawings or direct by the Engineer.
- .2 Where the Contractor elects to employ construction joints other than shown and the Engineer so approves, waterstops shall be provided for the full length of the joint if required by the Engineer and without additional compensation to the Contractor.
- .3 The surface of hardened concrete shall be roughened and thoroughly cleaned of foreign matter and laitance, and shall be thoroughly wetted with water but not saturated and the forms re-tightened against the face of the hardened concrete before depositing additional concrete. Epoxy bonding agents may be required as directed by the Engineer.

3.4 Cold and Hot Weather Concreting

- .1 Conform to requirements of CSA-A23.1.
- .2 Protect slabs being finished during drying conditions above 25°C and / or during high winds with moisture retention film.

3.5 Concrete Protection for Reinforcement

- .1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with CSA-A23.1 and with Section 03 20 00 - Concrete Reinforcement of this Specification.

3.6 Conduits and Pipes

- .1 Conduit and pipe shall not be embedded in water retaining concrete structures unless it is indicated on the Drawings or approved by the Engineer.
- .2 Conduit and pipe embedded in concrete shall not be of a material harmful to the concrete and shall:
  - .1 Not displace more than 4% of the area of the cross section of a column on which stress is calculated, including the area of concrete displaced by the bending of the conduit or exit path of the conduit out of the column.
  - .2 Not exceed one-third the solid portion of the slab thickness.
  - .3 Not be spaced closer than three diameters on centre.
  - .4 Have a concrete covering of not less than 25mm.
- .3 Be so installed that it will not require cutting, bending or displacement of the reinforcement or impair the structural strength of the system.

3.7 Install Items Specified Under Other Sections

- .1 Install hangers, sleeves, anchors, etc. specified under other Sections.
- .2 Pour concrete after other trades have satisfactorily installed their materials.
- .3 Do not eliminate or displace reinforcement to accommodate hardware. Consult Engineer prior to relocation of hardware.

3.8 Slabs on Grade

- .1 Seal punctures and damaged areas of vapour barrier before placing concrete. Use vapour barrier material, lapped over punctures and damaged areas minimum 150mm in all directions. Seal continuously with tape.
- .2 Place adjustable screeds at suitable locations. Do not pierce vapour barrier.
- .3 Carefully place concrete to required elevations indicated on Drawings.
- .4 Where shown on Drawings, separate slabs-on-grade from vertical surfaces with 12mm thick joint filler. Extend joint filler from bottom of slab to within 6mm of finished surface. Refer to Section 03 25 00 - Concrete Accessories for joint filler requirements.

- .5 Saw cut control joints in straight lines, within 24 hours after finishing. Cut in pattern shown on Drawings if shown. Use 3mm thick blade, cut 1/3 depth of slab. Saw cut construction joints to straight lines with true, square edges.

### 3.9 Equipment Pads

- .1 Provide concrete pads for equipment where and as indicated on Drawings. Adjust dimensions of pads to reviewed Shop Drawings. Unless shown otherwise on Drawings, height of pads to be minimum 100mm and extend 200mm beyond equipment base.
- .2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.
- .3 Steel trowel surface smooth: as per Equipment Requirements.

### 3.10 Curing and Protection

- .1 Cure and protect freshly placed concrete in accordance with CSA-A23.1 and this specification.
- .2 Cure concrete slabs, and concrete toppings by one of the following methods:
  - .1 Ponding or continuous sprinkling.
  - .2 Absorptive fabric covered with polyethylene and kept continuously moist.
- .3 Cure concrete walls as follows:
  - .1 Continuously soak top of wall.
  - .2 Loosen forms as soon as possible without damaging concrete.
  - .3 Maintain continuous supply of water to top of wall to keep inside of forms wet.
- .4 During hot weather provide additional initial curing for concrete slabs in accordance with recommendations of ACI 305R.
  - .1 Keep surface moist by fogging until bleeding has stopped if rate of evaporation exceeds rate of bleeding.
  - .2 Apply evaporation retardant if rapid drying ambient conditions exist.
- .5 Curing compounds may be used on columns and non-watertight walls and roof slabs except as noted. Contractor to submit proposed application procedure for review.
  - .1 Apply compound immediately after removal of forms.
  - .2 Apply compound with roller, brush or airless sprayer in accordance with manufacturer's instructions.
  - .3 Submit proof of compound compatibility with subsequent coatings and membranes.
  - .4 Submit procedure for removing curing compound where subsequent coating or membranes are not compatible with curing compound.
- .6 Curing compounds may not be used for floor slabs, toppings, architectural concrete or surfaces to receive bonded toppings.

3.11 Frost Protection

- .1 After concrete curing process is completed, provide continuous protection for slabs and foundations on ground to prevent subgrade below from freezing during cold weather. Provide heated enclosures, insulation, etc., as required.
- .2 All concrete poured and masonry work shall be hoarded and heated to protect the work during freezing conditions. The cost of this shall be included in the Contractor's tender cost.
- .3 Damage to structures due to flotation or heaving due to frost or groundwater shall be replaced at the Contractor's expense.

3.12 Formed Concrete

- .1 Inspect concrete surfaces immediately upon removal of forms.
- .2 Treat imperfections in formed surfaces in accordance with CSA-A23.1.
- .3 Modify or replace concrete not conforming to qualities, lines, details and elevations specified herein or indicated on drawings.

3.13 Finishing Formed Surfaces

- .1 Finish all exposed formed concrete surfaces, including interior wall surface submerged in water, with a smooth-form finish conforming to CSA-A23.1, unless noted otherwise.
- .2 All non-exposed surfaces 500 mm below soil can be finished with rough-form finish conforming to CSA-A23.1.
- .3 Fill all surface voids wider than 0.5mm and deeper than 1.0mm for all exposed wall surfaces in contact with treated water after crack repair, but prior to hydraulic testing of reservoir. Surface voids shall be filled with patching mortar in accordance with the manufacturer's instructions.
- .4 Inspect concrete surfaces immediately upon removal of all formwork.
- .5 Patch imperfections when concrete is green.
- .6 Remove all exposed metal form ties, nails and wires, break off fins and remove all loose concrete.
- .7 Thoroughly wet all form tie pockets and patch with patching mortar followed by proper curing.
- .8 Chip away honeycombed and other defective surfaces to depth of not less than 25mm with the edges perpendicular to the surface. Thoroughly wet and patch with patching mortar followed by proper curing.

3.14 Finishing Walks, Curbs, Ramps, Steps

- .1 Finish edges to smooth radius.

- .2 On walks, platforms and ramps, tool control joints across at 1.8 m o.c., unless otherwise noted in these Specifications or on the Drawings.
- .3 Broom finish surface of platforms, steps, walks, curbs and ramps.
- .4 Apply curing compound to manufacturer's directions.

3.15 Grouting

- .1 Install non-shrink grout under equipment bases as shown on Drawings and in accordance with the manufacturer's recommendations.

3.16 Bonded Toppings

- .1 Bonded topping to comply with CSA-A23.1-04 except as noted.
- .2 Slabs to receive topping concrete to have exposed aggregate finish (minimum 5 mm amplitude) produced by green cutting, or sandblasting.
- .3 Clean base course surface and keep continuously moist for minimum of twelve (12) hours prior to placing topping.
- .4 Remove excess water from surface and allow surface to dry to a saturated surface dry condition.
- .5 Place cement/sand bonding grout in accordance with CSA-A23.1-04.

3.17 Defective Concrete

- .1 Concrete not meeting the requirements of the Specifications and Drawings shall be considered defective concrete.
- .2 Concrete not conforming to the lines, details or grades specified herein or as shown on the Drawings shall be modified or replaced. Finished lines, dimensions and surfaces shall be correct and true within tolerances specified herein and in the Section 03 10 00 - Concrete Formwork and Falsework of these Specifications.
- .3 Concrete placed which results in excessive honeycombing or other defect in critical areas of stress shall be repaired or replaced.
- .4 To conform to the strength requirements, the average of all tests shall exceed the specified strength. When three or more tests of the concrete taken from same sample are available, the average of any three consecutive tests shall be equal to, or greater than the specified strength, and no single strength test shall fall more than 3.5 MPa below the specified strength. Implement corrective measures if tests are below specified strength:
  - .1 Changes in mix proportions for the remainder of the work, for which Mix Designs shall be submitted in accordance with these Specifications.
  - .2 Core drilled and tested from the areas in question in accordance with CSA-A23.2 within 7 days of defective concrete test cylinder results as directed by Engineer. Cores shall meet the strength requirements of CSA-A23.1.

- 3.18      Clean-Up
- .3      Concrete failing to meet the strength requirements of this specification shall be repaired or replaced at the Contractor's expense.
  - .1      As work progresses, remove from site all debris and excess materials. Work area shall be kept continuously clean, so as not to interfere with proper inspection or the work of other Trades.
  - .2      At completion of work, remove from site all debris, excess materials and equipment.

END OF SECTION