

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03100 CONCRETE FORMWORK</b>	

**PART 1. GENERAL**

1.01 SUMMARY

- A. Comply with Division 1, General Requirements.
- B. This Section forms part of Section 03300, Cast-in-Place Concrete.

1.02 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
  - 1. American Concrete Institute (ACI):
    - a. 347, Guide to Formwork for Concrete.
  - 2. Canadian Standards Association (CSA):
    - a. A23.1, Concrete Materials and Methods of Concrete Construction.
    - b. S269.1, Falsework for Construction Purposes.
    - c. S269.2-M, Access Scaffolding for Construction Purposes.
    - d. S269.3-M, Concrete Formwork
  - 3. National Lumber Grades Authority (NLGA):
    - a. Standard Grading Rules for Canadian Lumber.

1.03 DESIGN REQUIREMENTS

- A. Design formwork in accordance with CSA S269.1, S269.2-M, and S269.3-M and CSA A 23.1 Clause 6.4 Formwork to provide specified finishes.
- B. Design formwork and falsework to carry dead loads and construction live loads.
- C. When high range water reducer (superplasticizer) is used in concrete mix, design forms for full hydrostatic pressure.
- D. Make joints in forms watertight.
- E. Design formwork to meet variations from a reference system specified in CSA A23.1 Clause 6.4.6.

1.04 SUBMITTALS

- A. Shop Drawings:
  - 1. Submit manufacturer's product data sheets including materials, installation, application, and maintenance instructions for:

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03100 CONCRETE FORMWORK</b>	

- a. Form release agent.

## **PART 2. PRODUCTS**

### **2.01 FORM MATERIALS**

- A. General:
  - 1. Materials:
    - a. Lumber for Formwork and Falsework: Grade-marked sawn lumber graded in accordance with NLGA.
    - b. Plywood for Formwork: CSA A23.1; high density overlay (plastic overlay) grade plywood.
- B. Form Release Agent:
  - 1. Use form release agent on all cast in place concrete .
  - 2. Material: Release agent that does not bond with, leave residue on, stain, or adversely affect concrete surfaces, and does not impair subsequent treatments of concrete surfaces when applied to forms
  - 3. Freezing point: -15 degrees C or lower.
  - 4. Manufacturers and Products:
    - a. Master Builders, Inc.; Rheofinish.
    - b. Cresset Chemical Company; Crete-Lease 20-VOC.
    - c. NCA/Acrow-Richmond Ltd.; RICH-COTE.
    - d. W.R. Meadows of Canada Ltd.; Sealtight Duogard.
    - e. Euclid Admixture Canada, Inc.; Eucoslip VOX.
- C. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides preventing loss of paste or water between the two surfaces.
- D. Form Ties:
  - 1. Material: Steel.
  - 2. Spreader Inserts:
    - a. Conical or spherical type.
    - b. Design to maintain positive contact with forming material.
    - c. Furnish units that will leave no metal closer than 25 mm to concrete surface when forms, inserts, and tie ends are removed.
  - 3. Wire ties not permitted.
  - 4. Flat bar ties for panel forms; furnish plastic or rubber inserts with minimum 25 mm depth and sufficient dimensions to permit patching of tie hole.
  - 5. Through-Bolts: Tapered minimum 25 mm diameter at smallest end.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03100 CONCRETE FORMWORK</b>	

### **PART 3. EXECUTION**

#### **3.01 FORM SURFACE PREPARATION**

- A. Remove water, snow, ice, laitance, curing compound, loose soil, and other debris and thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants prior to coating surface.
- B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by the manufacturer.

#### **3.02 ERECTION**

- A. General:
  - 1. Unless specified otherwise, follow applicable recommendations of CSA S269.1, S269.2-M and S269.3-M.
  - 2. Align form joints and make watertight. Keep number of joints to a minimum.
  - 3. Laterally brace formwork and falsework and prevent displacement during concrete placement.
  - 4. Form chases, openings, projections, recesses, expansion joints and construction joints.
  - 5. Form around pipes, mechanical, and electrical equipment which penetrate the concrete structure.
  - 6. Incorporate frames, castings, pipes, sleeves, and similar items into formwork.
  - 7. Do not re-use damaged formwork which may not provide a uniform consistent finish.
- B. Beveled Edges (Chamfer):
  - 1. Form 20 mm bevels at concrete edges, unless otherwise shown.
  - 2. Where beveled edges on existing adjacent structures are other than 20 mm, obtain Contract Administrator's approval of size prior to placement of beveled edge.
- C. Wall Forms:
  - 1. Locate form ties and joints in an uninterrupted uniform pattern.
  - 2. Inspect form surfaces prior to installation to assure conformance with specified tolerances.
  - 3. Do not use through-the-wall removable form ties for walls of liquid holding structures and exterior walls below grade.
  - 4. Where excavation shoring system is used as formwork, fasten form tie to shoring in a suitable manner to withstand applied loads.
- D. Form Tolerances: Comply to tolerances of CSA A23.1.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03100 CONCRETE FORMWORK</b>	

- E. Fasteners: Use only galvanized nails and fasteners when such fasteners will be left in place in the permanent structure.
- F. Void Forms: Brace void forms to prevent distortion and floatation.
- G. Lateral Supports: Where required, brace walls until permanent lateral supports are in place.

**3.03 FORM REMOVAL**

- A. Remove wall formwork as soon as possible after concrete has attained adequate strength to support its own weight and superimposed loads, without cracking or deflecting excessively in order to facilitate effective finishing, but not earlier than 30 hours after concrete placement if:
  - 1. Concrete is sufficiently hard so as not to sustain damage by form removal operations, and
  - 2. Curing and protection operations are maintained.
- B. Do not expose wall concrete to temperature differential shock causing thermal cracks.
- C. Remove nails, fasteners, tie wire and similar items at the surface.

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 6</b>
<b>REVISION 0</b>	<b>SECTION 03210 REINFORCING STEEL</b>	

**PART 1. GENERAL**

1.01 SUMMARY

- A. Products supplied but not installed under this section:
1. Reinforcing bars for grouted in dowels.

1.02 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
1. American Society for Testing and Materials International (ASTM):
    - a. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
    - b. .
  2. Canadian Standards Association (CSA):
    - a. A23.1, Concrete Materials and Methods of Concrete Construction.
    - b. A23.3, Design of Concrete Structures for Buildings.
    - c. G30.18-M, Billet-Steel Bars for Concrete Reinforcement.
    - d. W47.1, Certification of Companies for Fusion Welding of Steel Structures.
    - e. W186M, Welding of Reinforcing Bars in Reinforced Concrete Construction.
  3. Reinforcing Steel Institute of Canada (RSIC):
    - a. Reinforcement Steel Manual of Standard Practice.
  4. International Conference of Building Officials (ICBO):
    - a. ICBO Research Report.

1.03 SUBMITTALS

- A. Product Data Sheets:
1. Submit three samples and three copies of manufacturer's product data sheets including installation and maintenance instructions for:
    - a. Chairs, bolsters, bar supports, and side form spacers.
- B. Shop Drawings:
1. Reinforcing Bars:
    - a. Submit reinforcing bar placement drawings prepared in accordance with

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 6</b>
<b>REVISION 0</b>	<b>SECTION 03210 REINFORCING STEEL</b>	

Reinforcement Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and as specified below.

- b. Indicate reinforcing bars that form part of an individual concrete placement and reinforcing bars that extends into adjacent placements.
- c. For each reinforcing bar placement shop drawing, submit a separate bar list and bending schedule showing size, shape, dimensions, and numbers of bars required for each bar type.
- d. Identify reinforcing bars in the bar list and bending schedule with a separate bar mark that corresponds to bar marks shown on reinforcing bar placement drawings.
- e. If bar list and bending schedule contain details of bars of more than one reinforcing bar placement drawing, then arrange bar marks in separate groups for each placement drawing. Clearly indicate for each bar mark the corresponding reinforcing bar placement drawing number.
- f. For slabs, show a separate plan indicating concrete thicknesses, reinforcing bars, and dowels for walls and columns cast in slab.
- g. For walls, show separate elevations indicating concrete thicknesses, reinforcing bars, and dowels for slabs and adjacent walls cast in wall.
- h. Do not add new information on previously reviewed shop drawings.
- i. Reinforcing bar placement shop drawings will be reviewed for bar sizes, locations, and spacing, and will receive submittal stamp and signed. Reviewed bar list and bending schedule will be dated only.

C. Quality Control Submittals:

- 1. Submit certified mill test reports of steel reinforcing bars: Determine physical and chemical properties of steel reinforcing in accordance with requirements of CAN/CSA-G30.18-M.

1.04 QUALITY ASSURANCE

- A. Welder Qualifications: CSA W47.1 and CSA W186-M certified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ship bundles of reinforcing bars identified by tags containing bar marks along with bar list.
- B. Store materials to prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from Site.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 6</b>
<b>REVISION 0</b>	<b>SECTION 03210 REINFORCING STEEL</b>	

## **PART 2. PRODUCTS**

### 2.01 MATERIALS

- A. Reinforcing Bars:
  - 1. Deformed steel bars: CAN/CSA-G30.18-M; Grade 400R except Grade 400 W where welding is indicated or specified. Do not substitute with epoxy-coated bars.
- B. Mechanical Splices:
  - 1. Mechanical Threaded Connections: Furnish metal coupling sleeve with internal threads engaging threaded ends of bars, capable of developing in tension or compression 125 percent of yield strength of bar.
    - a. Manufacturers and Products:
      - 1) DB-SAE by Dayton/Richmond by Dayton Superior.
      - 2) Lenton Form Saver by Erico Canada Inc.
      - 3) D150 DBR Coupler and DBR Setting-Splice Bar, with size equivalent to DB-SAE, by Dayton Superior Canada Limited.
- C. Dowel-in bar: Suitable for existing dowel bar splicer with rolled UNC or tapered threads as required:
  - 1. DI by Dayton/Richmond by Dayton Superior.
  - 2. Splice bar by Erico Canada Inc.
  - 3. D-51, D-52, or D-53, with size equivalent to DI, by Dayton Superior Canada Limited.
- D. Welded Wire Reinforcement:
  - 1. ASTM A185 or ASTM A497 using ASTM A82 wire of 517 MPa (75 ksi) minimum tensile strength.
  - 2. Furnish flat sheets only, rolled sheets not permitted.

### 2.02 ACCESSORIES

- A. Tie Wire:
  - 1. Black, soft-annealed 1.6 mm diameter wire.
  - 2. Nylon-, epoxy-, or plastic-coated wire.
- B. Bar Supports and Spacers:
  - 1. Adequate for accurate placing and as required for construction loads.
  - 2. Provide non-conductive bar supports in contact with exposed surfaces that has geometry and bond characteristics that prevents moisture movement from the

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 6</b>
<b>REVISION 0</b>	<b>SECTION 03210 REINFORCING STEEL</b>	

- surface to the reinforcement.
3. In beams, columns, walls, and slabs exposed to view after form removal: Small concrete blocks made up of same color and strength as concrete being placed around them.
  4. Precast concrete supports of same strength as concrete for reinforcing in concrete placed on grade.
  5. Do not use plastic or stainless steel bar supports or side form spacers.
  6. Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports are not high or strong enough.

### 2.03 FABRICATION

#### A. Reinforcing Bars

1. Comply with CSA A23.1 and CSA A23.3.
2. Tolerances:
  - a. Length:  $\pm 25$  mm.
  - b. Height of truss bar: +0 to -10 mm.
  - c. Outside dimensions of stirrups, ties, and spirals:  $\pm 10$  mm.
  - d. Other bends:  $\pm 25$  mm.
3. Use longest bar possible.
4. Keep number of splices to a minimum.
5. Do not weld chairs, bolsters, bar supports, or spacers to reinforcing bars.

#### B. Reinforcing Splices:

1. Lap Splices:
  - a. Splice by lapping reinforcing bars, unless specified otherwise.
2. Welded Splices:
  - a. Full-penetration direct butt-splice welds in accordance with CSA W186-M and as specified.
3. Splices in Welded Wire Reinforcement:
  - a. Comply with CSA A23.3-04 Clause 12.18 and 12.19.

## PART 3. EXECUTION

### 3.01 PREPARATION

- A. Notify Contract Administrator when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.
- B. Clean reinforcing bars of loose rust, mill scale, dried cement paste, mud, oil, or other coatings that will affect adhesion in accordance with CSA A23.1-04, Clause 6.1.5 Surface Conditions of Reinforcement, prior to placing concrete.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 5 of 6</b>
<b>REVISION 0</b>	<b>SECTION 03210 REINFORCING STEEL</b>	

- C. Coat wire projecting from bar supports with dielectric material, epoxy, or plastic.

### 3.02 REINFORCING BAR INSTALLATION

- A. Place reinforcement within tolerances specified in CSA A23.1 Clause 6.6.8 Tolerances for location of reinforcement.
- B. Splicing:
1. Use lap splices, unless otherwise shown or permitted in writing by Contract Administrator.
  2. Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar in tension and compression.
  3. Stagger splices in adjacent bars a minimum of 1500 mm.
- C. Dowel Bar Splicers:
1. Use only in areas specifically approved in writing by Contract Administrator.
  2. Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICBO Research Report.
  3. Install dowel bar splicers with plastic setting plugs.
  4. Lightly grease internal threads in accordance with manufacturers printed instructions.
  5. Maintain minimum edge distance and concrete cover.
- D. Mechanical Splices:
1. Install mechanical splices in accordance with manufacturer's printed instructions. Request presence of manufacturer's representative to verify proper installation.
- E. Tying Reinforcing Bars:
1. Bend tie wire away from concrete surface. Ensure a cover for tie wires form tie bolts etc are same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.
- F. Reinforcement around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut or disrupted for opening. Extend steel reinforcing a standard lap length beyond opening at each end.
- G. Welding Reinforcement:
1. Only Type W bars may be welded.
  2. Do not perform welding until welder qualifications are approved.
- H. Straightening and Rebending: Field bending of reinforcing steel bars is not permitted.
- I. Unless permitted by Contract Administrator, do not cut reinforcing bars in field.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 6 of 6</b>
<b>REVISION 0</b>	<b>SECTION 03210 REINFORCING STEEL</b>	

3.03 TESTS AND INSPECTION

- A. An independent testing agency will be retained by the City to visually inspect and test reinforcing steel welds.
- B. An independent testing agency will be retained by the City to inspect each mechanical splice and dowel bar splicer and verify each component is installed in accordance with manufacturer's instructions.

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

**PART 1. GENERAL**

1.01 SUMMARY

- A. This Section forms part of Section 03300, Cast-in-Place Concrete.
- B. Section Includes:
  - 1. Cast-in-place concrete accessories including:
    - a. Expansion and construction joints for the Work including:
      - 1) Joints in cast-in-place concrete with a dimensioned separation between the two separate sections of concrete.
      - 2) Joints in cast-in-place concrete with no separation between the two separate sections of concrete.
- C. Products Installed But Not Supplied Under the Work of This Section:
  - 1. Location and installation affect the Work of this Section. List is not guaranteed as being complete.
    - a. Anchor bolts.
    - b. Frames for covers and openings.
    - c. Equipment castings and pipe fittings.

1.02 DEFINITIONS

- A. Expansion Joint:
  - 1. Dimensional separation between two separate sections of concrete with PVC waterstop to permit movement. Space between the sections is filled with specified joint filler and finished with sealant.
- B. Construction Joint:
  - 1. Joint in cast in place concrete with no separation between the two separate sections of concrete. Construction joint above grade shall not contain a waterstop. Construction joint in below grade structures shall contain PVC waterstop.
- C. Sawn Control Joint:
  - 1. Joint intended to control cracking location with top reinforcing bars terminated at the joint where shown.

1.03 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
  - 1. American Society for Testing and Materials International (ASTM):
    - a. ASTM A123, Standard Specification for Zinc Coating (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

- b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
- c. A780, Standard Practice for Repair of Damages and uncoated Areas of Hot Dip Galvanized Coatings.
- d. C920, Standard Specification for Elastomeric Joint Sealants.
- e. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- f. D1056, Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.
- g. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- h. D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- 2. Canadian Standards Association (CSA):
  - a. A23.1, Concrete Materials and Methods of Concrete Construction.
  - b. A123.3, Asphalt Saturated Organic Roofing Felt
  - c. G30.18-M, Billet-Steel Bars for Concrete Reinforcement
  - d. G40.20/21, General Requirements For Rolled or Welded Structural Quality Steels / Structural Quality.
  - e. S6, Canadian Highway Bridge Design Code.

#### 1.04 SUBMITTALS

##### A. Shop Drawings:

- 1. Master Plan(s) of Concrete Placements:
  - a. Before submitting shop drawings of reinforcing bars, submit master plan(s) showing separate concrete placements and locations of construction joints, in addition to those joints indicated on the Drawings.
- 2. Joints: Expansion, Construction, and Control.
  - a. Submit detailed shop drawings of each joint type. Submit an elevation or section taken through the plane of the joint showing the walls and slabs at the joint.
- 3. PVC Waterstops,
  - a. Details of water stop system, sizes, types, splices, method of securing and supporting waterstop to maintain proper orientation and location during concrete placement.
  - b. For PVC Waterstops:
    - 1) Identify all splices for waterstop
    - 2) Identify all field and shop splices
    - 3) Provide details of securing waterstop to reinforcing bar with carrier bars
- 4. Construction and Control Joints: Layout and location for each type.
- 5. Details of joint fillers, sealant, adhesives, and other appurtenances.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

B. Product Data Sheets

1. Submit three copies of manufacturer's product data sheets including installation, application, and maintenance instructions for:
  - a. PVC waterstops.
  - b. Foamed PVC joint filler.
  - c. Control joint sealant.
  - d. Adhesive for expansion joint filler.

1.05 QUALITY ASSURANCE

- A. Waterstop Manufacturer Qualifications: Demonstrate 5 years, minimum, continuous successful experience in production of water stops and waterstop systems.
- B. Verify that specified products are correctly installed and comply with manufacturer's printed instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site: Verify that delivered materials are in accordance with Specifications and manufacturer's product data sheets prior to unloading and storing on-site.
- B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight.

1.07 WARRANTY

- A. Provide 5 year performance warranty for neoprene expansion joint system water stop.

**PART 2. PRODUCTS**

2.01 PLASTIC WATER STOP

- A. Extruded from elastomeric plastic compound of prime virgin polyvinyl chloride (PVC) resin free of scrapped material, reclaimed material, or pigment.
- B. Factory-made vertical and horizontal crosses, tees, and ells, to form a continuous unbroken seal.
- C. Specific Gravity: Approximately 1.37.
- D. Shore Durometer Type A Hardness: Approximately 80.
- E. Type: Center bulb with parallel ribs or protrusions on each side of strip center.
- F. Corrugated or tapered type water stops are not acceptable.
- G. Thickness: Constant from bulb edge to outside stop edge.
- H. Minimum Weight per Metre of Water Stop:
  1. 2.30 kg for 10 mm by 150 mm.
  2. 3.40 kg for 10 mm by 230 mm.
- I. Fabrications: Use only shop factory fabricated splices for flat ell, flat tee, flat cross, vertical ell, vertical tee and vertical cross. Only butt splices will be permitted in the field.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

J. Manufacturers and Products:

1. Vinylex Corp.; Catalog No. 03250/VIN: No. RB6-38H (150 mm by 10 mm) and No. RB9-38H (230 mm by 10 mm).
2. Greenstreak Plastic Products; Catalog No. 03150/GRD: Style 732 (150 mm by 10 mm), Style 735 (230 mm by 10 mm), and Style 727 (230 mm by 10 mm/ 5 mm) split bulb.
3. Durajoint Concrete Accessories; Type 9 (150 mm by 10 mm), and Type 10 (230 mm by 10 mm).
4. .

2.02 TAPE FOR JOINTS

- A. Polyethylene or coated paper
- B. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as joint that will adhere to premolded joint material or concrete surface.

2.03 SLIP DOWEL

- A. Speed Dowel by Sika Greenstreak Sleeve designation PSD12/#6TX

2.04 PREMOLDED JOINT FILLER

- A. Self-expanding Cork:
  1. ASTM D1752, Type III.
  2. Manufacturer and Product: WR Meadows; Self-expanding cork.
- B. Bituminous Type: ASTM D994 or D1751.
- C. Sponge Rubber:
  1. ASTM D 1752, Type 1 Density not less than 480 kg per m<sup>3</sup> by W.R. Grace Ltd.

2.05 POURABLE JOINT FILLERS

- A. Filler for Nonpotable Water Containment Structures:
  1. Pourable, two-component, cold-applied compound meeting ASTM C920, Type M, Grade P, Class 25, Use T.
  2. Color: Black.
  3. Manufacturer and Product: W.R. Meadows, Inc.; Gardox.

2.06 ACCESSORIES

- A. Joint Sealants: As specified in Section 07900, Joint Sealants.
- B. Nonshrink Grout: As specified in Section 03600, Grouting.
- C. Reinforcing Steel: As specified in Section 03210, Reinforcing Steel.
- D. Nails: Galvanized, as required for securing premolded joint filler.
- E. Masking Tape: As required to temporarily adhere to concrete at each side of joint to receive filler.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 5 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

- F. Galvanized Rebar at Control Joints: CAN/CSA-G30.18-M Grade 400W prior to galvanizing.
- G. Ties for PVC Water Stop: "Hog Rings" or grommets for each edge at 300 mm maximum spacing.

2.07 HOT-DIP GALVANIZING

- A. Galvanize steel where noted in accordance with CAN/CSA-G164-M.
- B. Galvanize bolts, nuts, washers, and anchor bolts for connections to galvanized steel in accordance with CAN/CSA-G164-M.
- C. Complete fabrication, and prepare surfaces of steel by removing weld spatter, flux and residue, burrs, and surface defects before galvanizing.
- D. Tap threads of nuts after galvanizing.

**PART 3. EXECUTION**

3.01 GENERAL

- A. Commence concrete placement after joint preparation is complete.
- B. Construction Joints in Unrestrained Slabs on Ground:
  - 1. Slabs may be placed continuous from outside edge to outside edge, outside edge to expansion joint, or from expansion joint to expansion joint, unless shown otherwise.
- C. Construction Joints in Walls:
  - 1. Locate construction joints 2000 mm minimum away from junction of two or more walls, , nearest edge of an opening wider than 600 mm, and a construction joint in a slab on which the wall rests.
  - 2. Place wall in alternate portions with a distance between vertical construction joints not exceeding the following:
    - a. 15,000 mm for walls of other than liquid holding structure.

3.02 SURFACE PREPARATION

- A. Construction Joints:
  - 1. Prior to placement of abutting concrete, clean contact surface:
  - 2. Perform cleaning so as not to damage water stop, if one is present.
- B. Expansion Joint:
  - 1. Use wire brush or other motorized device to mechanically roughen and thoroughly clean concrete surfaces on each side of joint from plastic water stop to top of joint.
  - 2. Use dry high pressure air to remove dust and foreign material, and dry joint.
  - 3. Prime surfaces as required before placing joint filler.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 6 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

4. Avoid damage to water stop.
5. Install slip dowels in accordance with manufacturers printed instruction. Saw cut dowels. Do not use sheared or bent dowels.

### 3.03 INSTALLATION OF WATER STOPS

#### A. General:

1. Join water stops at intersections to provide continuous seal.
2. Locate water stop in the centre of the joint.
3. Secure water stop in correct position. Tie water stop to reinforcing steel using grommets, "Hog Rings," or tie wire at maximum spacing of 300 mm. Do not displace water stop during concrete placement.
4. Repair or replace damaged water stop.
5. Place concrete and vibrate to obtain impervious concrete in vicinity of joints.
6. Joints in Footings and Slabs:
  - a. Ensure that space beneath water stop is completely filled with concrete.
  - b. During concrete placement, make visual inspection of water stop area.
  - c. Limit concrete placement to elevation of water stop in first pass, vibrate concrete under water stop, lift water stop to confirm full consolidation without voids, then place remaining concrete to full height of slab.

#### B. PVC Water Stop:

1. Install in accordance with manufacturer's printed instructions and as shown on drawings.
2. Splice in accordance with water stop manufacturer's printed instructions.
  - a. Provide finished splices with cross-sections that are dense and free of porosity with tensile strength of not less than 80 percent of unspliced materials.
  - b. Use only shop made water stop fabrications for all splices except noted below.
  - c. Field splice is permitted only for straight butt welds.
3. Wire looped plastic water stop may be substituted for plastic water stop.

### 3.04 EXPANSION JOINT INSTALLATION

#### A. Bituminous Type Premolded Joint Filler:

1. Installed in areas where specified or shown.
2. Drive nails approximately 450 mm on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.
3. Secure premolded joint filler in forms before concrete is placed.

#### B. Pourable Joint Filler:

1. General: Install in accordance with the manufacturer's written instructions, except as specified below:
  - a. Apply primer prior to pouring joint filler.
  - b. Fill entire joint above the water stop with joint filler as shown.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 7 of 7</b>
<b>REVISION 0</b>	<b>SECTION 03251 CONCRETE JOINTS</b>	

- c. Use masking tape on top of slabs at sides of joints; clean spillage.  
Remove masking tape afterwards.
- d. Coordinate with Section 07900, Joint Sealants.

3.05 SAWN CONTROL JOINTS

- A. Use only where specifically shown.
- B. Locate with string line or other positive means.
- C. Fill with sealant after 28 day compressive strength has been achieved.

3.06 SETTING ANCHOR BOLTS FOR EQUIPMENT, AND FRAMED FABRIC STRUCTURES

- A. Receive, handle, and set anchor bolts in accordance with the requirements of the trade supplying them. Protect anchor bolts after setting to maintain correct alignment and level.

3.07 FRAMES FOR COVERS AND OPENINGS

- A. Set frames at locations and required elevations.

3.08 EQUIPMENT CASTINGS AND PIPE FITTINGS

- A. Set castings and pipe fittings at locations and elevations required.

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

**PART 1. GENERAL**

1.01 SUMMARY

- A. Comply with Division 1, General Requirements.
- B. Comply with requirements of CSA A23.1 and A23.2, except where noted otherwise in this Specification.
- C. The following sections form part of this Section:
  - 1. Section 03100, Concrete Formwork
  - 2. Section 03210, Reinforcing Steel
  - 3. Section 03251, Concrete Joints
  - 4. Section 03345, Concrete Curing and Finishing
  - 5. Section 03600, Grout and Miscellaneous Concrete Work.
- D. Do not use materials that are toxic in installed condition. Do not use volatile organic compounds where not permitted by law. Where use of volatile organic compounds is permitted, provide adequate ventilation and take necessary safety precautions.
- E. Section Includes:
  - 1. Normal-density concrete.
  - 2. Repair of cracks that develop in concrete.

1.02 DEFINITIONS

- A. Exposed Concrete: Visible concrete surfaces inside or outside of structures, including surfaces above liquid level.
- B. Hydraulic Structures: Liquid holding or containment structures whether above and/or below grade and includes roofs of the containment structure.
- C. Habitable structures: Structures that are accessible and may be used for storage or conveyance or utilities.
- D. Below Grade structures: Structures that are below or partially below grade. Below grade habitable structures, for water tightness requirements, are considered hydraulic structures.
- E. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 5 mm, cracks 0.1 mm or wider as well as any crack that leaks in hydraulic structures and below grade habitable spaces; cracks 0.25 mm and wider in non hydraulic structures, spalls, chips, air bubbles greater than 10 mm in diameter, pinholes, bug holes

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

greater than 4mm in diameter, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints or penetrations or openings, fins and other projections, form pop outs, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

- F. New Concrete: Less than 60 days old.
- G. Type of concrete: Project specific concrete type and shall not be confused with type of cements or finishes.
- H. Exposure classes of concrete: As defined in Table 1 CSA A23.1-04
- I. Water/Cementing Material Ratio (W/C): A weight ratio of total water content including admixtures over the weight of all cementing materials.

### 1.03 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
  - 1. Canadian Standards Association (CSA):
    - a. A23.1, Concrete Materials and Methods of Concrete Construction.
    - b. A23.2, Methods of Test and Standard Practices for Concrete.
    - c. A3001, Cementitious Materials for Use in Concrete.
    - d. A3003, Chemical Test Methods for Cementitious Materials for Use in Concrete and Masonry.
    - e. A3004, Physical Test Methods for Cementitious Materials for Use in Concrete and Masonry.
    - f. A3005, Test Equipment and Materials for Cementitious Materials for Use in Concrete and Masonry.
  - 2. American Concrete Institute (ACI):
    - a. 304.2R, Placing Concrete by Pumping Methods.
  - 3. American Society for Testing and Materials International (ASTM):
    - a. C260, Specifications for Air-Entraining Admixtures for Concrete.
    - b. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.]
    - c. C900, Test Method for Pullout Strength of Hardened Concrete.
    - d. C1017/C1017M ,Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
    - e. C1074 [-04], Standard Practice for Estimating Concrete Strength by the Maturity Method.
    - f. C157(-08) Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
  - 4. AASHTO T 318-02(2007) Water Content of Freshly Mixed Concrete Using

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

Microwave Oven Drying.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Type of Concrete Class of Exposure and Compressive Strengths.
  - 1. Normal-density concrete: Type A: Class of Exposure: S-2 - 32MPa at 56 days, W/C 0.45.
- B. Performance requirement for temperatures during curing.
  - 1. Design concrete mix taking in the account the expected ambient temperature during the curing. Peak curing temperature of concrete shall not exceed 40 degree C and shall not be less than 10 degrees C.
- C. Density.
  - 1. Air entrained normal density concrete: As defined in CSA 23.1-09 Clause 3 except the density shall be not less than 2250 kg/m<sup>3</sup>.
- D. Concrete Shrinkage at 28 Day Drying Age:
  - 1. 0.040 percent maximum for laboratory trial mixes of proposed concrete made with 40 mm aggregate with and without superplasticizer.
  - 2. 0.045 percent maximum for laboratory trial mixes of proposed concrete made with 20 mm aggregate with and without superplasticizer.
  - 3. If shrinkage specimen tests for concrete exceed shrinkage limits, modify concrete mix to reduce shrinkage. Repeat tests with new mix.
  - 4. Test shall be conducted as per modified ASTM C157 as specified herein.
- E. Construction Tolerances:
  - 1. Comply with CSA A23.1-09 Clause 6.4 unless noted otherwise.
- F. Concrete Finishes:
  - 1. As specified in Section 03345, Concrete Curing and Finishing.

#### 1.05 SUBMITTALS

- A. Product Data Sheets:
  - 1. Submit manufacturer's product data sheets in accordance with Section 01300 including installation, application, and maintenance instructions for:
    - a. Chemical admixtures.
    - b. Crack injection material.
    - c. Repair materials.
- B. Concrete Mix Design:
  - 1. Design in accordance with CSA 23.1 Table 5 based on performance requirements.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

2. Submit proposed mix, and supplier's applicable standard deviations.
  3. Tabulate concrete mixes. Indicate type of cements, size of coarse aggregate; water/cementing material ratio, admixtures used, air content, slump, and locations of use for each mix. Identify mix with pump or bucket type of discharge. Also identify mix for cold weather and hot weather concreting..
  4. Submit detailed plan for cold weather placement, curing and protection of concrete in weather for ambient temperatures below 5 degree C.
  5. Submit detailed plan for hot weather placements, curing and protection of concrete for ambient temperatures over 27 degree C.
  6. Concrete mix designs will be reviewed for conformance with requirements of the Specifications and will be returned with Contract Administrator's comments.
- C. Source Quality Control Submittals:
1. Provide certification that source for fine and coarse aggregates are not subject to deleterious expansion.
  2. Drying shrinkage Test:
    - a. Perform laboratory trial mixes of concrete used on project. Make two sets of three specimens for each shrinkage test.
    - b. Provide test for Concrete containing 20mm aggregate with or without the use of superplasticer.
    - c. Prism Specimen Size: 100 mm by 100 mm by approximately 280 mm with effective gauge length of 250 mm.
    - d. Specimens: Fabricate, cure, dry and measure as specified in ASTM C157 and modified as follows:
      - 1) Remove specimens from molds aged 23 hours  $\pm$  1 hour after trial batching.
      - 2) Place immediately in water at 22.8 degrees C plus or minus 2 degrees C for at least 30 minutes.
      - 3) Measure the specimen within 30 minutes thereafter to determine original length and then submerge in saturated limewater at 22.8 degrees C plus or minus 2 degrees C.
      - 4) Measure specimens at age 7 days to determine expansion expressed as percentage of original length. Length at age 7 days shall be base length for drying shrinkage calculations (0 days drying age).
      - 5) Store specimens immediately in humidity control room maintained at 22.8 degrees C plus or minus 2 degrees C and 50 percent plus or minus 4 percent relative humidity for remainder of test.
      - 6) Measure to determine shrinkage expressed as percentage of base length and report separately for 7, 14, 21, and 28 days of drying after the 7 days of moist curing.
      - 7) Computing Drying Shrinkage Deformation of Each Specimen:

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 5 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

- a) Difference between base length (at 0 days-drying age) and length after drying at each test age.
- b) Compute average drying shrinkage deformation to nearest 0.001 percent at each test age.
- c) If drying shrinkage of any specimen departs from average of that test age by more than 0.004 percent, disregard results obtained from that specimen.

**D. Quality Control Submittals:**

1. Submit Concrete quality control plan for the project. Include the following:
  - a. Certification from a professional engineer who has designed the mix based on the requirements of the Contract Documents and that concrete mix will meet the performance requirements. Where the mix designer is not a professional engineer, then the signing officer of the ready mix plant shall sign the certification.
  - b. Identify the Company and contact names of subcontractors, material suppliers, and testing companies involved with concrete manufacture and placement.
  - c. Identify concrete requirements for each element of the project.
  - d. Identify all tests that will be used for material acceptance and indicate minimum specification requirements for each test.
  - e. Identify the frequency of testing for each test.
  - f. Identify the course of action to be taken if the testing program indicates that specification requirements have not been met.
  - g. Concrete quality control plan shall not take precedence over any other Contract documents.
2. Submit concrete delivery records.

**E. Concrete Placing Schedule:**

1. Submit concrete placing schedule.

**F. Certificates:**

1. Submit certificate of Ready Mixed Concrete Production Facilities.
2. Submit certification that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete.
3. Submit certification that deleterious substances in aggregate are within limits specified in CSA A23.1-09, Table 12 - Limits for Deleterious Substances and Physical Properties of Aggregates.
4. Submit certification that proposed performance mix will produce concrete meeting the requirements of Specifications.
5. Submit certification that proposed mix design strengths have been selected allowing for the supplier's standard deviations as indicated in CSA A23.1-09, Clause 4.4.6.6- Compressive Strength Requirements..
6. Submit certification that proportion of supplementary cementing material in

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 6 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

combination of General Use (GU) hydraulic cement will provide the performance of the specified cement type.

7. Submit certification that bonding agent, if used, will meet the requirements of Specifications.
8. Submit certification that crack injection materials are suitable for continuous submersion and that they will not release toxic materials into the water.

#### 1.06 QUALITY ASSURANCE

- A. Ready Mixed Concrete Producer: Certified member in good standing of the local Ready Mixed Concrete Association.
- B. Concrete Testing:
  1. Testing of concrete for materials, compression and water content of freshly mixed concrete will be done by third party agencies paid for by the Contractor.
  2. Pay for additional testing required because of changes in material or the mix proportions, as well as any extra testing of concrete or materials occasioned by their failure to meet the specification requirements.
  3. The use of testing services does not relieve the Contractor of his responsibility to provide materials and construction in compliance with the Drawings and Specifications.
- C. Pre-placement Meeting:
  1. Hold a meeting at least four weeks prior to the initial placement of concrete to review the detailed requirements for preparing the concrete design mixes, finishes, and procedures for concrete placement for the structures.
  2. Arrange for the attendance at the meeting of the Contract Administrator, City, and of concrete subcontractors.
  3. Notify the Contract Administrator at least 15 working days prior to the scheduled date of the meeting.
  4. The Contract Administrator will set an agenda for the meeting at least five working days prior to the scheduled date of the meeting.
  5. Contractor to provide Work plan detailing:
    - a. Control of traffic on Site.
    - b. Equipment to be used and availability of standby.
    - c. Hot / cold weather concreting details.
    - d. Personnel resources.
    - e. Quality assurance procedures.
    - f. Safety on Site.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturers' recommendations for delivery, storage, and handling.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 7 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

- B. Store materials in a manner that will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from Site.

#### 1.08 SITE CONDITIONS

A. Cold Weather Requirements:

1. The following requirements are in addition to CSA A23.1-09, Clause 7.4.1.5.Cold Weather Concreting.
2. Provide temperature-controlled enclosures for areas where concrete is placed whenever ambient air temperature is 5 degrees C or lower.
3. Protect concrete from the adverse effects of space-heated enclosures including local overheating and combustion products.
4. Heat mix-water and, if necessary, aggregates when air temperature is at or below, or predicted to go below, 5 degrees C at any time during the next 24 hours.
5. Maintain temperature of reinforcing bars and forms above 10 degrees C prior to placing concrete.
6. Maintain temperature of concrete when deposited in forms not less than 15 degrees C and not higher than 25 degrees C.
7. Maintain temperature of concrete at surfaces at least 10 degrees C for a minimum period of seven days after placing and achieving minimum 75 percent of specified strength. Concrete temperature may then be lowered to ambient air temperature at a rate of 1.2 degree C per hour or 10 degrees C per day.
8. Keep concrete continuously moist during the curing period.

B. High-temperature Control Requirements:

1. The following requirements are in addition to A23.1-09, Clause 7.4.1.4 Hot Weather Concreting.
2. Limit peak temperature during the curing period to 40 degree C maximum. Placing temperature that will satisfy this requirement depends on ambient temperature, humidity at the time of placing, thickness of the concrete, and curing methods employed.
3. Consider use of retarders, low- heat cement, slag replacement, ice in mixing water, pre-cooling of aggregates, cooling of concrete through continuous wet curing, and similar methods in order to prevent concrete temperatures from exceeding the above specified peak temperature at any time.
4. Monitor concrete temperatures for walls and slabs. After concrete temperature has peaked, control rate of cooling to ambient air temperature at a rate of ½ degree C per hour to prevent cracking.
5. Notwithstanding requirements of subparagraphs .1 and .2 above, do not place concrete with temperature higher than 25 degree C. Concrete with temperature in excess of 25 degree C on arrival at the Site will be rejected. Remove rejected concrete from the Site.

C. Protection:

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 8 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

1. Protect freshly placed concrete from damage due to construction operations and from cold, heat, rain, snow, running water, drying winds, and any other circumstances which would likely cause deterioration of concrete quality.
  2. Use waterproof insulated covers or other suitable materials to enclose freshly placed concrete under these conditions.
- D. Frost Protection for Slabs on Grade:
1. Provide continuous protection for slabs on grade to prevent subgrade below from freezing during cold weather. Provide heated enclosures and insulation as required.
- E. Influence of Ambient Concrete Temperature on Concrete Crack Control:
1. To minimize the formation of thermal cracks during placement and curing, maintain previously cured concrete and concrete that will be placed against it at the same temperature.
  2. Failure to minimize temperature differential between adjacent pours will result in temperature induced cracking. Repair such cracks as specified in this Section.

## **PART 2. PRODUCTS**

### 2.01 MATERIALS

- A. Portland Cements/ Blended Hydraulic Cements:
1. CSA A23.1 Table 7 Types of blended hydraulic cement:
    - a. Type: HS, HSb. as appropriate
    - b. Supplementary Cementing materials shall be limited to ground granulated blast-furnace slag (S), fly ash (F) and silica fume (SF).
- B. Aggregates:
1. Normal-density Concrete:
    - a. Coarse aggregate: CSA A23.1; rough and angular gravel or crushed stone.
    - b. Fine aggregate: CSA A23.1; natural sand.
- C. Admixtures:
1. Compatible with each other and with other concrete materials.
  2. Calcium chloride, thio-cyanates, or admixtures containing more than 0.05% chloride ions are not permitted.
  3. Air-entraining admixture: ASTM C260; non-detergent type.
  4. Water-reducing admixtures: ASTM C494; Type A.
  5. Set-retarding admixture: ASTM C494; Type B.
  6. Superplasticizing admixture: ASTM C494; Type F
- D. Water: CSA A23.1; clear and free from oil, acid, alkali, organic matter, or other

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 9 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

deleterious substances with a maximum soluble chloride ion content of 0.10 percent by weight.

- E. Bonding agent: Suitable for conditions of service and performance requirements of this Section

## 2.02 CONCRETE MIXES

### A. General:

1. Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete that when placed properly is watertight and durable with strength and other properties specified. Comply with -CSA A23.1-09 Clause 4.3.6 Volume Stability Considerations.
2. Use same type and brand of cement/cementing material throughout.
3. Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1-09 Clause 4.4.6.6- Compressive Strength Requirements. If the concrete supplier has no established Standard Deviations for concrete of the specified strengths, use a value of 4 MPa minimum.
4. Use high-slump concrete by addition of superplasticizing admixture for walls and columns.

### B. Types of Normal Density Concrete:

1. Type A-Exposure Class S2: Concrete for structures, foundations, equipment bases, pipe supports, concrete encased duct banks, benching, and concrete wearing slab, containing reinforcing bars, unless specified otherwise.

### C. Mixes for Normal Density Concrete:

1. Cementing Materials Content:
  - a. Provide cementing materials contents as required to meet performance.
2. Coarse Aggregates:
  - a. Nominal size 20 mm to 5 mm, for walls and slabs less than or equal to 300 mm thick, beams, and Type B concrete.
3. Air Content:
  - a. Comply with CSA A23.1-09, Table 4 - Requirements for the Air Content Categories.
  - b. Provide air content category 2, unless noted otherwise.
  - c. Provide air content category 1 for loading bays, parking areas, and below grade and hydraulic structures, sidewalks curbs and gutters. If high volume supplementary cementing material (HVSCM) is used consult with the Contract Administrator on air content requirements for steel trowelled slabs.
  - d. Provide 3 percent maximum air content for concrete forming floors

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 10 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

where floor hardener is used.

4. Admixtures:
  - a. Use water-reducing admixture as necessary.

D. Mix for Wall and Column Grout:

1. Mix same as for wall and column placements except no coarse aggregate

E. Mix for Pumped Concrete:

1. Comply with ACI 304.2R and this Specification.
2. Uniform grading curves for fine and coarse aggregate.
3. Superplasticizing admixture may be used for pumped concrete.
4. Do not use admixtures which promote bleeding.
5. Successfully used previously or for new mix carry out pumping test for successful placement.

2.03 SOURCE QUALITY CONTROL

- A. Testing by an independent laboratory in accordance with CSA A23.1 and A23.2, where test results less than one year are not available, to determine:
  1. Chemical composition and physical properties of aggregates.
  2. Presence and quantity of deleterious substances in aggregates.

**PART 3. EXECUTION**

3.01 PREPARATION

A. General:

1. Determine requirements of other trades, inform concerned trades, and assume responsibility for location, installation, and quality of items which affect the Work of this Section.

B. Preparation of Surfaces:

1. Remove water, snow, ice, loose soil, laitance, curing compound, wood, and other debris from surfaces on or against which new concrete will be placed.
2. Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.

3.02 PLACING CONCRETE

A. General:

1. Do not commence concrete placing until sufficient manpower and equipment is available to complete the placement expeditiously preventing the formation of

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 11 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

- cold joints, and to produce specified surface finish.
2. Provide standby equipment for critical items in case of equipment failure.
  3. Verify that cast-in-place accessories, inserts, and reinforcement are set correctly and are not disturbed during concrete placement.
  4. Place concrete on dry and clean substrate.
  5. Place concrete between expansion or construction joints in one continuous operation.
  6. Submit field review quality control sheet.
- B. Depositing:
1. Deposit concrete in a manner that prevents segregation in accordance with CSA A23.1-09 Clause 7.2.4 - Depositing.
- C. Time Limitations on Concrete Placement:
1. Do not use concrete after a period of two hours has passed since first mixing of ingredients.
  2. Do not use high-slump concrete after slump falls below 100 mm for non-flowing concrete and 125 mm for flowing concrete. Where permitted, re-temper in accordance with manufacturer's printed instructions. Monitor, and correct if required, air content of concrete that has been re-tempered.
- D. Adverse Weather Conditions:
1. Make suitable arrangements to prevent damage to fresh concrete, under adverse weather conditions.
  2. Do not allow rain, sleet, or snow to increase mixing water or damage surface finish.
  3. Plan placement frequency such that lift lines will not be visible in exposed concrete finishes.
  4. Provide windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
  5. Do not place concrete when ambient temperature is below 5 degrees C or approaching 5 degrees C and falling, without special protection.
  6. Do not place concrete against frozen earth or ice, or against forms and reinforcement with frost or ice present.
  7. Provide heated enclosures when air temperatures are below 5 degrees C.
  8. Maintain surface temperature of concrete above 5 degrees C.
  9. External Heating Units:
    - a. Vent heating units to atmosphere and do not locally heat or dry concrete. Where water cure is specified, maintain wet condition.
    - b. Do not exhaust heater flue gases, directly into enclosed area
  10. Temperature Monitoring:
    - a. Provide thermocouple wires in concrete for temperature monitoring.
- E. Time Interval Between Concrete Placements:

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 12 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

1. Construction Joints: 7 days wet cure continuously.
2. Expansion Joints/Contraction Joints: 1 day.
3. Wait at least 2 hours after depositing concrete in long columns and walls thicker than 200 mm before depositing concrete in beams, girders, or slabs supported thereon.

F. Consolidation:

1. Consolidate the concrete during and immediately after depositing, thoroughly and uniformly by means of tamping, hand tools, finishing machines, and vibrators in order to obtain dense, watertight, homogeneous concrete well bonded to reinforcing bars.
2. Carefully vibrate concrete around the conduits, waterstops, to make sure thorough contact.
3. Bend edge of horizontal waterstops slightly upward allowing concrete to flow under and completely fill space below the waterstop . Verify no air is trapped below waterstop and concrete is in contact with waterstop over its entire surface area.
4. Provide sufficient windows in forms or to allow for concrete placement through windows and for visual observation of concrete.
5. Vibration consolidation not to exceed distance of 1 m from point of placement.
6. Do not allow concrete to form cold joints.

G. Maximum Size of Concrete Placements:

1. Limit size of each placement to allow for strength gain and volume change due to shrinkage
2. Should placement sequence result in cold joint install water stop in joint.

3.03 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

- A. Repair cracks in the completed structures employing a suitable polyurethane injection technique to make such cracks completely watertight after repair.
- B. Remove surface injection materials following completion of Work and finish affected areas to match surrounding concrete.
- C. For dry areas, propose repairs to meet the specifications.

3.04 FIELD QUALITY CONTROL

A. General:

1. Tests will be made throughout progress of the Work and will be paid for by the Contractor to determine concrete quality. Tests will be in accordance with CSA A23.1 and A23.2. Provide labour, concrete, and other facilities for making the test specimens.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 13 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

2. Provide and maintain facilities for storing and initial curing of test cylinders, and provide suitable crates for shipping test cylinders in accordance with CSA A23.2- 09 Test Method A23.2-3C - Making and Curing Concrete Compression and Flexural Test Specimens. Provide microwave oven and facility of carrying out test in field.
  3. The testing laboratory shall provide the test results to the City, Contract Administrator, Contractor and material supplier within 5 days of availability. For test that fails to meet the Specification inform Contract Administrator, Contractor and material supplier within 48 hours of the test.
- B. Standard Strength Tests:
1. Provide concrete for one standard strength test consisting of 4 cylinders for each 40 m<sup>3</sup> of concrete of each type placed in any day. If the amount placed, for each type of concrete is less than 100 m<sup>3</sup> in a day, provide concrete for one standard strength test of 4 cylinders. One cylinder will be tested at 7 days and one at 28 days and two cylinders at 56 days.
- C. Water content of freshly mixed concrete
1. Carry out water content test in accordance with AASHTO T 318
  2. Test may be carried out in field or in laboratory
  3. Test concrete in a set of three samples at the time of taking the concrete cylinders and as requested by the field staff.
- D. Concrete Temperature Monitoring:
1. Monitor temperature of concrete starting immediately after placement until the end of 7 days curing period.
  2. Record ambient temperature during concrete monitoring period also.
  3. Install thermocouple wire sensors in sufficient numbers, into each concrete pour in excess of 20 cubic metres poured in one day, to truly represent the concrete temperatures of the pour.
  4. Connect thermocouple wires to central temperature logger that records the temperatures at regular interval of one half hour.
  5. Provide records of temperatures daily of previous 24 hours.
  6. For each pour, at the end of the curing period, provide temperature graphs of the concrete and the ambient temperature.
  7. Consider the use of temperature monitoring system such as Hobo U12 Outdoor Thermocouple Temperature Logger with software and thermocouple wire sensors supplied by Onset Computer Company.
- E. Air Content Tests:
1. Testing agency will carry out air content tests in accordance with CSA A23.1 and A23.2.
- F. Slump Tests:

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 14 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

1. Testing agency will carry out slump tests in accordance with CSA A23.1 and A23.2.
- G. Failure to Meet Strength, Air Content, or Slump Requirements:
1. When measured slump or air content falls outside of required limits, carry out a check test immediately on another portion of the same sample. In the event of a second failure, the concrete will be considered to have failed to meet the requirements. Remove the whole batch, from which the samples were taken, off the Site.
  2. When the strength requirement provisions are not met, carry out one or more of the alternatives:
    - a. Change the mix proportions
    - b. Carry out nondestructive testing
    - c. Provide additional curing on portions of the structure represented by the test specimen.
    - d. Core drill portion of the structure in question and test cored cylinder in accordance with CSA 23.2-09
    - e. Test method A23.3-14C Obtaining and testing drilled cores for compressive strength.
    - f. Load test structure to design loading
    - g. Other test the City may require for acceptance.
  3. When, after carrying out these requirements, there is still doubt about of the adequacy of the concrete, strengthen or replace, as directed, portions of the Work which failed to develop the required strength.
- H. Uniformity of Mixed Concrete
1. If the results of slump, slump flow, air content or density for any mix design do not comply with CSA A23.1-09, Table 13 - Determination of Within-Batch Uniformity, alter mixing operations and equipment until tests indicate that the requirements are satisfied.
- I. Concrete Delivery Records:
1. Submit with each batch of concrete before unloading, a typed delivery ticket prepared at the ready mix plant containing following information:
    - a. Name of ready-mix batch plant.
    - b. Date and serial number of ticket, truck plate number
    - c. Name of Contractor.
    - d. Project Name.
    - e. Specific class of concrete with identifying mix number.
    - f. Amount of concrete in cubic metres
    - g. Time loaded or of first mixing of cement and aggregates.
    - h. Amount of admixtures, or water added on Site.
  2. Keep records of the time when each load arrives at the Site and when discharge is completed. Record the temperature of fresh concrete.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 15 of 15</b>
<b>REVISION 0</b>	<b>SECTION 03300 CAST-IN-PLACE CONCRETE</b>	

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

**PART 1. GENERAL**

1.01 SUMMARY

- A. Comply with Division 1, General Requirements.
- B. This Section forms part of Section 03300, Cast-in-Place Concrete.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
  - 1. Canadian Standards Association CSA A23.1-09 Concrete Materials and Methods of Concrete Construction.
  - 2. ACI 309.2R Identification and Control of Visible Effects of Consolidation on Formed Concrete Surfaces
  - 3. American Society for Testing and Materials International (ASTM):
    - a. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens).
  - 4. American Society of Concrete Construction Guide for Surface Finish of Formed Concrete.

1.03 DEFINITIONS

- A. Aggregate transparency: Mottled surface appearance resulting from deficiencies in the mortar.
- B. Air surface voids: Also termed as air pockets or bug holes. Small regular or irregular cavities resulting from entrapped air bubbles in the surface of formed concrete. Air surface voids less than 12 mm in diameter or depth may be acceptable unless specified otherwise.
- C. Fin /form streaking: A narrow linear projection on foamed concrete surface resulting from mortar flow into spaces in the formwork.
- D. Finish: The texture of a surface after consolidating and finishing operation has been performed.
- E. Form offsets: An abrupt change in alignment, either horizontally or vertically.
- F. Honeycomb: Condition of irregular voids due to failure of the mortar to effectively fill the space between coarse aggregate particles generally in formed concrete.
- G. Laitance: A thin weak brittle layer of cement and aggregate fines on concrete surface.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

- H. Layer lines: Dark lines on formed surfaces indicating boundary between concrete placements. Cold joints are one form of layer lines.
- I. Sand streaking: Exposed fine aggregate surface of formed concrete due to excessive bleeding along the form.
- J. Soundness: A quantitative measure of suitability of concrete to perform as a solid substrate or base for a coating or patching material. Sound concrete substrates usually exhibit strength and cohesiveness without excessive voids or cracks.
- K. Subsidence cracking: Tension cracking when concrete settles after initial set.
- L. Surface defects: Includes air surface voids, form streaking, sand streaking, aggregate transparency, colour variation, layer lines, cold joints, soft areas, offsets and bulges. Air surface voids or bug holes smaller than 12 mm are not considered as defects as long as they are generally spaced out.
- M. Porosity: Small voids that allow fluids to penetrate an otherwise impervious material.

#### 1.04 SUBMITTALS

- A. Product Data Sheets
  - 1. Submit as per Section 01300 product data sheets including installation, application, and maintenance instructions for:
    - a. Non metallic shake on floor hardener
- B. Shop Drawings
  - 1. Submit shop drawings indicating finishes for floors and walls.

#### 1.05 QUALITY ASSURANCE

- A. Concrete finishers: Skilled personnel with a minimum of five years proven satisfactory experience finishing concrete of comparable size and scope.
- B. Engage manufacturers' representative for on Site supervision prior to, during, and after applications. Verify that specified products are correctly applied; amount and finishing procedures comply with manufacturer's printed instructions for project.
- C. Conference Prior to Slab Placement:
  - 1. Conducted by Contractor.
  - 2. Agenda:
    - a. Concrete mix design.
    - b. Placing techniques.
    - c. Finishing techniques.
    - d. Product application procedures.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

- e. Equipment required for the procedures.
- 3. Attendees:
  - a. Contractor's superintendent.
  - b. Subcontractor's representative involved in concrete placement and finishing.
  - c. Resident Inspector from Contract Administrator's Office.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prevent deterioration or contamination of stored materials. Deteriorated or contaminated materials will be rejected and must be removed from Site.

1.07 SITE CONDITIONS

- A. Comply with special requirements of Section 03300, Cast-in-Place Concrete for Work under cold weather and high temperature conditions.
- B. During curing, ensure the temperature is kept uniform over the whole surface and across the cross section of the concrete. A temperature gradient across the member may cause cracking. Protect the concrete surface from rapid drying due to high concrete and/or ambient temperatures, low humidity, high winds, or heated interiors.

**PART 2. PRODUCTS**

2.01 MATERIALS

- A. Curing:
  - 1. Wet cure all concrete.
- B. Shake on Floor Hardener:
  - 1. Premixed blend of mineral aggregates, wetting and densifying agents, and Portland cement, shake on type;
  - 2. Manufacturer and Product
    - a. Sika Canada Inc., Durag Premium.,
    - b. Euclid Admixture Canada, Inc., Surfex
    - c. BASF: Maximent
    - d. Dayton Superior Canada Limited, Quartz Tuff
- C. Polyethylene sheet: CGSB 51 GP 51M; 0.15 mm thick.
- D. Wet curing materials: Non-staining waterproof curing paper, burlap, or canvas coverings.
- E. Bonding agent: Suitable for conditions of service and performance requirements of this Section.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

F. Repair Mortars

1. For air surface voids and surface repairs to a depth of 20 mm:
  - a. Sika Canada., Sika MonoTop - 623.
  - b. W.R.Meadows., Meadow Patch T1
2. For repairs of spalls up to depth of 100 mm
  - a. King Packaged material company., In Pakt construction grout
  - b. Sika Canada., Sika 111, Sika 122, Sika 122 winter grade.

**PART 3. EXECUTION**

3.01 PREPARATION

- A. Review the requirements for applied finishes.
- B. Concrete slabs to receive floor hardener:
  1. Aerated Static Pile Bunkers
  2. Biofilter Bunker
  3. Mixing & Receiving Building

3.02 TOLERANCES

- A. General
  1. Comply with CSA A23.1- 09, Clause 7.5.1 – Surface Tolerances for slabs and floor.
  2. Slopes in floor slabs as indicated in drawings. If slope is not shown, floor drains, trenches, swales, shall indicate low points in the slab.
- B. Straightedge Method:
  1. Flat: Finish tolerance 5 mm in 3000 mm.

3.03 CONCRETE FINISHING

- A. General:
  1. Concrete finishing effort is directly dependent on forming, concrete placing, and curing techniques. Perform finishing procedures until specified finishes are achieved.
  2. Complete concrete finishing in areas where mechanical and electrical equipment will be installed prior to commencement of such installation.
  3. Where floor slopes and sumps are indicated on the drawings, the floor must be constructed so that water flows to the drain(s) without ponding.
- B. Slab or Floor Surfaces:
  1. General:
    - a. Carry out finishing operations in accordance with CSA A23.1 09, Clause

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 5 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

7.5.3 – Initial Finishing of Horizontal Surfaces.

- b. Initial finishing operations consist of placing, spreading, consolidation vibrating, and screeding, immediately followed by bull floating, or darbying.
  - c. Complete leveling and consolidation before free moisture or bleeding of free water rises to top surface.
  - d. Provide at least one standby power trowel. Provide sufficient finishers and equipment for the Work.
  - e. Take precautions necessary to protect the finish against inclement weather.
  - f. Commence final finishing operations by finishing the edges and grooving as required followed by floating and trowelling, when concrete has stiffened sufficiently to prevent the working of excess mortar to the surface and is able to sustain foot pressure, and after removing free bleed water.
  - g. Straighten with straightedge as often as necessary to achieve specified floor tolerances.
2. Trowel Finish (Type S-1):
- a. After initial finishing and floating, trowel surface with steel hand or power trowel in accordance with CSA A23.1, Clause 7.5.4.3.2 - Trowelling, keeping blade flat at first and raising blade angle a little more on subsequent passes. Leave surface smooth, dense, of fine uniform texture without a swirl and free of blemishes.
  - b. Do not use dry cement or additional water during troweling. Do not over finish.
  - c. Do not use power machine when concrete has not attained necessary set to allow finishing. Do not introduce high and low spots in slab during trowelling.
  - d. Do first steel trowelling for slab by hand.
3. Wood Float Finish (Type S-2):
- a. Bring surface to required finish plane.
  - b. Wood float concrete surface in accordance with CSA A23.1-09, Clause 7.5.4.2 Floating.
  - c. Remove laitance and leave surface clean.
4. Broom Finish (Type S-4):
- a. Provide nonslip surface finish by brooming the surface in accordance with CSA A23.1, Clause 7.5.6.1 - Nonslip Surfaces with application of steel or fibre brooms at least 450 mm wide.
  - b. Pull broom gently over the surface from side to side at right angles to direction of traffic, with adjacent strokes slightly overlapping.
  - c. Produce a broom finish surface free from porous spots, irregularities, depressions, or rough spots with uniform corrugations less than 3 mm.
5. Dry shake on powder application (Type S-7):
- a. After initial finishing of horizontal surface as stated above wait for concrete to set to a point that leaves an indentation of 6 to 10 mm when walked upon.
  - b. Concrete should be bleed free and can support the weight of the power

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 6 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

trowel

- c. Float open the surface.
- d. Apply portion of dry shake powder evenly over the area as specified for the application by hand or mechanical spreader.
- e. Power float the surface as soon as the dry shake material absorbs the moisture from the base slab.
- f. As soon as concrete is hardened sufficiently power trowel to specified Type S-1 finish.
- g. Application Rate:
  - 1) Floor hardener Type S-7B:
    - a) Shake apply floor hardener at a minimum rate of 7.5 kg/m<sup>2</sup>. Apply the shake mix in two separate applications using approximately two thirds of the total amount specified for the first application and the balance for the second.
    - b) Apply hardener evenly over the floor surface in one direction.
    - c) Machine float just enough to bring moisture completely through the shake and to embed and compact the shake into the base concrete.
    - d) Immediately following the floating of the first shake apply the balance of the hardener. Spread shake evenly and in direction perpendicular to the first shake. Float as specified for the first shake.
    - e) Comply with manufacturer's printed instructions for installation and curing.

C. Formed Surfaces:

- 1. General Finishing:
  - a. Finish in accordance with CSA A23.1-09, Clause 7.7 Finishing of formed surfaces unless noted otherwise.
  - b. Formwork Tie Holes:
    - 1) Cut formwork ties 25 mm from surface of concrete.
    - 2) Make edges of depressions sharp.
    - 3) Fill depressions with pre-blended non shrink non ferrous grout of same colour as the concrete.
  - c. Irregularities:
    - 1) Grind smooth fins, projections, irregularities, and offsets, including those at construction joints.
    - 2) Where irregularities and offsets cannot be remedied by grinding, chip concrete surface sufficiently deep and apply thoroughly bonded pre-blended non shrink non ferrous grout in similar procedure for repair of honeycomb and defective concrete.
  - d. Surface Depressions:
    - 1) Fill surface voids size greater than 12 mm and other surface

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 7 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

- depressions with a sand cement mortar to match the surface of surrounding concrete.
- e. Spalled Corners:
    - 1) Use repair materials of similar appearance and strength as the surrounding concrete to reconstruct corner to match adjacent corners.
  - f. Honeycomb, Soft Areas, and Defective Concrete:
    - 1) Do not repair honeycomb, soft areas, and defective concrete until reviewed by Contract Administrator and permission granted to proceed with the repair Work.
    - 2) Remove honeycomb, soft areas,, and defective concrete down to sound concrete with edges slightly undercut or perpendicular to the surface. Remove a minimum depth of 25 mm. No feather edges are permitted.
    - 3) Pre-dampen patch area.
    - 4) Use pre blended non shrink non ferrous grout of same colour as the concrete for exposed concrete surfaces.
    - 5) Use bonding agents in patching Work.
    - 6) Patch surface slightly higher than the surrounding concrete.
    - 7) Wet cure patches to equivalent of 10 days minimum.
    - 8) When patched surface has hardened, rub surface with carborundum brick to a true surface, free from streaks, discolourations, and other imperfections, to match flush with surrounding concrete.
  - g. Subsidence cracking:
    - 1) Depending on the depth, locations and function of the structure the repair system may require injection grouting and repairs similar to the defective concrete.
2. Type W -1 (Ordinary Wall Finish)
    - a. Carry out general finishing as specified above.
  3. Type W -2 (Smooth Wall Finish)
    - a. Carry out general finishing as specified above.
    - b. Fill air surface voids greater than 3 mm.
    - c. Fill nail head depression more than 2mm deep.
    - d. Provide wall finish similar to Photo 1 P1 Finish as presented in Guide for Surface Finish of Formed Concrete.
  4. Type W -3 (Form Liner Finishes)
    - a. Type W-3A (Controlled Permeability Form Liner):
      - 1) Coordinate installation and stripping of Form Liner, in accordance with manufactures recommendation and as specified in Section 03100, Concrete Formwork.
      - 2) Strip forms as soon as possible to ensure the textured surface finish is not damaged
      - 3) Carry out general finishing as specified above.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 8 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

5. Columns, Beams and Curbs, sides of equipment and pipe saddle supports:
  - a. Provide Type W-2.

#### 3.04 CURING CONCRETE

- A. Begin curing immediately following placing and finishing in accordance with CSA A23.1-09 Clause 7.4.2 except as noted below.
- B. Rate of evaporation is depend on relative humidity, concrete temperature and winds velocity; for rate of evaporation of moisture from concrete surface covered with water see CSA A23.1 appendix D Guidelines for curing and protection.
- C. Wet cure for 7 consecutive days at a minimum temperature of 10 degrees C. This requirement supersede CSA23.1 Table 20 Allowable curing regimes.
- D. Establish the requirements of specified finishes for concrete surfaces before applying curing compound. Verify that curing compound is compatible with applied finishes.
- E. Do not use curing compounds
- F. Formed Surfaces (Walls and Columns)
  1. Wet cure as specified by pouring water between the formwork and concrete surface where possible.
- G. Unformed Surfaces (Slabs)
  1. Cover with absorbent material kept continuously saturated as soon as cement will not wash out or finish be damaged.

#### 3.05 PROTECTION

- A. Keep traffic, which would affect or disturb the curing procedures, off the finished surfaces for a period of seven days.
- B. Protect exposed concrete finishes against damage until acceptance of the Work by the City. Do not allow rain, sleet, or snow to increase mixing water or damage surface finish.
- C. Protect floors which are to receive architectural finishes against contamination by oil, paint, or other deleterious materials which may affect finish.
- D. Protect items set into floors from damage. Verify that alignment is not disturbed.

#### 3.06 FIELD QUALITY CONTROL

- A. Measure floor flatness and levelness. Report deficiency. Propose method to remediate. Repair as required.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 9 of 9</b>
<b>REVISION 0</b>	<b>SECTION 03345 CONCRETE CURING AND FINISHING</b>	

- B. Flood the sloped floor surface with water to a depth necessary and allow the water to flow into drain(s). Observe all areas of ponding. Repair all depressed area exceeding the following:
1. For dry areas ponding depth greater then 3 mm.

3.07 SCHEDULE OF CONCRETE FINISHES

- A. Provide concrete finishes as scheduled:

<b>Area</b>	<b>Type of Finish</b>	<b>Notes</b>
<b>SLABS</b>		
Sidewalks	S-4	
Where shake on hardener is applied	S-7B	
Other exterior slabs	S-2	
<b>EXTERIOR WALL SURFACES</b>		
Above grade/exposed (above a point 150 mm below finish grade)	W-2	
Backfilled (below a point 150 mm below finish grade)	W-1/ W-3A	
<b>INTERIOR WALL SURFACES</b>		
In dry areas including walls, soffits, pipe supports, and equipment bases	W-2	

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03400 PRECAST CONCRETE</b>	

**PART 1. GENERAL**

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. CAN3-A23.4, Precast Concrete – Materials and Construction.
  2. CSA-A251 M, Qualification Code for Manufacturers of Architectural and Structural Precast Concrete.
  3. CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  4. ASTM International (ASTM):
    - a. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.

1.02 SYSTEM DESCRIPTIONS

- A. Interlocking Precast Concrete Blocks
1. Supply all materials and install the smooth-faced interlocking concrete block type retaining wall as shown on the Contract Drawings for the following:
    - a. ASP Bunkers Retaining Walls.
    - b. Biofilter Retaining Walls
    - c. Mixed Feed Bunker Retaining Walls
    - d. Mixing and Receiving Building Interior Dividing Wall
  2. The retaining wall shall be constructed with precast monolithic concrete blocks in accordance with the dimensions, lines and grades shown on the Drawings or the Manufacturer’s recommended guidelines.
- B. Traffic Barriers
1. Supply all material and install precast traffic barriers to delineate and/or protect the following:
    - a. Biosolids Composting Pad west access allowance.
    - b. Phase 1 L&YW Composting Pad west access allowance.
    - c. Phase 1 L&YW Composting Pad east access allowance.
    - d. Electrical Transformer protection east of M&R building.
    - e. Leachate tank.

1.03 SUBMITTALS

- A. Informational Submittals:
1. Shop Drawings
    - a. Manufacturer’s materials specifications, installation instructions, and general recommendations.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03400 PRECAST CONCRETE</b>	

- b. Manufacturer's drawings (plans, cross-sections, elevations, typical sections, details, and connections).

#### 1.04 QUALITY ASSURANCE

##### A. Qualifications of Precasting Manufacturers:

1. Precast Concrete and Precast Prestressed Concrete: Product of manufacturer with 3 years' experience producing precast concrete products of quality specified.
2. Precast Plant: PCI certified plant with current certification.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. At the time of delivery, the Contractor shall inspect and confirm proper type and grade of materials. All product specifications shall be reviewed to assure that all specified materials have been delivered.
- B. The Contractor shall store and handle all materials in accordance with manufacturer's recommendations. The Contractor shall avoid excessive mud, wet concrete, epoxy, or other deleterious materials from coming in contact with and affixing to materials.
- C. The Contractor shall discard all damaged materials and not use them in wall construction.

## **PART 2. PRODUCTS**

#### 2.01 MATERIALS

##### A. Interlocking Precast Concrete Block Wall

1. The retaining wall shall be constructed with precast monolithic concrete blocks in accordance with the dimensions, lines and grades shown on the Drawings or the Manufacturer's recommended guidelines.
2. Blocks shall be 762mm x 762mm x 1524mm long (+/- 6mm), chamfered on all sides, provided with shear keys, 12 mm clearance around each key, with steel lifting loops. Exposed faces shall have a smooth finish conforming to CSA CAN3-A23.4-M78 Section 24.2.4 Grade A.
3. Consistency of finish shall be maintained with the use of the same concrete mix and the same type of form oil for the entire project. Non-exposed surfaces shall be of uniform surface finish, roughly screeded with no open pockets or distortions in excess of 12mm.
4. The top course of blocks shall be bench style lock block with recessed lifting loops or inserts, and must be supplied with a flat top surface, i.e. no shear keys.

##### B. Precast Concrete Traffic Barrier

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03400 PRECAST CONCRETE</b>	

1. “New Jersey” Style Median Barrier to be precast manufacturer’s standard product.
2. Barriers shall be 860 mm high x 660 mm wide x 3000 mm long (+/-60 mm).
3. Two lifting holes; one at each end for lifting.
4. Conforming to CSA A23.4.00.

2.02 CONCRETE MIX

- A. Per Section 03300, Cast-in-Place Concrete - Type A.

2.03 REINFORCEMENT

- A. Per Section 03210, Reinforcing Steel

2.04 SOURCE QUALITY CONTROL

- A. Prepare minimum three standard concrete test cylinders for each 35 m<sup>3</sup> or fraction thereof of concrete placed in the precast work in accordance with ASTM C31.
- B. Test and record concrete strengths.

**PART 3. EXECUTION**

3.01 ERECTION

- A. Handle and erect precast concrete units with care as recommended by manufacturer.
- B. Erect precast units plumb, straight, level, square, and in proper alignment.
- C. Fasten units securely in place and brace to maintain position, stability, and alignment until permanently connected and structure is complete and stable.
- D. Field Cutting: Not allowed.
- E. After installation, clean soiled precast concrete surfaces with detergent and water, using fiber brush and sponge.
- F. Use extreme care to prevent damage to precast concrete surfaces and to adjacent materials.
- G. Rinse thoroughly with clean water immediately after using cleaner.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 4</b>
<b>REVISION 0</b>	<b>SECTION 03400 PRECAST CONCRETE</b>	

3.02 FIELD QUALITY CONTROL

A. Inspection:

1. With Contract Administrator, inspect precast concrete for chips, cracks, discoloration, and other damage.
2. Record location and condition of damaged or nonmatching units.

B. Resolution:

1. Repair damage to satisfaction of Contract Administrator and City.
2. Remove units with damage or repairs not acceptable to Contract Administrator.
3. Install new acceptable units in place of those removed.
4. Perform reinspection and obtain acceptance by Contract Administrator.

3.03 PROTECTION

- A. Protect precast units from chipping, spalling, cracking, or other damage to the units after delivery to Site.
- B. After erection, protect units from damage.

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 5</b>
<b>REVISION 0</b>	<b>SECTION 03600 GROUT AND MISCELLANEOUS CONCRETE WORK</b>	

## **PART 1. GENERAL**

### 1.01 SUMMARY

- A. This Section forms part of Section 03300, Cast-in-Place Concrete.
- B. Section Includes
  - 1. Grouting including:
    - a. Filling tie holes.
    - b. Filling openings and blockouts.
    - c. Grouting under base plates for equipment and fittings, pre-engineered framed fabric structure, and structural steel.
    - d. Through bolt openings.
    - e. Machine bases 26 hp and up.
    - f. Refinishing.
  - 2. Product Installed But Not Supplied Under the Work of This Section
    - a. Reinforcing bar for grouted - in bar.

### 1.02 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
  - 1. American Concrete Institute (ACI):
    - a. 351.1R, Grouting between Foundations and Bases for Support of Equipment and Machinery.
  - 2. American Society for Testing and Materials International (ASTM):
    - a. C230/C230M, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
    - b. C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
    - c. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

### 1.03 SUBMITTALS

- A. Shop Drawings:
  - 1. Product data of grouts including installation, application, and maintenance instructions.
  - 2. Proposed method for keeping existing concrete surfaces wet prior to placing hydraulic cement grout.
  - 3. Forming method for fluid grout placements.
  - 4. Curing method for grout.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 5</b>
<b>REVISION 0</b>	<b>SECTION 03600 GROUT AND MISCELLANEOUS CONCRETE WORK</b>	

B. Quality Control Submittals:

1. Manufacturer's printed Instructions:
  - a. Water/Cementing material ratio of grout.
  - b. Mixing of grout.
2. Manufacturer's Certificate of Compliance:
  - a. Grout free from chlorides and other corrosion-causing chemicals.
  - b. Nonshrink hydraulic cement grout properties of Types II and III, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
3. Test Reports for Nonshrink Hydraulic Cement Grout:
  - a. Field test reports and laboratory test results for field-drawn samples.

1.04 GUARANTEE

- A. Manufacturer's guarantee containing disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished will not be accepted.

**PART 2. PRODUCTS**

2.01 NONSHRINK HYDRAULIC CEMENT GROUT SCHEDULE

- A. Furnish nonshrink hydraulic cement grout of type specified for applications in the following schedule:

Application	Temperature Range	Maximum Placing Time	
		20 minutes	Greater than 20 minutes
Filling tie holes	I	I	I
Column base plates single-storey	I or II		II
Machine bases 25 hp or less	II	II	II
Through-bolt openings	II	II	II
Machine bases 26 hp and up	III	III	III
Baseplates and/or soleplates with vibration, thermal movement, etc.	III	III	III

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 5</b>
<b>REVISION 0</b>	<b>SECTION 03600 GROUT AND MISCELLANEOUS CONCRETE WORK</b>	

## 2.02 NONSHRINK HYDRAULIC CEMENT GROUT

### A. Type I:

1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107:
  - a. Flowable consistency 140 percent, five drops in 30 seconds, in accordance with ASTM C230.
  - b. Flowable for 15 minutes.
4. No bleeding of grout at maximum allowed water.
5. Minimum strength of flowable grout,
  - a. 20 MPa at 3 days,
  - b. 35 MPa at 7 days,
  - c. 48 MPa at 28 days.
6. Manufacturers and Products:
  - a. BASF Building Systems Inc.; Construction Grout.

### B. Type II:

1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. No segregation or settlement of aggregate at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C939 and ASTM C1107, Grade B:
  - a. Fluid consistency 20 to 30 seconds using flow cone method.
  - b. Temperatures of 5, 27, and 38 degrees C.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout,
  - a. 25 MPa at 1 day
  - b. 30 MPa at 3 days
  - c. 52 MPa at 28 days.
7. Maintain fluid consistency when mixed in 1 to 7 m<sup>3</sup> loads in ready-mix truck.
8. Manufacturers and Products:
  - a. BASF Building Systems Inc.; Master Flow 928.
  - b. Euclid Chemical Co.; Hi Flow Grout.
  - c. Dayton Superior Corp.; Sure Grip High Performance Grout.

### C. Type III:

1. Metallic and nongas-liberating.
2. Prepackaged aggregate grout requiring only the addition of water.
3. No segregation or settlement of aggregate at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C939 and ASTM C1107, Grade A:

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 5</b>
<b>REVISION 0</b>	<b>SECTION 03600 GROUT AND MISCELLANEOUS CONCRETE WORK</b>	

- a. Fluid consistency 20 to 30 seconds using flow cone method.
- b. Temperatures of 5 and 38 degrees C.
- 5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
- 6. Minimum strength of fluid grout,
  - a. 28 MPa at 1 day
  - b. 35 MPa at 3 days
  - c. 62 MPa at 28 days.
- 7. Maintain fluid consistency when mixed in 1 to 7 m<sup>3</sup> loads in ready-mix truck.
- 8. Manufacturer and Product:
  - a. BASF Building Systems Inc.; Embecco 885.

D. Nonshrink Epoxy Grout:

- 1. Minimum strength of grout: 62 MPa at 1 day.
- 2. Manufacturers and Products:
  - a. Euclid Chemical Co.; E3-HP.
  - b. Dayton Superior Corp.; Sure-Grip Epoxy Grout (J-55).
  - c. BASF Building Systems Inc.; Masterflow 648 CP.

2.03 DOWELLING GROUT

A. Hydraulic Cement Grout:

- 1. Set 45 by BASF Building Systems Inc.
- 2. Epoxy grout:
  - a. Flo-Rok FR5Max Injection Anchoring System by Ucan Fastening Products.
  - b. Sikadur Injection Gel by Sika Canada Inc.

**PART 3. EXECUTION**

3.01 NONSHRINK GROUT

- A. General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative's printed training instructions.
- B. Form Tie or Through-Bolt Holes: Provide nonshrink hydraulic cement grout, Type I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes coordinate dry pack dense grout application with vinyl plug.
- C. Grouting Machinery Foundations:
  - 1. Use nonshrink hydraulic cement grout except where equipment supplier specifically recommends nonshrink epoxy grout.
  - 2. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by abrasive blasting,

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 5 of 5</b>
<b>REVISION 0</b>	<b>SECTION 03600 GROUT AND MISCELLANEOUS CONCRETE WORK</b>	

- chipping, or by mechanical means to remove any soft deleterious material.
3. For nonshrink hydraulic cement grout, thoroughly clean concrete surface and metal surfaces to be in contact with grout to remove all paint, oil, grease, loose rust, and all other foreign matter.
  4. For nonshrink epoxy grout, thoroughly clean concrete surface and abrasive blast metal surfaces to be in contact with grout unless grout manufacturer states in writing that abrasive blasting is not necessary.
  5. Set machinery in position and wedge to elevation with steel wedges or use cast-in leveling bolts.
  6. Form with watertight forms at least 50 mm higher than bottom of plate.
  7. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions.

### 3.02 GROUTED-IN DOWEL

- A. Using a Hydraulic Cement Based Dowelling Grout:
  1. Drill hole in existing concrete of diameter equal to diameter of dowel bar plus 20 mm.
  2. Clean hole of dust and debris.
  3. Fill hole to surface with dowelling grout.
  4. Install dowel bar and wipe away overflow.
  5. Secure dowel bar firmly in position and do not disturb bar for minimum of 24 hours after installation.
- B. Using an Epoxy Type Dowelling Grout:
  1. Drill hole and install dowel in accordance with manufacturer's printed instructions.

### 3.03 SCHEDULE OF MISCELLANEOUS CONCRETE WORK

- A. Filling Openings and Box-outs:
  1. Fill openings and box-outs in walls with concrete made with non shrink non-ferrous pre-blended hydraulic cement grout, placed under pressure.
  2. Inject epoxy grout at the interfaces if required to make concrete watertight.

**END OF SECTION**

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 1 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

**PART 1. GENERAL**

1.01 SCOPE OF SERVICES

- A. Repair temperature or shrinkage induced cracks as stated in Section 03300, Cast-in-Place Concrete.

1.02 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
  - 1. American Society for Testing and Materials (ASTM):
    - a. D570, Standard Test Method for Water Absorption of Plastics.
    - b. D638, Standard Test Method for Tensile Properties of Plastics.
    - c. D648, Standard Test Method for Deflection of Plastics Under Flexural Load.
    - d. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
    - e. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 DEFINITIONS

- A. Crack: Complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing.
- B. Crack Injection: Method of sealing or repairing cracks by injecting a polymer.
- C. Large Cracks: Wider than 0.4 mm.
- D. Small Cracks: Width equal to 0.4 mm or less.

1.04 SUBMITTALS

- A. Shop Drawings:
  - 1. Physical and chemical properties for polyurethane resins.
  - 2. Technical data for metering, mixing, and injection equipment.
- B. Quality Control Submittals:
  - 1. Manufacturer's recommended surface preparation procedures and application instructions for polyurethane resins.
  - 2. Installation instructions for repairing core holes with epoxy grout.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 2 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

3. Statements of Qualification for polyurethane resins:
  - a. Injection applicator.
  - b. Injection pump operating technician.
4. Sample bottle.

#### 1.05 QUALITY ASSURANCE

##### A. Qualifications for Injection Staff:

1. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
  - a. Licensed and certified by polyurethane manufacturer.
  - b. Minimum 3 years experience in successful polyurethane injection for at least 3,000 linear metres of successful crack injection including 610 linear metres of wet crack injection to stop water leakage.

#### 1.06 PERFORMANCE REQUIREMENTS

- A. The injected polyurethane injection resins shall fill the cracks, and in no case shall the depth of penetration of the injection material be less than ninety percent (90 percent) of:
  1. The full thickness of the concrete section for cracks; and
  2. The depth between the waterstop and the inside face of the structure for joints.
- B. The cured injected polyurethane injection resin shall form a dense rubber-like flexible foam compression gasket-type seal.
- C. Notwithstanding the foregoing, injected cracks or joints found to exhibit leakage shall be deemed as deficient Work irrespective of the depth of penetration observed in quality control core drilled samples. Carry out re-injection of deficient Work as required to meet the performance requirements at no cost to the City.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Package polyurethane resins material in new sealed containers and label with following information:
  1. Manufacturer's name.
  2. Product name and lot number.
  3. ANSI Hazard Classification (formerly SPI Classification).
  4. ANSI recommended precautions for handling.
  5. Mix ratio by volume instructions.
- B. Storage and Protection: Store polyurethane resins materials containers in accordance with manufacturer's printed instructions or in the absence of such information at ambient temperatures above 20 degrees C and below 49 degrees C.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 3 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

## **PART 2. PRODUCTS**

### 2.01 MANUFACTURERS

- A. Polyurethane Resin Manufacturers:
1. Specton Construction Products Ltd., Acton, ON.
  2. DeNeef Construction Chemicals (U.S.) Inc.
  3. Multiurethanes Limited, Mississauga, ON.

### 2.02 POLYURETHANE RESIN

- A. Single-component Diphenylmethane Diisocyanate (MDI) based, water-activated, hydrophobic type resin.
- B. In cured state forms a dense rubber-like closed cell flexible foam compression gasket seal.

### 2.03 SURFACE SEAL

- A. Sufficient strength and adhesion for holding injection fittings firmly in-place, to resist pressures preventing leakage during injection.
- B. Capable of removal after injection adhesive has cured.

### 2.04 SAMPLE BOTTLE

- A. 125 millilitre natural wide mouth HDPE bottle or 4 ounce clear PVC cylinder bottle supplied with caps.
- B. For polyurethane resin, supply each sample bottle containing a volume of water equal to 5 percent of the volume of the bottle.

### 2.05 SOURCE QUALITY CONTROL

- A. Test Requirements: Perform tests for each batch of polyurethane resins.

## **PART 3. EXECUTION**

### 3.01 GENERAL

- A. Structurally repair cracks in structures as specified in Section 03300, Cast-in-Place Concrete.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 4 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

- B. Cracks:
  - 1. Repair by injection of polyurethane resins.
  - 2. Repair cracks specified or as shown.
- C. The width of the cracks shown may vary along the length and through the thickness of the concrete section.
- D. Remove all excess unused polyurethane resins materials inside the structure prior to the end of the Work.

### 3.02 PREPARATION

- A. Free cracks from loose matter, dirt, laitance, oil, grease, salt, and other contaminants.
- B. Clean cracks in accordance with polyurethane resins manufacturer's printed instructions.
- C. Clean surfaces adjacent to cracks from dirt, dust, grease, oil, efflorescence, encrustation, and other foreign matter detrimental to bond of surface seal system in accordance with manufacturer's printed instructions.
- D. Do not use acids and corrosives for cleaning, other than those specified herein unless neutralized prior to injecting.

### 3.03 APPLICATION

- A. Drilling Holes for Injection:
  - 1. Drill holes shall be installed along cracks designated for repair as required to meet the performance requirements for injection.
  - 2. The requirements for installing drill holes for injection provided below represent acceptable minimum standards of practice.
  - 3. Drill holes for injection at an angle between forty-five (45) degrees and thirty (30) degrees from perpendicular to the surface of the concrete and perpendicular to the alignment of the cracks, to intersect the cracks at the midpoint of the concrete section, except as noted otherwise.
  - 4. Locate the drill holes on alternate sides of the crack where possible, unless the orientation of the crack is known or has been verified by non-destructive testing techniques or core drilling.
  - 5. The spacing of the drill holes not to exceed 300 millimetres, except as noted otherwise.
  - 6. Adjust the location and angle of the drill holes to suit the orientation of the crack and at the required angle, such as using a template, during the Work especially at the commencement of drilling holes for injection and at the beginning of each subsequent shift.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 5 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

7. Take measures to prevent drilling the holes for injection too shallow, or too deep.
  8. Remove dust and debris in the drill holes and on the interior surface of the structure resulting from the drilling operation, by flushing with water prior to installing the injection packers or ports.
  9. Install injection packers or ports in the drill holes in accordance with the manufacturer's printed instructions with the zerk coupling, or other one-way ball or check valve, to permit testing for watertightness
- B. Application of Surface Seal along Cracks:
1. Apply a surface seal along the length of the designated cracks on the top side and underside of slabs, or both sides of walls, as required in order to contain and prevent escape of the polyurethane injection resins in accordance with manufacturer's printed instructions.
  2. Cure the surface seal in accordance with manufacturer's printed instructions.
- C. Mixing Polyurethane Injection Resin:
1. Add accelerator to the polyurethane injection resin at the required dosage to produce a cured polyurethane material meeting the performance requirements, and mix thoroughly in accordance with the manufacturer's printed instructions until a homogeneous mixture is obtained outside of the structure.
  2. Heat the polyurethane injection resin materials prior to and during the mixing and injection as required and in accordance with manufacturer's printed instructions to a temperature between 30 degrees C and 55 degrees C. Injection of polyurethane injection resin when it is less than 30 degrees C or more than 55 degrees C is prohibited.
- D. Injection of Cracks:
1. Inject the polyurethane injection resins with water, or in a neat form into cracks in a sequential manner, and re-inject as required, to meet the performance requirements.
  2. Start injection into each crack at lowest elevation entry port for vertical cracks and at one end for horizontal cracks in vertical structure. Continue injection at first port until resin begins to flow out of next port. Plug first port and start injection at second port until polyurethane resin flows from next port. Inject crack in a sequential manner until the full length of the crack has been injected. At no time inject more than 1800 mm length of vertical crack before verifying that the first 300 mm of injected crack is set and cured.
  3. Prior to commencing the injection Work along a crack in horizontal structure when processed with zerk couplings are used, remove the zerk couplings from the injection packers or ports except for the two packers located where the injection Work will commence. Commence injection Work in the first two packers. Once clean resin is vented from the third injection packer, cease

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 6 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

injection at the first packer, and install the zerk coupling and commence injection at the third packer. Repeat the process for the fourth and subsequent packers until the full length of the crack has been injected.

E. Finishing:

1. Cure polyurethane resins after crack have been completely filled to allow surface seal removal without draining or runback of polyurethane resin] material from crack.
2. Remove surface seal and injection packers or ports from along the crack.
3. Finish face flush with adjacent concrete.
4. Indentations or protrusions caused by placement of entry ports drill holes, or damage from removal of surface seal are not acceptable.
5. Grind off protrusions, and patch indentations and holes from packers and ports with a suitable patch material to the satisfaction of the Contract Administrator.
6. Remove surplus surface seal material on splatters and injection material runs and spills from concrete surfaces.

3.04 EQUIPMENT

- A. Portable, positive displacement type pumps with in-line metering to meter and mix two adhesive components, and inject mixture into crack.
- B. Polyurethane Injection Equipment:
  1. Positive displacement type pump.
  2. Equip the polyurethane injection equipment with pail heater(s) suitable for plastic pails capable of maintaining the polyurethane resin and accelerator mixture between 10 and 70 degrees C.
  3. A thermometer with each pump for monitoring the temperature of the polyurethane resin.
- C. Discharge Pressure: Automatic pressure controls capable of discharging injection material at pressures up to 1400 kPa, plus or minus 5 percent, and able to maintain pressure.

3.05 FIELD QUALITY CONTROL

- A. Injection Pressure Test:
  1. Disconnect mixing head of injection equipment and connect two adhesive component delivery lines to pressure check device.
  2. Pressure Check Device:
    - a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
    - b. Pressure gauge capable of sensing pressure buildup behind each valve.
  3. Close valves on pressure check device and operate equipment until gauge

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 7 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

pressure on each line reads 1100 kPa.

4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 1050 kPa within 3 minutes.
5. Run pressure test for each injection equipment unit:
  - a. Beginning and end of each injection Work day.
  - b. When injection Work as stop for more than 45 minutes.
6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

**B. Bottled Samples:**

1. During the injection operation, provide at least one (1) sample of the mixed polyurethane injection resins per shift per injection pump in a sample bottle.
2. For polyurethane injection, half fill each sample bottle, containing a small amount of water (5 percent by volume) with polyurethane injection resin material from the pump discharge hose. Swirl or lightly shake sample to thoroughly mix resin with the water. When foaming rises near the top of the bottle, install the cap to contain the expanding resin material.
3. Place the filled sample bottle upright in a box or pail and allow the sample to cure. After sample has been allowed to cure, cut the bottled sample open and visually inspect the contents to verify that the polyurethane injection resins material has completely reacted and cured.
4. Label each bottled sample with the Contractor's name, date and time sample was taken, and the location in the structure where the sample was taken. Record details of the bottle samples.
5. Should a bottled sample(s) indicate a problem with the polyurethane injection resins take verifying core sample immediately from the cracks, where the material was used.
6. Should the above-referenced bottle sample(s) and core sample(s) indicate a problem with the polyurethane injection resins arrange to have a Technical Representative of the polyurethane injection resins manufacturer come to Site to review the bottled sample(s) and core drilled sample(s) with the Contract Administrator and provide technical advise on corrective measures.
7. Carry out further investigation Work or corrective measures recommended by the Technical Representative of the polyurethane injection resins manufacturer.

**C. Crack Injection Tests:**

1. Initial Cores:
  - a. 100 mm diameter for full depth along cracks taken from Contract Administrator selected locations.
  - b. Label each core with core number, location, and date when core was obtained.
2. Provide suitable containers for storage, curing, and transportation of test specimens.

<b>Bid Opportunity 839-2012</b>	<b>BRRMF L&amp;YW AND PILOT BIOSOLIDS COMPOSTING</b>	<b>Page 8 of 8</b>
<b>REVISION 0</b>	<b>SECTION 03740 CONCRETE REPAIR CRACK INJECTION</b>	

3. Methods of Testing Cores:
  - a. Penetration: Visual examination.
4. Test Requirements:
  - a. Penetration: Meet performance requirements.
5. Evaluation and Acceptance of Tests:
  - a. If initial cores pass tests as specified, polyurethane resin injection Work at area represented by cores will be accepted.
  - b. If initial cores fail either by lack of penetration crack repair Work shall not proceed further until areas represented by cores are re-injected or repaired and retested for acceptance.
  - c. Obtain verifying core samples, number and location as selected by Contract Administrator, after rework of areas represented by failed initial cores is complete.
6. Core Hole Repair:
  - a. Correct Work as result of testing upon notification from Contract Administrator.
  - b. Refill initial and verifying core holes with an epoxy grout tamped and rodded in-place to form a dense fill for full depth of core hole.
  - c. Finish surface to blend and flush with adjacent concrete.

**END OF SECTION**