

PART 1 - GENERAL

ITEM CONCRETE SURFACING AND COMPONENTS - SKATEPARK (c/w all skatepark features including: metal riding rails, walls, transitions, banks, seating, steps, ramps, metal edging, coping, embeds, and specialized structures specified: fencing, shade structures, etc.).

1.1 Requirements Included:

The *Contractor* shall furnish all labour, materials, equipment to supply and install the concrete as detailed on *Contract Drawings*. Bid price shall include, supplying and placing of all concrete form work, concrete reinforcing metal, cast-in-place concrete, shotcrete and all related accessories.

1.2 Related Work:

.1 This section of the specification forms part of the contract documents and is to be read, interpreted and coordinated with all other parts.

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| .1 | Qualification and valid COR, B10.1 and B10.2 | |
| .2 | Geotechnical Report | |
| .3 | Excavation, Backfill, Compaction and Grading | Section 02223 |
| .4 | Concrete Formwork | Section 03100 |
| .5 | Concrete Reinforcement | Section 03200 |
| .6 | Pre-cast Architectural Concrete | Section 03400 |
| .7 | Mortar & Masonry Grout | Section 04060 |
| .8 | Miscellaneous Metal Work | Section 05500 |

1.3 Trial Mixes:

.1 Trial mixes including on-site trial pour of a concrete section (including finishing and curing methods) shall be conducted. If appropriate, the following properties shall be evaluated in the trial: workability, air content, finishability, setting time, temperature development, hardened air-void parameters, strength and durability.

1.4 Samples and Prototypes:

.1 Materials Samples: submit the following samples of materials for approval to the *Contract Administrator*. Approved samples shall be used as the acceptable standard for all materials used on the project.

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| .1 | Forming materials, including Board Form finish materials. |
| .2 | Gaskets, sealing materials, and form jointing system (as applicable). |
| .3 | Ties where specified. |

- .4 Form release agent.
 - .5 Expansion and isolation joints.
- 1.5 Sample Panels:
- .1 At least fourteen (14) days before beginning work, construct on-site sample of proposed Architectural Board Form finishes and slab-on-grade finishes, each sample being at least 500mm x 500mm. Construct additional samples as necessary until a sample is approved by the *Contract Administrator*.
 - .2 Samples shall be reviewed and approved by the *Contract Administrator* prior to commencing concrete work. Any concrete placed prior to sample approvals may be rejected. Construct additional samples when required by the *Contract Administrator* until acceptable finish is achieved.
 - .3 The samples SHALL NOT be part of the exposed Architectural concrete or finished slabs.
 - .4 All finishes shall be compared to the approved samples on site for compliance.
- 1.6 The test section must be produced by the same workers who will complete the work.
- 1.7 Obtain approval of the *Contract Administrator* for test sections. The approved test sections will become the standard.

PART 2 – MATERIALS

- 2.1 Materials:
- .1 Portland Cement: to CAN/CSA-A5, normal Type 10 and sulphate resistant type 50 for ground contact (as noted on Drawings).
 - .2 Blended hydraulic cement to: CSA3-A362.
 - .3 Supplementary cementing materials to CAN/CSA-A23.5.
 - .4 Cementitious hydraulic slag: to CAN/CSA-A363.
 - .5 Water: to CAN/CSA-A23.1.
 - .6 Aggregates to: CAN/CSA-A23.1. Coarse aggregates to be normal densit
 - .7 HardCem to manufacturer's specifications.
 - .8 Air entraining admixture to: CAN/CSA-A266.1.
 - .9 Use of admixtures to have prior approval of the Contract Administrator.
 - .10 Joint sealing: Horizontal joints – Masterfill 3001 Semi Rigid Epoxy; Vertical joints – 'Ultra' elastomeric flexible polyurethane.

- .11 Curing Compounds:
- .1 Curing compounds meet ASTM C309, Type 1, Class A, with VOC complying with US Federal Air Quality Regulation 40 CFR 52-254.
 - .2 Curing compound shall be applied at the rate recommended by the manufacturer to achieve ASTM C309 water retention limits.
 - .3 Note: Masterkure 200W by Master Builders complies with this.
- .12 Concrete Mixes:
- .1 The Mix Design Requirements in Table 1 are to be used in formulating concrete supplier mix proportions to meet these requirements.
 - .2 The resulting concrete suppliers detailed mix proportions to be submitted with Tender, to be approved by *Contract Administrator* prior to start of tests and supply.
 - .3 The mixes shown on the following page are recommendations for concrete and shotcrete mix design requirements for construction of this skateboard park. These recommendations take into account the EcoSmart objective to use high volumes of fly ash while maintaining or improving the cost, performance and constructability of the resulting concrete mixtures.
 - .4 This submittal is suitable for tendering for concrete supply in accordance with CAN/CSA A23.1-00, Alternative 1, i.e, when the Contractor requires the concrete supplier to assume responsibility for the concrete mix proportions. Under Alternative 1 supply, the concrete supplier is not obligated to divulge the concrete (or shotcrete) mixture proportions. However, given the special nature of this project (including the recommended use of Hard-Cem), the concrete supplier is required to submit the proposed mixture proportions to the *Contract Administrator* for review and acceptance to spec, prior to supply. The mixture proportions will not be divulged to other parties without written approval of the concrete supplier.

Table 1: Concrete and Shotcrete Mix Design Requirements

Concrete Type	1		2		3	
	Foundations, Walls, Footings		Slabs, Decks, Stairs		Shotcrete	
Temperature	Warm	Cold ***	Warm	Cold ***	Warm	Cold ***
Typical Placing Method	Pump/Tailgate	Pump/Tailgate	Pump	Pump	Shotcrete	Shotcrete
CSA Exposure Class	F-2	F-2	C-1	C-1	C-1	C-1
Min 56 Day Compressive Strength, MPa	25	25	35	35	40	40
Mix W/CM Ratio	0.55	0.55	0.40	0.40	0.40	0.40
Max Aggregate Size, mm	20	20	20	20	10	10
Min CM Content * kg/m ³	N/A	N/A	380	380	450	450
Fly Ash (Type F or C1) % by Mass of CM	40	35	30	25	25	20
Silica Fume Content % by Mass of CM	0	0	0	0	8	8
Synthetic Microfibre kg/m ³	0	0	1.0	1.0	1.0	1.0
Hard-Cem Content, kg/m ³	0	0	0	0	0	0
AIR CONTENT, % **	1-4	1-4	5-8	5-8	7-10	7-10
Slump, mm	80±20	80±20	80±20	80±20	70±20	70±20

* CM=Cementing Materials (Cement, Fly Ash, Silica Fume)

** Air content at point of discharge for concrete. For shotcrete *as-shot* air content in 3.5 to 5% range

*** Cold is defined as: when ambient temperature at time of pour or shotcreting and expected within 7 days to fall below 10°C.
 Contractor is then to take cold weather precautions specified in CSA A23.1 and ACI 506R-90.

Concrete and shotcrete mix design requirements by:

AMEC Earth & Environmental Limited, D.R. Morgan, Ph.D., P. Eng., Chief Materials Engineer

- .13 Aggregate:
- .1 Aggregate for concrete and shotcrete shall meet the requirements of CSA A23.1-00.
 - .2 The combined aggregate gradations limits for shotcrete shall conform to the gradation limits shown in Table 1.

**Table 2 – Combined Gradation Limits
 For Shotcrete Aggregate**

<u>Metric Sieve Size</u>	<u>Total Passing Each Sieve Size, % by Mass</u>
14mm	100
10mm	90-100
5mm	70-85
2.5mm	50-70
1.25mm	35-55
630µm	20-35
315µm	8-20
160µm	2-10
80µm	0-3

- .14 Reinforcing Steel:
- .1 In accordance with Structural Drawing Notes and Section 03200. Refer to Details for various areas. Reinforcing steel shall be of type and grade stated on drawings or specified. Unless otherwise noted or specified, all bars shall be deformed and in accordance with CSA Standard G30-12, Grade 400, and all welded steel wire fabric shall be in accordance with CSA Standard G30.5. All reinforcing steel shall bear identifying marks of specification to which it has been rolled and all bars which are not so marked shall not be used in structure. All reinforcing steel shall be a bendable, weldable grade.
 - 2 Welding of reinforcing is not permitted without written approval by the *Contract Administrator*.
 - .3 Welded wire mesh (102mm x 102mm MW 25.8 x MW 25.8, 5.74mm dia.) shall be resistant to corrosion and conform to CSA G30.5. (Multiple layers may be used to give area equivalent to above).
 - .4 Clear cover for reinforcement:
 - Cast against soil.....75mm
 - Exposed to soil or weather 15m and smaller.....40mm
 - .5 All dowels and anchor bolts shall be placed BEFORE the concrete is poured.

- .6 Unless noted otherwise, reinforced walls as follows:
- Vertical: -10m @ 600 (24") on centre.
 - Horizontal: -10m @ 450 on centre.
 - Additional: -10m Corner Reinforcing where indicated.
 - Dowels: - 20m (smooth or deformed) for control construction joints and tie-in to existing concrete, if called for.

- .7 Unless noted otherwise, all reinforcing shall be spliced with minimum length as follows:

<u>BAR SIZE</u>	<u>CONCRETE STRENGTH</u>		
	<u>25 MPA</u>	<u>28 MPA</u>	<u>30 MPA</u>
10m	450	450	450

- .8 Splices and anchorages in reinforcing:

<u>BAR SIZE</u>	<u>SPLICE</u>	<u>ANCHORAGE</u>
10m	450	300
15m	630	762 as indicated (otherwise 370mm)
Wire Reinf.	200	200

2.2 Testing:

- .1 The City may retain an independent material testing firm to carry out the following test:
- 1) Poured Concrete: test: slump, air content and compressive strength and evaluate the properties identified in 1.3 for trial mixes.
 - 2) Shotcrete: test: compressive strength, air content, boiled absorption and vol.of permeable voids to ASTM C642.
 - 3) Such other testing as may be requested by the Designated Inspecting Authority. The materials testing firm may be requested to submit one set of test results directly to the Contractor.
- .2 The cost of initial testing shall be paid by the City, additional re-testing shall be paid by the Contractor.
- .3 The Contractor shall maintain records of concrete items: date, location of pour/application, quality (rated strengths of shipments and any additives such as retarders), air temperature, and any tests taken.

PART 3 – EXECUTION

3.1 General:

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1-00.

3.2 Workmanship:

- .1 Obtain *Contract Administrator's* approval before placing concrete. Provide 24 hours notice, minimum, prior to placing concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix design.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain *Contract Administrator's* approval of proposed method for protection of existing concrete during placing and curing new concrete areas.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or plains of weakness. If a section cannot be placed continuously, construction joints shall be located as permitted by the *Contract Administrator*. All pour and construction joints shall be formed with a straight-edge fixed to formwork or other methods submitted by Contractor and approved by *Contract Administrator*. Placing shall be carried out at such a rate that concrete which is being integrated with fresh concrete is still plastic.
- .7 Compact concrete with high-frequency vibrators applied directly to concrete by experienced personnel. Do no over-vibrate. Rap outside of forms with a hammer to ensure joints and exposed areas are well cast.
- .8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Attach steel dowels of deformed steel reinforcing bars with epoxy adhesive to the depths shown on the drawings or specified by the manufacturer.
- .9 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period shall be especially protected. Any chipped, abraded or cracked edges, slabs shall be repaired by Contractor at no cost to City.
- .10 Do not place load upon new concrete until authorized by *Contract Administrator*.
- .11 Place slabs-on-grade in alternate panels, complete with maximum size of 16m². Where specified on drawings, joints shall be either keyway type or dowelled joints which will have 20m epoxy coated smooth bars x 600mm long at 400mm o.c. max. Infill panels to be placed a minimum of seven (7) days after placing adjacent panels. Seal joints where specified.
- .12 Unless otherwise specified by the Contractor's curing plan approved by *Contract Administrator*, wet cure all concrete slabs for a minimum of seven (7) days using wet burlap covered with polyethylene sheets. Wet the burlap at regular intervals.

3.3 Inserts:

- .1 NO sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where expressly detailed on structural drawings or approved by the *Contract Administrator*.
- .2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the *Contract Administrator* before placing of concrete.

3.4 Placing Grout:

- .1 Grout underside of steel column and beam bearing plates (usually in pockets below slab) with non-shrinking grout to manufacturer's instructions. Place grout to cover steel shims left in place.

3.5 Tolerances:

- .1 Concrete tolerances to be in accordance with CAN/CSA-A23.1-00, or as noted in Sub-section 3.1.5 of Section 03100, Concrete Formwork.

3.6 Grade Preparation:

- .1 Inspect sub-grade for adequate and uniform compaction. Remove any debris. Assure positive drainage. Check for 'soft' spots with probe rod.
- .2 Excavate soft spots to sound material and fill with suitable granular material to prepare a smooth and even sub-grade allowing for specified depths of granular base and concrete to meet design grades.
- .3 Compact to requirements called for on the drawings.
- .4 Place fill, to requirements of the drawings. Compact to sub-grade requirement allowing for specified structural fill material.
- .5 Dispose of surplus and unsuitable excavated material in an approved location.
- .6 Provide containment and drainage for curing water, ensuring water does not fall on adjacent roadways or shoulders or impede traffic movement in any way.

3.7 Granular Base:

- .1 Obtain *Contract Administrator's* approval of sub-grade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Place granular base to achieve minimum 150 mm thickness to within 50mm of lines. Then grade the final 50mm with finer mulch suitable for wet compacting; compact layers to minimum 95% Proctor requirements.

3.8 Preparation:

- .1 Prior to placing of any concrete, the work shall be cleared, cleaned or otherwise prepared in accordance with the design drawings, details and specifications in order that the work may proceed in an orderly fashion in accordance with the intended schedule of development. All existing services, structures, already completed works, etc., shall be protected and preserved as necessary.

3.9 Form Construction and Steel Reinforcing:

- .1 Forms shall be so constructed that the finished concrete will conform with the shapes, lines, grades and dimensions indicated on the plan.
- .2 Use Form Ply, paper finish plywood for exposed concrete surfaces as designated on the drawings.
- .3 Form walls using plastic cone ties for sandblasted concrete walls. Arrange all ties in symmetrical, aligned vertical and horizontal rows. They shall be so arranged that when the forms are removed, no ties shall be within 25mm of any exposed surface. Wire ties will not be permitted; they shall not be used through surfaces where discolouration will be objectionable. All wall reinforcing shall be continuous at corners and intersections. Use corner bars or hooks.
- .4 Plug, tape and seal all cracks and holes in forms to withstand pressure and remain watertight.
- .5 Design forms to permit removal without damage to finish.
- .6 Clean and condition formwork before each use. Repair or replace any damaged form that may effect the concrete finish.
- .7 After removal of plastic cone ties, snap tie or similar exposed metal ends with rust inhibitive coating. Insert recessed cement plugs to uniform depth, taking care not to damage surrounding edge of concrete.
- .8 Lumber used in forms shall be free from warp. For any exposed surfaces, it shall be dressed to a uniform width and thickness and be free from loose knots, decay or other defects. For unexposed surfaces and rough work, undressed lumber may be used if means be taken to prevent leakage of mortar.
- .9 Unless otherwise specified, suitable molding or bevels shall be placed at the angles or forms to round or bevel the edges and re-entrant angles on the concrete as shown on details.
- .10 The inside of forms shall be coated with non-straining mineral oil or other approved liquid or thoroughly wetted, (except in freezing weather). Where oil is used, it shall be applied before the reinforcement is placed.

- .11 Care shall be taken to ensure that forms do not become dried and warped before concrete is deposited. Before concrete is placed, forms and reinforcement shall be checked and approved by the *Contract Administrator's* site representative.
 - .12 Forms shall not be disturbed until the concrete has adequately hardened. Forms are to be removed in a regular sequence of elapsed time between pour and removal so as to maintain colour consistency. The proper time for removal of forms shall be determined by the *Contract Administrator*.
 - .13 Whenever forms are removed from showing faces before the concrete has become hard and dry, the surface of the concrete shall be immediately wetted and kept wet for at least 7 days. Defects in showing faces shall be rectified to the satisfaction of the *Contract Administrator*.
 - .14 All edges shall be chamfered as shown on drawings, minimum 19mm @ 1.1.
- 3.10 Formwork: (See Section 03100)
- .1 Do formwork to Workers' Compensation Board of Manitoba regulations governing Concrete Formwork and Falsework as follows:
 - .1 Form materials for concrete surfaces which will be exposed to view, or which require smooth and uniform surfaces for applied finishes or other purposes, shall consist of square edged smooth panels of paper finish plywood. Panels shall be made in a true plane, clean, free of holes, surface markings, and defects.
 - .2 Form release agents and curing agents shall be compatible with applied finishes where applicable. Do not use release agents containing wax or oil in connection with concrete to receive applied coatings.
 - .3 Ties in exposed work shall generally be placed symmetrically about any section with plywood sheets and from each wall section.
 - .4 Grout all holes.
 - .2 Set to proper grade and alignment. Assure positive drainage.
 - .3 Construct straight and warp free with no bulging when concrete placed. Fit tightly at joints and corners.
 - .4 ~~Falsework for full pipe shall conform to CSA S269.1 "Falsework for Construction Purposes" and WCB regulations for safety.~~ Not applicable to this project.
- 3.11 Reinforcement
- .1 Refer to Structural designations on Drawings and Specifications and comply with requirements.
 - .2 Obtain *Contract Administrator's* approval of all reinforcing prior to any placement of concrete.

3.12 Installation:

- .1 Refer to Contract Drawings, Skateboard Park Structural Details. Do all concrete work to requirements of Structural Details and Notes on Drawing.
- .2 Refer to Structural Drawings and Details for dimensions, thickness of slabs, reinforcement and form. Plan temporary and permanent drainage before slabs are placed.
- .3 Make individual footings to dimensions shown on drawings.

3.13 Formed Surfaces:

- .1 Inspect formed surfaces for defects immediately after removal of formwork.
- .2 Remove or cut back to a depth of 19mm from the surface of the concrete all bolts, ties, nails or other metal that is not required and repair immediately.
- .3 Patch all sleeve holes flush with concrete surface in strict accordance with manufacturer's printed instructions. Do not patch or grout snap tie or cone holes.
- .4 Grout all steel inserts in strict conformance with grout manufacturer's printed instructions.
- .5 Remove imperfections such as bulges, fins, lips and stains to permanently exposed surfaces as directed by *Contract Administrator* by chipping or grinding and patch to match adjacent surfaces. Do not proceed with grinding until the concrete has sufficiently hardened to prevent dislodgement of coarse aggregate particles.
- .6 Curved and flat shapes to be screeded using accurately cut screed boards and templates in accordance with drawing sections. Reinforce screeds and templates and keep of manageable size to avoid distortion.

3.14 Patching:

- .1 Areas to be repaired shall be determined by the *Contract Administrator* and shall not exceed 0.2 square metres for each 93 square metres of surface area, and shall be widely dispersed. Repairs shall match the surrounding area. Architectural concrete requiring repair in excess of above standard is subject to rejection by the *Contract Administrator* and shall be removed and replaced. Removal and replacement of work shall be at no additional cost to the City.
- .2 Before commencing any repair work, the Contractor shall confirm repair procedures with the *Contract Administrator* and establish by trial mix the formula required. The Contractor shall demonstrate his repair techniques on a prototype sample panel.
- .3 The following are key steps to making a repair to architectural concrete:

- .1 Prepare the area to be repaired. This should include achieving the desired finish in the surrounding area. Remove loose particles and chip out part of the sound concrete to avoid feather edge repairs.
 - .2 Proportion the repair mix by weight according to the same proportions as used in the concrete mix but substituting a portion of white cement for grey cement. This should be based on tests to determine what is required to match the finished surface.
 - .3 Apply a coat of bonding material to the root of the areas to be repaired, being careful to avoid dripping on any surface to be exposed.
 - .4 Fill in the area to be repaired with mortar of the stiffest consistency that will permit placing. Consolidate in place and strike off so as to leave the repaired area slightly higher than the surrounding surface to permit initial shrinkage. The repair shall be left undisturbed for at least one hour before being textured.
 - .5 Cure the repaired area by keeping continuously damp for 7 days.
 - .6 Clean the repaired area to remove laitance and match the surrounding area.
- .4 Repair of cracks in concrete slabs and slabs-on-grade shall be the sole responsibility of the Contractor at no expense to the City to satisfy the requirements of the intended final use. Cracks in the skateboard bowl slabs shall be routed out and epoxy filled. Grind smooth. Grind smooth cured slab edges at control joints and cracks as required to produce smooth transition.
- 3.15 Tolerances:
- .1 Finish surfaces to within 3mm in 3m as measured with straight edge placed anywhere on the surface. Slope to drain away wherever adjacent to building. Local depressions greater than 1mm under straight edge are not permitted.
 - .2 Match surrounding grades smoothly and evenly.
- 3.16 Control Joints:
- .1 Locate and install control joints where shown on the drawings.
 - .2 Except where shown otherwise, provide saw cut control joints in slab on grade in accordance with CSA/CAN.3-A23.1-00 and in locations shown.
 - .3 Saw cuts shall be completed when concrete has hardened sufficiently that cutting can be performed without damaging the slabs.
 - .4 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins or permanent structure.

- .5 Avoid re-entrant corners into flat slab areas. Curve such corners, provide extra reinforcement and place control joint or saw joint to such corners.
- .6 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.17 Skateboard Park Concrete

- .1 Typically the skateboard park concrete is placed in individual panels and segments to suit designed, compound surfaces. These are placed in 'leap-frog' fashion, allowing maximum amount of shrinkage to take place before placing intermediate panels.
- .2 The construction joint between panels, segments and flat slabs is to be key way type joint (no dowels), unless called for on drawings. Use styrene or wood block outs. Use form release on all edges prior to pour.
- .3 Drainage slopes must be planned with care from slab section edges to drain path shown on drawings or direct to drain. Ensure that drains are not plugged from surface material from unpoured sections.
- .4 When placing, ensure good vibration and rapping with hammer along joints and edges.

3.18 Curing:

- .1 Curing Plan:
 - .1 Contractor shall submit curing plan/quality control plan for each concrete element to *Contract Administrator* for review prior to commencement of concrete work. The curing plan shall include:
 - type of curing material
 - duration of curing
 - procedures and methods for keeping concrete moist for the required time period
 - protection of surfaces being cured from construction traffic and activities
 - provisions to address adverse weather conditions such as high winds and hot/cold weather
 - .2 Keep slabs where fly ash content is >30% moist for at least seven consecutive days, and where fly ash content is <30% for at least five consecutive days after placing unless otherwise approved by the *Contract Administrator*.
 - .3 Slabs may be cured using specified curing compound. Coverage rate and method of application shall be in accordance with manufacturer's written specifications.
 - .4 Cure all concrete in Skateboard Park for 56 days prior to allowing any traffic. Provide protective barriers to prevent traffic into Skateboard Park.

- .5 Inform the Contract Administrator before pours when air temperature is at or will be above 27° C, during the basic curing period. Follow CSA A23.1 provisions for warm weather curing, including use of synthetic moist curing cover and mist, as required, in sunny, windy and/or warm weather.

3.19 Finishing:

- .1 Sack-rub green concrete as required to ensure all patching appears monolithic with the adjoining concrete.
- .2 Finish surfaces to produce smooth, uniform surfaces free of open texturing and exposed aggregate. Do not work more mortar into surface than required; do not use neat cement as drier to facilitate finishing.
- .3 Schedule of Finishes:
 - .1 Smooth Finish
 - .1 Smooth finish all concrete surfaces in skateboard park, all walls, all stair risers. Steel or mag trowel to produce a smooth, dense surface with no irregularities greater than 1mm. Tolerances to flat plane shall be no greater than 3mm (1/8") in 3m (10'). Smooth Finish to be non-textural with no exposed aggregate. Flat slabs to be power trowelled.
 - .2 For both hand and power trowelled surfaces, test panels to be done prior to start to establish acceptance criteria with park designer.
 - .2 Sand Blast Finish – Where Specified
 - .1 Sandblast all stair treads (not risers), exposed concrete footings for poles and concrete base for tower structures.
 - .2 Provide medium sand blast finish concrete as approved sample provided.
 - .3 This finish shall apply to formed surfaces which are not exposed to view and where roughness is not objectionable.
 - .4 The surface, in general, shall not require any treatment after form removal, other than repair of defective concrete, snap-tie holes, and the removal of ridges and surface irregularities.
 - .3 Architectural Finish:
 - .1 This finish shall apply to formed architectural surfaces which are exposed to view, in accordance with Section 03100.
 - .4 Finishing with Fly Ash: (Fly Ash complying to CSA-A23.5, Class F or C1)

- .1 The timing for finishing will be determined by the site trial pours, and laboratory trial mixes may give some insight with regard to the setting time for a given concrete mix.
 - .2 Finishers typically rely on the presence of bleed water as an indicator for commencement of finishing. However, with fly ash concretes, bleed water is typically significantly reduced, and therefore, the finishers must gain hands-on experience during the site trial pours to determine when they should begin finishing.
- 3.20 HardCem Finish: Only if specified in Table 1: Concrete & Shotcrete Mix Design Requirements (Page 4 of this section).
- .1 HardCem is a product that is mixed into the entire concrete mixture, (i.e., replaces some of the fine aggregate), and acts as a hardener on the surface as well.
 - .2 HardCem is expected to increase the abrasion and wear resistance of the surface.
 - .3 Note: HardCem is a dark (black or nearly black) product, and using it in a concrete mixture darkens the concrete. It is preferable for the park concrete to be darker to reduce glare from the sun.
- 3.21 Unformed Surface: The finish to be provided for the various unformed surfaces shall be:
- .1 Plastic Concrete Surfaces:
 - .1 Working of the concrete surface shall take place while it is sufficiently plastic to achieve the desired shape, plane, and texture. Screeding shall be followed by one or more of the operations of darbying, floating, trowelling, and tooling of edges and joints, in that order, to provide the surface finish specified in the drawings or by the Architect.
 - .2 Initial finishing shall be accomplished by screeding, darbying, or bull floating and shall be performed in accordance with the requirements of CAN/CSA-A23.1-00, Clause 22.2.
 - .3 Initial finishing operations shall be completed before any bleed or free water appears on the concrete surface. Overworking, which can bring excessive fines to the concrete surface, shall not be permitted.
 - .4 Final finishing shall be accomplished by mechanical floating, mechanical trowelling, creation of the specified surface finish, and tooling of edges and joints, in that order. Exposed edges and corners shall be detailed. Surfaces at tooled edges and corners shall be trowelled and sand-blasted to remove tool edge marks. Hand floating and trowelling shall only be permitted in small areas of restricted access. All final finishing procedures shall conform to the requirements of CAN/CSA-A23.1-00, Clause 22.5.

- .5 Final finishing shall commence after bleed water has disappeared from the surface and when the concrete has stiffened sufficiently to prevent the working of excess water to the surface. Concrete with higher proportions of fly ash can be expected to exhibit reduced bleeding, and trial mixes in 1.3 should be used to determine the appropriate time for commencing final finish. No additional dry cement or water shall be used to facilitate finishing.
 - .6 The final finish to be provided shall be as specified herein and as noted on the drawings:
 - .1 Float Finish – for slab surfaces as noted.
 - .2 Sandblast Finish – light sandblasted if specified on drawings. Provide a sample section of sandblast that is approved by the *Contract Administrator* in accordance with subsection 1.6.2 above.
 - .3 Provide sample panels for the *Contract Administrator's* approval in accordance with subsection 1.4.2 above. This finish is typically applied to slabs or unless noted otherwise on the drawings.
- 3.22 Formed surface: The finishes to be provided for the various formed surfaces shall be:
- .1 Unexposed Finish:
 - .1 This finish shall apply to formed surfaces which are not exposed to view and where roughness is not objectionable.
 - .2 The surface, in general, shall not require any treatment after form removal, other than repair of defective concrete, snap-tie holes, and the removal of ridges and other irregularities.
- 3.23 Backfill:
- .1 Allow concrete to cure for 7 days prior to backfilling. Comply with all structural requirements. Curing time is longer for retaining walls over 3'-0". Backfill height as specified on the drawings, approved by *Contract Administrator*.
- 3.24 Defective Concrete:
- .1 Remove defective concrete, blemishes and embedded debris; repair as required and directed by *Contract Administrator*.
- 3.25 Depositing Concrete:
- .1 Concrete shall be deposited in forms as nearly as practical in its final position, to avoid re-handling and in approximately uniform horizontal layers. Depositing shall be continuous until the unit of operation is complete and as rapid as practicable to ensure bonding of the successive layers.

- .2 Concrete shall be thoroughly worked around reinforcement and embedded fixtures and in to all parts of the forms. Coarser particles shall be worked back from the face of the forms. Vibrate and rap concrete mass in forms, especially around embeds and against keyways and lockouts, in accordance with good industry practice.
 - .3 Shotcrete to be formulated and applied in accordance with ACI 506.2-95 'Specification for Shotcrete' and good industry practice. Mix designs to be submitted for approval prior to starting work.
 - .4 Concrete surfaces to be complete and tight against all coping. Proper coping protection as shown on drawings to be maintained at all times.
- 3.26 Protection:
- .1 All areas of the work shall be protected from damage including that caused by vandalism, security against all risk to public, security guards until acceptance, temporary barriers, warning devices and other such equipment or material as required to protect the completed work and work site shall be the responsibility of the Contractor.
 - .2 Grind and round off corners where required.
- 3.27 Cleanup:
- .1 The work area shall be thoroughly cleared of all debris, excess material and litter accumulated during the course of the work or associated with the work and such material shall be disposed to an approved site.
- 3.28 Restoration of Improvements:
- .1 All damage to areas incidental to this work shall be repaired by the Contractor to the satisfaction of the City.
- 3.29 Final Dressing:
- .1 After concrete fully set, prior to handover, dress all areas with dressing stone and grinder as directed by *Contract Administrator*. This will include slab surfaces, edges, control and construction joints, coping/slab joints and walls.
- 3.30 Quality Control:
- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the City in accordance with CAN/CSA-A23.2-00.
 - .2 The City will pay for costs of tests.
 - .3 Testing Laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under the same conditions as concrete which they represent.

- .4 If results of test show concrete to be less than specified in quality or strength, the *Contract Administrator* shall have the right to have the mix designs altered for the remainder of the work at no cost to the City. Further testing and remedial measures required by CAN/CSA-A23.1-00 shall be done, the costs of this work paid for by the Contractor.
- .5 Inspection or testing by the City will not augment or replace Contractor quality control nor relieve him of his contractual responsibilities.

3.31 Alternative Methods of Construction:

- .1 Alternative methods must be approved in accordance with B6 prior to the close of the Bid Opportunity. Submissions after this will not be accepted.
- .2 Alternative methods must be pre-engineered by a structural engineer registered in the Province of Manitoba and retained by the Contractor.