CONCRETE ACCESSORIES

1. GENERAL

1.1 Work Included

.1 Non-ferrous grout.

.2 Anchoring adhesive.

.3 Curing and sealing compounds.

.4 Moisture retention film.

.5 Repair mortar.

1.2 Qualifications

.1 All sealant installations are to be done by established firm having at least five (5) years of proven, satisfactory experience in these trades and employing skilled personnel.

.2 Submit proof of qualifications in writing to the Contract Administrator prior to commencement of Work.

1.3 Shop Drawings

.1 Submit Shop Drawing for Curing and sealing compounds in accordance with Section 01 33 00 - Submittal Procedures.

1.4 Maintenance Data

.1 Provide operation and maintenance data for each exposed sealant for incorporation into maintenance manual specified in Section 01 78 00 - Closeout Submittals.

2. PRODUCTS

2.1 Materials

.1 Pre-moulded expansion joint filler (for joints associated with slabs on grade such as pads at doors): asphalt impregnated vegetable or cane fibreboard, conforming to ASTM D1751, sizes indicated on Drawings. Acceptable products: W. R. Meadows Sealtight Fibre Expansion Joint Filler complete with Snap-Cap and Sealtight #164, Hi-Spec, or Cold Applied SOF-Seal sealant or Fosroc Fibreboard complete with Pliastic or Colpor 200PF sealant.

.2 Sealants

.1 Joint sealants - interior saw cut joint sealant: Dow Corning No. 795. Provide custom colour(s) for control joint sealant and colour is to match the adjacent surface colour. For non-coated and painted (natural) concrete adjacent surfaces, utilize Limestone colour for saw cut joints.

.2 Joint sealants for non-liquid-retaining areas - exterior saw cut joints: Dow Corning No. 795. Provide Limestone colour for saw cut joints.

.3 Primers: as recommended and supplied by sealant Manufacturer.

.4 Backer rod: closed cell vinyl foam.

.5 Non-ferrous grout, below structural steel base plates: pre-mixed, non-shrink, Master Builders 713, Sika M-Bed, CPD Non-Shrink Grout, Steel C1 Grout, minimum 35 MPa compressive strength.

.6 Latex patching agent: Duraweld-C Latex Bonding Agent.

.7 Epoxy bonding agent: Master Builders Concresive 1001 LPL, Dural Duralbond, Sikadur 32 HI-bond.

.8 Anchoring adhesive: Hilti Hit HY-150 Adhesive. Utilize Hilti Hit-ICE for cold weather applications.

.9 Curing and sealing compound: conforming to ASTM C 1315, Type II, Class A; shall be compatible with scheduled finishes and coatings and permeability shall not exceed 0.40 kg/m^2/72 hrs. Acceptable products: Sika Florseal WB 25 or Sonneborn Kure-N-Seal 30.

.10 Moisture retention film: Master Builders Confilm, Sika Film, or TK Products Tri-Film.

.11 Repair mortar: Meadow-Crete H by W. R. Meadows.

3. EXECUTION

3.1 Examination

.1 Before starting this Work, examine Work done by others that affects this Work.

.2 Notify the Contract Administrator of any conditions that would prejudice proper completion of this Work.

.3 Commencement of Work implies acceptance of existing conditions.

.4 The Contract Administrator, at his discretion may complete isolated destructive testing of the in-place sealants. Contractor is to remediate areas where destructive testing occurs at the Contractor's expense.

3.2 Installation

.1 Pre-installation Conference for sealant and curing and sealing compounds: one (1) week prior to installation of the above products into the Works, the Contractor shall conduct a meeting with applicator, installers of Work adjacent to or sealant products, and the Contract Administrator to review the following:

.1 General project requirements.

.2 Manufacturer's product data sheets and installation guides.

.3 Substrate conditions and procedures for substrate preparation and product installations.

.4 Responsibility and costs associated with verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and coordination for all parts of the Work rests with the Contractor. Provide agenda and meeting minutes. Distribute agenda to the attendees four (4) days prior to the Pre-Installation Conference. Distribute Pre-Installation Conference meeting minutes within four (4) days of the meeting.

.5 Pay for all costs associated with the pre-installation conference excluding the Contract Administrator cost.

.2 Install all concrete accessories in accordance with Drawings and Manufacturer's recommendations and ensure compatibility. Install straight, level, and plumb.

.3 Ensure items are not disturbed during concrete placement.

.4 Coordinate Work of this Section with other construction.

3.3 Latex Patching Agent

.1 Latex patching agent is to be used for patching formed concrete surfaces where required, installed to Manufacturer’s instructions.

3.4 Repair Mortar

.1 Apply repair mortar for defective concrete where directed by the Contract Administrator.

.2 Prepare surfaces and apply repair mortar to Manufacturer’s instructions. Use pea gravel to extend the mixture in accordance with the Manufacturer’s instructions.

END OF SECTION

CONCRETE FORMING

1. GENERAL

1.1 Work Included

.1 Wood and/or steel forms for all cast-in-place concrete.

.2 Form openings for other trades.

.3 Coordinate installation of concrete accessories.

.4 Set anchor bolts, anchors, sleeves, frames, and other items supplied by other trades.

1.2 Design Standards

.1 Design and detail forms and supporting falsework in accordance with the current editions of the NBC, CSA A23.1, CSA S269.1, CAN/CSA-S269.3, ACI 347, ACI 347.2R, and applicable construction safety regulations.

.2 Design of the formwork, falsework, and reshoring shall be performed by a Professional Engineer registered in the Province of Manitoba. The Contract Administrator doing the design shall review the in-place formwork, falsework and reshoring and certify in writing that the Work is in conformance with her/his design.

1.3 Quality Assurance

.1 Construct and erect concrete formwork in accordance with CSA A23.1, CAN/CSA-S269.3, ACI 347, ACI 347.2R and all applicable construction safety regulations for the place of Work.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Clearly indicate sizes, methods of construction, materials, arrangement of joints, ties and shores, location and size of falsework, schedule of erection and stripping, reshoring, etc.

.3 Shop Drawings and design briefs are to bear the seal of a Professional Engineer registered in the Province of Manitoba.

.4 Formwork, falsework, and reshoring are to be reviewed by the same Professional Engineer prior to each concrete casting.

.5 Professional Engineer to report, in writing, that reviewed formwork, falsework, and reshoring are in accordance with the design, prior to each concrete casting.

2. PRODUCTS

2.1 Exposed Surfaces

.1 Square-edged, smooth-surfaced panels true in plane, free of holes, surface markings, or defects.

2.2 Unexposed Surfaces

.1 Square-edged tongue and groove lumber, plywood or other material, suitable to retain concrete without leakage or distortion.

2.3 Wood Materials

.1 Plywood: Douglas fir, conforming to CSA O121 solid one side, sheathing grade. Sound undamaged sheets with clean true edges.

.2 Lumber: conforming to CAN/CSA O141.

.3 Nails, spikes, and staples: galvanized; in accordance with CSA O86.

2.4 Prefabricated Forms

.1 Steel type: minimum 1.6 mm steel thickness; well matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

2.5 Accessories

.1 Form ties: removable snap-off metal type, fixed length, minimum working strength of 13 kN when assembled; free of defects that will leave holes deeper than 25 mm from concrete surface. Use plastic cone snap type or screw type on exposed surfaces. Wire ties are not permitted.

.2 Form release agent: colourless mineral oil that will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete.

.3 Corner or chamfer fillets: mill finished pine, 25 mm width, maximum possible lengths, mitre ends.

.4 Sealing tape: reinforced, self-adhesive, waterproof Kraft.

3. EXECUTION

3.1 Examination

.1 Before starting this Work, examine Work done by others that affects this Work.

.2 Notify the Contract Administrator of any conditions that would prejudice proper completion of this Work.

.3 Prior to the erection of the formwork, the construction joint shall be sand blasted and cleaned in accordance with Section 03 30 00 – Cast-in-Place Concrete.

.4 Commencement of the Work implies acceptance of existing conditions.

3.2 Erection

.1 Verify lines, levels, and centers before proceeding with formwork. Ensure dimensions agree with Drawings.

.2 Construct formwork and falsework to meet design and regulatory requirements, and to produce finished concrete conforming to surfaces, shapes, lines, and dimensions indicated on Drawings.

.3 Arrange and assemble formwork to permit removal without damage to concrete.

.4 Align joints and make watertight, to prevent leakage of cement paste and disfiguration of concrete. Keep form joints to a minimum. Tape joints as necessary.

.5 Arrange forms to allow removal without removal of principal shores, where these are required to remain in place.

.6 Obtain the Contract Administrator's acceptance before framing openings in concrete slabs, beams, walls, and columns not indicated on Drawings.

.7 Provide falsework to ensure stability of formwork. Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.

.8 Position form joints to suit any expressed lines required in exposed concrete.

.9 Provide chamfer on all external corners and fillets on all internal corners and edges of exposed concrete unless shown otherwise.

.10 Form chases, slots, openings, drips, and recesses if detailed on the Drawings.

.11 Set screeds with top edge level to required elevations.

.12 Check and readjust formwork to required lines and levels during placing of concrete.

.13 Where construction joints are required in beams and suspended slabs, form joints at the one third point in the span unless shown or noted otherwise on Drawings.

3.3 Tolerance

.1 Construct formwork to produce concrete with dimensions, lines, and levels shown on the Drawings.

.2 Forms shall be constructed to meet the requirements for shape, dimensions, and tolerances specified in CSA A23.1, Construction Tolerances for Cast-In-Place Concrete.

.3 Tolerances are not cumulative.

3.4 Inserts/Embedded Items/Openings

.1 Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded in and passing through concrete members.

.2 Accurately locate and set in place items that are to be cast directly into concrete.

.3 Coordinate Work of other Sections and Divisions and cooperate with trades involved in forming openings, slots, recesses, chases, and setting sleeves, bolts, anchors, and other inserts.

.4 Coordinate installation of concrete accessories as specified in Section 03 10 00 - Concrete Accessories.

.5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

.6 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs and to provide uniform surface on exposed concrete.

3.5 Field Quality Control

.1 Inspect and check complete formwork, falsework, shoring, and bracing to ensure that Work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and parts are secure.

.2 Ensure Professional Engineer responsible for the formwork, falsework, and re-shoring design reviews the Work prior to each concrete casting. Provide written confirmation from the Professional Engineer that she/he has reviewed the formwork and conforms to the design.

.3 Inform the Contract Administrator when formwork is complete and has been cleaned, to allow for review. The Contract Administrator's review will be for verification that earth bottoms are clean, and that forms are clean and free from debris.

.4 Allow the Contract Administrator to review each section of formwork prior to re-use. Formwork may be re-used if acceptable to the Contract Administrator. Re-use of forms shall be subject to the requirements of CSA A23.1.

3.6 Cleaning

.1 Clean formwork in accordance with CSA A23.1. Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings, and debris from within forms. Flush completely with water to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 Formwork Preparation

.1 Apply form release agent in accordance with Manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices, and embedded parts.

.2 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

3.8 Form Removal

.1 Notify the Contract Administrator prior to removing formwork.

.2 Do not remove forms and falsework until concrete has gained either sufficient strength to carry its own weight, plus construction loads and design loads that are liable to be imposed or 75% of design compressive strength, whichever is greater. Verify strength of concrete by compression tests to satisfaction of Contract Administrator.

.3 Remove falsework progressively, in accordance with regulatory requirements and ensure that no shock loads or imbalanced loads are imposed on structure.

.4 Loosen forms carefully without damaging concrete surfaces. Do not apply tools to exposed concrete surfaces.

.5 Leave forms loosely in place for protection until curing requirements are complete.

END OF SECTION

CONCRETE REINFORCEMENT

1. GENERAL

1.1 Work Included

.1 Reinforcing steel bars for cast-in-place concrete, complete with tie wire.

.2 Support chairs, bolsters, bar supports, spacers, and tie wire for reinforcing.

1.2 Quality Assurance

.1 Perform concrete reinforcing work in accordance with CSA A23.1.

1.3 Inspection and Testing

.1 If requested by the Contract Administrator, submit three (3) certified copies of the mill test report of reinforcement supplied, indicating physical and chemical analysis.

1.4 Shop Drawings

.1 Submit bar lists and placing drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Clearly indicate bar sizes, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules and supporting and spacing devices.

.3 Drawings and details to conform to CSA A23.1, CAN/CSA-A23.3, and RSIC's Reinforcing Steel Manual of Standard Practice.

.4 Detail placement of reinforcing where special conditions occur.

.5 Detail lap lengths and bar development lengths to CSA A23.1 and RSIC's Reinforcing Steel Manual of Standard Practice, unless otherwise shown on the Drawings. Use Class B tension top lap splices unless noted otherwise.

1.5 Delivery and Storage

.1 Deliver, handle, and store reinforcement in a manner to prevent damage and contamination.

.2 Deliver bars in bundles, clearly identified in relation to bar lists.

2. PRODUCTS

2.1 Reinforcing Materials

.1 Reinforcing steel: 400 MPa yield grade; deformed billet steel bars conforming to CSA G30.18; plain finish.

2.2 Accessory Materials

.1 Tie wire: minimum 1.6 mm annealed type or patented system accepted by the Contract Administrator.

.2 Chairs, bolsters, bar supports, and spacers: adequately sized for strength and support of reinforcing steel during construction.

.3 Bar chairs to be non-corrosive PVC chairs or purpose made concrete chairs. Steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks or wood supports are not acceptable.

.4 Side form spacers to be non-corrosive PVC spacers, purpose made. Steel bar chairs, galvanized bar chairs, PVC chairs, concrete bricks, broken concrete blocks, or wood supports are not acceptable.

3. EXECUTION

3.1 Examination

.1 Before starting this Work, examine Work done by others that affects this Work.

.2 Notify the Contract Administrator of any conditions that would prejudice proper completion of this Work.

.3 Commencement of Work implies acceptance of existing conditions.

3.2 Fabrication

.1 Fabricate reinforcing steel in accordance with CSA A23.1 and the Drawings.

.2 Locate reinforcing splices not indicated on the Drawings at points of minimum stress.

.3 Fabricate within the following tolerances:

.1 Sheared length: plus 0, minus 25 mm.

.2 Stirrups, ties, and spirals: plus 0, minus 10 mm.

.3 Other bends: plus 0, minus 25 mm.

.4 All bending shall be done cold with a suitable machine accurately producing all lengths, depths, and radii shown on the bending details.

.5 After initial fabrication, reinforcing steel shall not be re-bent or straightened unless so indicated on the Drawings.

.6 Heating of reinforcing steel will not be permitted.

3.3 Installation

.1 Place reinforcing steel in accordance with reviewed placing drawings and CSA A23.1.

.2 Chairs supporting slab reinforcing shall not be further apart than 1200 mm in either direction. Tie reinforcing steel at maximum spacing 600 mm.

.3 Adequately support reinforcing and secure against displacement within tolerances permitted.

.4 Place reinforcing steel to provide concrete cover as required by CSA A23.1, but not less than shown in the following table, unless shown otherwise on the Drawings:

Item	Coverage (mm)
Surface poured against ground, and bottom of slab on grade unless noted.	75
Slab on grade: Top to principle reinforcing and sides	60

.5 Place reinforcing bars to tolerances in accordance with CSA A23.1, Clause 6.6 – Fabrication and Placement of Reinforcement. Tolerances are not cumulative.

3.4 Safety Protection for Reinforcing Ends

.1 Highly visible protection safety caps or other acceptable safety product shall be installed for all reinforcing ends immediately following placement of bars.

.2 The reinforcing end protection shall be made secure so that accidental contact will not easily dislodge the protection. Dislodged protection shall be re-installed immediately.

3.5 Cleaning

.1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.

.2 Remove all loose scale, loose rust, concrete from prior pours, and other deleterious matter from surfaces of reinforcing.

END OF SECTION

CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 Work Included

.1 Supply of required concrete components as premixed dry ingredients for on-site preparation, or of batch plant to site mix individual components of the concrete.

.2 Supply of all reinforced cast-in-place concrete shown on the Drawings.

.3 Setting anchors, inserts, frames, sleeves, and other items supplied by other Sections.

.4 Placing and curing of concrete.

.5 Finishing formed concrete surfaces.

.6 Finishing concrete slab surfaces.

.7 Repairing concrete imperfections.

1.2 References

.1 National Building Code of Canada 2010 and the Manitoba Amendments.

.2 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 ACI 306R-10, Guide to Cold Weather Concreting.

.5 ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete.

.6 ASTM C494, Standard Specification for Chemical Admixtures for Concrete.

1.3 Quality Control

.1 The Contractor shall be fully responsible for quality control of all aspects of production, pre-placement, placement, and post-placement of concrete and related testing.

.2 Cast-in-place concrete shall conform to the CSA A23.1. Concrete shall be delivered under the Performance Alternative as outlined in CSA A23.1, Table 5.

.3 Testing of cast-in-place concrete shall be performed by a CSA A23.1 certified Third Party Testing Agency. Testing shall to conform to CSA A23.1/A23.2. Third Party Testing shall be paid for by the Contractor.

.4 Distribute the Third Party Testing Agency test data to the Contract Administrator and the City immediately upon receiving.

.5 Submit and implement a Quality Control Plan a minimum of four (4) weeks prior to first scheduled concrete casting; the Quality Control Plan shall include:

.1 Identify the Quality Control Manager.

.2 Concrete supplier certification with Manitoba Ready Mixed Concrete Association.

.3 Qualifications of construction supervisory personnel.

.4 Quality Control testing plan for concrete.

.5 Pre-placement procedures, checklists, and project specific finishing procedures for concrete.

.6 During placement contingency plans and procedures.

.7 Post-placement procedures and checklists for concrete.

.6 Submit mix design statements for each type of concrete:

.1 Mix design statements shall be sealed and signed by a Professional Engineer registered in the Province of Manitoba experienced in preparing concrete mix designs.

.2 Submit documentation a minimum of four (4) weeks prior to the first scheduled concrete casting demonstrating that the proposed mix designs and materials will achieve the required strength, durability, and performance requirements.

.3 The mix design statements shall clearly correlate to the Mix Types in Table 1 at the end of this Section.

1.4 Quality Assurance

.1 Checklists supplied by the Contractor will be used for reviewing the work.

.2 Notify the Contract Administrator at least forty-eight (48) hours before:

.1 Complete formwork, embedded items, and concrete reinforcement are ready for review. Contractor shall schedule review of embedded items and reinforcing in walls prior to closing forms.

.2 Any on-site concrete mixing is to be performed.

.3 Allow ample time for review, and corrective work, if required, before scheduling concrete placement.

.4 The City reserves the right to arrange and pay for a City's CSA A23.1 certified Third Party Testing Agency to test the concrete works. Provide unencumbered access to all portions of the Work and cooperate with appointed Third Party Testing Agency.

2. PRODUCTS

2.1 General

.1 All materials in concrete mixes shall be compatible.

2.2 Concrete Materials

.1 Portland Cement: Type GU and Type HS or HSb conforming to CSA A3000.

.2 Fine aggregate: conforming to Normal-Density Fine Aggregate, CSA A23.1, Tables 10 and 12.

.3 Coarse aggregate: conforming to Normal-Density Coarse Aggregate, CSA A23.1, Table 11 and 12.

.4 Ensure that no aggregates are used that may undergo volume change due to alkali reactivity, moisture retention or other causes. Confirm suitability of aggregate with a petrographic analysis.

.5 Water: potable, clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious matter, meeting requirements of CSA A23.1, Table 9.

.6 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the project.

.7 Supplementary cementing materials: conforming to CSA A3000.

2.3 Admixtures

.1 Air entrainment: conforming to ASTM Standard C-260.

.2 Chemical admixtures, water-reducing agent, superplasticizer: conforming to ASTM Standard C-494.

.3 Admixtures containing chlorides will not be permitted.

2.4 Accessories

.1 For accessories refer to Section 03 10 00 - Concrete Accessories.

2.5 Concrete Mixes

.1 Provide concrete mixed in accordance with requirements of CSA A23.1 and this Specification Section. Pay all costs for the mix design.

.2 Concrete design compressive strength and class of exposure as indicated in attached Table 1. Concrete mixes are to be designed to mitigate dry and plastic temperature and shrinkage cracks.

.3 Use accelerating admixtures in cold weather only when accepted by the Contract Administrator. If accepted, the use of admixtures will not relax cold weather placement requirements. Do not use calcium chloride.

.4 Use set-retarding admixtures during hot weather only when accepted by the Contract Administrator.

.5 All admixtures are subject to acceptance by the Contract Administrator. List all proposed admixtures in mix design statement submission. Do not change or add admixtures to accepted design mixes without the Contract Administrator's review and acceptance.

.6 Dry concrete premix delivered to site must be accompanied by a delivery slip in accordance with CSA A23.1.

.7 Self-consolidating concrete mixes will not be permitted for use on this project.

3. EXECUTION

3.1 Pre-Installation Review

.1 Pre-Installation review for cast-in-place concrete: one (1) week prior to installation of concrete works, the Contractor shall conduct a teleconference or site meeting with mix designer, batch plant Quality Control Manager, Third Party Testing Agency Representative, concrete installers, concrete finishers, waterstop installers, concrete curing applicators, concrete sealer Technical Representative, reinforcing steel installers, floor coating applicators, installers of work adjacent to or that penetrates the concrete works, and the Contract Administrator to review the following:

.1 General project requirements.

.2 Contractor's Quality Control Plan for each class of concrete.

.3 Contractor's procedures prior, during, and following concrete castings.

.2 Provide agenda and teleconference/meeting minutes. Distribute agenda to the attendees four (4) days prior to the Pre-Installation Conference. Distribute Pre-Installation Conference meeting minutes within four (4) days of the meeting.

.3 Pay for all costs associated with the Pre-Installation Conference excluding the Contract Administrator cost.

3.2 Placing Concrete

.1 Place concrete in accordance with requirements of CSA A23.1 and as indicated on the Drawings. Layout of the Work and accuracy of same is the Contractor's sole responsibility.

.2 Place concrete to mitigate dry and plastic temperature and shrinkage cracks.

.3 Prior to the erection of the formwork, construction joints shall be sand blasted and cleaned as per Clause below entitled "Construction Joints" of this Specification Section.

.4 Notify the Contract Administrator a minimum of forty-eight (48) hours prior to placing concrete. Under no circumstances shall concrete be placed without notifying Contract Administrator.

.5 Arrange for testing of cast-in-place concrete.

.6 The concrete shall be placed rapidly and evenly as near to its final position as possible to reduce the risk of segregation, flowlines, and cold joints.

.7 Ensure all anchor bolts, seats, plates, and other items to be cast into concrete are securely placed and will not interfere with concrete placement and will not be displaced during casting.

.8 All equipment for transporting the concrete shall be cleaned of hardened concrete and foreign materials before placing concrete.

.9 Immediately before concrete is placed, Contractor shall carefully inspect all forms in accordance with Section 03 11 00 - Concrete Forming, to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel and embedded parts are in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and material removed.

.10 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling or flowing. Vibrators shall not be used to move concrete. Under no circumstances shall the concrete that has partially hardened, be deposited in the forms.

.11 Concrete shall be thoroughly compacted by mechanical vibrators during placing operations. Concrete shall be thoroughly worked around the reinforcement, embedded fixtures and into the corners of the forms.

.12 Vibrate concrete using the appropriate size equipment as placing proceeds, in accordance with CSA A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.13 Where placing operations would involve dropping the concrete more than 1,500 mm, it shall be placed through canvas hoses or galvanized iron chutes. Concrete shall not be raised at a rate greater than that for which proper vibration may be affected.

.14 In locations where new concrete is dowelled to existing concrete, drill holes in existing concrete, clean thoroughly, pack solidly with epoxy grout suitable for intended exposure, and insert steel dowels.

.15 At construction or expansion joints a minimum of three (3) days shall elapse between adjacent castings and the adjacent casting shall have obtained 75% of the design strength.

.16 Do not place concrete if carbon dioxide producing equipment has been in operation in the building or in the enclosure during the twelve (12) hours preceding the pour. This equipment shall not be used during placing or for twenty-four (24) hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases or drying from heaters.

.17 Honeycomb and embedded debris are not acceptable.

.18 Remove and replace defective concrete.

.19 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

.20 Prepare set or existing concrete by removing all laitance and loose or unsound materials and apply bonding agent in accordance with Manufacturer's recommendations.

3.3 Hot and Cold Weather Concreting

.1 Deliver, place and cure concrete in hot or cold weather in accordance with the requirements in CSA A23.1.

3.4 Concrete Protection for Reinforcement

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with Section 03 20 00 - Concrete Reinforcement.

3.5 Construction Tolerance

.1 The Work shall be carefully and accurately set out; true to the positioning, levels, slopes, and dimensions shown on the Drawings and conforming to tolerance requirements of CSA A23.1 and Section 03 11 00 - Concrete Forming and Section 03 20 00 - Concrete Reinforcement.

.2 If these tolerances are exceeded, the Contractor may, at the discretion of the Contract Administrator, be required to remove and replace or to modify the placed concrete before acceptance. The costs incurred by the Contract Administrator for such investigation, testing, or review of reconstruction and the cost of reconstruction shall be borne by the Contractor.

3.6 Finishing Slab Surfaces

.1 Screeding, bull floating or darbying, floating, and trowelling of slab surfaces shall conform to CSA A23.1and as specified below.

.2 Broom finish exterior slab surfaces to achieve nonslip surface conforming to CSA A23.1.

3.7 Finishing Formed Concrete

.1 Allow the Contract Administrator to review concrete surfaces immediately upon removal of the forms.

.2 Modify or replace concrete not conforming to qualities, lines, details, and elevations specified herein or indicated on the Drawings to the satisfaction of the Contract Administrator.

.3 Finish exterior formed surfaces to Smooth-Form Finish conforming to CSA A23.1.

3.8 Construction Joints

.1 Construction joint locations shall be as shown on the Drawings if required.

3.9 Curing and Protection

.1 Cure and protect freshly placed concrete in accordance with CSA A23.1.

.2 Exterior concrete shall receive moist curing for a period of at least seven (7) calendar days. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

.1 Surface covered with canvas or other satisfactory material and kept thoroughly and continuously wet with soaker hoses.

.2 A liquid membrane forming curing sealer, applied at the rate recommended by the Manufacturer. Curing sealer shall not be used on a surface where bond is required for the finishes.

.3 Surfaces of concrete that are protected by formwork that is left in place for seven (7) calendar days, shall not require any additional curing (except as specified for hot weather). If the formwork is removed in less than seven (7) calendar days, the concrete shall receive moist curing as above.

.3 No concreting will be allowed until all materials required for the curing phase are on-site and ready for use.

.4 At the end of the curing and protection period, the temperature of the concrete shall be reduced gradually at a rate meeting both the requirements of CSA A23.1 Table 21 for allowable differential temperature in the concrete and ACI 306R Table 5.1 for the allowable rate of temperature change of the edges of the concrete until the outside air temperature has been reached.

.5 Concrete that is allowed to freeze or attain insufficient curing conditions shall be subject to all necessary investigations and testing as deemed necessary by the Contract Administrator and all such concrete shall be removed and the portion reconstructed as directed by the Contract Administrator, at the Contractor's cost.

.6 Supply and arrange for water for wet curing concrete.

3.10 Equipment Pads, Pipe Supports, and Cast in Metal Items

.1 Provide concrete pads and supports for equipment where and as indicated on Drawings. Adjust dimensions to reviewed equipment Shop Drawings.

.2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel surface smooth. Chamfer exposed horizontal and vertical edges.

.4 Clean excess concrete from metal frames, inserts, weld plates, etc. Clean and tool concrete around the above noted items.

3.11 Grouting

.1 Grout all miscellaneous anchor bolts with non-ferrous or epoxy grout as specified or as required per reviewed equipment Shop Drawings using templates for accurate positioning.

.2 Grout under base plates and other items as required to provide continuous support over the entire contact areas.

3.12 Defective Concrete

.1 Concrete not meeting the requirements of the Specifications and Drawings will be considered defective concrete.

.2 Concrete not conforming to the lines, details, and grades specified herein or as shown on the Drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein and in Section 03 11 00 - Concrete Forming.

.3 Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

3.13 Repair

.1 Allow Contract Administrator to review concrete surfaces immediately upon removal of all formwork.

.2 Remove all exposed metal form ties, nails, and wires, break off fins and remove all loose concrete.

.3 Any imperfect joints, voids, stone pockets, or other defective areas and tie holes, as specified, shall at once be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 40 mm with sawcut edges perpendicular or dovetail to the surface. The area to be repaired and a space at least 150 mm wide entirely surrounding it shall be wetted to prevent absorption of water from the repair mortar.

.4 Cure all repairs thoroughly in accordance with Manufacturer’s instructions.

Table 1: Concrete Mix Types

Mix Type	Intended Application	Minimum Compressive Strength (MPa)	Class of Exposure
1	Slab on grade: Exterior	33 (28-Day)	N

END OF SECTION