

**PART 1 GENERAL**

**1.1 GENERAL REQUIREMENTS**

- .1 Conform to General Instructions, Division 1.

**1.2 WORK INCLUDED**

.1 Provide all plant, labour, equipment and materials to complete the cast-in-place concrete work. The work includes, but is not limited to:

- reinforced concrete footings, walls, columns, beams, and slabs.
- New interior and exterior slabs-on-grade
- patching sleeves, pockets
- concrete topping
- grouting of column and beam bearing plates

**1.3 RELATED WORK SPECIFIED ELSEWHERE**

- .1 Excavating, Backfilling and Rough Grading - Section 02200.
- .2 Perimeter and below floor insulation - Division 7
- .3 Infloor heating - Division 15
- .4 Below floor insulation - Division 16
- .5 Acid Staining of Exposed Concrete Floor

**1.4 WORK INSTALLED UNDER THIS SECTION, SUPPLIED BY OTHERS**

- .1 Setting of anchors and sleeves for mechanical, electrical trades (Division 15 and 16) and Dasher board installer.
- .2 Building in of iron and steel items - Divisions 5, 15, and 16.
- .3 Setting of anchors and other hardware to be cast into the concrete - Division 5, 15 and 16.

**1.5 REFERENCE STANDARDS**

- .1 Unless otherwise stated, the applicable provisions of these reference standards are to be considered a part of this application. Standards to be current issue.
- .2 Maintain copies of the following standards on the site at all times.

- .3 National Building Code.
- .4 C.S.A. Standard CAN3-A23.1-M, "Concrete Materials and Methods of Construction".
- .5 C.S.A. Standard CAN3-A23.2-M, "Methods of Test for Concrete".
- .6 C.S.A. Standard CAN3-A23.3-M.
- .7 A.C.I. Standard 302, "Recommended Practice for Concrete Floor and Slab Construction".
- .8 A.C.I. Standard 347, "Recommended Practice for Concrete Formwork".
- .9 A.C.I. Standard 301, "Specification for Structural Concrete for Buildings".
- .10 A.C.I. Standard 117. "Standard Specifications for Tolerances for Concrete Construction and Materials".
- .11 CRSI Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
- .12 Workplace Safety Act or any other regulations of the Manitoba Labour Board relating to the work of this section.

#### **1.6 COORDINATION & COOPERATION**

- .1 Coordinate the work of this Section with the work of other sections and advise other trades when materials to be built into the forms will be required.
- .2 Co-operate with other sections to ensure an uninterrupted sequence of construction.
- .3 Install any items furnished by others, miscellaneous iron work, anchors, pipe sleeves, hardware, etc., that are to be built into the concrete work.
- .4 Form all holes and openings shown or required to accommodate the work of other trades.
- .5 Make good all openings left in construction around pipes, openings for struts, anchorages, etc.

**1.7 SHOP DRAWINGS**

- .1 Examine all drawings forming a part of this Contract and conform to the requirements of all such drawings. Confirm all dimensions respecting anchor bolt requirements with related sections.
- .2 Submit shop drawings for the steel reinforcing and falsework for review by the Consultant. If such drawings are not satisfactory to the Consultant, make all required changes prior to the start of the work.
- .3 Shoring and falsework drawings are to show assumed values for all loads, types and grades of materials, dimensions, sizes and connection details. Shop drawings for falsework and shoring are to be signed and sealed by a Professional Engineer, who will be responsible for the design and implementation of these structural systems, including field review.
- .4 Shop drawings for reinforcing steel shall include detailed placing drawings and bar lists as outlined in the requirements of RSIC manual of standard practice. The placing drawing will show, quantity, bar size, bar grade, length or mark number, location, and spacing of bars. Bar lists will show bar size, bar grade, length and bending dimensions.
- .5 The Consultant's review of the shop drawings does not relieve this Sub-Contractor of his responsibility for ensuring that all forming systems are constructed properly and are maintained in position as long as necessary to ensure the integrity of the structure during construction.
- .6 Provide formwork drawings for architectural concrete for exposed walls showing all joints, reglets, tie locations, tie types, and panel layouts for the Architect's review and approval.

**1.8 ARCHITECTURAL CONCRETE**

- .1 Architectural Concrete includes all concrete elements that are exposed to view in the finished structure. This includes but is not limited to exposed concrete columns, foundation walls, planters, lightpole foundations, and exposed slabs.

- .2 Quality of Finish for Architectural Concrete: The quality of finish shall be such that, when the forms are stripped, it meets the standards set out below, without further finishing work other than treatment of tie holes and clean-up. This requirement is waived for smooth concrete to receive a paint finish, in which case grinding of joints and filling of voids will be permitted.
- .3 Dense, concrete finishes free of defects such as deep or extreme honeycombing, inconsistencies in plane, cold joint lines and loss of fines. Minor imperfections may be acceptable. Major defects will necessitate replacement. The judgement as to what constitutes major or minor defects will be the Consultant's. Patching will not be permitted and if used, will constitute a major defect. Repairs, i.e. removal of sections of a member, may be carried out if approved by the Consultant, but the repair shall match the colour and texture of the surrounding concrete.
- .4 Concrete finish shall be uniform in colour.
- .5 Concrete finishes shall exhibit sharp, accurate definition at corners, arrises, reglets and the like, generally free of chipped or spalled areas and within dimensional tolerances set out in A23.1. Members shall be visually straight.
- .6 Plane surfaces without protuberances, indentations, ridges or bulges.
- .7 Under no circumstances shall repair to any architectural concrete be undertaken without the Consultant's written consent. Concrete members which are repaired without the Consultant's consent will be classified as defective and the Consultant may require their removal and replacement.

#### **1. 9      SAMPLES**

- .1 Construct representative samples for each type of Architectural Concrete element that have an exposed concrete finish. The consultant will review these samples in regard to colour, finish, tie pattern, rustication, etc. The sample panels will serve as a benchmark for minimum acceptance or rejection of all similar concrete work.

- .2 Wall or flatwork samples are to be a minimum of 2000mm wide x 3000mm high/long to provide proper representation of the final element with interior and exterior corners, soffits, control joints and reglets, rustication and any other special features.
- .3 Panel to be constructed with specific concrete mix, forms, form release agents, stains etc. that will be employed in the building of the final architectural concrete elements.
- .4 Repeat construction of the panel as many times as necessary until approved by the consultant.
- .5 At the discretion of the Consultant, samples may be part of the final structure located in a non-exposed area of the building.

**1.10 DESIGN CRITERIA - CONCRETE**

- .1 Design all concrete mixes for the compressive strength and slump requirements as specified in "Proportioning" of this section. Allow for the appropriate coefficient of variation for each strength class for the batch plant supplying the concrete.
- .2 Submit mix designs for each class of concrete for review by the Consultant at least two weeks prior to the commencement of concreting.

**1.11 DESIGN CRITERIA - FORMWORK**

- .1 Formwork, falsework and shoring is to be designed, erected, braced and maintained so that it will safely support:
  - .1 The liquid weight of the concrete.
  - .2 All applied construction loads, such as equipment, personnel, runways, and wind loads to which the system may be subjected.
  - .3 All supported loads including reshored slabs.
- .2 Follow the provisions of the Construction Safety Act as amended to-date and the recommendations of the current A.C.I. Standard 347.

- .3 Refer to equipment drawings for critical dimensions. Detail forms in these areas to provide the specified requirements.
- .4 Tolerances within C.S.A. Standard CAN3-A23.1 except that tolerances for equipment anchors, inserts, etc. to equipment supplier's requirements.
- .5 All formwork as identified by the Construction Safety Act are to be designed and inspected by a professional engineer licensed in the Province of Manitoba. Stamped drawings of all formwork requiring an engineer certification are to be kept on site during the work available for review by the Ministry of Labour and any of the Consultants.
- .6 Submit Formwork drawings and reshoring drawings for review by the consultant signed and sealed by a Professional Engineer licensed in the Province of Manitoba. Formwork and reshoring to be designed for all anticipated loading including unbalanced loading when placing concrete, increased depth of concrete during depositing of plastic concrete prior to rake out, all applicable lateral loads on formwork, increased construction loading on reshored slabs, and all other load conditions.
- .7 In areas where concrete is the architectural finish and is exposed to view provide all new forms with a high density phenolic resin overlay on concrete side of form. Design forms to provide a tight smooth surface with enough strength to withstand additional vibration to achieve a Class 'A' finish in accordance with ACI 347.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Cement - in accordance with C.S.A. Standard CAN3-A5-03.

.2 Aggregates:

- .1 Fine and course aggregate materials and grading in accordance with Section 5 of C.S.A. Standard CAN3-A23.1-M. Maximum size of course aggregate to suit spacing of reinforcing bars in accordance with C.S.A. Standard CAN3-A23.1.
- .2 Pit run gravel will is not be acceptable.
- .3 Use pea gravel (6mm to 10mm) where concentration of reinforcement requires the use of a smaller diameter aggregate and in toppings where the topping thickness is reduced below 50mm minimum thickness.

.3 Admixtures:

- .1 Use only those chemical admixtures and air entraining agents compatible with other admixtures in the mix.
  - .2 Chemical admixtures shall be type 1, Water Reducing Admixtures by Grace.
  - .3 Admixtures to be compatible with the air entraining agent.
  - .4 Superplasticizer - Normal setting, high range water reducing superplasticizing admixture in accordance with ASTM C-494 Conchem S.P.N. by Master Builders, Eucon-37 by Euclid Chemical or, Sternflo by Sika Canada.
- .4 Reinforcing Steel (plain) - new deformed bars in accordance with CSA G30.18 with a guaranteed yield stress of 400 Mpa.
- .5 Reinforcing Steel (epoxy coated) - as for item .5 with epoxy coating to ASTM A775. All shop or field cut ends to be immediately coated in accordance with ASTM A775 and MTO Form 1443.
- .6 Welded Wire Fabric - in accordance with CSA Standard G30.15-M1983(R1991).
- .7 Reinforcing Steel Supports - in accordance with R.S.I.O. Manual of Standard Practice. All the wires, chairs and other bar supports to be plastic or plastic coated construction compatible with end use. All chairs are to be plastic construction.

- .8 Spray-Applied Curing and Sealing Compounds - to conform with A.S.T.M. Standard C-309, to be 1100-Clear, or Vocomp 20 by W.R. Meadows, Clearseal WB 150 by Euclid Chemical Company, Florseal WB 18 by Sika Canada or equal. Curing compounds must be compatible with the finish flooring adhesive system. All curing and sealing products are to be non-yellowing. (Note: Floor areas where acid etched concrete is to be employed other means of curing may need to be employed if curing compound is not compatible with acid etching process)
- .9 Evaporation Reducer - Master Builders "Confilm, Eucobar by Euclid Chemical Company, or Evapre by W.R. Meadows.
- .10 Lumber, Plywood and other formwork materials to C.S.A. Standard CAN3-A23.1, Article 11.3, except as noted.
  - .1 Contact surfaces of forms for concrete which will be exposed to view in the completed structure to be new, Douglas Fir Plywood, with a high density phenolic resin overlay on concrete side of form.
- .11 Form Oil - colourless, non-staining, mineral oil, free of kerosene.
- .12 Form Ties:
  - .1 For general wall areas, removable or snap-off metal ties that after removal of forms, no metal is within one inch of the finished surface.
  - .2 Heavy duty ties for one sided form construction.
  - .3 On exposed sides of walls, metal ties with plastic cone formers to suit architectural details complete with suitable plugs.
- .13 Grout: non-shrink, non ferrous. M-Bed Standard by Sternson Construction Products, CG-86 Construction Grout by W.R. Meadows, or Dry Pack Grout by Euclid Chemical Company.
- .14 Vapour Barrier: 10 mil polyethylene Perminator by W.R. Meadows, or equal.
- .15 Asphalt Impregnate Fibreboard: 12mm thick fibreboard, uniformly saturated with a bituminous binder.
- .16 Control Joint Filler: at sawcut control joints in all exposed concrete floors provide 'Loadflex' by Sika Canada, 'Euco 700' by Euclid Chemical Company, or approved equal.



- .17 Latex Bonding Agent: for bonding toppings to precast slabs or cast-in-place concrete items - Sika Latex by Sika, Intralok by W.R. Meadows, or approved equal.
- .18 Circular Column Forms: All circular forms to have plastic liner on inner ply to prevent transfer of spiral markings to concrete.
- .19 Fiber Reinforcing for Toppings: 51mm (2") long fibrillated polypropylene fibers complete with plasticizer to increase slump. Conloc Se Fibers by Pro Technologies Ltd., Fibermesh 300 fibers by Propex Concrete Systems, or equal.
- .20 Exposed Topping Material Where Topping Depth is Less Than 40mm W.R. Meadows Meadow-crete. GPS used in conjunction with Meadow Patch-T1 or approved equal.
- .21 Concrete Densifier and Hardener: Liqui-Hard by W.R. Meadows, Euco Diamond Hard by Euclid Chemical Company, or Ashford Formula by Cure Crete Distribution Inc.

## 2.2 PROPORTIONING OF CONCRETE - GENERAL

- .1 Job-mixed concrete will not be allowed on this project.
- .2 Provide mixed-in-transit, ready-mixed concrete in accordance with C.S.A. Standard CAN3-A23.1-M, obtained from a supplier approved by the Consultant for use on this project.
- .3 Mix all concrete with materials so graded and proportioned to produce a plastic mass of such consistency that it will flow slowly under its own weight and which can be readily worked into corners of forms and under and around reinforcing without forming voids or honeycombed surfaces.
- .4 Furnish to the Sub-Contractor, a "delivery ticket" for each batch of concrete delivered to the site, which shall be kept on record for the inspection of the Consultant. Each ticket shall show the following:
  - . Date and truck number
  - . Sub-Contractor's name
  - . Job designation
  - . Specified concrete strength, slump, air content and admixture
  - . Batch volume
  - . Time of batching

- .5 For concrete mixes requiring entrained air, do not pre-mix the air entraining agent with a chemical admixture solution. Where both an air entraining agent and chemical admixture are used, dispense the two materials separately.
- .6 Accelerating or retarding chemical admixtures shall only be used with the prior approval of the Consultant or at the Consultant's written request. Do not use calcium chloride or products containing calcium chloride.
- .7 Chemical admixtures and air entraining agents shall be supplied by the same manufacturer and be compatible. Use in strict accordance with the manufacturer's directions.
- .8 The compressive strength of all concrete is to be determined from test cylinders made in accordance with C.S.A. Standard CAN3-A23.2-M.
- .9 For fibre concrete provide fibres at a rate of 1kg. Per cubic metre of concrete. Provide a compatible slump enhancer to ensure that no slump loss occurs with the addition of fibres.
- .10 Do not use fly ash in concrete that will be exposed to view nor in concrete that will be exposed to freeze-thaw cycles.
- .11 Minimum truck load 1-1/2 c. meter.

- .12 Proportion the materials in accordance with the mix designs supplied under Article 1.10 of this Section to provide the following specified design strengths, slumps and air contents

Location	Specified 28 day Concrete Strength	Slump (mm)	Air Content	Exposure Class	Water Cement Ratio
Lean fill	15 MPa	125 max	nil		
Interior slab-on-grade	30 MPa	76 <sub>+</sub> 25	nil		0.55
Foundation walls and integral Columns	25 MPa	76 <sub>+</sub> 25	5.5% <sub>+</sub> 1%	F-2	0.55
Footings	20 MPa	76 <sub>+</sub> 25	nil		
Isolated interior concrete piers	25 MPa	76 <sub>+</sub> 25	nil		
Exterior slabs-on-grade, sidewalks, curbs	32 MPa	76 <sub>+</sub> 25	6.5% <sub>+</sub> 1.5%	C-2	0.45
Exterior Concrete Columns, planters, light pole foundations,	32 MPa	76 <sub>+</sub> 25	6.5% <sub>+</sub> 1.5%	C-2	0.45
Toppings	30 MPa	75 <sub>+</sub> 25 <sup>1</sup>	nil		

All concrete toppings containing aggregates greater than 6mm to have fibers added

<sup>1</sup> - Slump to be 76<sub>+</sub>25 prior to added fibers and plasticizer.

### 2.3 PLANT QUALITY CONTROL

- .1 All materials, batching and mixing procedures are subject to test or inspection by the Consultant or his designed representatives.
- .2 Provide samples of materials as may be required at no additional cost to the Owner.
- .3 Provide access to pits, batch plants, etc., as may be required by the Consultant or his designated representatives.
- .4 The cost of testing will be paid by the Owner.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Examine and obtain all necessary measurements of previously executed and existing work which may affect the work of this section prior to commencing operations.
- .2 Report any discovered discrepancies to the Consultant so that instructions can be given for the necessary remedial action.

**3.2 ERECTION OF FORMS**

- .1 Construct all forms to have sufficient strength, stability and rigidity to prevent bulging or deflection under the liquid weight of concrete and to support in addition, all construction loads to which they may be subjected including equipment, runways and wind forces in accordance with A.C.I. Standard 347.
- .2 Erect forms to the lines, dimensions and elevations shown on the drawings such that the completed work is within the tolerance limits for reinforced concrete buildings in accordance with Sub-Section 1.8 of this Section.
- .3 Provide for all openings, offsets, risers, brackets, haunches, depressions and curbs as shown or required in the formwork.
- .4 For typical wall surfaces, arrange form ties such that after removal of the forms, no metal is within 25mm of the finished surface.
- .5 Clean forms of all debris prior to concreting. Provide temporary openings at the base of walls, column forms and at other locations where necessary to facilitate cleaning and inspection. Place openings so that "wash water" will have a clean run to the outside of the forms.
- .6 Provide 20 x 20 chamfers on all exposed corners of concrete, exposed to view in the finished structure.
- .7 Coat forms with a non-staining mineral oil prior to the placing of reinforcing steel in accordance with C.S.A. Standard CAN3-A23.1. Where concrete surfaces are to receive a final coat of paint, plaster, etc., omit the form oil and wet down the forms just prior to concreting.

- .8 Refer to architectural drawings for all tie and reveal locations in exposed concrete walls and ceilings.
- .9 Take special care when lowering plastic lined circular forms over reinforcing steel to avoid scratching plastic liner.
- .10 Place continuous dovetail anchor slots in concrete walls where masonry abuts concrete wall. Also place continuous dovetail slots at spacing shown on typical details for all concrete walls, beams, slab edges, and columns that are faced with a masonry veneer.
- .11 Install anchors, inserts, and other hardware supplied by other divisions for support of Mechanical and Electrical equipment, precast support, lintel support, structural steel and miscellaneous metals items etc.
- .12 Take precautions to ensure bleeding from subsequent concrete lifts do not bleed out and stain already finished work that is exposed in the finished structure. Provide control joints only at reveal locations and seal, tape, or caulk panel joints.
- .13 Do not use de-icers or other chemicals to remove ice on or from within forms.
- .14 For concrete walls that are exposed to view in the finished structure tie corners exterior to the concrete wall. In general ensure all ties are not within 300mm horizontal distance and 150mm vertical distance from the edge of walls, openings, or reveal locations. Obtain approval of the architect for all tie locations prior to pouring.
- .15 Use new undamaged plywood with a maximum reuse of 3 times for all for concrete items that are exposed to view in the finished structure. Do not use any form material in these areas that will cause blemishing or nonuniform texture or colour of the concrete.
- .16 Do not form holes in concrete columns, beams or close to columns in slabs and drops unless specifically shown on structural drawings. Obtain written permission for all openings in these locations from the Consultant.

### **3.3 REINFORCING STEEL**

- .1 Placing, spacing, splicing and protection of reinforcement in accordance with CSA Standard CAN3-A23.3.1-M94.
- .2 Maintain the cover required for reinforcement as shown on the drawings. Where not specifically shown, refer to CSA Standard CAN3-A23.1-M94.
- .3 Supply and install 90x90x65 brick chairs for the support of reinforcing in slab-on-grade. In areas where poly vapour barrier or membrane are used ensure brick chairs are of a type and are place in a manner which will not puncture the poly vapour barrier. Space chairs 1200 o/c each way. Lap welded wire fabric at least one mesh plus 50 at all splices.

### **3.4 CONCRETE PLACING**

- .1 Do not start concrete placing until the Consultant has reviewed and approved all preparations including forms, joints, and reinforcing steel.
- .2 All conveying, depositing, compaction and vibration is to be done in accordance with the current C.S.A. Standard CAN3-A23.1-M94.
- .3 Maximum elapse of time between charging and placing is not to exceed 1½ hours. Reject concrete which exceeds this limit. In hot weather, this time period may have to be reduced as directed by the Consultant.
- .4 Place concrete carefully around all accessories, such as pipes, sleeves, and conduits.
- .5 When concrete is to be placed in restricted locations, take special precautions to ensure close contact between the concrete and steel. Take care to exclude air pockets and honeycombed areas. Use of a superplasticizer may be required for proper placement.
- .6 Use " elephant trunks" for high lift concrete placement to prevent segregation.

- .7 When buggies are used for placing concrete in slabs on soil, they are to be supported on runways and not directly on the reinforcing steel.
- .8 Place reinforcing steel for slab-on-grade on 90x90x65 concrete bricks spaced 1200 o.c. each way.
- .9 Maintain a sufficient number of internal mechanical vibrators on site to properly compact the concrete within 15 minutes of placing, but not less than two vibrators for any pour.
- .10 Mechanical vibrators which are applied to the outside of the forms are not permitted without prior approval of the Consultant.
- .11 Thoroughly compact all concrete during placing to ensure that the finished concrete is free of voids or other defects.
- .12 Ensure that reinforcement, hardware, and inserts are not disturbed during concrete placement.
- .13 Strike off-floor surfaces at the level shown on the drawings by means of previously set, continuous pipe screeding, set on adequate supports.
- .14 Notify the Consultant at least 24 hours in advance of any scheduled pour.
- .15 Just prior to placing concrete place polyethylene vapour barrier lapped 200 (8") at joints and wrapped up sides of walls or slab edge. Do not install vapour unless building is closed in from accumulation of rain on top of membrane. Take special care not to damage vapour barrier. Repair all tears rips and punctures as per manufactures' instructions.
- .16 Apply liquid surface evaporation reducers by sprayer to protect the concrete from pre-mature surface drying when required. Mix in accordance with the manufacturers instructions and apply in a thin film following the bullfloating operation. Do not work liquid materials into the surface of the concrete.
- .17 Place concrete stair non-slip nosing strips into concrete stairs. Take special care to ensure strips are aligned equally from tread to tread and are installed straight vertically and horizontally.

- .18 Take precautions to ensure bleeding from subsequent concrete lifts do not bleed out and stain already finished work that is exposed in the finished structure. Provide control joints only at reveal locations and seal, tape, or caulk panel joints.
- .19 Over insulation layer of heated floor lay 10 mil poly vapour barrier turned up at edges to the top of the slab. Lap vapour barrier 250mm and tape at joints.
- .20 Coordinate with mechanical trades for placing concrete around in-floor heating pipes. Pipes are to be filled with water and maintained under pressure during floor pour. Heating pipes are to be monitored by mechanical trades. The Concrete Floor Contractor is not to place any concrete unless mechanical trades are onsite to supervise the pour and to ready to repair pipes if a leak should appear. The Concrete Floor Contractor is to employ methods that do not risk puncturing or displacing heating pipes during the concrete floor pour.

### **3.5 CURING AND PROTECTION**

- .1 Protection and curing of concrete for a minimum of 7 days in accordance with Section 21 of C.S.A. Standard CAN3-A23.1-M94.
- .2 Maintain all equipment and materials for the protection and curing of concrete on site, ready to use before concrete placing is started.
- .3 All areas in noted flooring schedule to be left as exposed hardened concrete floor are to have a non-metallic surface hardener applied. Apply hardener in two equal shakes in strict accordance to manufactures instructions to achieve a surface hardness for a light duty floor.
- .4 Completely cover floor, topping slabs with 4 mil polyethylene sheeting, properly lapped at side and edge laps and weighted down immediately after finishing.



- .5 A sprayed-on membrane curing compound may be used in lieu of polyethylene sheeting for concrete, except as follows:
  - .1 Floor areas which are to have topping or other surface treatments are not to have spray-applied compounds employed, but must be polyethylene cured.
  - .2 The areas that are to have liquid hardeners applied that are incompatible with curing and sealing compounds.
  - .3 The areas that are to have acid etched floor finish.
- .6 Freshly finished floors are not to be used for seven (7) days after completion and only light use is permitted for an additional 7 days.
- .7 General Contractor shall protect the floor in areas where Acid etched finish is to be applied from staining by any substance that will affect the acid etching process

### **3.6 COLD WEATHER CONCRETE**

- .1 All concreting operations during cold weather in accordance with Section 21 of CAN3-A23.1-M. Carefully protect all corners and edges.
- .2 Exercise particular care to ensure that previously placed concrete and reinforcing steel are adequately heated to prevent freezing of new concrete placed directly against it.
- .3 Exercise care to avoid rapid temperature changes (thermal shock) when removing an area from temporary heating conditions.
- .4 Remove and replace all concrete damaged by frost or freezing at the direction of the Consultant at no cost to the Owner.
- .5 Accelerating chemical admixtures shall not be used without the written approval of the Consultant.

### **3.7 HOT WEATHER CONCRETE**

- .1 All concreting operations during hot weather in accordance with Section 21 of C.S.A. Standard CAN3-A23.1-M.

- .2 Exercise particular care to prevent surface crazing of floor slabs due to combined high temperatures and drying winds.
- .3 The use of a water reducing-retarding chemical admixture in the concrete mix may be required at the Consultant's discretion.

**3.8 FINISHING OF HORIZONTAL SURFACES**

**.1 Floors:**

- .1 Refer to A.C.I. Standard 302 for recommended procedure for concrete floor and slab construction and finishing.
- .2 Floor Flatness Shall Conform to the Following Requirements
  - .1 Slab-on-grade in all areas, shall conform to the following ACI F-number requirements:
    - Specified Overall Value:  $F_F -25/F_L -18$
    - Minimum Local Value:  $F_F -15/F_L -10$
    - Surface Waviness Index (SWI) = 4
  - .3 Also refer to A.C.I. Standard 117-90, Specification for Structural Concrete and maintain surface tolerances for all general slabs in accordance with Section 4.5.7 of that Standard for Flat Floor tolerance (3/16" in 10' straightedge).
- .3 Provide slopes to drains as directed by the Architect.
- .4 The Specified Overall Value (SOV) describes the flatness or levelness value that must be achieved when all measured values of that type on the total slab are combined.
- .5 The Minimum Local Value (MLV) describes the flatness or levelness value below which replacement by the Contractor is required.

- .6 Floor flatness and levelness tests on the slabs shall be conducted in accordance with the provisions set forth in ASTM E1155-87. Floor tolerance measurements shall be made by the Owner after completion of the final finishing operations. Measurements will be made by using a Dipstick Floor Profiler as manufactured by the Edward W. Face Company Inc, of Norfolk Va.
- .7 Slabs measuring at or above both of the specified Minimum Local F-numbers shall be accepted for tolerance compliance as constructed. No remedies for sub-Minimum Local F-numbers, other than replacement of the slab, will be permitted.
- .8 If the F-Number Combined Values for Slab-on-Grade fail to meet or exceed either of the Specified Overall Values for all slabs other than, gymnasium slab, the Contractor shall rebate to the Owner an amount equal to the larger of the following, where:  
\$ = Total rebate amount  
0.60 = Rebate amount per sq. metre  
TA= Total Area of Slab sq.m  
S = Specified Overall Value (F-number)  
A = Actual Overall Value (F-number)
- For  $F_F$ :  $\$ = 0.60 \times TA \times (S/A) \times (S-A)$   
For  $F_L$ :  $\$ = 0.60 \times TA \times (S/A) \times (S-A)$
- .9 Provide sufficient lighting as necessary for finishing requirements.
- .10 Concrete floors shall be steel floated with a disc type power floating machine, having a 600 disc, and weighing at least 300 pounds. Continue the floating operation until sufficient moisture is brought to the surface to fill all voids. After floating when the floor has hardened sufficiently so that excess fines will not be brought to the surface, trowel with a steel trowel to a surface free of all pinholes and trowel marks. See A.C.I. Standard 301, Section 11.7.
- .11 Following finishing operations for all floors noted in the room finish schedule to remain as, exposed concrete and not to have acid etched finish, fill sawcut control joints with joint filler and seal with unthinned cure and seal compound, applied in strict conformance with manufactures' instructions.

- .12 In areas to have acid etched finish fill joints after acid etching process. Thoroughly clean sawcut joints and fill with joint filler applied in strict conformance with manufacturers' instructions. Color filler as indicated by Architect
- .13 All areas in noted flooring schedule to have hardener, apply hardener in strict accordance to manufacture's instructions.
- .13 Just prior to turn-over, clean plain concrete floor areas and reseal with one coat of compatible sealer applied in strict conformance with manufacturers instructions.

### 3.9 CONCRETE TOPPINGS

Place a concrete topping of the thickness and in the areas shown on the drawings as follows:

- .1 Thoroughly clean top of slabs to receive topping of all material likely to affect a good bond between precast unit and the topping.
- .2 Clean the existing surface using stiff brooms and a small jet from a high pressure hose. Remove all dirt from crevices and depressions.
- .3 The surface shall be wet down at least four hours before placing the topping and shall be kept saturated until the topping is placed, but in no case shall there be any free water on the surface when the topping is placed.
- .4 Prior to placing the topping, apply latex bonding agent to surface of precast or concrete slab in strict accordance to manufactures instructions.
- .5 The topping shall then be placed finished and cured, in accordance with the appropriate requirements, including slopes to drains where applicable.
- .6 Employ toppings with peastone aggregate at all locations where topping thickness is less than 50.

- .7 For areas employing concrete toppings with aggregate size greater than 6mm add fiber reinforcing at a rate of 900 grams (2 lbs) of fibers plus 570 grams (1 ¼ lb) of plasticizer per cubic metre of concrete. The addition of the fibers shall not cause a slump reduction to the concrete when added at the job site. After adding fiber and plasticizer, allow a minimum of 10 minutes mixing time to ensure thorough dispersion. Discharge load within 30 to 40 minutes of the completion of the 10 minute mix period.
- .8 Refer to CURING & PROTECTION portion of this specification for curing of topping slabs.

### **3.10 FINISHING OF VERTICAL SURFACES**

- .1 In areas where concrete walls will be exposed, take extra care to avoid 'bugholes' and honeycombing. When placing concrete, re-vibrate critical areas to ensure complete consolidation of concrete near form surfaces.
- .2 For reveal and tie locations, see architectural drawings.

### **3.11 TREATMENT AND REPAIRS FOR FORMED SURFACES**

- .1 After removal of forms, the surfaces of concrete, exclusive of architectural concrete, are to be given one or more of the finishes specified hereafter. Methods used are to be in accordance with Section 24 of C.S.A. Standard CAN3-A23.1-M. Refer to Section 1.8 of this specification and Section 27 of C.S.A. Standard CAN3-A23.1-M for requirements of architectural concrete.
- .2 When, in the opinion of the Consultant, satisfactory repairs cannot be made, then the defective work is to be cut out and replaced as directed by the Consultant.
- .3 Treatment of honeycombed areas is to be carried out as directed by the Consultant. Do not treat such areas prior to receiving instructions from the Consultant.
- .4 Patch tie holes and other defects (unless otherwise directed by the Consultant as noted in paragraphs 2 and 3 above). Remove fins exceeding 5mm in height.

**3.12 CONSTRUCTION JOINTS**

- .1 Construction joints in walls and floors shall be placed in locations approved by the Architect.
- .2 Construction joints shall be poured to the adjoining wall as detailed on the drawings.
- .3 Before placing adjoining concrete at construction joints, clean the existing surface of dirt, laitance and loose aggregate.
- .4 Where additional resistance to horizontal shear is required, mortises or keys shall be formed in the concrete. The pouring sequence and the location of construction joints shall be as shown on the plans, noted herein, or as approved by the Consultant.

**3.13 CONTROL JOINTS**

- .1 Provide control joints where shown and noted on the drawings in foundation and retaining walls and in floor slabs. Control joints in floor slabs shall be sawcut to the depth shown as soon after placing the concrete as the surface will allow without chipping but not later than 24 hours after placing.

**3.14 GROUTING OF COLUMN BASE AND BEAM BEARING PLATES**

- .1 Rough finish the top of walls, piers, or slabs which receive steel columns or steel beams.
- .2 After the erection and alignment of columns and beams, fill the space beneath the plates with a non-shrink grout. Take particular care to ensure that air pockets or voids are eliminated.
- .3 Mix and place grout in strict accordance with the manufacturer's directions.

**3.15 FIELD QUALITY CONTROL**

- .1 All materials and workmanship shall be subject to test and inspection by a testing and inspection company appointed by the General Contractor.
- .2 Cost of testing and inspection will be paid by the Owner, except as noted hereafter.

- .3 Provide unhindered access to the project for purposes of inspection and testing. Provide storage space and the necessary protection for test specimens against damage or loss while on site.
- .4 Provide representative samples of the materials as requested by the testing and inspection company at no cost to the Owner.
- .5 All field tests for concrete quality and all criteria relating to failure to meet test requirements in accordance with C.S.A. Standard CAN3-A23.1-M, Section 17, except as follows:
  - .1 Each test shall consist of three standard cylinders, accompanied by a slump test and measurement of air content (where applicable). Unless otherwise directed by the Consultant, one cylinder shall be tested at 7 days and the remaining two at 28 days.
  - .2 The inspection company shall take concrete tests for:
    - i) not less than one test for each class of concrete placed each day, and
    - ii) not less than one test for each 100 cubic meters or portion thereof placed in any day.
- .6 The cost of any additional testing and/or the cost of replacement of any part of the structure resulting from failure of the concrete to meet the test requirements shall be borne by the Sub-Contractor.
- .7 Notify the testing company of the pouring schedule sufficiently in advance so that tests may be made.

**3.16 CLEAN-UP**

- .1 At the completion of the work of this Section, remove from the site any excess materials, debris and equipment.

END OF SECTION