

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, and spacers for reinforcing.

1.2 Quality Control

- .1 Perform concrete reinforcing Work in accordance with CAN/CSA-A23.1-00.

1.3 Inspection and Testing

- .1 If requested by Contract Administrator, submit three (3) certified copies of 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 01300 – Submittals.
- .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 CAN/CSA-A23.1-00, CAN/CSA-A23.3, and RSIC Reinforcing Steel Manual of Standard Practice.
- .4 Detail placement of reinforcing where special conditions occur.
- .5 Detail lap lengths and bar development lengths to CAN/CSA-A23.1-00, unless otherwise shown on the Drawings.

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: minimum 400 MPa yield grade; deformed billet steel bars conforming to CAN/CSA-G30.18; material R and W (where indicated on the Drawings); plain finish.
- .2 Welded Steel Wire Fabric: plain type, conforming to ASTM A185; flat sheets; plain finish.

CONCRETE REINFORCEMENT

2.2 Accessory Materials

- .1 Tie Wire: minimum 1.6 mm annealed type, or patented system accepted by Contract Administrator.
- .2 Chairs, Bolsters, Bar Supports, Spacers: adequately sized for strength and support of reinforcing steel during construction.
- .3 Bar Chairs: to be non-corrosive PVC chairs or concrete chairs purpose made. Steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks, stones, or wood supports are not acceptable.
- .4 Side form spacers to be non-corrosive PVC spacers, purpose made. PVC chairs, steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks, or wood supports are not acceptable.

3. EXECUTION

3.1 Fabrication

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1-00 and Drawings.
- .2 Locate reinforcing splices not indicated on Drawings at points of minimum stress.
- .3 Fabricate within the following tolerances:
 - .1 Sheared length: + 0, - 25 mm
 - .2 Stirrups, ties, and spirals: +0, - 10 mm
 - .3 Other bends: + 0, - 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 rebent or straightened unless so indicated on the Drawings.
- .6 Heating of reinforcing steel will not be permitted.

3.2 Installation

- .1 Place reinforcing steel in accordance with reviewed placing drawings and CAN/CSA-A23.1-00. Chair slab reinforcing not further apart than 1.2 m in either direction. Tie reinforcing steel at maximum spacing 600 mm.
- .2 Adequately support reinforcing and secure against displacement within tolerances permitted.

CONCRETE REINFORCEMENT

- .3 Place reinforcing steel to provide concrete cover required by CAN/CSA-A23.1-00, but not less than shown below or noted otherwise on the Drawings:
 - .1 Beam stirrups: 40 mm unless noted otherwise; main steel: 50 mm.
 - .2 Slabs (top and bottom): 50 mm.
 - .3 Column ties: 40 mm; main steel: 50 mm.
 - .4 Walls: 50 mm unless noted otherwise.
 - .5 Concrete formed against earth (including bottom of slab on grade): 75 mm.
- .4 Maintain alignment as follows:
 - .1 Slabs: ± 5 mm.
 - .2 Other structural members: ± 10 mm.
 - .3 Rebar bends and ends: ± 50 mm.
- .5 Do not disturb or damage polyethylene film or void form while placing reinforcing steel.
- .6 Install purpose made highly visible protective safety caps on all exposed projecting bar ends.

3.3 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.
- .3 Remove concrete splatter on bars before concrete has hardened.

END OF SECTION

CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 Work Included

- .1 All reinforced cast-in-place concrete Masonry infill.
- .2 Setting anchors, inserts, frames, sleeves, and other items supplied by other Sections.
- .3 Repairing concrete imperfections.
- .4 Concrete curing.

1.2 Quality Control

- .1 Cast-in-place concrete shall conform to the CAN/CSA-A23.1-00.
- .2 Testing shall conform to CAN/CSA-A23.2-00.
- .3 These standards shall be available in the Contractor's Site office for reference by the Contractor, sub-trades, and Contract Administrator.
- .4 A Concrete Review Report will be completed with each concrete pour. Each Concrete Review Report shall be signed by the Contractor and submitted to the Contract Administrator.

1.3 Qualification

- .1 Concrete flatwork finishing is to be done by an established firm having at least five (5) years of proven, satisfactory experience in this trade and employing skilled personnel.
- .2 Submit proof of qualifications in writing to the Contract Administrator.

1.4 Inspection and Testing

- .1 Notify the Contract Administrator at least forty eight (48) hours before complete formwork and concrete reinforcement is ready for review. Reinforcing in walls shall be reviewed prior to closing forms.
- .2 Allow ample time for notification, review, and corrective work, if required, before scheduling concrete placement.
- .3 Concrete sampling, inspection, and testing is to be performed by a CSA certified inspection and testing firm appointed and paid for by the City.
- .4 Provide unencumbered access to all portions of work and cooperate with appointed firm.

CAST-IN-PLACE CONCRETE

- .5 Submit proposed mix design statements of each class of concrete to the Contract Administrator for review four weeks prior to commencement of the work. If blended cement is proposed for sulphate resistant concrete, testing data supporting conformance to CSA-A3000 satisfactory to the Contract Administrator shall be submitted with the mix design statement.
- .6 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.
- .7 At least three (3) concrete test cylinders will be taken for every 75 m³ or less of each class of concrete placed.
- .8 At least three (3) test cylinders will be taken daily for each class of concrete placed.
- .9 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.
- .10 Additional slump and air content tests may be taken as necessary (up to every truck) to verify quality of concrete at the discretion of the Contract Administrator.
- .11 Testing of concrete will be performed in accordance with CAN/CSA-A23.2-00. Test results will be issued to the Contractor, the Contract Administrator, and the City.
- .12 The Contractor shall pay costs for required retesting due to defective materials or workmanship.
- .13 If accepted by the Contract Administrator, the Contractor may arrange and pay for additional tests for use as evidence to expedite construction.
- .14 To conform to the strength requirements, the average of all tests shall exceed the specified strength. When three (3) or more tests of the same class of concrete are available, the average of any three (3) consecutive tests shall be equal to, or greater than the specified strength, and no strength test shall fall more than 3.5 MPa below the specified strength. If any of the criteria of the foregoing are not met, the Contract Administrator shall have the right to require one or more of the following:
 - .1 Changes in mix proportions for the remainder of the work.
 - .2 Cores drilled and tested from the areas in question as directed by the Contract Administrator and in accordance with CAN/CSA-A23.2-00. The test results shall be indicative of the strength of the in-place concrete.
 - .3 Full scale load testing of the structural elements.
 - .4 The changes in the mix proportions, cores drilled and tested, and load testing shall be at the Contractor's expense.

CAST-IN-PLACE CONCRETE

- .5 Concrete failing to meet the strength requirements shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

2. PRODUCTS

2.1 Concrete Materials

- .1 Cement: Normal Type 10 (Type GU) Portland Cement conforming to CAN/CSA-A3000 and sulphate resistant Type 50 (Type HS) Portland Cement or HSb conforming to CAN/CSA-A3000.
- .2 Fine Aggregate: conforming to Normal-Density Fine Aggregate, CAN/CSA-23.1-00. If requested by the Contract Administrator, submit evidence at least two weeks before use in concrete mix showing conformance to Normal-Density Fine Aggregate, CAN/CSA-A23.1-00, Table 4 and Table 6.
- .3 Coarse Aggregate: conforming to Normal-Density Coarse Aggregate, CAN/CSA-23.1-00, Group I, 20 to 5 mm, and 10 to 2.5 mm. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Coarse Aggregate, CAN/CSA-A23.1-00, Table 5 and Table 6. Group II may be used for special requirements such as gap grading, pumping, or for blending two (2) or more sizes to produce Group I gradings.
- .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 report if requested by the Contract Administrator.
- .5 Water: potable, clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious matter.
- .6 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the work.
- .7 Supplementary cementing materials: conforming to CAN/CSA-A3000.

2.2 Admixtures

- .1 No admixtures other than air-entraining agent, water-reducing agent, and superplasticizer shall be used without the written authorization of the Contract Administrator, unless specified.
- .2 Air entrainment: conforming to ASTM Standard C260.
- .3 Water-reducing agent: Type WN conforming to ASTM Standard C494.
- .4 Superplasticizer: conforming to ASTM Standard C494.
- .5 General Chemical Admixtures: conforming to ASTM Standard C494.

CAST-IN-PLACE CONCRETE

- .6 Calcium chloride or admixtures containing calcium chloride shall not be used in concrete.

2.3 Accessories

- .1 Curing Sealer: conforming to ASTM C309.
- .2 Moisture Retention Film: Master Builders Confilm.

2.4 Concrete Mixes

- .1 Pay all costs for mix design.
- .2 Provide concrete mixed in accordance with requirements of CAN/CSA-A23.1-00 and as indicated on Table A at the end of this Section and on the Drawings. Table A and Drawing requirements shall govern where there is a difference between Table A and Drawings, and CAN/CSA-A23.1-00 Tables 6 to 10 requirements.
- .3 Maximum allowable substitution of cement with supplementary cementing materials shall be 20% by weight except that blended cements may contain the amount of supplementary cementing materials as required for the intended purpose such as sulphate resistance. Blended cements shall be used as blended by the Manufacturer without additional substitution of cement with supplementary cementing materials unless the resulting blend is supported with testing data showing conformance to CSA-A3000 satisfactory to the Contract Administrator.
- .4 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.
- .5 Use set-retarding admixtures during hot weather only when accepted by the Contract Administrator.
- .6 All admixtures must be compatible within the mix. Concrete with freezing and thawing exposure must satisfy the durability requirements of CAN/CSA-A23.1-00, Sections 14 and 15.
- .7 All admixtures are subject to acceptance by the Contract Administrator. List all proposed admixtures in mix design submission. Do not change or add admixtures to accepted design mixes without the Contract Administrator's review and acceptance.
- .8 The water:cementing ratio must be calculated and shown based on all available mixing water excluding aggregate absorption.
- .9 Concrete delivered to Site must be accompanied by a delivery slip indicating time of completion of mixing, design strength of concrete, air content, and actual water-cement ratio.

CAST-IN-PLACE CONCRETE

.10 Patching Mortar:

- .1 The patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2.5 parts sand by damp loose volume.
- .2 White Portland cement shall be substituted for a part of the grey Portland cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by trial patches.
- .3 The quantity of mixing water shall be no more than necessary for handling or placing. Mixing water shall include 1 part latex bonding agent to 3 parts water. Maximum water to cement ratio shall be 0.40.

.11 Self-compacting concrete mixes will not be permitted for use on this work.

3. EXECUTION

3.1 Placing Concrete

- .1 Place concrete in accordance with requirements of CAN/CSA-A23.1-00 and as indicated on the Drawings. Layout of the work and accuracy of same is the Contractor's sole responsibility.
- .2 Notify the Contract Administrator a minimum of twenty four (24) hours prior to pouring concrete. Under no circumstances shall concrete be poured without notifying Contract Administrator, or in his absence, arranging for review of the work and sampling of concrete.
- .3 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. Concrete shall be placed within 1.5 hours of mixing.
- .4 Ensure all anchor bolts, seats, plates, and other items to be cast into concrete are securely placed and will not interfere with concrete placement.
- .5 All equipment for transporting the concrete shall be cleaned of hardened concrete and foreign materials before placing concrete.
- .6 Immediately before concrete is placed, Contractor shall carefully inspect all forms 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.

CAST-IN-PLACE CONCRETE

- .7 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, which has partially hardened, be deposited in the forms.
- .8 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.
- .9 Vibrate concrete using the appropriate size equipment as placing proceeds, in accordance with CAN/CSA-A23.1-00. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.
- .10 Prepare set or existing concrete by removing all laitance and loose or unsound materials and apply bonding agent in accordance with Manufacturer's recommendations.
- .11 Where placing operations would involve dropping the concrete more than 1.5 m, 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.
- .12 In locations where new concrete is dowelled to existing concrete, drill holes in existing concrete, thoroughly clean the holes, place non-shrink grout in holes, and insert steel dowels so that grout is packed solidly for full depth around the dowels.
- .13 A minimum of three (3) Calendar Days shall elapse between adjacent pours separated by construction joints or expansion joints.
- .14 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.
- .15 Honeycomb or embedded debris is not acceptable.
- .16 Remove and replace defective concrete.
- .17 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- .18 Prior to the erection of the formwork for walls and beams, construction joints shall be sand blasted and cleaned.
- .19 At the start of casting of walls or beams on slabs, a layer of grout slurry approximately 12 mm to 25 mm thick shall be placed immediately prior to the placement of concrete.

CAST-IN-PLACE CONCRETE

3.2 Cold Weather Concreting

- .1 The requirements of this section shall be applied to all concreting operations during cold weather, i.e., if the mean daily temperature falls below 5°C during placing or curing.
- .2 Supplementary equipment as required below shall be at the Site if concrete is likely to be placed in cold weather.
- .3 Formwork and reinforcing steel shall be heated to at least 5°C before concrete is placed.
- .4 The temperature of the concrete shall be maintained at not less than 10°C for seven (7) Calendar Days. In no case, shall the heating be removed until the concrete has reached a minimum compressive strength which will be specified by the Contract Administrator as determined from compressive strength tests on specimens cured under the same conditions as the concrete work in question.
- .5 Aggregates shall be heated to a temperature of not less than 20°C and not more than 65°C. Water shall be heated to a temperature between 55°C and 65°C. The temperature of the concrete at the time of placing in the forms shall be within the range specified in CAN/CSA-A23.1-00 for the thickness of the section being placed.
- .6 When the mean daily temperature may fall below 5°C, a complete housing of the work, complete with heaters, fuel, maintenance, and attendants, shall be provided.
- .7 Combustion-type heaters may be used if their exhaust gases are vented outside the enclosures and not allowed to come into contact with concrete surfaces. Fire extinguishers must be readily at hand wherever combustion-type heaters are used.
- .8 When the ambient temperature is below -15°C, the housing shall be constructed so as to allow the concrete to be placed without the housing having to be opened. If the mixing is done outside of the housing, the concrete shall be placed by means of hoppers installed through the housing. The hoppers are to be plugged when not in use.
- .9 When the ambient temperature is equal to or above -15°C, the Contractor will be permitted to open small portions of the housing for a limited time to facilitate the placing of the concrete.
- .10 Before depositing any of the concrete, the Contractor shall show that enough heating equipment is available to keep the air temperature surrounding the forms within the specified range. This shall be accomplished by bringing the temperature inside of the housing to the specified 10°C at least 12 hours prior to the start of the concrete placing.
- .11 The Contractor shall supply all required heating apparatuses and the necessary fuel. When dry heat is used, a means of maintaining atmospheric moisture shall be provided.
- .12 Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns that may occur in the equipment.

CAST-IN-PLACE CONCRETE

- .13 The Contractor shall keep a curing record of each concrete pour. The curing record shall include date and location of the pour, mean daily temperature, temperatures above and below the concrete within the enclosures, temperatures of the concrete surface at several points, and notes regarding the type of heating, enclosure, unusual weather conditions, etc. This record shall be available for review by the Contract Administrator at all times, and shall be turned over to the Contract Administrator at the end of the concreting operations.

3.3 Hot Weather Concreting

.1 General:

- .1 The requirements of this Clause shall be applied during hot weather, i.e., when air temperatures are above 25°C during placing.
- .2 Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 27°C. Aggregate stockpiles may be cooled by water sprays and sun shades.
- .3 Ice may be substituted for a portion of the mixing water provided the ice has melted by the time mixing is completed.
- .4 Forms and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white, and/or the use of water sprays.
- .5 Sun shades and wind breaks shall be used as required during placing and finishing.
- .6 Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".
- .7 The Contract Administrator's acceptance is necessary before the Contractor may use admixtures such as retardants to delay setting, or water-reducing agents to maintain workability and strength, and these are to be included in the mix designs submitted to the Contract Administrator.
- .8 Curing shall follow immediately after the finishing operation.

.2 Hot-Weather Curing:

- .1 When the air temperature is at or above 25°C, curing shall be accomplished by water or by using saturated absorptive fabric, in order to achieve cooling by evaporation. Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

CAST-IN-PLACE CONCRETE

.3 Job Preparation:

- .1 When the air temperature is at or above 25°C, or when there is the probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined under “Severe Drying Conditions” below, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.

.4 Concrete Temperature:

- .1 The temperature of the concrete as placed shall be as low as practicable and in no case greater than that shown below for the indicated size of the concrete section.

Thickness of Section (metres)	Temperatures (°C)	
	Minimum	Maximum
less than 0.3	10	27
0.3 – 1	10	27
1.2	5	25

.5 Protection from Drying:

.1 Moderate Drying Conditions:

- .1 When surface moisture evaporation exceeds 0.75 kg/m²/hour, windbreaks shall be erected around the sides of the structural element.

.2 Severe Drying Conditions:

- .1 When surface moisture evaporation exceeds 1.0 kg/m²/hour, additional measures shall be taken to prevent rapid loss of moisture from the surface of the concrete. Such additional measures shall consist of the following:
 - .1 Erecting sunshades over the concrete during finishing and placing operations.
 - .2 Lowering the concrete temperature.
 - .3 Placing concrete at cooler part of the day when there is little or no direct sunlight.
 - .4 Increasing humidity by applying fog spray immediately after placement and before finishing.
 - .5 Care shall be taken to prevent accumulation of water that may reduce the quality of the cement paste.

CAST-IN-PLACE CONCRETE

.6 Beginning the concrete curing immediately after trowelling. Under certain conditions moisture retention film may be used.

.3 Surface Moisture Evaporation Rate:

.1 The monograph, Figure D1, Appendix D of CAN/CSA-A23.1-00 shall be used to estimate surface moisture evaporation rates.

3.4 Concrete Protection for Reinforcement

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with Section 03200 – 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 Section 03200 – Concrete Reinforcement.

.1 Sizes of Member or Thickness of Slabs: + 6 mm, - 0 mm.

.2 Cover of Concrete over Reinforcement: ± 3 mm.

.3 Variations from Plumb: 6 mm in 3 m, 10 mm maximum.

.4 Variations from Flat: 3 mm in 3 m, 6 mm maximum.

.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 Curing and Protection

.1 Cure and protect freshly placed concrete in accordance with Clause 21 of CAN/CSA-A23.1-00.

.2 All 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.

CAST-IN-PLACE CONCRETE

- .3 Surfaces of concrete, which 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 not exceeding 10°C per day 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 The supply (both quantity and time of supply) of water for curing concrete shall be subject to control of the Contract Administrator and prior arrangements shall be made by the Contractor with the Contract Administrator for its supply. The Contractor shall be responsible for, at his own cost, to supply, install, maintain, and move extensions to water services as required for conveying water to the work Site. Water required for curing concrete will be supplied by the City, from the DBPS.

3.7 Defective Concrete

- .1 Concrete not meeting the requirements of the Specifications and Drawings will be considered defective concrete; the Contractor shall remediate all 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. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein.
- .3 Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense.

3.8 Clean-Up

- .1 As work progresses and at the completion of work, remove from Site all debris, excess materials, and equipment.

CAST-IN-PLACE CONCRETE

Table A

Mix Type	Portion of Structure	Min. Compressive Design Strength @ 28 Days (MPa)	Cement Type	Min. Cementing Material Content (kg/m ³)	Max. Water Cementing Material Ratio	Nominal Aggregate Size (mm)	Slump (mm)	Entrained Air Content (%)
1	Containment structural concrete beams, grade beams, slabs and walls Containment sump pits. Class of exposure: C-1	35	50 (HS)	335	0.40	20 to 5	*80 ± 25	4 to 7
2	Non- containment structural concrete in contact with soil and backfill or exposed to weather or freezing and thawing – pile caps, concrete beams, grade beams, pads, and curbs Class of exposure: C-1	35	50 (HS)	--	0.40	20 to 5	*80 ± 25	5 to 8
3	Interior structural concrete, 150 concrete on steel deck Class of exposure: N	30	10 (GU)	--	0.50	20 to 5	80 ± 25	Less than 3
4	Topping on hollowcore and 103 concrete on steel deck Class of exposure: N	30	10 (GU)	--	0.50	10 to 2.5	80 ± 25	Less than 3
5	Miscellaneous concrete – curbs, equipment bases, pipe supports within heated buildings and benching Class of exposure: N	25	10 (GU)	--	0.50	20 to 5	80 ± 25	Less than 3
6	Grout or Concrete used in Masonry infill	20	10 (GU)	--	--	10 to 2.5	150 ± 30	Less than 3

Note: * Concrete for walls and beams of containment areas shall be superplasticized; other elements with congested reinforcement may also be superplasticized subject to review by the Contract Administrator. Superplasticized concrete slump shall be 200 ± 30.

END OF SECTION