DIVISION 3

CONCRETE

BUILDING WORK

DIVISION 3

CONCRETE WORK

INDEX

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 Work Includes

A. Plain and fair face formwork of wood, Steel and Fibrous glass reinforced plastic formwork, for cast-in place concrete, complete with shoring, bracing and anchorage.

B. Form openings for mechanical and electrical work.

C. Coordinate installation of items supplied by other sections of work.

D. Pre-formed construction joints

E. Forming of expansion joints.

1.02 Related Work

A. Section 03200: Concrete Reinforcement

B. Section 03251: Expansion and Contraction Joints

C. Section 03300: Cast-in-Place Concrete

D. Section 04220: Concrete Masonry Unit

E. Supports, Anchors and Seals for Mechanical Installations.

F. Supporting Devices for Electrical Installations.

1.03 Quality Assurance

A. Construct and erect concrete formwork in accordance with The Engineer's Instructions.

1.04 Reference Standards

A. ACI 347 - Recommended practice for concrete formwork.

1.05 Shop Drawings

A. Submit shop drawings in accordance with Section 01340.

B. Indicate pertinent dimensioning, methods of construction, materials, arrangement of joints, ties and shores, location of bracing and temporary supports, schedule of erection and stripping.

C. Prepare shop drawings under seal of Professional Structural Engineer.

PART 2 PRODUCTS

2.01 Wood Form Materials

A. Plywood: Douglas Fir or Spruce species; sheathing grade; sound undamaged sheets with clean true edges.

B. Lumber: spruce species; sheathing grade; with grade stamp clearly visible.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of sufficient strength and character to maintain formwork in place while pouring concrete.

2.02 Formwork Accessories

A. Form Ties: Removable or Snap-off metal type of fixed or adjustable length; form ties should be free of defects and should not leave a hole larger than 25 mm in the concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Fillets for Chamfered corners: Rigid foam plastic type; of required size; maximum possible lengths.

2.03 Acceptable Manufacturers

A. Other Acceptable Manufacturers:

1. The Contractor shall submit to the Engineer the names of 3 manufacturers and their products which will be acceptable under this section. Approval of the manufacturer or product must be obtained before proceeding with associated work.

2.04 Concrete Accessories

A. Polystyrene in the form of permanent formwork, to be used as an expansion joint filler.

B. **Waterstops:** As manufactured by "Servicised Ltd." flat dumbbell type 250 FD. Purpose made polyvinyl chloride; minimum 12N/mm2 tensile strength; minus 46 degrees C to plus 79 degrees C working temperature range, 250 mm wide; maximum possible lengths; profiled as required; including all necessary junction pieces, or Expedite Supercast Watafoil 250 mm wide plain web, incorporating reinforced eyeleted outer-flanges, or approved equal.

PART 3 EXECUTION

3.01 Formwork Erection

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

B. Construct formwork, shoring and bracing to meet design and code requirements, so that resultant finished concrete conforms to required shapes, lines and dimensions.

C. Arrange and assemble formwork to permit dismantling and stripping, so that concrete is not damaged during its removal.

D. Align joints and make watertight, to prevent leakage of mortar and disfigure appearance of concrete. Keep form joints to minimum.

E. Obtain the Engineer's review for use of earth forms. When using earth forms, hand-trim sides and bottoms, and remove loose dirt prior to placing concrete.

F. Arrange forms to allow stripping without removal of principal shores, where and when these are required to remain in place.

G. Obtain the Engineer's review before framing openings in structural members, which are no drawings.

H. Provide bracing to ensure stability of formwork. Prop or strengthen previously constructed formwork liable to be over stressed by construction loads.

I. Provide chamfer strips on external corners of members only where shown on drawings.

J. Construct formwork to provide completed concrete surfaces after removal of forms and prior to patching and finishing of cast-in-place formed surfaces.

3.01 Formwork Erection (Cont'd)

K. Form expansion joints in the positions shown on the drawings and finish-off as follows:

- Joint filled with polystyrene material in the form of permanent formwork.

L. Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

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

3.02 Inserts, Embedded Parts, And Openings

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

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform work unless specifically indicated on drawings or reviewed prior to installation.

D. Install concrete accessories in accordance with manufacturer's recommendations; straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. 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. Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

3.03 Field Quality Control

A. Inspect and check completed formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and parts are secure.

B. Inform the Engineer when formwork is complete and has been cleaned, to allow for inspection. Obtain review prior to placing concrete.

C. Allow the Engineer to inspect each section of formwork prior to reuse.

3.04 Finishes

A. Plain Finish:

Formwork generally and to concrete surfaces to be plastered may be sawn formwork.

B. Fair Faced Finish (Grade 1):

1. Concrete surface which are described as fair face finished shall be finished free from honeycombing and excessive air holes, fines and projections arising from defective mixing, placing of formwork, and shall, if necessary, be filled with mortar and rubbed with fine carborundum stone. The finish shall be integral with the body of the concrete and shall not be obtained by means of an applied rendering.

2. The quality of the surface of concrete exposed to view shall be consistent throughout the project and the following methods shall be adopted to obtain the required fancy. The Contractor may submit alternative proposals for the approval of the Engineer if he so desires.

   a. Formwork for fair faced concrete shall be either of steel, fibrous glass reinforced plastic or exterior grade plywood not less than 16mm thick properly detailed to the satisfaction of the Engineer whose approval is required in writing before order the formwork. The Formwork boards shall not be used more than (4) times.

   b. In addition to the above forms of linings, the forms shall be coated before placing the reinforcement with an approved colourless mineral oil free of kerosene, and shall be applied in accordance with the manufacturer's printed instructions.

   c. All surplus oil on form surface and any oil on reinforcing steel shall be removed.

C. Approval by the Engineer to Fair Faced Finishes:

1. The Contractor shall submit for approval of the Engineer a sample panel not less than 60cm x 120cm to demonstrate the quality of the exposed concrete to be produced by forms, at his own expense.

2. The quality of the finished work shall be measured against the quality of the approved sample panel and the work of inferior quality shall be repaired or replaced as directed by the Engineer without any additional cost.

3.04 Finishes (cont'd)

3. The quality of the finished surfaces shall be of uniform colour and consistency throughout the project. Should there by any inconsistency in colour or texture in any of the finished surfaces the Engineer may order the repair or the demolition of a portion of concrete work and its reconstruction at the Contractor's own expense.

4. Construction joints, in special cases of weather conditions and if approved by the Engineer, shall be studied in detail ahead of time and the joints shall be grooved in a predetermined pattern approval by the Engineer.

3.05 Cleaning

A. Clean forms as erection proceeds, to remove foreign

Matter: Remove cuttings, shavings, and debris from within forms. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-outs ports.

B. During cold weather, remove ice 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 heated enclosure. Use compressed air or other means to remove foreign matter.

3.06 Form Removal

A. Notify Engineer prior to removing formwork.

B. Do not remove forms, shores and bracing until concrete has gained sufficient strength to carry its own weight, and construction and design load which are liable to be imposed upon it. Verify strength of concrete by compressive test results.

C. Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalanced loads are imposed on structure.

D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

E. Leave forms loosely in place, against vertical surfaces, for protection until complete removal is approved by the Engineer.

F. Store removed forms, for exposed architectural concrete, in manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

3.06 Form Removal (cont'd)

G. Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction. Remove load supporting forms only when concrete has attained 75 percent (75%) of required 28 day compressive strength, provided construction is reshored.

H. Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 Work Included

A. Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete, complete with tie wire.

B. Support chairs, bars supports, spacers for reinforcing.

1.02 Related Work

A. Section 03300: Cast-in-place concrete.

1.03 Quality Assurance

A. Perform concrete reinforcing works in accordance with BS4449, BS4461 & BS4483.

1.04 Source Quality Control

A. Submit 3 certified copies of mill test report of supplied concrete reinforcing, indicating physical and chemical analysis.

B. Provide the Engineer with access to fabrication plant to facilitate inspection of reinforcement. Notify of commencement and duration of shop fabrication, in sufficient time to allow for proper inspection.

1.05 Reference Standards

A. BS 8110 Code of practice for design and construction of structural concrete.

B. CRSI 63 Recommended Practice for Placing Reinforcing Bars.

C. CRSI 65 Recommended Practice for Placing Bar supports, Specifications and Nomenclature.

D. BS 4483 Steel fabric for reinforcement of concrete.

E. BS4449 Hot rolled steel bars for the reinforcement of concrete.

1.05 Reference Standards (cont'd)

F. AWSD12.1 Welding Reinforcement Steel, Metal Inserts connections in Reinforced Concrete Construction.

G. ACI-318M-1995 American Concrete Institute – Manual of Standard.

PART 2 PRODUCTS

2.01 Reinforcing

Grade	Minimum Yield Strength
Hot Rolled Mild Steel	(Fy=280) MPa
High Yield Steel	(Fy= 420) MPa

2.02 Quality Requirements

A. Steel reinforcement shall be hot rolled mild steel, and high yield steel bars, all in accordance with BS 4449, BS4461 & BS4483.

2.03 Fabrication

A. Fabricate concrete reinforcing in accordance with BS4449, BS4461 & bs4483

B. Locate reinforcing splices not indicated on drawings, at points of minimum stress. Location of splices: to be reviewed by the Engineer.

2.04 Accessory Materials

A. Tie Wire: Minimum 1.5mm gauge annealed type, or patented system accepted by Engineer.

B. Chairs, bolsters, bar supports, spacers: Sized and shaped for strength and support of reinforcing during construction conditions.

C. Special chairs, Bolsters, Bar Supports, Spacers where adjacent to architectural concrete surfaces: Plastic coated type; sized and shaped as required.

PART 3 EXECUTION

3.01 Placement And Fixing Of Reinforcement

A. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.

B. Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings which would reduce bond to concrete.

C. All reinforcement shall be fixed rigidly in position. At intersections the bars shall be bound together with tying wire and the loose ends of the wire shall be turned towards the inside of the member.

D. Reinforcement shall only be spliced or welded where shown on the drawings. All welding procedures shall be subject to approval.

E. Reinforcement shall be fixed in the positions shown on the drawings within a tolerance of 5mm of 5% of the lowest dimension of the cross-section of the member, whichever is greater.

F. The concrete cover to the reinforcement shall be carefully maintained utilizing approved spacers where necessary. The minimum concrete cover to all steel shall be:

50mm	for concrete below ground
25mm	for internal concrete faces above ground
30mm	for exposed fairface concrete surfaces

G. Where concrete spacer blocks are used they shall not exceed 50mm square in section and shall be precast from concrete of similar mix proportions and strength as the adjacent concrete, except that the largest size of aggregate shall be 10mm.

H. Spacer blocks shall not be used where the concrete face will be visible in the finished work, without the approval of the Engineer.

I. Each concrete spacer block shall be securely fixed to the reinforcement with wire or a clip. The wire or clip shall be embedded in the center of the blocks so that it does not subsequently cause rust marks on the concrete surface.

J. Supports and other subsidiary bars necessary to maintain the reinforcement in position shall be provided at approved intervals with concrete cover not less than that of the adjacent reinforcement.

K. Fabric reinforcement shall be used in standard sheets where possible. Adjoining sheets shall be over lapped at least on rectangle or 60 diameters of the bar at the lap, whichever is the greater.

3.01 Placement And Fixing Of Reinforcement (Cont'd)

K. Fabric reinforcement shall be used in standard sheets where possible. Adjoining sheets shall overlap by at least on rectangle or 60 diameters of the bar at the lap, whichever is the greater.

L. Scaffold boards shall be provided to ensure that the reinforcement is not displaced by being walked during concreting or other operations.

M. During concreting operations a competent steel fixer shall be in attendance to ensure that the reinforcement is maintained in the position as pouring and compaction proceeds.

3.02 Steel Weight

A. Calculation of Steel reinforcement bars, weight to be calculated as follows:

Diameter (mm)	Weight (Kg/mm)
6	0.222
8	0.395
10	0.617
12	0.888
14	1.210
16	1.580
18	2.000
20	2.460
22	2.980
24	3.550
25	3.850
26	4.170
30	5.550
32	6.318

END OF SECTION

SECTION 03251
EXPANSION AND CONTRACTION JOINTS

PART 1 GENERAL

1.01 Work Included

A. Forming expansion joints in concrete.

B. Furnish and install performed expansion joint filler.

1.02 Related Work

A. Section 03300: Cast-in-Place concrete.

1.03 References

A. ASTM D175 preformed expansion joint filler for concrete paving and structural construction.

1.04 Submittals

A. Provide 150 mm long sample of expansion/contraction joint.

B. Manufacturer's printed installation submittals.

PART 2 PRODUCTS

2.01 Materials

A. Acceptable Manufacturers:

The Contractor shall submit the names of (3) manufacturers and their products which will be acceptable under this section. Approval of the manufacturer or products must be obtained before proceeding with associated works.

B. Joint Filler: compressible impregnated fiber boards.

PART 3 EXECUTION

3.01 Installation And Workmanship

A. Locate and form expansion and contraction joints.

END OF SECTION

SECTION 03300
CAST-IN PLACE CONCRETE

PART 1 GENERAL

This section specifies work required for pain and reinforced concrete.

1.01 Standards

All work shall be carried out in accordance with the following reference standards:

A. The American concrete institute, A.C.I.

2nd. The American society for testing materials.

3rd. The American association of state highway and transportation officials (AASHTO).

D. Jordan code for fairfaced concrete

In case of discrepancy between this specifications and the above reference standards, this specifications shall take precedence.

1.02 Related Work

A. Section 03100: Formwork for Concrete.

B. Section 03200: Concrete Reinforcement.

C. Section 03370: Concrete Curing.

1.03 Quality Assurance

Perform cast-in-place concrete work in accordance with the Engineer's Instructions.

1.04 Testing Agency

A. Inspection and testing will be performed by a firm in accordance with Section 01410.

B. Provide free access to work and cooperate with the appointed firm.

C. Submit proposed mix design to inspection and the testing firm for review prior to commencement of work.

D. Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

E. Six (6) concrete standard test cubes will be taken for every 60 or less cubic meters of concrete placed.

1.04 Testing Agency (Cont'd)

F. Six (6) additional test cubes will be taken during either hot or cold weather concreting, and be cured on job site under same conditions as concrete it represents.

G. One (1) slump test will be taken for each set of test Cube taken.

1.05 Certifying The Batching Plant

A. The Contractor shall seek the Engineer's approval on the batching plant used for concrete production. Contractor shall provide an access to the plant for the Engineer's personnel and shall assist them to check the batching plant prior to granting the Engineer's approval thereon and regularly thereafter as required by the Engineer.

B. Checking shall include without limitations:

1. The integrity of the mixing blade and its compatibility with the profile of the mixing bowl.

2. The weighing accuracy:

   Weighing devices shall be examined and its accuracy shall fall within the following tolerances :

Cement +	2% of the weight of the cement in the batch.
Aggregate +	2% of the weight of each aggregate in the Batch.
Water +	2% of the weight of water added to the batch.
Admixtures +	5% of the amount to be added to the batch.

3. Calibration of weighing equipment:

   Sufficient test weighing shall be kept available on site for checking the accuracy of all scales. The scales shall be checked at the commencement of preliminary concrete tests and checks shall be carried out at intervals as directed by the Engineer but in any case not greater than 2-weeks. The results of these checks shall be recorded and submitted to the Engineer.

   All scales shall be inspected and tested over their complete range by a specialist and at least every three months, the results being record and submitted to the Engineer.

1.05 Certifying The Batching Plant (Cont'd)

B. Checking shall include without limitations : (Cont'd)

3. Calibration of weighing equipment: (Cont'd)

With admixture dispensers, a calibrated container shall be provided to check the accuracy of measurement at least once each month.

1.06 Warranty/Guarantee

All warranties/guarantees to be issued by the Supplier, manufacturers and sub-contractors shall be counter-signed by Main Contractor and both of them will be liable for repair/replace the items/works, etc., during the warrantee/guarantee period.

PART 2 PRODUCTS

2.01 Concrete Materials

A. Cement: Ordinary Portland Cement.

Cement shall comply with the relevant standards.

Only ordinary Portland cement shall be used in all of the structural elements.

B. Fine And Coarse Aggregates:

Wadi Gravel or crushed basalt stone shall be allowed as coarse aggregate.

Only Wadi sand shall be allowed as fine aggregate.

All Aggregates shall however be tested and the quarry shall be proven to comply with the Contract Specifications. Crushed Lime Stone and Fines shall not be used.

C. Water shall comply with the Engineer's Instructions

D. Admixtures: The use of admixtures shall be required to provide the mix with workability, impermeability, resistance to shrinkage cracks, etc., as the concrete grade and use may dictate. Comply with Engineer's Instructions.

2.01 Concrete Materials (Cont'd)

Other than those prescribed in these specifications, no other admixture will be permitted unless:

a) It has been proven by testing the trial mixes that its addition enhances the concrete strength and durability properties.
b) It has been proven by chemical analysis that it contains no chloride or sulphate compounds.
c) It has been expressly approved by the Engineer.

Following are the basic admixtures required for concrete mixes. Contractor shall include the cost of these admixtures in the price of concrete:

1- Feb flow LD 10: Plasticizer for concrete.

2- Feb proof: Integral liquid waterproof.

Amount per cubic meter of finished concrete shall be in accordance with the Manufacturer's recommendations and instructions, and the Engineer's approval. (FEB products or approved equal)

2.02 Water-Tight Concrete Construction

A. General: Concrete described as "Water-tight" shall be constructed in accordance with the General Specifications except where modified by the following provisions. The Contractor shall give the necessary care and attention to the work at all stages to obtain a water-tight construction. Concrete which does not satisfy this requirement shall be made water-tight at the Contractor's expense.

B. Aggregates: Aggregates shall have a low drying shrinkage and shall have an absorption not greater than 3 percent, measured in accordance with Engineer's Instructions.

C. Workability: The workability of the concrete shall be carefully chosen to ensure that the concrete can be fully compacted in the formwork and around the reinforcement without a water cement ratio, such as will result in a porous concrete. The Contractor shall continuously monitor the workability of the concrete being placed and shall reject anywhere where the deviation from the chosen slump exceeds plus or minus 25 mm. All concrete shall be mechanically vibrated.

D. Formwork: Formwork ties which pass through any part of the structure shall not be used unless effective precautions are taken to ensure water-tightness after removal. All ties cavities are to be filled with an approved non-shrink cement mortar.

2.02 Water-Tight Concrete Construction (Cont'd)

E. Curing: The concrete shall be cured in accordance with Engineer's Instructions but for not less than 4 days. The Contractor shall also take measures to limit the fluctuations in surface temperature of the concrete.

F. Joints: Concrete shall be placed continuously between and up to predetermined joints. The surface of the concrete during placing shall be kept reasonably level between vertical joints. In the event of an unavoidable stoppage in positions not predetermined, the concrete shall be terminated on horizontal planes and against vertical surfaces, and the Contractor shall take any additional action required to make a water-tight joint at his own expense.

The locations and details of predetermined joints shall be as shown on the drawings and shall comply with the following:

Kickers are to be cast monolithically with the concrete on which they stand (not less than 150mm high).

Particular care shall be taken to ensure that wall formwork fits tightly on the kicker or lower lift of concrete to prevent loss of grout which could cause porosity of the joint.

G. Testing: As soon as possible after the structure has been completed and the concrete has achieved its 28 days strength, it shall be tested for water-tightness by filling it with water.

2.03 Light Weight Aggregates

A. General

All light weight aggregate for concrete shall conform to BS 3797 Part 2 "Light weight Aggregates for Concrete".

B. Grading

Light weight aggregate shall be well and uniformly graded and shall be approved by the Supervising Engineer.

Combined Aggregates

Approved fine and coarse aggregate in each batch of concrete shall be combined in proportion as approved by the Engineer according to test results giving the required compressive concrete stress as specified per type of concrete.

2.03 Light Weight Aggregates (cont'd)

B. Grading (cont'd)

Special combined aggregate gradation shall be used for concrete members with reinforcement to close to permit proper gradation to another, this shall not be made during the progress of the work unless approved by the Engineer. Such changes will be admitted only after satisfactory test results.

2.04 Acceptable Suppliers

A. List of Approved Sub-Contractors/Suppliers:

Out of the Work of sub-contractors and suppliers of material needed for concrete works, the Contractor shall limit his selection to the Sub-Contractors/Suppliers approved by the Engineer.

2.05 Accessories

A. Non-shrink Grout: premixed compound consisting of non- metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 17MPa in 2 days and 48 MPa in 28 days.

2.06 Concrete Mixes

A. Mix Concrete in accordance with the Engineer's Instructions

Concrete mixing shall be made in conformity to the requirements outlined in the foregoing sections for concrete material, on the other sections pertaining to controlling temperature, and on the mixes properties outlined in the following tables.

B. The following table gives general guidelines on the constituents of different mixes to be produced:

2.06 Concrete Mixes (cont'd)

Trial mixes to be made by the Contractor, to establish mix design for all the concrete types.

Concrete Grade	Minimum cement content (Kg/M3)	Maximum size of aggregates (MM)	Maximum free water Cement ratio	Characteristic Cube Strength MPA		Slump (MM)	Used in the following:
				At 7days	At 28days		
C15	200	20	0.70	10	15	100-150	Blinding
C20	250	20	0.65	13	20	100-150	behind stone walls
C25	300	20	0.60	18	25	80-120	columns
C30	350	20	0.55	20	35	80-120	All reinforced Concrete members expect columns as shown on drawings

C. Under all circumstances, the use of accelerating admixtures will not be allowed.

D. Trial Mixes:

1. Immediately upon award of Contract, the Contractor shall make trial mixes in adequate number of specimens as per the relevant standards and in accordance with the Engineer's instructions.

2. From the results of tests made on the Specimens, Contractor shall propose the mix design of the concrete grade listed in the tabulation referred to in sub article 2.05-B.

3. Additionally, the Contractor shall perform the trial mixes incorporating the additive.

PART 3 EXECUTION

3.01 Placing Concrete

A. Place concrete in accordance with Engineer's Instructions.

B. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

C. Ensure anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause hardship in placing concrete. Rectify the same and proceed with work.

3.01 Placing Concrete

D. Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.

F. Prepare previously placed concrete by cleaning with steel brush.

G. Pour concrete continuously between predetermined construction and control joints.

H. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

I. Maintain concrete cover to reinforcement as noted on structural drawings.

3.02 Blinding Concrete

Thickness shall be as shown on the drawings. Blinding concrete shall be used under all structural ground floor slabs, grade beams and reinforced concrete footings.

3.03 Patching

A. Allow the Engineer to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed.

3.04 Defective Concrete

A. Modify or replace concrete not conforming to required lines, details and elevations.

B. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of Engineer for each individual area.

3.05 Concrete Finishing

A. Provide concrete surfaces to be left exposed as directed and in accordance with the Engineer's Instructions.

3.06 Curing And Protection

A. Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION

SECTION 03346
CONCRETE FLOOR FINISHING

PART 1 GENERAL

1.01 Section Includes

A. Finishing to concrete floor slabs with cement screed.

1.02 Submittals

A. Submit under provisions of section 01340.

1.03 Maintenance Data

A. Maintenance Data Provide data on maintenance operations.

1.04 Quality Assurance

A. Perform Work in accordance with the Engineer's instructions and recommendations.

B. Maintain 2 copies of each document on Site.

C. Floor Finishers
   1. Bonded concrete screed with cold rolled continuous wire mesh reinforcement (where required).

1.05 Mockup

A. Provide mockup of floor finish as instructed by the Engineer's.

B. Construct mockup area under conditions similar to those which will exist during actual placing, not more than (5 m x 5 m) with coatings applied.

C. Mockup may remain as part of the Work.

1.06 Delivery, Storage, And Handling

A. Deliver, store, protect, and handle products to site in strict accordance with the Manufacturer's written instructions.

B. Deliver materials in manufacturer's packaging including application instructions.

1.07 Environmental Requirements

A. Temporary lighting, heating and ventilation shall be in strict accordance with manufacturer's instructions and recommendations.

PART 2 EXECUTION

2.01 Examination

A. Verify that floor surfaces are acceptable to receive the work of this section.

2.02 Preparation

A. Clean sub-floor down to a hard base with a rotating wire brush to remove concrete laitance.

B. Remove thicker patches of crumbling concrete by means of a hammer and cold chisel, or with suitable motor equipment.

C. Completely remove from site loosened materials, debris etc. by sweeping and vacuum cleaner.

D. Wash the Concrete sub-floor by hosing the floor with liberal amounts of water, to provide a reliable key for the screed topping.

2.03 Mixing

A. The mortar is generally made up in accordance with the following formulations, however, the Engineer's instructions and recommendations should be strictly adhered to:

10	parts by weight ordinary Portland cement.
20	parts by weight wadi sand 0 - 3 mm grain size.
40	parts by weight chippings of basalt quartz "where required" or some other hard stone or gravel 5 - 7 mm grain size.
0 - 1	part by weight water, depending on the moisture in the sand.

B. Minimum cement content shall be 400 kg/m3 and the compressive strength shall be 40MPa after 28 days.

C. Contractor shall use super plasticizer as approved by the Engineer.

D. The Mortar shall be mixed on site.

2.04 Laying

A. Prepare adequate forms to meet the Engineer's approval and in accordance with the Engineer's recommendations and instructions.

B. Prime the cleaned sub-floor with a mixture of bonding agent and water in the ration of 1 4; apply with a brush type (S.B.R.)

C. Set the forms to the required thickness, taking into consideration slopes, falls and crossfalls.

D. Lay cold rolled continuous wire mesh, covered with 25 mm of cement screed.

E. Observe expansion joint 6/10mm and follow through into the screed the joints shall filled with the polysulphide material "where required" as instructed by the Engineer.

F. Lay the concrete screed between the forms alternately and spread with a rake, and draw-off surplus mortar.

G. Lay an approved aluminium tamper across the forms at an oblique angle, not at right angle. Remove surplus mortar by moving the tamper to and with a sawing action. While this is being done, a ridge of mortar about 3cm thick should be maintained along the front edge of the tamper in the customary manner. Wood tampers are not allowed.

H. All mixtures should be used up within one hour. Mixtures aging more than one hour should be discarded, and a fresh mixture used to finish the Job.

I. Spread the quartz material "where required" over the surface before the screed dry type (master top 100) as manufactured by FEB or approved equal color as selected by the Engineer's, then trowel the screed mechanically.

J. Ramp areas top surfaces shall have rough texture epoxy finish as approved by the Engineer's, the other areas shall have trowel smooth top surface with a machine.

K. Sprinkle over the surface water with a brush. The mixture has to be stirred carefully whilst being made up and then at frequent intervals when being applied in order to prevent spotting, which occurs if water is sprinkled over the mortar.

L. If the smoothing is carried out by hand, knee boards must be used. Should the smoothing be carried out with a machine, boards or sheets of hardboard should be employed in order to prevent foot marks.

2.05 Curing

A. Avoid draughts and direct sun light.

B. Cover the screed with overlapping 20 mill micron thick polyethylene film and spray with water.

C. Leave the polyethylene film in position for 8 days.

D. Avoid water to come in contact with the freshly laid screed.

E. Foot traffic over the laid screed is possible after only 3 days, but the floor should not be subjected to maximum loads for one week. These periods should be appropriately extended if temperatures are low and/or humidity is high.

2.06 Tolerances

A. Maximum Variation of surfaces flatness for the screeded areas 3mm in 3 meters.

B. Correct defects in the floor by grinding or removal and replacement of the defective work.

2.07 Warranty

A. Provide written warranties in the name of the Employer.

B. Warranty shall provide for making good within a period of five (5) years, at no cost to the Employer; repair and make good screeding and pay for repair or replace all affected or damaged surfaces at no cost to the Employer.

END OF SECTION

SECTION 03370
CONCRETE CURING

PART 1 GENERAL

1.01 Work Included

A. Initial and final curing.

B. Curing materials.

1.02 Related Work

A. Section 03100: Formwork.

B. Section 03300: Cast-in-Place Concrete.

1.03 References

A. ANSI A168.1 practice for curing concrete.

B. ACI 305 recommended practice for hot weather concreting.

C. ACI 306 recommended practice for cold weather curing.

D. ACI 308-71 recommended practice for curing concrete.

PART 2 PRODUCTS

2.01 Materials

A. Water: Potable

B. Absorptive Mats Burlap: cloth made of JUTE or KENAF minimum weight 0.29 Kg/m2.

C. Membrane Curing Compound: acrylic, or chlorinated rubber type, pigmented.

D. Polyethylene Film: 0.1 mm thick, clear color.

PART 3 EXECUTION

3.01 Curing water should be of a temperature compatible with concrete temperature and not more than 11 degree C cooler than concrete surface.

3.02 Pounding

A. Maintain 100% coverage of water over slabs continuously for 5 days.

3.03 Spraying

A. Spray water over slabs and maintain wet for 5 days.

3.04 Absorptive Mat

A. Saturate burlap and place over exposed areas, lapping ends and sides minimum 50% over lap, and maintain in place saturated for 5 days.

3.05 Membrane Curing Compound

A. Apply curing compound in strict accordance with manufacturer's instructions.

END OF SECTION