

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to the SPECIFICATIONS AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.02 SUMMARY

- A. Provide labor, material, equipment, and services necessary for the proper and complete installation of Concrete Reinforcement and related items as indicated on the Drawings and as herein specified.
1. Reinforcing steel
 2. Welded wire fabric (mesh)
 3. All accessories, including spacers, ties, slab bolsters, chair bars, clips, and other devices for properly placing, spacing, and supporting the reinforcement.
- B. Related Section
1. Section 03300 – Cast-In-Place Concrete

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. American Concrete Institute (ACI) – latest edition
1. (ACI 301) "Structural Concrete for Building"
 2. (ACI 306) "Recommended Practice for Cold Weather Concrete"
 3. (ACI 315) "Manual of Standard Practice for Detailing Reinforced Concrete Structures"
 4. (ACI 318) "Building Code Requirements for Reinforced Concrete"
 5. (ACI 347) "Formwork for Concrete"
 6. (ACI 605) "Recommended Practice for Hot Weather Concrete"
 7. (ACI 613) "Recommended Practice for Design of Concrete Mixes"
 8. (ACI 614) "Recommended Practice for Measuring, Mixing, and Placing Concrete"
- B. American Society for Testing and Materials (ASTM)
1. (ASTM C94) "Standard Specification for Ready-Mixed Concrete"

1.04 SUBMITTALS

The following shall be submitted in accordance with Section 01330 submittal procedures:

- A. Shop Drawings
1. Submit shop drawings showing dimensions, bar sizes, bar grades, bar spacing, bar schedules, bending details, and placing diagrams and details for all reinforcement and accessories.
 2. Reinforcement in foundation walls, piers, and footings shall be shown in elevation at least 1/4" = 1'-0" scale.
 3. Detail reinforcing in accordance with ACI 315.
 4. Refer to Section 01330, Submittal Procedures.
- B. Samples
1. Submit samples of reinforcing supports and wall ties.

1.05 PRODUCT HANDLING

- A. Storage of materials:
 - 1. Store reinforcing steel under cover and protect from rusting, oil, grease, and/or distortion.
 - 2. Remove for storage only those materials needed for immediate use.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars ASTM A615 Grade 60, deformed.
- B. Welded Reinforcing Bars ASTM A615 Grade 40, deformed.
- C. Ties and Stirrups ASTM A615 Grade 60, deformed.
- D. Welded Wire Fabric ASTM A 82 & A185 ultimate tensile strength of at least 70,000 psi.
- E. Accessories: All necessary spacers, ties, chains, bolsters, and other devices required to properly support and fasten reinforcing shall be galvanized steel or plastic in accordance with ACI 315. Legs or other parts in contact with forms of exposed surfaces shall be plastic coated.

2.02 FABRICATION

- A. Fabricate and mark reinforcing bars in accordance with ACI 315 and ACI 318, and the current CRSI "Manual of Standard Practice."

PART 3 EXECUTION

3.01 GENERAL

- A. All metal reinforcement shall be free from loose mill and rust scale and other coatings that destroy or reduce the bond. Metal reinforcement shall not be straightened or rebent in a manner that will injure the material. All bars shall be bent cold to the required shapes before they are placed in the forms. Bars with kinks or bends not required shall not be used.
- B. Chair bars for secure placement and positioning of reinforcing steel is to be provided. Chair bar or similar approved manufactured devices intended for use must be submitted to the Architect and approved in writing prior to ordering materials. Reinforcing supports shall be of proper height, length, spacing, size and material type; and submittal shall include this data with current manufacturer data sheets. In no case shall brick, wood, or other non-conforming reinforcing steel supports be used. Maximum spacing of mesh support chairs shall be 18" in each direction.
- C. When it is necessary to splice reinforcement, bars shall have Class "B" splices (per ACI 318 – Latest Edition, Section 12.15) or shall be lapped at least 40 bar diameters, placed in contact and wired. Laps shall be avoided at points of maximum stress. Tie wire tails shall be turned inward, away from the concrete surfaces.
- D. All rods shall be securely wired together at all intersections.

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- E. Where welded wire fabric is indicated for slabs, the mesh fabric must be adequately supported and typically placed 1 1/2" below the top surface of the slab at 3" and 4" thick slabs, and 2" below the top surface of the slab at 5" and 6" thick slabs. Mesh shall be placed to achieve a "draped" application with 3/4 inch concrete cover over mesh (top) at each joist/beam. Mesh shall lap 8" minimum or one space plus 2", whichever is larger.
 - F. Where continuous bars are called for, they shall be run continuously around corners and lapped at necessary splices or hooked at discontinuous ends. Laps shall be Class "B" splices or shall be lapped 40 bar diameters unless otherwise specified. Corner bars shall be a minimum of 2'-0" x 2'-0" size.
 - G. Notify ENGINEER for inspection of completed installation of reinforcement at least two (2) full work days prior to scheduled placement of concrete. Do not place concrete without prior approval of the structural ENGINEER.
 - H. Concrete forming and reinforcement placement shall provide adequate space and clearance for complete and proper deposit of concrete mix, vibrator use, rodding, and mix distribution.
 - I. All embedded items, anchor bolts, headed stud plates, etc. shall be securely anchored in place using tie-wire, reinforcing steel, form-ties, or other accepted mechanical means to maintain their proper location and elevation.
 - J. Unless otherwise approved by the structural ENGINEER in writing, boxing-out is not an allowed substitute for monolithic pours, specified embedded hardware, or grouting-in technique.
 - K. Aluminum shall not be allowed to be placed or embedded within any concrete mixes, no exceptions.
 - L. Reinforcing steel and all steel embedded items shall not be in contact with, nor set within 3/4", of dissimilar metals.
 - M. Embedded conduits shall be separated from reinforcing steel by a minimum of 1", clear concrete, or as otherwise indicated upon contract structural drawings.
 - N. Forms shall be oiled prior to their erection. Reinforcing bars, which are coated with form oil or any other bond breaking material will be rejected and will require replacement at no additional cost.

END OF SECTION 03200

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to the SPECIFICATIONS AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.02 SUMMARY

- A. Provide labor, materials, equipment and services necessary for the proper and complete installation of Cast in Place Concrete and related items as indicated on the Drawings and as herein specified.
1. Interior and exterior concrete footings, foundation walls, retaining walls, floor slabs, wall infills at block areas, and pilasters.
 2. Construction joints including forms.
 3. Concrete aprons.
 4. Cleaning, finishing, and protection of concrete surfaces.
 5. Forms for concrete work.
 6. Furnish and install admixtures, anchors, flashing reglets, and similar items in conjunction with concrete work.
 7. Sawcutting of existing slab-on-grade, demolition and disposal of cut sections, and re-patching the slab with new concrete.
 8. Secure licensed geotechnical engineer's written approval for all proof-rolling, backfilling and compaction procedures associated with new foundation and slab work.
 9. Flexible/swellable waterstops for use at concrete wall cold joints.
 10. Asphaltic bond breaker applied to wall surface prior to slab placement.

1.03 RELATED WORK

- A. Install anchorage devices and other embedded items required for work of other Sections.
- B. Setting anchor bolts and grouting base and bearing plates for structural steel work.
- C. The following items are not included in this Section and will be performed under the designated Sections:
1. Section 02300 – Earthwork
 2. Section 05120 – Structural Steel
 3. Section 05210 – Steel Joists
 4. Section 05310 – Steel Deck
 5. Section 03200 – Concrete Reinforcement
 6. Section 07210 – Building Insulation
 7. Section 07901 – Joint Sealants

1.04 REQUIREMENTS OF REGULATORY AGENCIES

- A. American Concrete Institute (ACI) – latest edition
1. (ACI 301) "Structural Concrete for Building"
 2. (ACI 306) "Recommended Practice for Cold Weather Concrete"
 3. (ACI 315) "Manual of Standard Practice for Detailing Reinforced Concrete Structures"

4. (ACI 318) "Building Code Requirements for Reinforced Concrete"
5. (ACI 347) "Formwork for Concrete"
6. (ACI 605) "Recommended Practice for Hot Weather Concrete"
7. (ACI 613) "Recommended Practice for Design of Concrete Mixes"
8. (ACI 614) "Recommended Practice for Measuring, Mixing, and Placing Concrete"

- B. American Society for Testing and Materials (ASTM) – latest edition
1. (ASTM C94) "Standard Specification for Ready-Mixed Concrete"
 2. (ASTM C932) "Surface Applied Bonding Agents for Exterior Plastering"
 3. (ASTM C631) "Surface Applied Bonding Agents for Interior Plastering"

1.05 TESTING LABORATORY/QUALITY CONTROL

- A. The OWNER is required to employ and pay for the services of a Certified Independent Testing Laboratory. The TRADE CONTRACTOR shall provide all labor, materials, and storage facilities to implement the tests required by the testing lab.
- B. The Testing Laboratory is required to perform slump tests, air content, and concrete compression test cylinders and submit a complete test result report to the Architect and OWNER. Each concrete load delivered to the site shall be tested.
- C. Should the strength of the test cylinders fall below the required strength, the ENGINEER may require changes in aggregate or mix proportions for the remainder of the work, and may require the drilling and testing of concrete core specimens in accordance with ASTM C42. If the core tests show deficient strengths, the Architect may require the removal of the work or load tests on the portion of the structure that fails to develop the required strength. Such load tests shall conform to the Building Code Requirements for Reinforced Concrete (ACI 318), current edition.
- D. The inspection by the Laboratory does not relieve the TRADE CONTRACTOR of his responsibility to construct in accordance with the plans and specifications and to use safe, standard methods of construction. The Laboratory bears no responsibility for safeguarding the public, workmen or the structure during the construction.
- E. OWNER to pay for, and TRADE CONTRACTOR to coordinate the services of a Massachusetts licensed geotechnical engineer to provide review and approval of all proof-rolling, back-filling, and compaction procedures associated with foundation and slab work.

1.06 SUBMITTALS

The following shall be submitted in accordance with Section 01330 Submittal Procedures:

- A. Submit complete concrete mix design including all admixtures, ingredients, quantities, and certifications to the Architect for approval prior to the mixing and placement of concrete.
- B. Samples: Submit samples of materials to the ENGINEER when requested.
- C. Delivery Tickets: As an indispensable aid to all parties in observing whether the requirements of this Specification and the project Specifications are being understood and followed, the producer of ready-mixed concrete will furnish a delivery ticket with each load of concrete delivered. The delivery ticket shall indicate the strength, the size of coarse aggregate, total water content, the slump ordered and the time water was added at the plant and commencement of mixing. Note on each ticket the location of placement. Forward one copy of each ticket to the Architect.

- D. Pouring Schedule: Submit to the ENGINEER with dates three days prior to initial placing of concrete and notify ENGINEER two (2) full workdays in advance of the hours scheduled for each day of pouring and/or changes in the Pouring Schedule.
- E. Pouring Record: Keep a daily record during concrete pouring of the date, hour, location of pour, outside temperature, temperature of concrete (when outside temperature is below 40°) and weather. Keep record up-to-date and available for Architect and Testing Laboratory inspections. Submit copy of pouring record to the Architect weekly.
- F. Manufacturer's Literature, including technical data sheets and ASTM compliance where relevant:
 - 1. Patching mortar if used; upon approval of the Architect
 - 2. Forms for construction joints and premoulded joint filler
 - 3. Grout
 - 4. Below slab and perimeter insulation
- G. Submit licensed geotechnical engineer's written reports and testing results for all earthwork (proof-rolling, backfilling and compaction) associated with foundation and slab work.

1.07 PRODUCT HANDLING

- A. The ENGINEER or his representative shall have unrestricted access to points where concrete materials are stored, proportioned, or mixed. All materials, equipment, and methods used shall be subject to his observation and approval at any time.
- B. Cement: Store to prevent deterioration or contamination. Cement which has become caked, partially set or otherwise deteriorated, damaged or contaminated shall be rejected.
- C. Aggregate: The fine and coarse aggregate used shall be stored and handled so as to preserve the gradation and cleanliness of the material.
- D. Any ready-mixed concrete awaiting placement at the jobsite for more than one-half hour from the time of arrival shall be immediately and unconditionally rejected.

1.08 SUPERVISION

- A. During the progress of the concrete work, provide a competent superintendent, acceptable to the ENGINEER, especially experienced in cast in place reinforced concrete work, who has been authorized as the General TRADE CONTRACTOR's agent to receive and execute the Architect's orders and contract document requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement:
 - 1. All cement shall be fresh stock of an approved standard brand meeting the requirements of ASTM C150, type I or II.
 - 2. Type III high early strength Portland cement may be used only when approved in writing by the ENGINEER.
- B. Coarse Aggregate:
 - 1. Crushed stone or gravel having clean, hard, strong, uncoated particles free from injurious amounts of soft, thin, elongated or laminated pieces, alkali, organic or other

deleterious matter and shall conform to ASTM C33. Maximum aggregate size shall be 3/4".

- C. Fine Aggregate:
 - 1. Fine aggregate shall consist of sand, stone, screenings or other inert material with similar characteristics having clean, strong, durable, uncoated grains free from lumps, soft or flaky particles, clay, shale, alkali, organic matter or other deleterious substances, and shall conform to ASTM C33.
 - 2. Grading shall be as follows: 100% shall pass a 3/8" sieve; at least 95% shall pass a No. 4 sieve; at least 45% shall pass a No. 16 sieve; at least 70% shall be retained on a No. 5 sieve; and at least 90% shall be retained on a No. 100 sieve.
- D. Concrete Admixture:
 - 1. Concrete admixtures to increase cement dispersion and workability of the concrete mixtures may be used. Such mixtures shall be specifically subject to the approval of the ENGINEER. No calcium chloride is permitted as an accelerator. Submit copies of all admixture literature to the Architect for approval.
 - 2. An approved air-entraining admixture shall be used for all concrete in aprons, exterior platforms and any work exposed on the exterior. Admixtures shall conform to ASTM C260.
 - 3. All admixtures shall be used in strict accordance with manufacturer's recommendations. The admixtures shall be included in all tests and designs of concrete mixtures as specified hereinafter.
 - 4. An air-entraining admixture shall be added to the mix at the batching plant for all exterior exposed concrete, prior to mixing the ingredients. Use of calcium chloride will not be permitted.
- E. Water: Clean, potable, and free from oils, acids, alkali, organic matter or other deleterious material.
- F. Grout (Bearing Plate): Non-shrink, non-metallic, 5,000 psi min. compressive strength grout may be used. The maximum application thickness of grout under column bases shall be 1.5 inches.
- G. Form Ties: Form ties shall be of type to leave no metal closer than 1 1/2" to surface, equal to Richmond, type SWC.
- H. Forms for construction joints, non-corrosive.
- I. Concrete may contain Fly-Ash or Slag. A maximum of 15% is allowed.

2.02 CONCRETE MIXTURES

- A. Concrete for footings, foundation walls, and pilasters, slabs on grade, aprons, housekeeping and equipment pads shall have a minimum compressive strength (F'c) of 4,000 psi at 28 days.
- B. Concrete for deck slabs on metal form deck shall have a minimum compressive strength of 5,000 psi at 28 days.
- C. Determination of mix:
 - 1. The concrete mix will be determined by a testing laboratory employed by the OWNER so that its ultimate compressive strength at 28 days in the field will be not less than 4,000 psi (3,500 psi for deck slabs) with proper workability and consistency. All cement, aggregate and other materials required for this test should be furnished and delivered to the laboratory by the TRADE CONTRACTOR or Testing Laboratory.
 - 2. The testing laboratory will establish a curve representing the relation between the water/cement ratio and the average ultimate 28 day compressive strength. The curve will

be established by at least 4 points, each of which will represent the average value from at least 4 standard cylinders. The water/cement ratio for field use as determined from the curve should correspond to a strength of 3600 psi.

3. The proper concrete mix shall be determined for each change in materials. The ENGINEER may waive new concrete trial mix tests provided that certified trial mix test results conform to the requirements of specifications submitted to the ENGINEER for approval.
- D. The water/cement ratio for exposed concrete or for concrete placed in freezing weather and exposed to deicing salts shall be 0.40 to 0.45.
- E. The maximum permissible slump for all footings, foundation walls and piers shall be 4". The maximum permissible slump for slabs on grade, deck slabs, pads and aprons shall be 3". Slumps shall be determined in accordance with ASTM C 143.
- F. Concrete (except for interior 3" slabs on deck and interior slabs on grade) shall be air entrained by use of an approved admixture to provide not less than 4% nor more than 6% of air by volume as determined in accordance with ASTM C 173.
- G. Concrete used at infill areas and at footings below tendons shall include super plasticizer with 6" to 8" slump.

2.03 FLEXIBLE/SWELLABLE WATERSTOPS

- A. At concrete foundation wall cold joints where a flexible waterstop is detailed, provide one of the following:
 1. Hydrotite CJ-0725-3K by Greensteale Plastic Products Company, Inc.
 2. Parastop II by Tremco, RPM Company.
 3. Volclay Waterstop-RX by Cetco.

2.04 ASPHALTIC BOND BREAKER

- A. Bond breaker coating to be placed on wall surfaces at slab contact areas, prior to slab placement shall be:
 1. Mastic or Semi-Mastic by Sonneborn, BASF.
 2. Sealmastic by W.R. Meadows Sealtight.
 3. Karnak Trowel Grade Mastic by Karnak.

PART 3 EXECUTION

3.01 CONCRETE FORMWORK

- A. Concrete forms shall be constructed to produce finished concrete of the exact sizes, lines and locations shown. Forms shall have the strength and rigidity to support wet cement without spreading, sagging, or settlement and be fitted with tight joints to prevent leakage of concrete mixture. Forms shall be constructed so that finished concrete lines and surfaces shall not vary more than 1/8" in 12" and this variation shall not be cumulative.
- B. The formwork shall include the forming of all openings, pockets and chases indicated on the Drawings or for which directions are given prior to the depositing of concrete for the sections of the work affected. Temporary cleanout openings shall be provided at the base of column, pier and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.
- C. All shores shall be braced diagonally in both longitudinal and transverse directions. In addition, adequate diagonal braces shall be provided at ends of the framework.

The un-braced length of shores shall not exceed 50 times the least dimension. Shores shall be properly wedged at top and/or bottom as required. Precautions shall be taken to ensure that there is no movement of shores, braces or other supports during the pouring of concrete.

- D. Forms shall be Constructed of the following materials as indicated for the use and purposes intended:
 - 1. For unexposed surface and rough work, undressed lumber or ordinary plywood may be used. Lumber once used in forms shall have nails withdrawn and surfaces to be in contact with concrete shall be thoroughly cleaned before being used again.
 - 2. For exposed exterior sides of foundation walls which show exposed above grade and surfaces of walls, ceilings, beams and columns to be left exposed in finished spaces, forms shall be lined with smooth plywood, concrete form grade or equivalent material subject to ENGINEER's approval. All joints shall be filled with suitable joint filler in order to produce a reasonably straight, smooth surface, free from honeycombs, bulges, depressions and fins. Forms of surfaces to be painted or rubbed shall be formed in maximum lengths to minimize the joints.
 - 3. Contact surfaces of forms shall be of 3/4" exterior grade, DFPA Plyform B-B Chamfer strips for exposed edges shall be 3/4". Form oil shall be a non-staining mineral oil.
 - 4. Form ties shall be of a type approved by the Architect. Ties shall be adjustable in length as to permit tightening of the forms and shall be of such design as to leave no metal closer than 1 1/2" to the surface after removal. The use of snap ties or wire times will be permitted. The ties shall be on sufficient strength to resist all construction loads.
- E. Form ties shall be provided wherever necessary to prevent spreading of forms. Each time shall have a minimum working strength of 3000 lbs. when fully assembled.
- F. For exposed surfaces, all forms shall be coated with a non-staining mineral oil that shall be applied immediately before the reinforcement is placed. For unexposed surfaces and rough work, the forms may be wetted thoroughly in lieu of oiling, except that in freezing weather oil shall be used. Form oil shall be applied prior to placing, to ensure that form oil does not contact reinforcement.
- G. Make provisions of other work as noted below.
- H. Removal of Forms: The removal of forms shall not be started until the concrete has attained the necessary strength to support its own weight and any construction live loads. Forms for vertical surfaces shall not be removed sooner than 72 hours after pouring.

3.02 PROVISION FOR OTHER WORK

- A. All necessary blocking, slots, chases, recessed openings and other items relating to concrete shall be installed as required by the Architectural, Structural, Mechanical and Electrical Drawings and all Sections of the Specifications. Ample opportunity shall be given for all trades to furnish or install anchors, inserts, sleeves, conduits, frames, nailing blocks, hangers and equipment or fixtures to provide for later phases or the work.
- B. Utmost precaution shall be taken in pouring concrete to avoid any damage to or displacement of any of the above provisions.

3.03 MIXING OF CONCRETE

- A. Concrete shall be ready-mixed or transit-mixed from an approved concrete plant, mixed and delivered in accordance with ASTM C94. The ENGINEER shall have free access at all times to the batching and mixing devices for sampling and inspection of all materials, Manufacturer's rated capacity of mixers shall not be exceeded. Site mixing is not allowed.
- B. The mixing equipment shall be capable of accurately measuring and combining the

aggregates, cement and water within the specified time into a thoroughly mixed and uniform mass and of discharging the mixture without segregation. Each entire batch of concrete shall be discharged before recharging.

- C. Ready-mixed concrete shall be mixed in a batch mixer of approved type. Each batch shall be mixed for at least 2 minutes during which time the drum shall rotate at a peripheral speed of about 200' per minute. Mixing shall be timed when all of the solid materials are in the mixer. Water shall be added before one fourth of the mixing time has elapsed. Ready-mixed concrete shall be transported to place of deposit by methods that prevent separation or loss of ingredients.
- D. When transit truck mixers are used, they shall be a revolving drum type that is watertight. Concrete materials shall be accurately measured at the proportioning plant. Water shall not be added at the site (except for super plasticized mixes).
- E. When hand mixing is authorized, it shall be done on a watertight platform in a manner to ensure a uniform distribution of the materials throughout the mass. Mixing shall be continued until a homogeneous mixture of the required consistency is obtained.
- F. The retempering or remixing of concrete or mortar that has been partially hardened will not be permitted. Concrete shall be mixed not more than 45 minutes before it is deposited (Total mix time including travel to jobsite). Water shall not be added at the jobsite.

3.04 PLACING OF CONCRETE

- A. All forms must be absolutely clean and free from shavings, dirt or other foreign matter before any concrete is placed.
- B. Concrete shall be deposited not more than 45 minutes after water has been added by methods that prevent separation or loss of ingredients. Under no circumstances shall concrete that has partially hardened be used.
- C. Concrete shall be deposited continuously or in layers of such thickness that concrete will not harden sufficiently to cause formation of seams and planes of weakness. If a section cannot be placed continuously, construction joints as described below may be used at approved locations.
- D. Care shall be taken to work into corners and angles of forms and around reinforcement without permitting the materials to segregate or free water to collect on the surface and without disturbing the location of the reinforcement.
- E. Concrete shall be compacted with mechanical vibrators of the internal type handled only by experienced operators in a manner that will not cause segregation. Vibration shall not be used to move concrete. Vibrators shall produce visible settlement and flow of concrete in an area at least 2' around point of application. Vibrators shall be supplemented by forking or spading in corners and angles of forms and along surfaces of forms while concrete is plastic. At least two vibrators shall be in working condition at the job at all times.
- F. Concrete for wall, columns and piers shall be placed in layers to prevent honeycombing. Each layer shall be vibrated and forms shall be externally vibrated to free air bubbles.
- G. If concrete is required to be placed at a level more than 3' below delivery level, it shall be chuted at a slope of not less than 1 in 2 or shall be deposited through canvas elephant trunks, galvanized steel chutes, or by other approved methods that will avoid segregation of the ingredients.
- H. No concrete shall be deposited in water or on muddy or frozen surfaces.

- I. Spread Footings shall bear level or undisturbed soil having an allowable bearing capacity of one (1) ton per square foot.
- J. If bearing materials with a lower bearing capacity than 1 ton per square foot are encountered at the specified elevations, the underlying unsuitable material shall be removed and replaced with suitable material to be approved by the ENGINEER/Architect.
- K. The ENGINEER assumes no responsibility for the validity of the subsurface conditions.

3.05 TESTS

- A. During the progress of the work, cylinders for compression tests shall be prepared, stored and cured in strict accordance with the current ASTM C31. These cylinders shall be delivered by the TRADE CONTRACTOR to the testing laboratory or collected directly by the Testing Laboratory field technician. All concrete shall be tested by an independent ACI certified testing lab, hired, scheduled and paid for by the OWNER.
- B. The ultimate compressive strength for any two (2) cylinders tested at 28 days shall average not less than 4000 psi, at all concrete, and 5,000 psi for deck slabs on metal form deck.
- C. Concrete samples for the cylinders and for the air contents test shall be made when, where and as directed by the ENGINEER or Testing Laboratory. Unless otherwise directed by the Architect, the cylinders shall be made in groups of six (6). Two (2) cylinders will be tested at 7-day cure, and two (2) cylinders will be tested at 28-day cure to determine compressive strength of the concrete in accordance with ASTM C39. Two (2) remaining cylinders will be stored for 56 day testing, if needed. Air entrainment and slump will be tested at each sample as well. Test results, which are determined by the Architect to be deficient, or questionable, will require that the TRADE CONTRACTOR pays for additional testing and coring of the in-place concrete, including petrographic examination with report as directed by the ENGINEER. Concrete determined by the ENGINEER to remain deficient after final testing shall be entirely removed and replaced at no additional cost. Test for the entrainment at placement per ASTM C-231-97 and slump per ASTM C-143.
- D. The OWNER will pay all laboratory costs. All materials, cylinders, slump cones, air meters, field labor and transportation to the laboratory shall be furnished by the TRADE CONTRACTOR or Testing Laboratory.
- E. Submit all testing agency field and lab reports to the ENGINEER for approval.

3.06 CURING OF CONCRETE

- A. Keep all concrete in a continuously moist condition for a period of seven days after pouring:
 - 1. Cure walls first 72 hours by leaving forms in place and when removed, protected by covering with burlap, liquid membrane curing compound, or other method approved by the ENGINEER.
 - 2. Cure floor slabs by one of the following methods:
 - a. Cover with burlap kept continuously wet.
 - b. Cover with waterproof paper with sealed joints capable of preventing evaporation.
 - c. Use an approved curing compound that will not adversely affect the bonding characteristics of the floor material.
- B. Protect concrete so that temperature at surface does not fall below 50° F. for seven days after pouring.
- C. Cold Weather Operation: In freezing weather, suitable means shall be provided to prevent sur-

face temperatures below 50° F until the concrete has thoroughly hardened. When temperatures are, or are expected to fall below 40° F., all water and aggregates shall be heated before mixing to a mixture temperature of at least 70°F. When heating devices are required, they shall be fired before starting concrete operation. Only electric heaters are permitted. No LPG or oil-fired heaters allowed. Rapid drying out of concrete due to overheating shall be avoided. Before placing concrete, the forms shall be free from frost and ice. Salts, chemicals or other foreign materials shall not be used to prevent freezing of concrete.

- D. Hot Weather Operation: In hot weather, extreme care shall be used to prevent rapid drying out of exposed concrete surfaces by sprinkling with water as frequently as necessary to maintain the surfaces in a moist condition for at least 7 days by coating the surface with an approved liquid membrane curing compound or by other approved methods.
- E. Preparations for hot or cold weather operations shall be made sufficiently in advance of the time when such conditions may be expected to occur.

3.07 CONCRETE SLABS ON GROUND

- A. Have installation of underground and embedded items, insulation and earth fill approved before slabs are placed. Coordinate field inspection by each product manufacturer to obtain acceptance, and submit their field report to the ENGINEER.
- B. The specified wire fabric reinforcing shall be provided in all ground supported slabs. Place and support fabric 1½ to 2 inches below top of slab.
- C. Screeds shall be set to grades as shown and concrete slabs poured to thickness shown on Drawings.
- D. Provide continuous coating of asphaltic mastic bond breaker where slab abuts wall unless otherwise shown on Drawings.

3.08 FINISHING OF CONCRETE

- A. Concrete floor slabs that are to remain exposed or are to receive resilient tile shall be finished monolithically as follows: After concrete has been placed and thoroughly compacted by vibration, the surface shall be struck off at the proper elevation by means of previously set screeds. Fines shall be brought to the surface and coarse aggregate pressed down by means of a darby. The floor shall be floated with an approved disc-type power-floating machine and troweled smooth and hard. After a delay during which the concrete has hardened sufficiently to ring under the trowel, it shall be given a second troweling, using pressure to create the final dense surface, free from blemishes. In no case shall dry cement be sprinkled on the surface during the finishing operation. When tested for straightness, the finished surface shall not vary more than 1/8" in 10'. Irregularities in the surface shall be ground smooth after the curing period to the Architect's satisfaction and at the TRADE CONTRACTOR's expense.
- B. No floating or troweling shall be done on floor slabs while the material is wet or sloppy. Finishing operations shall be delayed until all surface water has disappeared.
- C. All interior and exterior concrete surfaces that will be exposed shall have all deformities and fins removed and all tie holes, honeycombs, voids and other defective areas patched to provide reasonably smooth finished surfaces. Where portions of concrete foundation walls show exposed, surfaces shall be rubbed down immediately after stripping with fine carborundum stone, using Portland Cement and clean water as a lubricant. Surfaces shall be worked so that no joints or deformities will show through after being finished. Concrete surfaces that are not exposed shall have severe deformities removed and all form ties cut back and patched with patching mortar. Patch major voids and honeycombed areas with the specified patching mortar.

- D. No sealers, coatings or curing compounds shall be used on concrete surfaces that are to be painted or scheduled to receive waterproof coating systems or other flooring applications without written approval from the material manufacturer and ENGINEER. Such surfaces shall be covered and wet cured for a minimum of seven days.
- E. Provide all necessary patching of concrete as required around items installed for work of other trades.
- F. Steel troweled surfaces that will remain exposed shall be protected from traffic and premature drying by covering with a layer of approved Kraft paper conforming to FS UU-P-264A. All seams shall lap 5" and shall be continuously sealed with masking tape or other means recommended by manufacturer. Paper shall remain in place for 28 days unless covered sooner by flooring material.
- G. Exterior slabs to be broom finished, final brushing in direction of pitch.
- H. Provide 3/4" formed or tooled chamfer at all exposed edges of concrete unless otherwise shown.

3.09 CONSTRUCTION JOINTS

- A. Construction joints shall be formed with keyed bulkheads located as shown on the drawings and/or as herein specified. Reinforcement shall continue through the joints and additional reinforcing placed as shown on details.
- B. Concrete deposited on one side of a construction joint shall be allowed to set at least 24 hours before the adjoining concrete is poured. Before new concrete is poured against the hardened concrete, all laitence shall be removed and the surface of the hardened concrete roughened at the joint in such a manner that will not leave loose or damaged material at the surface. The joint shall then be saturated with water and covered with a coating of neat cement grout, against which the new concrete shall be placed before this grout has attained its initial set.
- C. Unless otherwise shown, construction joints shall be located as follows:
 - 1. Foundation Walls: Vertical joints shall be placed so that maximum continuous pour does not exceed approximately 40 feet in any straight length. Joints shall be poured in alternate sections. Horizontal construction joints will not be permitted except as shown on the drawings. Refer to structural notes (concrete notes) for control joint details.
 - 2. Floor Slabs on Ground with Wire Mesh Reinforcing: Joints shall be located so that slab is poured in alternate panels in a checkerboard pattern, each panel not exceeding 1000 S.F. in area, nor 25' in any one length. All control joints shall be saw-cut within 24 hours of concrete placement. Refer to "Sealant" Section 07901 for filling joints. Refer to structural notes (concrete notes) for control joint details.
 - 3. Do not place construction joints within 10 feet of any corner.
- D. All exposed joints shall be rubbed and ground smooth to match adjoining surfaces.
- E. All proposed locations of the construction joints shall be submitted to the ENGINEER for approval.

3.10 PROTECTION AND CURING

- A. General: The TRADE CONTRACTOR shall have available suitable materials such as tarpaulins or Kraft paper for the proper protection of freshly poured concrete during emergencies such as rain storms.
- B. Curing

1. Immediately after placing or finishing concrete surfaces not covered by forms shall be protected from the loss of surface moisture for a period of not less than 7 days where a normal Portland cement has been used or 3 days where a high early strength Portland cement has been used, by covering with Kraft paper, wet quilts or wet burlap, lapped 4 at edges and ends.
2. Kraft paper if used shall be sealed at all edges and overlaps and weighted at edges to prevent its blowing away.

3.11 EXISTING SLAB CUTTING AND PATCHING

- A. The existing concrete slab-on-grade shall be cut, partially demolished and patched with new materials at all locations to receive footings, shower basins, wheelchair lifts, penetrations and all mechanical, electrical and plumbing proposed items.
- B. At all cut and patch areas of slab construction, the following generalized procedures shall be followed:
 1. All perimeters of slab penetrations shall be saw-cut to 1 ½" depth minimum to "score" the concrete for accurate and damage free removal. Deeper saw-cutting may be used, if opted by the TRADE CONTRACTOR, provided that precaution is used with exploratory services to avoid cutting of any embedded or sub-slab conduit, tendons, tie-rods, etc.
 2. In no case shall existing steel tie-rods, or their concrete encased housings be cut or damaged. Refer to the foundation plan and respective sections for tie-rod locations and construction.
 3. Chip away existing concrete and properly dispose of materials.
 4. Excavate earth as required to place new services, apparatus, footings, etc.
 5. Proof-roll existing acceptable sub-base soils prior to placing new soil, gravel, structural fill or crushed stone. Obtain the licensed geotechnical engineer's approval for above.
 6. Place specified fill and crushed stone in specified loose lifts, compacting each layer as specified. Obtain the licensed geotechnical Architect's approval for above.
 7. Place reinforcing steel and new concrete sections as indicated.

END OF SECTION 03300

