

DIVISION 3 - CONCRETE

SECTION 03300 - CONCRETE & CEMENT WORK

03300.0100 GENERAL

1. Include all labor, materials, equipment and appliances and perform all operations in connection with the installation of concrete and cement work as shown on the drawings and specified herein, and generally include the following:
 - a. Concrete work for all foundations, footings, piers, walls, floor slabs, and all other items of concrete as required to make the work of this section complete, and as detailed on the drawings hereinafter specified.
 - b. All required formwork.
 - c. Reinforcing steel and wire mesh, including chairs, spacers and tie wires.
 - d. Installing and/or building in of all items embedded in the concrete such as anchor bolts, inserts, sleeves, blocking, etc., as required by this and other trades under this and other contracts.
 - e. Cement mortar protection for pipes and conduits in slabs.
 - f. Vapor barrier under slabs on grade.
 - g. Premoulded joint fillers.
 - h. Finishes of all concrete and concrete slabs.
 - i. Concrete walks, platforms, terraces and curbs.
 - j. Testing and inspecting concrete work.
 - k. Concrete foundations for all motors, pumps, tanks and other items of equipment provided under Mechanical and Electrical Contracts.
 - l. Construction and expansion joints.
 - m. Perimeter insulation.
 - n. All other items of concrete and cement and related work to be inferred as needed to make the work of this contract complete.
 - o. Damp proofing all basement walls below grade.

- p. Water stops at basement footings.
- q. Set anchor bolts provided by structural steel contractor for all columns and other bearing plate locations as required.

03000.0300 RELATED WORK SPECIFIED ELSEWHERE

- 1. Waterproofing - Division 7.
- 2. Miscellaneous bolts, anchors, reglets, inserts, etc., required by other trades and installed under this Section.

03300.0400 CODE REQUIREMENTS AND APPLICABLE STANDARDS

- 1. Local building codes, laws and regulations govern all work. Adhere to where mandatory, specifications and drawings to the contrary notwithstanding.
- 2. ACI 318-95.
- 3. ACI 301-96 (paragraph reference).
 - a. Except as modified herein.
 - b. Contractor to maintain current copies of ACI-301 manual on site.

03300.0500 SHOP DRAWINGS

- 1. Submit shop drawings for approval in accordance with the requirements of the Supplementary General Conditions showing locations, size, length and bending of all bars, and also such additional details as may be required to completely cover the furnishing and installing of all reinforcement, chairs and spacers and execution of all concrete work. Allow sufficient time for checking and approval prior to fabrication. Show the location, sizes and forms of all required openings, miscellaneous steel items, inserts, anchor bolts, recesses, etc., as required for work under this and other Contracts.
- 2. All details shall be in accordance with the current rules and practices of the American Concrete Institute and jurisdictional codes, except where otherwise indicated.
- 3. Shop drawings shall indicate all slab depressions.

03300.0600 COORDINATION

- 1. Properly coordinate the work of this Section with work of contiguous trades.

03300.0700 MATERIALS

1. Cement: ASTM-C150 Type I, Type II, or Type III may be used only with written permission of the Architect. Air-entrained concrete where specified shall be obtained by use of approved air-entraining agents, the use of air-entraining, or other type cements is expressly prohibited without prior approval of the Architect. Cement used throughout the project shall not vary in color so as to prejudice appearance of exposed concrete. Only one brand of any type of cement shall be used for exposed concrete surfaces.

2. Aggregate: ASTM C33 except as modified herein.

a. Fine Aggregate shall conform to the following requirements:

Not more than 3% shall pass the No. 200 sieve.

Rational analysis shall conform to Table A as follows:

<u>Table A</u>	<u>By Weight</u>
Kaolin	Max. % 6
Quartz & Feldspar	Min. % 75
10 Cycle Sodium Sulphate	Max. % loss 6
5 Cycle Magnesium Sulphate	Max. % loss 15

It shall not show darker than light amber when tested by colorimetric method.

The graduation of the sand shall be constant and the fineness modulus shall not vary by more than 0.2.

b. Coarse Aggregate: Shall consist of hard crystalline stone or gravel free from clay, silt, shale, or decomposed or thin laminated pieces. The pieces shall be clear and uncoated, and conforming to Table B below:

<u>TABLE B</u>	<u>GRAVEL OR STONE</u>
<u>Abrasion Test</u> with Los Angeles Machine (ASTM Designation C-131) Max. Permissible percent by weight	40
<u>Soundness Test</u> (ASTM Designation C-88) Max. permissible percent by weight for 10 cycles, magnesium sulphate for 5 cycles, sodium sulphate	7.5

Chemical Test (ASTM Designation C-289)
and/or Petrographic Analysis (ASTM
Designation C-295) max. permissible
percent of following reactive minerals.

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Opal or Opaline chart	0.25%
Chalcedony	5%
Glassy or crytocrystal lime acidic to intermediate volcanic rocks or tuffs	3%

Test with all aggregate for potential reactivity in accordance with ASTM C295, C289, and C227. Supply certified test reports by an agency satisfactory to the Architect for compliance of the aggregate to the contract documents.

Coarse aggregate where specified for lightweight structural concrete shall conform with the requirements of ASTM C330 - graded to size 3/4" to #4 of Table 1 therein.

3. Admixtures.

- a. Air-entraining admixtures shall be Darex AEA, neutralized Vinsol-Resin, or equivalent as approved by the Architect.
- b. Plasticizer shall be "Pozzolith" as manufactured by Master Builders.
- c. No other admixtures will be permitted without the express approval of the Architect.

4. Reinforcing bars shall be new billet stock unless otherwise specified and shall conform to ASTM 615, Grade 60. The Contractor shall furnish, when requested by the Architect, a certificate from the manufacturer guaranteeing that the present product meets the specification requirements.
5. Wire Mesh for concrete reinforcement shall consist of welded wire fabric conforming to ASTM Designation A185.
6. Mixing water shall be clean and potable. If there is any question as to its suitability, it shall be tested in accordance with AASHTO Standard Method of Test T-26.
7. Premolded Joint Material: Celotex Corp. "Flexell" or approved equal. Expansion joint sealer shall be Sonneborne Building Products, Inc. Sonolastic, one component Paving Joint Sealer or approved equal.

8. Surface Hardener: "Lapidolith" by Sonneborne Building Products, Inc., "Hornlith" by A.C. Horn Co., Inc. or "Saniseal" by the Master Builders Co.
 - a. Shall be installed in accordance with the Manufacturer's recommendations.
 - b. Provide five (5) year written guarantee by Manufacturer.
9. Vapor Barrier: "Vis Queen" as manufactured by Visking Division of Union Carbide, Polyethylene sheets, .066" thick, or other approved equal.
10. Perimeter Insulation: Shall be "Styrofoam SB" as manufactured by Dow Chemical Company or approved equal. Insulation shall be 2" thick unless otherwise noted on the drawings.
11. Grout under base plates: Fosroc "Conbextra" or approved equal.
12. Other materials as herein specified.

03300.0800 STORAGE OF MATERIALS

1. General: Storage facilities are subject to the approval of the Architect. Afford easy access for inspection and identification of shipments.
2. Cement: Store cement well off the ground in a dry, weather-tight adequately ventilated structure with provision to prevent the absorption of moisture.
3. Aggregates: Store aggregates in a manner to assure good drainage to preclude the inclusion of foreign matter, and to preserve the gradation. Keep each size group separate by means of bulkheads between the piles.
4. Reinforcing Steel: Store reinforcing steel off the ground under cover and protected from rusting, oil, grease and distortion.

03300.0900 FORM WORK

1. Chapter 2 of ACI 301 is included in its entirety except as modified hereinafter.
2. Design form work to be strong, rigid, accurately formed to within 1/4 inch of the lines and dimensions shown on the drawings and strong enough to support the dead weight of the concrete without deflection or leakage.
3. Design form ties so that they may be cut off no less than 1 inch from any concrete surface. Patch all holes left by form ties in a manner satisfactory to the Architect.

4. Coat all wall forms with a form oil. Keep reinforcement clean of form oil.
5. Provide temporary openings in forms to permit inspection, cleaning, and placing concrete.
6. Remove forms so as not to damage concrete. Remove forms in accordance with paragraph 2.3.4.

03300.1000 REINFORCING

1. Accurately fabricate reinforcing steel to the details and dimensions shown on the drawings, maintain bars free from dust, mud, rust, scale, oil, distortion, and structural defects.
2. Bend all bars cold and in a manner which will not injure the bars. Do not use bars with bends or kinks not indicated on the drawings. Fabricate in accordance with ACI315-80 standards.
3. Support all reinforcement rigidly in its design location prior to placing concrete, support reinforcing off the ground on precast concrete blocks.
4. Place all reinforcement within the limits of a days' operation, firmly supported and firmly connected before start of concrete placement. Provide concrete cover as indicated in paragraph 5.5 except as otherwise noted. Correct bent or displaced bars before placing concrete.
5. Prepare bending and placing drawings at a scale deemed suitable by the Architect for the work shown. Submit copies of shop drawings in accordance with the general conditions for review; correct and resubmit as required until approval is obtained. Maintain on the job site, an approved up-to-date set of shop drawings bearing the approved stamp by the Architect. All work shall conform to these drawings.

1. Proportion all concrete to attain the properties and strength indicated in Table E.

Table E	
<u>Description</u>	<u>28 Day Strength</u>
Piers and Footings	4000 psi
Slabs on grade	5000 psi
Foundation Walls	4000 psi
Floor Slabs (on Decking)	3500 psi

2. Submit a mix design, to the Architect, no less than 35 days prior to placement of concrete; for each class of concrete. The mix design consists of:
 - a. Mix proportions including admixtures.
 - b. Gradation and specific gravities of aggregates.
 - c. Test reports of the components quality as outlined in Paragraph 7.
 - d. Strength tests of designed mix indicating strength at least 20% higher than job requirements.
 - e. Slump, weight, and air content of designed mix.
3. The Architect, may at his discretion, require additional cement or other changes to the mix if the designed mix fails to meet the specification.
4. Produce concrete with a slump not exceeding 4 inches.
5. General Contractor shall arrange for making and testing samples of the concrete as placed. Tests will be in accordance with ASTM Standards. Failure of the concrete to comply with the contract documents as evidenced by these tests is sufficient cause for rejection of the concrete placed. Cost of all tests shall borne by the Owner.

03300.1200 MIXING

1. Equipment: Machine mix all concrete in a mechanical batch-type mixing plant conforming to acceptable standards. Provide mixers with adequate facilities for the accurate measurements and control of each of the materials entering the mixer.

Prepare all batches by weight in automatically controlled batch plants.

2. Mixing: Do not charge mixers in excess of the manufacturers rated capacity for mixing, or operate in excess of the rated speed. Excessive mixing requiring the addition of water to preserve the required consistency will not be permitted. Discharge the entire batch before recharging. Discharge all wash water before recharging. Once initial sets has taken place, do not attempt to temper the concrete by addition of water.
3. Ready-Mixed Concrete: May be used provided that the central plant producing the concrete and the mixing and transporting equipment is suitable for the production, transportation and placing of the specified concrete. Ready-mixed concrete shall conform to the requirements of ASTM Designation C94 except as modified herein. Mixing in transit shall be prohibited.

03300.1300 PREPARATION FOR PLACING CONCRETE

1. Remove water from all areas where concrete is to be placed. Do not permit water to flow over freshly placed concrete. Clean forms and concrete handling equipment thoroughly. All form work, reinforcement, etc., will be inspected and approved prior to placing concrete. Clean earth foundations of mud, water, loose material and debris.

03300.1400 PLACING CONCRETE

1. Place concrete only when the weather conditions are suitable for proper placing, finishing and curing.
2. Mix, transport, and place concrete to maintain proper consistency and avoid segregation. Maintain concrete in a plastic state at all times from mixing to placing in final position.
3. Convey concrete from mixer to final location in a manner which will prohibit segregation. Do not exceed 3 foot fall from mixer conveyance. Do not exceed 6 foot free fall when placing in final position.
4. Vibrate all concrete in place with approved internal vibrators. Do not vibrate after initial set has taken place.

03300.1500 CONSTRUCTION JOINTS & EMBEDDED ITEMS

1. ACI 301, Chapter 5 is included in its entirety except as modified hereinafter.
2. Where not shown, locate construction joints to provide the least impairment to the structure: Location and detail of all construction joints must be approved by the Architect.

3. Location construction joints to produce the following maximum length of concrete placement:

Beams and slabs cast on ground	30 feet each way
Walls	50 feet each way

4. Accurately locate all inserts, sleeves, anchor bolts, etc. Mislocation or embedded items is solely the responsibility of the Contractor.

03300.1600 BONDING AND GROUTING

1. Clean all laitance and loose material from surfaces of set concrete, slush face of joint with neat cement grout. Place new concrete before grout has set.
2. Grout all base plates with a mix of one part cement to two parts sand.

03300.1700 PATCHING

1. Patch all slight honeycomb and other surface defects by chipping out defective material and patching with a 1 part cement to 3 parts sand mortar.
2. Where in the Architect's opinion the defects will impair the structural adequacy of the member, make repairs as directed by the Architect. All costs relating to such repairs will be borne by the Contractor.
3. Where in the Architect's opinion, the defects will impair the finished appearance of the area, make repairs as directed by the Architect. All costs relating to such repairs will be borne by the Contractor.

03300.1800 PROTECTION AND CURING

1. Protect concrete from injury, from any cause for no less than five (5) days after placing. Begin curing immediately after the concrete has attained its initial set. Cure by water spray, saturated burlap or curing compound. Cure in accordance with ACI 301, Chapter 12.

03300.1900 INCLEMENT WEATHER

1. Place concrete only when the ambient temperature is between 40 degrees F and 85 degrees F.

In order to place concrete at temperatures outside of the above range, special instructions may be issued by the Architect. All costs involved in implementing these special instructions will be borne by the Contractor.

2. In general, the special instructions will be in accordance with the recommendations of ACI 305-82 and ACI 306-88, except that Chapter 6 of ACI 306 will not be utilized.

03300.2000 FINISHING CONCRETE

1. Formed surfaces ACI 301 Chapter 5.3.3 is included in its entirety.
2. Flatwork: ACI 301 Chapter 5.3.4 is included in its entirety except as modified herein.
 - a. Finish all flat floors except as noted below with a steel trowel finish suitable for receiving floor finishes. Class A tolerance verify requirements with Architect.
 - b. Finish exterior slabs with non-skid broom finish. Class B tolerance.
 - c. Do not float or trowel concrete surfaces while the material is wet or sloppy. Delay finishing operations until all surface water has disappeared. Do not dust cement over wet areas to accelerate drying.
3. Surface Hardener: Unless otherwise specified, all exposed interior concrete slab surfaces shall be treated with the specified surface hardener, applied in strict accordance with the manufacturer's printed instructions.
4. Wood Float Finish: Concrete platforms shall be finished by tamping with special tools to force the aggregate away from the surface, then screening with straight edge to bring surface to the required lines. While the concrete is still green, it shall be wood-floated to a true and uniform plane with no coarse aggregate visible.
5. Screeds for All Finished Work: Provide metal screeds as approved by the Architect. Screeds shall be set with instruments to proper elevations.

03300.2100 CONCRETE SIDEWALKS, TERRACES, RAMPS AND CURBS

1. Concrete and the equipment, workmanship, testing, etc., and materials therefore, shall conform to the applicable requirements of Division 3, CONCRETE, of these specifications except as otherwise specified herein. Concrete shall be air-entrained 4000 psi minimum compressive strength at 28 days. Concrete shall have a slump of not more than 4". Air entrained shall range between 5 and 8%.
2. Subgrade Course:
 - a. The subgrade shall be constructed true to grade and cross-section as shown on the drawings and shall be constructed in accordance with the applicable requirements of PARAGRAPH, SUBGRADE PREPARATION. The subgrade for curbs shall extend in all cases at least 1 foot in width beyond the back face of the curb.

3. Forms: Wood or metal, straight, free from warp, of sufficient strength to resist springing during construction, and of a height equal to the full depth of the finished work. Wood forms shall be 2" surfaced plank. Metal forms shall be of approved section with a flat top surface. Benders or thin plank forms may be used for curb returns. Forms shall be set with the upper edge true to line and grade and shall be held rigidly in place by stakes placed on the outside of forms and set flush with the top edge of the form. Clamps, spreaders and braces shall be used where required to insure rigidity in the curb forms.
4. Concrete Placement and Finishing:
 - a. Sidewalks & Ramps: Place in forms in a layer of such thickness than when compacted and finished the walk will be of the thickness shown on the drawings. After the concrete has been placed between side forms, a strike-off guided by the side forms shall be used to bring the surface to the proper section to be compacted. The concrete shall then be tamped with a heavy tamper and given a final tamping with a light tamper. The surface shall be finished to grade and cross section with a wooden float at least 10 feet in length, 6 to 8 inches in width, and at least 1 inch in thickness with handles at each end for longitudinally floating along the surface. After float, the surface shall be troweled smooth and then finished with a fine hair push broom drawn over the surface traverse to the line of traffic. If necessary water may be added to the surface immediately in advance of brooming. Before final finish, the surface shall be checked with a 10 foot straight edge, and any irregularities of more than 1/8" in 10 feet shall be eliminated. Divide into rectangles at intervals of approximately five feet by means of contraction joints. The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least 1" by means of a jointer having a radius of 1/8" or a cutting blade not more than 1/8" thick. The completed surface shall be uniform in color and completely free of blemishes and tool marks.
 - b. Curbs: Place in the forms to the specified depth in 6" layers and thoroughly consolidate by tamping and spading so that there are no rock pockets at forms, and mortar entirely covers the top surfaces. Concrete may be compacted by means of mechanical vibrators approved by the Architect. The surface of the top of the curb shall be edged with the proper edging tool and floated and finished with a smooth wood float or a concrete rubbing block until it is true to grade and section and uniform in texture. These surfaces shall then be brushed with a fine hair brush with strokes parallel to the line of the curb. Ample water shall be used during the finishing operations. Immediately after removing the front curb forms, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until all blemishes, form marks, and tool marks have been removed. The surface of the face shall, while still wet, be brushed in the same manner as the curb top. The face of the finished curb shall be true and straight and the top

surface of curbs shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge, 10' long is laid on the top of the curb, or on the surface of gutters, the surface shall not vary more than 1/8" from the edge of the straight edge, except at grade changes or curves. All visible surfaces and edges of the finished curb, shall be free of all blemishes and form and tool marks, and shall be uniform in color, shape and appearance.

5. Expansion Joints:

- a. Provide expansion joints in sidewalks, terraces and platforms at all walk intersections and returns, at buildings, steps, structures, and other features against which the slabs abut. In addition, provide expansion joints for sidewalks at intervals of 20 feet. Form joints with expansion joint filler strips, 1/4" thick. The filler strips shall be Phillip Carey "Elastite", Serviceized Products Co. "KorkPak" or approve equivalent joint filler. Joint filler shall be held in place by means of steel pins or other devices to prevent warping of the filler during floating and finishing. After finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/4".
- b. Expansion joints for curbs: Form expansion joints for curbs with joint filler cut and shaped to the cross section of the curb. Provide expansion joints at the ends of all returns and directly opposite the expansion joints of abutting concrete walks and unless otherwise indicated shall be of the same type and thickness as the joints in the sidewalk. Where curbs do not abut concrete walks, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 20 feet.
- c. After the concrete has cured and is thoroughly dry, the upper part of all expansion joints shall be cleaned and shall be sealed with joint sealer. Sealer shall be a cold-applied 2 component, polysulfide type sealant conforming as a minimum to ASA Standard 116.1-60. The compound shall be capable of being mixed on-the-job to a consistency appropriate for pressure extrusion. When mixed and applied in accordance with the manufacturer's instructions, the mixture shall completely fill the joints without the formation of air holes and voids.

6. Curing: Immediately after the completion of the finishing operations, the exposed surfaces of concrete shall be cured by one of the following methods, as the Contractor may elect.

- a. The entire exposed surface shall be covered with quilted covers conforming to AASHTO Specification M-73. Immediately after placing, they shall be thoroughly wet with water and kept in a saturated condition for not less than 7 days.
- b. The entire exposed surface shall be wetted with a fine spray of water and then covered with waterproof paper conforming to ASTM Standard C-171. Sheets shall be laid directly on the concrete surface and overlapped 12" when a

continuous sheet is not used. The curing medium shall be not less than 18" wider than the concrete surface to be cured, and shall be securely weighted down by placing a bank of moist earth on the edges just outside the forms and over the transverse laps to form closed joints. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

7. Protection: After the concrete has been cured, all debris shall be removed, and the areas adjacent to the work shall be backfilled, graded, and compacted in a satisfactory manner in accordance with the lines and grades shown on the drawings. The completed work shall be protected from damage until accepted. The Contractor shall repair and clean, at no additional cost to the Owner, all concrete damaged or discolored during construction. Repair of sidewalks, if required, shall be made by removing and replacing defective portion between the nearest cleavage or expansion joints.

3300.2200 TRENCH DRAIN

1. Provide complete trench drainage systems where indicated on the drawings at wash bay. System shall include but is not necessarily limited to precast trench drains, cast iron heavy duty lock down grate covers, anchors, fittings, hardware, end caps and outlet end with 4" nipple. Coordinate with plumber who will provide and install piping tied into site drainage pools.
2. System shall be ACO S-100 Channel Slope trench drain system with "D" load class ductile iron slotted grate or approved equal.
3. Manufacturer's product literature and detailed shop drawings indicating the entire installation including all components and details referenced by catalog number and piping to storm drain location.
4. All materials, systems, components, etc. shall be installed in strict compliance with the manufacturer's printed product system specifications and installation instructions including ACO drainage systems manual and ACO drain technical installation.
5. The ACO Drain System requires a bedding of concrete on both sides and under the channels. An area must be provided for channel placement wide enough and deep enough to accommodate the channel and bedding concrete. Follow ACO installation techniques exist for proper placement of ACO trench. As noted in both the ACO Drain Products Catalog 02725/ACP and ACO Drain Technical Installation. Prescribed methods and systems shall be reviewed with ACO technical services personnel prior to installation.

03300.2300 PERIMETER INSULATION

1. Manufacture: Perimeter insulation shall be "Styrofoam SB" rigid type, as manufactured by Dow Chemical Co., or approved equal. Thickness as shown on Drawings.
2. Preparation: The surfaces to which insulation is to be applied shall be smooth, flat and trim.
3. Foundation Walls: Install on the inside surface of the foundation wall to a minimum depth of 24" below bottom of slab with a thin layer of asphalt emulsion. Apply a layer of roofers felt, cut in strips the thickness of the floor slab, to the insulation to prevent the concrete from bonding to the insulation; cement with asphalt emulsion. Conform with details shown on the drawings.

03300.2400 INSPECTION AND TESTS

1. All concrete operations are subject to inspection and test as ordered by the Architect. All tests will be made in accordance with the appropriate ASTM Standards. The Contractor will provide all required assistance in performing these inspections and tests. The cost of inspection and tests will not be borne by the Contractor. The test performed constitute sufficient cause for rejection should these tests indicate failure to comply with the Contract documents.

03300.2500 TESTING

1. Testing and Inspection which may be performed by the Owner:
 - a. The General Contractor shall schedule for the following services:
 - b. Test cylinders shall be made and stored in accordance with ASTM C-31. The method of sampling fresh concrete shall be in accordance with ASTM C-172. The Contractor shall provide a safe storage box for storage of test cylinders in an undisturbed manner.
 - c. Two (2) of the specimens shall be tested after seven (7) days and two (2) after twenty-eight (28) days. Two (2) cylinders will be saved for testing at 45 days. 45 Day tests will not be required if the 28 Day tests are satisfactory. The 7 day strength will be assumed to have 70% of the 28 days strength. For Type III cement, the 7 day test shall indicate 90% of 28 day strength.
 - d. Compression tests shall be conducted in accordance with ASTM C-39.

PROPOSED FIREHOUSE PROJECTS
TAPPAN FIRE DISTRICT
TAPPAN, NY

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- e. Slump tests shall be made for each truck load of concrete placed, in accordance with ASTM C-143.

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