

03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

a. Concrete will consist of cement, coarse aggregate, fine aggregate, water, and approved admixtures, proportioned and mixed to produce a plastic, workable mixture suitable to specific conditions of placement, and in accordance with the following specifications, All reinforcement and embedded items shown or detailed will be installed and secured in place prior to the placement of concrete.

b. Concrete will not be mixed or placed at ambient temperatures of forty (40) degrees F and less, without adequate frost protection. Forms, reinforcing, and subgrade will be free from latent ice or frost. The aggregate, or water, or both, will be heated as required to permit the placement of the mixture at concrete temperature ranging from fifty (50) to one hundred (100) degrees F. After placement, the concrete will be protected by suitable covering or heated enclosures, to maintain the concrete temperature within the range stated above, for the entire curing period. If frost protection methods fulfill all requirements for curing, actual curing procedures may be obtained.

PART 2 - PRODUCTS

1. CLASSIFICATION

Except where specifically required to meet special conditions, all concrete will be Class "A", "B", or "C", as designated for the various parts of the work, in accordance with the conditions of application or strength requirements. In general, and unless otherwise noted on the Plans or specifically in these Specifications, only Class AA: concrete will be used.

2. STRENGTH REQUIREMENTS

a. Mixes will be designed to secure concrete having the following compressive strength at the age of twenty-eight (28) days, as determined by compression test results:

Class	Minimum Average for any Four consecutive cylinders	Minimum for any one cylinder
"A"	4,000	3,250
"B"	3,250	2,750
"C"	2,500	2,000
"D"	8,000	10,000

b. All material is subject to testing and inspection prior to incorporation into the Work. All samples and specimens must be truly representative of the material proposed to be furnished. The Contractor will furnish and provide all samples and test specimens required, will bear all expenses in connection with laboratory testing, and will furnish certified copies of all test results performed by and Engineer approved laboratory.

c. All test cylinders will be taken, stored, and transported to the laboratory by the Contractor. A

minimum of three (3) cylinders will be taken for each individual pour, or for each fifty (50) cubic yards of concrete poured, whichever is the lesser. After test cylinders are made, the cylinders shall be transported to a controlled environment within 36 hours and kept close to 73E F as possible. Of the cylinders taken, one (1) will be broken at the age of seven (7) days, one (1) broken at the age of twenty-eight (28) days, and the remaining cylinder kept until test results indicate the concrete suitability. The seven (7) day strength should be approximately two-thirds (2/3) of the required twenty-eight (28) day strength, and failure to develop same will be cause for a recheck of the mix, and such changes made as deemed necessary to secure the required twenty-eight (28) day strength. If any of the twenty-eight (28) day tests fall below that specified above, the Contractor will make such loading and/or core tests as may be required by the Engineer, on the portions of the structure affected. Core tests will be made in accordance with ASTM C-42 methods. Should test results indicate that, in the Engineers opinion, the strength of the structure is inadequate, such strengthening or replacement as may be ordered by the Engineer, will be performed by the Contractor, prior to acceptance and payment for the work. All additional testing, and any such replacement work, will be paid for by the Contractor, with no additional payment from the Owner.

3. HIGH-EARLY STRENGTH CONCRETE

High-early strength concrete may be used as specified herein, or shown on the Plans, and may be used in other portions of the work when desired by the Contractor. The seven (7) day compressive strength of high-early strength concrete, of any class, will be equal to eighty (80) percent of the specified minimum twenty-eight (28) day strength for that class of concrete. The stipulated time for form removal may be correspondingly reduced where high-early strength concrete is used. The minimum curing period for high-early strength concrete will be three (3) days. All provisions of the Specifications, except for cement and removal of forms, will be applicable to high-early strength concrete.

4. MATERIALS

a. Portland Cement: Portland cement will be an approved brand, conforming to ASTM C-150, Type I; or, if so allowed by the Engineer, high-early strength Portland cement conforming to ASTM C-150, Type III. Use of special cement, or those using interground admixtures, will not be allowed. Cement content of concrete will be determined per ASTM C-138.

b. Aggregates: Pit run or naturally mixed aggregates are not approved, nor will a mixing of aggregate from different sources, or alternating batches of different aggregates in a stockpile be allowed. Sufficiently in advance of construction to allow standard gradations and proportioning to be determined, the Contractor will submit representative samples, or material certification for each type of aggregate to be used; fineness modulus of the aggregate proposed for use will not vary from such standards by more than +/-0.2. Fineness modulus will be computed for each sieve analysis made, determined by adding respective cumulative percentages of material coarser than the sieve in a U.S. Standard Series, and dividing by one hundred (100). The Series for fine aggregate will consist of Nos. 4, 8, 16, 30, 50, and 100; for coarse aggregates and total aggregates, 1-1/2 inch, 3/4 inch, and 3/8 inch sieves will be added to the Series.

c. Fine Aggregate: Fine aggregate will be comprised of clean, durable, siliceous or calcerous particles, free from adherent coatings, having a mortar strength not less than ninety (90) percent of standard Ottawa sand, per ASTM C-87. Aggregates subjected to colorimetric testing for organic impurities per AASHTO Method T-21, producing a color darker than standard will be rejected, unless they are capable of passing the mortar strength test.

d. **Gradation:** gradation will be within the following limits when tested under AASHTO Method T-27. Blending will be permitted if necessary to meet the following gradation limits:

U.S. Standard Sieve	Percent Retained
3/8-inch	0
No. 4(1/4)	0 - 5
No. 16(1/8)	20 - 55
No. 30(21/16)	45-75
No. 50(21/32)	70 - 90
No. 100(21/64)	90 - 98

e. **Coarse Aggregate:** Coarse aggregate will be comprised of washed, graded gravel, or crushed rock, screened to the required size. The particles will be hard, durable, tough, free from adherent coatings, and must be free from deleterious amounts of vegetable matter of soft, friable, thin, or elongated particles. The substances designated below will not be present in excess of the following amounts:

Soft Fragments	5 percent	Removable by decantation, one (1) percent
Clay Lumps	1/4 percent	

1. When the material removed by decantation consists essentially of crusher dust, the maximum allowable percentage may be increased to one and five tenths (1.5). Maximum chert content shall be 2% (" 0.5%).
2. Coarse aggregate will be well-graded from fine to coarse so that concrete of the required workability, density, and strength can be made without the use of excessive amounts of sand or cement paste. For Class "A" and "B" concrete, the maximum screen size will be one and one-half (1-1/2) inch, and for Class "C", the maximum size screen will be two and one-half (2-1/2) inch. Coarse aggregate grading will fall within the following limits:

	Percent by Weight Passing
Maximum size mesh screen (square mesh)	95 - 100
2 maximum size mesh screen (square mesh)	40 - 70
No. 4 sieve	0 - 6

3. Coarse aggregate will be subjected to a ten (10)-cycle sodium sulfate accelerated soundness test in accordance with ASTM C-88. Material failing to meet this test with a loss of less than five (5) percent weight, will be used only where it can be demonstrated to the satisfaction of the Engineer, that concrete with the same aggregate has given satisfactory service for a period of not less than five (5) years under conditions similar to those which it

will be subjected in the work.

f. Deleterious Substances: Deleterious substances in all aggregates will not exceed the following percentages by weight when tested under the designated ASTM methods.

	<u>Coarse</u>	<u>Fine</u>	<u>Test</u>
Material Passing No. 200 Sieve (wash)	1.0*	2.0	C-117
Shale	0.5	1.0	C-123
Soft, Friable Fragments		0.1	
Coal	0.5	1.0	C-123
Clay Lumps (on_inch sieve)	0.3	0.5	C-142
Combined Shale, Coal, Clay Lumps, and Soft, Friable Fragments	3.0	3.0	

g. Proportioning: Water used for mixing will be clean, clear, odorless, and potable. If of questionable quality, water will be tested under AASHTO Method T-26. The exact proportioning of all materials, required by the water-cement ratio, will be as required to produce workability and slump requirements for the class of concrete being poured. The Contractor will provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the mix. Proportions will be changed whenever necessary to obtain the specified strength and the desired durability, density, uniformity, and workability.

1. All materials will be measured by weight, except water, which will be measured by volume or weight. Cement will be considered as weighing ninety-four (94) pounds per cubic foot, and one (1) cubic foot per sack. One (1) gallon of water will be considered as weighing 8.33 pounds. Each cubic yard of concrete will contain not less than the quantity of cement stated below:
 - a. Class "A" - 6 sacks or 564 pounds
 - b. Class "B" - 5 sacks or 470 pounds
 - c. Class "C" - 4-1/2 sacks or 423 pounds
 - d. Class "D" - 6 sacks or 564 pounds with Silico Fume (when low reactivity is rigid.)
2. The Contractor will recognize that the above is the minimum quantity of cement required. Consistency and strength may be obtained with well-graded aggregate using the minimum cement; however, other aggregate, particularly the combined sand-gravel aggregate generally available, may require additional cement per cubic yard.
3. In calculating the total water content for any mix, the amount of moisture carried on the surface of the aggregate particles will be included. The total water content per sack of cement, for each batch of concrete, will not exceed the following water to cementitious ratios:
 - a. Class "A" - 0.42
 - b. Class "B" - 0.45
 - c. Class "C" - 0.48
 - d. Class "D" - 0.42
4. In all cases, the amount of water used will be the minimum amount needed to produce a plastic mixture of the strength specified, and a desired durability, density, uniformity, and workability. Generally the mix consistency will be that required for specified placement

methods and conditions. Ordinarily, slump will be between two and one-half (2-1/2) and three and one-half (3-1/2) inches. In no case will slump be less than one and one-half (1-1/2) inches, or more than four (4) inches, when tested with a standard slump cone. In order to stay within the wil parameters low or high range water deduced may be added at the plant or on site. No water shall be added on the job site.

5. Batching and weighing devices will provide means of regulation and control, and will be accurate within five-tenths (0.5) percent for aggregates and bulk cement. All such devices and operating methods must be subject to inspection by the Engineer. When batch trucks are used, each batch compartment will be charged with all dry materials for one (1) batch.
6. The exact proportioning of the mix may be varied within the limits specified in order to obtain concrete having the specified strength and other desired characteristics. The batch weighs of coarse and fine aggregates may be adjusted to ensure use of the least amount of fine aggregate to produce workable concrete with the proper slump. If it is impossible to produce concrete of the proper consistency without exceeding the specified limitations for percentages of coarse aggregate and total water ratio, the gradation of aggregates must be corrected, or the total batch weight of aggregates must be reduced. The amount of water added at the mixing chamber will be adjusted for the moisture contained on the surface of the aggregates, and for absorptive qualities of aggregates. Absorption of aggregates will be determined by AASHO Methods T-84 and T-85. Batch weighs of coarse and fine aggregate will be adjusted to compensate for moisture contained at time of use. Air entraining agents may be added only at the mixer.

h. Admixtures: An air-entraining agent conforming to Designation C-260 will be added to each batch of concrete. Entrained air quantities must be maintained at approximately four and one-half (4-1/2) percent of the total batch weight, and at all times will be within the range of the four (4) to seven (7) percent, when tested in accordance with ASTM C-231.

1. **Air-Entraining:** Conforming to ASTM C260. (152 " 12)
2. **Calcium Chloride:** Calcium chloride or admixtures containing more than 0.05% chloride ions by weight of admixture are not permitted.
3. **Water-Reducing Admixture:** ANSI/ASTM C494, Type A, and contain not more than 0.1% chloride ions by weight of admixture.
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 1. "Eucon WR-75"; Euclid Chemical Co.
 2. "Pozzolith 322N"; Master Builders.
 3. "Plastocrete 161" or "Plastiment NS"; Sika Chemical Corp.
 4. "Chemtard"; Chem-Masters Corp.
 5. "WRDA Series", "Daracem 55", "Daracem 65", or "MIRA70"; W.R. Grace.
4. **High-Range Water-Reducing Admixture (Super Plasticizer):** ASTM C494, Type F or Type G and contain not more than 0.1% chloride ions by weight or admixture.
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 1. "Daracom Series" or "ADVA"; W.R. Grace.
 2. "Sikament 86" or ASikament 86R"; Sika Chemical Corp.
 3. "Eucon 37"; Euclid Chemical Co.
 4. "Rheobuild" or "Pozzolith 440N"; Master Builders.
5. **Water-Reducing, Retarding Admixtures:** ASTM C494, Type D, and contain not more than 0.1% chloride ions by weight of admixture.
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 1. "Pozzolith 300R"; Master Builders.
 2. "Eucon Retarder 75"; Euclid Chemical Co.
 3. "Daratard-17"; W.R. Grace.
 4. "Plastiment"; Sika Chemical Co.

6. **Noncorrosive Nonchloride Accelerator:** ASTM C494, Type C or E, and contain not more than 0.1% chloride ions by weight of admixture.
 - a. **Certification and Tests:** The admixture manufacturer must have long-term noncorrosive test data from an independent testing laboratory (of at least 1-year duration) using an acceptable accelerated corrosive test method such as that using electrical potential measures.
 - b. **Requirement:** Written conformance to above mentioned requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review by the CHOICE 1.
 - c. **Products:** Subject to compliance with requirements, provide one of the following:
 1. "Pozzutec 20"; Master Builders.
 2. "Polarset Accelerator" or "DCI"; W.R. Grace.
 3. "Accelguard 80"; Euclid Chemical Co.
 4. "Plastocrete 161 FL"; Sika Chemical Co.
7. **Fibrous Reinforcement:** 100% pure or virgin polypropylene monofilament fibers, polypropylene fibrillated fibers or nylon fibers and specifically manufactured for use as concrete secondary reinforcement. Polypropylene fibers shall contain no reprocessed olefin materials. Fiber reinforced concrete finish shall be smooth with no visible evidence or surface fibers under wet or dry conditions. A "hairy" finish is not acceptable. Minimum length of fiber shall be 3/4". Volume per cu. yd. shall equal a minimum of 0.1% (1.5 pounds) or as recommended by manufacturer. Fiber manufacturer must document evidence of 5 years satisfactory performance history, compliance with ASTM C1116 Type III 4.1.3 and ASTM C1116 Performance Level I outlined in Section 21 Note 17. Delivery tickets shall state that fibers have been added at the concrete ready-mix plant.
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 1. "Forta CR"; Forta Corp.
 2. "Fibermesh"; Fibermesh, Inc.
 3. "Grace Fibers"; W.R. Grace.
 4. "Nycon"; Nycon, Inc.
 5. "Micro Fiber"; W.R. Grace.
 6. Fibermix "Stealth Fiber"; Fibermesh, Inc.
 7. Columbia "Rope"; Columbia, Inc.
8. **Normal Weight Aggregates:** Fine and coarse type conforming to ASTM C33, maximum size being as follows:
 - a. 2": Wearing course or topping and structural slab up to 3".
 - b. 3/4": 3-1/2" to 4-1/2" structural slabs.
 - c. 1": 5" to 6-1/2" structural slabs, beams and walls.
 - d. 1-1/2": Beams, walls, and structural slab more than 6-1/2" in thickness, pedestals and slabs on grade.
 - e. 2": Footings, piers, pile caps and mass concrete.
9. **Lightweight Aggregates:** Shall meet the requirements of ASTM C330.
10. **Water:** Clean, potable, free from acids, alkalies or organic materials. Shall meet requirements of ASTM C94.
 - i. **Fly Ash:** Not permitted as a substitute for Portland cement unless approved by the Engineer.
 - j. **Fly Ash:** Conform to ASTM C618, Type C or F. Fly Ash may be used to replace cement in the concrete mix not to exceed 15 percent of the cement content of the mix. Only one class of fly ash from a single source may be used.

PART 3 - PLACING AND FINISHING

1. PLACING

All concrete work must be so scheduled that any section begun on a day will be finished during daylight of the same day. Concrete will be placed before the initial setting occur. Generally, concrete will be placed against clean, dampened surfaces. Earthen subgrades, either undisturbed earth or properly consolidated material, will be free from mud and running water. Sand or rock subgrades will be completely confined and covered with waterproof sheathing material. Concrete will be worked into all corners and angles of forms, around reinforcement, and around all embedded items in such a manner to prevent segregation. The Contractor will provide all means necessary to convey the concrete from the mixer to its final position as rapidly as possible. Chutes sloped such that the concrete slides, but does not flow, may be used only when absolutely necessary. The Contractor will use tremies or elephant trunks where concrete is to be placed under water, or when vertical drops cause segregation. Concrete pumps are an allowable alternative. The maximum depth of horizontal layers will not be more than that which prevents segregation or formation of visible seams. All concrete will be placed with the aid of approved internal vibrating equipment, supplemented by hand forking or spading. Vibration will be applied directly to the concrete, never through forms or reinforcement. Failure to use vibrating equipment will be cause for additional testing, and if so determined by such testing, removal of such portions of the work as may be directed by the Engineer. Costs for such additional testing and/or removals will be solely by the Contractor. Unless otherwise noted, minimum curing time will be five (5) days. No superimposed work will be placed until time period has elapsed, without the approval of the Engineer.

2. REINFORCING STEEL

Install all reinforcing steel shown, including rods, fabric, or structural steel as indicated on the Plans. Unless otherwise noted, reinforcing will be placed to provide two (2) inches of concrete cover in walls or superimposed slabs, and three (3) inches of concrete cover if parchment is directly against excavated surfaces. All reinforcing will be supported, and splice lengths will be as recommended by the American Concrete Institute Manual of Standard Practice. Remove all scale, grease, rust, or any coating that may impair bonding with the concrete. All structural steel will be ASTM A-36. Unless otherwise noted, all reinforcing steel will be Grade sixty (60) and will conform to the following ASTM designations:

Welded Wire Fabric	A-185
Bar Mats	A-184
Bars	A-615

3. EMBEDDED ITEMS

Before placing concrete, remove any coatings of oil, scale, rust or other foreign matter. Kerf and thoroughly soak wood strips sued to form grooves, keys, joints, or bevels. Where waterstops are required, provision must be made in the material used to form the keyways to place the waterstop material approximately an equal distance into both the primary pour and the succeeding pour. This procedure will be followed for wall and footing connections, and for all wall and intermediate joints above the footings. Construction joint locations will be as noted on the Plans. Construction joints not requiring waterstops will use a standard key configuration, with reinforcing extended past the joint location. Should steel waterstop be used, all joints will be fully welded prior to placement of the key forming material. Other waterstop material, such as PVC must be fused or vulcanized per the manufacturer=s instructions. All metal fittings, spools, sleeves, etc. will be provided with an integral

waterstop when placed in water impounding or storage structures where watertightness is required. PVC fittings and pipe will utilize rubber gaskets or manufactured stops (A-Lok, Pres-Wedg, etc.) as approved by the Engineer. The Contractor may elect to use block-outs at fitting locations. These annular spaces around pipes will be filled with non-shrink grout finished flush with the faces of walls and bottoms of slabs. Should watertight joints be required, the grout material will be built up to form a cone terminating not less than three (3) inches above the top of floor or base slabs.

4. CONSTRUCTION JOINTS

At locations noted on the Plans, at the end of each pour, or where concrete placement is suspended for more than two (2) hours, provisions must be made for joining future work. Keyways with extended reinforcing as noted above are acceptable. Before depositing new concrete, the hardened concrete surfaces will be broomed, roughened slightly, wetted, and coated with neat cement paste or grout. The new concrete will be carefully rodded into grooves, keyways, recesses, and around bars and all other embedded items. Minimum bar lap lengths for ties to succeeding pours in eighteen (18) inches.

5. EXPANSION JOINTS

- a. Expansion joints, conforming to the dimensions and details noted on the Plans will extend entirely through walls or slabs. Exposed edges will be finished with an edging tool. All expansion joints in basins to contain liquid will be watertight joints as previously specified; all other joints will be plain unless noted otherwise.
- b. Plain Expansion Joints will be constructed of non-extruding, preformed joint filler, sealed with hot poured or cold applied sealing compound. Preformed joint filler must be cut to allow for the depth of sealing recess specified. Non-extruding material will conform to ASTM D-544, Type I, II, III, or IV. Concrete faces will be formed true to line, and perpendicular to walls or slabs. If sealed with hot poured compound, joint filler will terminate three-quarter (3/4) inch back from the exposed face. If cold applied compound is used, the filler will terminate one and one-half (1-1/2) inches from the exposed face. Recesses will be formed by using wood strips placed in the full width of the joint, and removed after the concrete has set. After the concrete has hardened, grooves will be thoroughly cleaned by approved methods.
- c. Hot Poured Joint Sealing Material will conform to ASTM D-241. Joints will be primed with cutback asphalt. Joint sealing material will be heated to a temperature recommended by the manufacturer, but not more than four hundred and fifty (450) degrees F. Material, which is overheated, will not be used. Pour continuously from end to end of the joint, in level lifts, until the joint is full. Joints, when cool, must present a smooth, uniform appearance, filled to within one-eighth (1/8) inch from the top. Material spilled or dripped on concrete surfaces must be removed immediately.
- d. Cold Applied Joint Sealing Material will conform to Federal Specifications SS-S-159b, and will be pulverized, hard asphalt, mixed with a suitable flux oil immediately prior to use.

6. FINISHING

- a. Formed concrete surfaces not exposed to sight or weather need not be finished other than the removal of lips, fins, and ridges. All other surfaces will be finished as follows:
 1. Exposed tops of walls will be brought to the proper elevation with excess water removed, and finished with a true and regular surface with a float and brush to match the finish of existing or adjacent surfaces. Added sand or cement drier will not be used.
 2. Exposed wall surfaces will be beveled at all corners and edges with three-quarter (3/4) inch molding placed in the forms. After the removal of the forms, remove all lips, ridges, and

evidences of form joints. Ream chip, and fill with non-shrink grout all honeycombs, voids, and holes; including those resulting from the removal of form ties and rods. Remedy local bulging by tooling and rubbing.

3. Floors of all structures, and other surfaces so noted, will be floated and troweled smooth. Edges, including those at expansion and contraction joints, will be finished with an edge or jointer having a suitable radius. Added sand or cement drier will not be used without the approval of the Engineer.
4. Roof slabs and unformed surfaces will be finished with a wood float. Walks and entrance pads will be floated to a uniform surface and broomed.

b. Manipulation of concrete adjacent to the surface of any lift will be the minimum necessary to produce not only the degree of consolidation desired in the surface layer of the concrete, but also a surface with the desired degree of roughness for bond with the next lift. Surface vibration or excessive working, including screening of any kind, will not to be permitted.

7. PATCHING CONCRETE

a. Concrete out of level or alignment, or defective areas which cannot be patched satisfactorily, will be removed or replaced. Patching will be done in a workmanlike manner to restore original quality and appearance, using non-shrink grout as described for specified locations. Patched areas, which are unsatisfactory in workmanship or appearance, will be repatched or removed and replaced as directed. Tie holes will be filled, and defective areas patched immediately following removal of the forms. Defective areas will be chipped to solid concrete, or to a minimum depth of one (1) inch, the patching area and surrounding areas wetted liberally, and mortar forced into place and compacted. The mortar will be finished flush, and will match the adjacent areas. Curing will be as specified for concrete.

b. Non-shrink grout will be used for patching locations as directed by the Engineer. Where discoloration from rust stains is not objectionable, use grout proportioned with one (1) part Portland cement, three (3) parts clean well graded sand (screened through a No. 4 Sieve), one-quarter (1/4) part non-shrink grout, and water to obtain the required consistency. For surfaces exposed to sight or weather, basic proportions stated above will be used except that non-shrink grout will be omitted, and white Portland cement will be substituted for such portion of Portland cement required until the color of the mortar matches that of the existing surface. Prior to use, each batch of mortar will be allowed to stand until the surface indicates an initial set, then remixed to a uniform consistency and applied while still in plastic condition. Mortar having lost his plasticity or ability to adhere, will not be used.

PART 4 - CURING

Concrete surfaces will be maintained in a moist condition, and a temperature between fifty (50) and one hundred (100) degrees F, to promote curing for a least five (5) days following initial set. Curing periods may be extended as directed to compensate for time in which surface temperatures of the concrete fall below fifty (50) degrees F. Concrete damaged by improper curing will be subject to removal and replacement as directed. Use of the following methods for curing does not relieve the Contractor of responsibility for obtaining acceptable concrete having the required strength and surface finish.

a. **Water Curing:** Comply with ACI 302 "Guide for Concrete Floor and Slab Construction", ACI 308 "Standard Practice for Curing Concrete", ACI 306 "Standard Practice for Cold Weather Concreting", and ACI 305 "Hot Weather Concreting", in addition to the following provisions:

1. Concrete shall be wet cured for (7) days
 - a. Cover all non-formed surfaces with wet burlap or burlene mats and keep them wet for the duration of the curing period.
 - b. For the period prior to application of the wet cure the surface shall be kept from drying out either through the use of fog misting equipment (equipment which atomize water, producing a very fine spray or mist) and/or and evaporation retardant. When using fog-misting equipment direct the spray above the surface of the concrete. Do not use fog misting or evaporation retardant as finishing aids.
 - c. For walls with wooden formwork, wet the form immediately after the concrete has been placed and keep wet until removed.
 - d. If forms are removed before the curing period is completed, curing compound shall be applied to all surfaces within 2 hours of form removal in accordance with the manufacturers printed instructions in such a manner as to cover the surface with a uniform film which will seal thoroughly.
2. All exposed concrete shall be sprayed in a liquid curing compound.
 - a. Apply curing compound in accordance with the manufacturers printed instructions in such a manner as to cover the surface with a uniform film, which will seal thoroughly.
 - b. For the period prior to application of the curing compound the surface shall be kept from drying out either through the use of fog misting equipment (equipment which atomize water, producing a very fine spray or mist) and/or evaporation retardant. When using fog-misting equipment direct the spray above the surface of the concrete. Do not use fog misting or evaporation retardant as finishing aids.
 - c. Immediately repair any damage to the seal provided by the curing compound which occurs in the first 7 days by application of additional curing compound over the damaged portion.
 - d. Apply curing compound as soon as the application will not mar the unformed surface and within 2 hours of removal of formwork for formed surfaces.

c. Earth or Sand Covering: The surface of the concrete will be maintained moist as above, covered with a two (2) inch layer of earth or sand.

d. Polyethylene Sheeting: Concrete surfaces will be completely covered with white or translucent polyethylene sheeting not less than four (4) mils in thickness. In the event that a continuous sheet is not used to cover the entire surface, edges and ends will be lapped a minimum of four (4) inches, and sealed by an approved method. Black sheeting will not be used.

e. Forms Left in Place: Forms left in place during any portion of the specified curing period will be sprinkled and maintained moist only as required to prevent concrete from rapid drying.

PART 5 - FORMS

a. Forms will be of wood, steel, or other approved material. Wood forms, unless lined with absorptive form lining plywood or similar material, will be tongue and groove lumber, shiplap, or lumber dressed on one (1) side and two (2) edges, and will be of uniform width. Forms must be built true to line and grade, and will be mortar-tight with sufficient rigidity to prevent displacement or sagging under the concrete load. Surfaces will be smooth and free from irregularities, dents, or holes when used for exposed surfaces. Internal ties and spacers will be of a type, that upon removal, no metal remains closer than one-half (2) inch from concrete faces. Wire ties will not be permitted where concrete surfaces will be permanently exposed. Unless otherwise indicated, suitable moldings will be placed in the form to round or level exposed edges. Forms, except when absorptive form lining is used, will be coated with a non-staining mineral oil shortly before the

concrete is placed. Forms for unexposed surfaces may be thoroughly wetted, in lieu of oiling, immediately before placement of concrete, except in freezing weather.

b. Forms will not be removed before the expiration of the number of days indicated below, except with express approval of the Engineer:

Columns and Beams	5 days
Walls and Vertical Faces	2 days

c. Cured strength of concrete shall be 75% of the design strength prior to form removal. When removed, forms will be handled in such a manner as required to prevent injury to the concrete.

PART 6 - WATERPROOFING AND SEALERS

a. A two coat Thoroseal System, Rustoleum 6500 System, or approved equivalent shall be used on:

Exposed exterior concrete walls to two feet below finished grade.
Exposed interior concrete walls.

b. All exposed concrete floors shall be sealed with Thoro Glaze as manufactured by Thoro System Products, Rustoleum 6500 System or approved equivalent.

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