

**SECTION 03300  
CAST-IN-PLACE CONCRETE**

**1.0 GENERAL**

**A. Description**

Cast-in-place concrete shall include, Portland cement concrete and the construction of small below grade Portland cement concrete structures constructed to the lines and dimensions and at the locations shown on the Plans and in accordance with the Contract Documents.

**B. Related Work Elsewhere**

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Aggregate Backfill: Section 02240
3. Water Main Installation and Chlorination: Section 02551
4. Water Valves and Appurtenances: Section 02552
5. Fire Hydrants: Section 02554
6. Sanitary Sewer Force Mains: Section 02563
7. Concrete Reinforcement: Section 03200

**C. Quality Assurance**

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

**2.0 MATERIALS**

**A. Materials Furnished by the Commission**

1. The Commission will not furnish any materials for Portland cement concrete.
2. The Contractor may purchase water from the Commission's potable water system in accordance with the current Commission policies and procedures.

**B. Contractor's Options**

1. The Contractor may furnish higher strength concrete than specified.

**C. Detailed Material Requirements**

**1. Portland Cement**

Portland cement shall be in accordance with AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

**2. Fine Aggregate**

Fine aggregate shall meet the gradation requirements contained in Table 03300-1 and shall be in accordance with the quality requirements of AASHTO M 6.

3. Coarse Aggregate

Coarse aggregate shall be in accordance with the Class A quality requirements of AASHTO M 80 using sodium sulfate to determine the soundness. Grading of aggregate shall be in accordance with AASHTO M 43, size numbers 57, 67, or 7, Table 03300-1.

4. Aggregate Gradations

TABLE 03300-1  
Mass Percent Passing

Sieves Sizes	AASHTO M 43		
	No. 57	No. 67	No. 7
U.S. Standard			
1 ½ inch	100 - -		
1 inch	95-100	100	-
¾ inch	-	90-100	100
½ inch	25-60	-	90-100
⅜ inch	-	20-25	40-70
No. 4	0-10	0-10	0-15
No. 8	0-5	0-5	0-5
No. 16	-	-	-
No. 50	-	-	-
No. 100	-	-	-

5. Water shall be Potable.

6. Admixtures

Admixtures to be used in concrete (except for air entrainment) shall be subject to prior written approval by the Commission. Admixtures for concrete shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610. The relative durability factor of concrete with Admixtures shall be determined in accordance with ASTM C 666, Procedure B.

a. Air entraining admixtures shall be in accordance with AASHTO M 154.

b. Admixtures shall be in accordance with AASHTO M 194.

c. High Range Water Reducing Admixtures

When specified, high range water reducing admixtures shall be liquid and meet the requirements of AASHTO M 194, Type F or G. When this material is used in patching, the admixture shall be liquid and meet the requirements of AASHTO M 194, Type F, for air entrained concrete with the following exceptions.

i. The water content shall be a maximum of 85% of that of the control.

- ii. The relative durability factor shall be a minimum of 90 when tested in accordance with ASTM C 666, Procedure B.
- iii. The 12 hour compressive strength for Type F admixture shall be 180% of that of control.

Additionally, the admixture shall be nonfoaming when tested in accordance with ASTM D 1173. It shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610.

#### 7. Fly Ash

Fly Ash may be used with prior written Commission approval.

Fly ash shall be in accordance with AASHTO M 295, pozzolan Class C or F.

#### 8. Concrete Reinforcement

Concrete reinforcement shall be the size and type specified and shall be in accordance with the requirements of Section 03200.

#### 9. Waterstops

Waterstops shall be made of rubber or polyvinyl chloride. The rubber type may be natural rubber, suitable synthetic rubber, or a combination of natural and suitable synthetic rubber. The polyvinyl chloride shall contain at least 90% virgin polyvinyl chloride. The remaining 10% may include one or more monomers copolymerized with vinyl chloride or consist of other resins mechanically blended with polyvinyl.

The waterstop shall be of the shape and dimensions shown on the plans. The cross section shall be uniform along the length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop shall be uniform. The waterstop shall be dense, homogeneous, and free from holes and other imperfections.

The waterstop shall meet the following requirements:

Tensile Strength, ASTM D 412, psi min.	2000
Elongation at Break, ASTM D 412, % min.	300
Hardness, Rubber, Type A Durometer, ASTM D 2240	55+5
Hardness, PVC, Type A Durometer, ASTM D 2240	75+5

#### 10. Forms

Forms shall be constructed of wood, steel, or other approved material. Wall ties approved by Commission shall be used where necessary. Surfaces of metal forms shall be free from irregularities, dents, and sags. Knot holes and broken places in wood forms shall be covered with metal patches. Lumber used in forms for exposed surfaces shall be smooth, uniform, and free from loose knots and other defects that would show defects in the finished concrete surfaces. For unexposed surfaces and rough work square-edge lumber may be used. By 'unexposed surfaces' is meant any concrete surface not exposed to view on

completion of the project. Interior and exterior corners shall have chamfer strips. The Contractor may be required to submit details of forming to the Commission before work proceeds.

11. Form Release Compounds

Form release compounds shall effectively prevent the bonding of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete nor adversely affect the quality or rate of hardening at the interface of the forms. The compounds shall be tested in accordance with MSMT 503.

12. Portland Cement Concrete Curing Materials

Curing materials shall be burlap cloth, sheet materials, or liquid membrane-forming compounds.

a. Burlap

Burlap cloth shall be made from jute or kenaf and shall be in accordance with AASHTO M 182, Class 1, 2, or 3.

b. Burlap Polyethylene Sheeting

Sheet material shall be in accordance with AASHTO M 171 except that tensile strength and elongation requirements are waived. White burlap polyethylene sheeting shall give a finished product weight of not less than 10 ounces per square yard.

c. Liquid Membrane

Liquid membrane-forming compounds shall be in accordance with AASHTO M 148.

Field control testing of the white pigmented curing compounds will be on the basis of weight per gallon. The samples shall not deviate more than +/- 0.3 pounds per gallon from the original source sample.

13. Vapor Barrier

a. Building paper shall be Sisal-Kraft building paper, conforming to requirements of FSS UUB 790A.

b. Polyethylene sheeting shall be 0.006 inch thick, conforming to requirements of ASTM D 2103.

### 3.0 EXECUTION

A. General

1. Concrete shall be mixed as specified in this Section and shall be delivered to the site in accordance with ASTM C 94.
2. The Contractor shall use concrete equipment of sufficient capacity to complete any unit, as indicated on Contract Documents, in one continuous operation consistent with placement operations as approved by the Commission.

3. Hand mixing may be permitted with written approval of the Commission for small volumes of concrete. However, its intended use is for small isolated areas where structural integrity is not critical.
4. Before placing any concrete, the Contractor shall install all sleeves, anchors, fittings, pipes, conduits, or other special devices called for in the Contract Documents. No concrete shall be placed until this work has been approved by the Commission. The Contractor shall ascertain that all material to be installed in the concrete by other trades has been placed prior to pouring any concrete. Any concrete poured without prior provisions having been made for inclusion of the indicated inserts and materials will be subject to rejection by the Commission and/or correction at the Contractor's expense.
5. Coat aluminum accessories and embedded items with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

B. Concrete Mixes

The concrete shall be proportioned by weight. Water and admixtures may be proportioned by volume or weight. The mix shall be homogeneous, placeable, and uniformly workable.

Coarse aggregate shall be maintained at a uniform moisture content at least equaling its absorbed moisture. Water, if used for wetting, shall meet the requirements of this Section.

Portland cement concrete mixtures shall conform to the Maryland SHA Standard Specifications for Construction and Materials (*Latest Version*).

C. Mixers and Agitators

1. All mixers shall display a current Maryland State Highway Administration approval stamp.

Mixers and agitators and mixing and delivery of ready-mixed concrete shall meet the requirements of AASHTO M 157 with the following exceptions:

- a. Transit mixed concrete will not be permitted. The following requirements shall apply when additional water is added on the job site:
  - i. No water shall be added after partial discharge of the batch.
  - ii. The water-cement ratio shall not be exceeded.
  - iii. Acceptance will be based upon a retest of the slump and air content.
- b. All concrete shall be discharged within 1 hour after the mixing water is added or 1 ½ hours after the addition of the cement to the aggregates, whichever is the lesser time.
- c. No mixer or agitator containing free water in the drum shall be loaded.

D. Hand Mixing Portland Cement Concrete

1. No hand mixing of concrete shall be allowed without first obtaining permission from the Commission.
2. The amount of concrete shall be small enough in quantity that, in the judgment of the Commission, the delivery of the same is impractical.
3. Scheduling of mixing and placing shall be coordinated with the Commission's resident inspector so that all work by the contractor is under the supervision of the resident inspector.
4. Under no circumstances shall hand mixing of concrete be allowed for any permanent buttresses that will not be subject to the 150 pound plus pressure test.

E. Forms

1. Design Criteria

Design of the forms shall be the Contractor's responsibility. Forms shall be designed for strength and deflection to resist all loads and pressure of wet concrete. The design shall provide for rate of pour, effect of vibration, and use of retarders, etc. In addition, horizontal surfaces shall have applied to them a live load of 50 pounds per square foot for purposes of designing forms for strength. This load is to be used in the design of the forms for strength only and is not to be used in computing deflections. In the design of forms for horizontal slabs, the live load applied for design purposes shall be a minimum of 120 pounds per square foot. (This does not apply to form joists, form wales, etc.) No form member or support thereof shall have a deflection in excess of  $L/240$  of its span length, and in no case shall said deflection exceed  $1/4$  inch.

2. Concrete forms shall be built true to line and grade, mortar-tight, and sufficiently rigid to prevent displacement or sagging between supports. All form work shall be provided with adequate clean out openings to permit inspection and easy cleaning after all reinforcement has been placed.

3. Forms at Construction Joints and Corners

At construction joints in concrete, ties or bolts shall be provided 3 to 6 inches from each side of the joint for tightening the forms against the hardened concrete (first pour) immediately prior to placing fresh concrete. At joints where forms have been removed and reconstructed, the form surface shall extend over the concrete already in place; and the forms shall be drawn tightly against the previously placed concrete immediately prior to placing the fresh concrete. Where forms have been extended, the forms shall be retightened against the concrete already in place immediately before placing fresh concrete.

Forms shall be filleted at all exposed sharp corners, except when otherwise indicated on the Plans and shall be given a bevel or draft in the case of all projections, such as girders, copings, etc., sufficient to ensure easy removal.

4. Bracing and Maintenance

Special attention shall be paid to bracing; and where the forms appear to be insufficiently braced or unsatisfactorily built, either before or during the placing of concrete, the Commission will order work stopped until the defects have been

corrected. All forms shall be so maintained as to eliminate the formation of joints due to the shrinkage of lumber. All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. For narrow walls where access to the bottom of the forms is not readily attainable, provide temporary openings and at such other locations as may be necessary to clean out all chips, dirt, sawdust, or other extraneous material immediately prior to placing concrete. Existing forms may be extended after the concrete in said forms has been in place for at least 12 hours, provided such form extension can be done without any damage to the previously placed concrete.

Unit stresses for forms, form supports, false work, and bracing shall not exceed the AASHTO Specification.

#### 5. Form Removal

All forms for concrete work shall be removed and disposed of by the Contractor after form work requirements have been complied with, except those which are designated to remain in place.

Forms shall remain in place a sufficient time to allow the concrete to set properly and the Contractor shall assume all responsibility for removing same. In no case shall forms be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. The Chief Engineer may, when he deems it advisable, order the forms to remain for a longer time, but his acquiescence in permitting the removal of forms shall not relieve the Contractor of responsibility for same.

Forms for pipe end walls may be removed after the concrete has been in place for a period of 24 hours unless it is necessary to protect the concrete against cold weather, in which case the forms shall remain in place for the entire protection period.

Forms for vertical surfaces shall remain in place for a period of 48 hours. If forms are removed before the concrete is 7 days old, the vertical surfaces shall be immediately covered with curing material and the concrete kept wet and so covered until the concrete is 7 days old. Horizontal formwork and false work carrying loads shall remain in place for a minimum of 7 days and until the concrete has attained a compressive strength of 3000 psi.

Internal bulkheads used for forming construction joints, contraction joints, expansion joints, etc. may be removed after the concrete has been in place for 24 hours, if it is necessary to do so for the continuance of the work without interruption.

Special care shall be taken not to break concrete edges in taking down forms. Any portion of concrete damaged while stripping forms may be ordered torn down and recast at the discretion of the Commission. Upon removal of forms, the Commission shall be notified by the Contractor. The Commission after inspecting the newly stripped surfaces, will designate what honey-combed parts, if any, shall be pointed up and how the slightly damaged portions of concrete, if any, shall be repaired or replaced. No freshly stripped surfaces shall be pointed up or touched in any manner before having been inspected by the Commission.

In all cases, the Contractor shall assume all responsibility arising from the removal of forms and shall assure himself that the concrete is properly cured to sustain loads before forms are removed.

## F. Concreting

1. Before placing concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from interior of forms. No struts, stays, and braces serving temporarily to hold the forms in correct shape and alignment pending the placing of concrete at their locations, will be permitted.

All concrete shall be placed in the dry, unless Plans and/or "Special Provisions" require the placement of tremie concrete.

All concrete shall be placed in a continuous operation. Concrete, after being placed in the forms, shall be thoroughly compacted and shall be spaded, tamped, or vibrated to the satisfaction of the Commission.

Chuting of concrete will be allowed only as approved by the Commission. No concrete shall have a free fall of over three (3) feet and if this height is exceeded, it shall be conveyed in place by approved spouts and chutes. Open troughs and chutes shall be metal or metal lined. Where steep slopes are required, the chute shall be equipped with baffles or be in short lengths that reverse the direction of movement. All chutes, troughs and pipes shall be kept clean and free from coatings or hardened concrete by thoroughly flushing with water after each run.

2. Retempering concrete by the addition of water shall not be permitted. The addition of water to the batch in the mixer, after ten (10) minutes have elapsed after the initial charging or the addition of water at any time after the concrete has been removed from the mixer, shall be construed as rettempering. Batches of concrete prepared contrary to these specifications shall be rejected and immediately removed from the project.

The concrete shall be mixed only in the quantity required for immediate use and concrete not in place within one hour from the time the ingredients were charged into the mixing drums, or that has developed initial set, shall not be used.

3. Cold Weather Specifications

Under no circumstances will concrete be permitted to be placed on frozen soil. Construction of plain and reinforced cement concrete pavements, curbs, gutters, combination curb and gutters, and sidewalks, except by specific written authorization and under very definite Special Provisions, shall not be continued when a descending air temperature in the shade and away from artificial heat falls below 45°F, or resumed until an ascending air temperature in the shade and away from artificial heat reaches 40°F.

If temperature is below 45°F then one or more of the following methods shall be used to obtain the required temperature all as approved by the Commission.

- a. When the method of heated mixing water is used, the water shall not be above 170°F when introduced into the mix.
- b. When the method of heated aggregates is used, aggregates containing frozen lumps, ice, or snow shall be allowed to enter the mixer. Aggregates may be heated by steam coils or other dry heat but not by discharging live steam or hot water into them. Heating by means of a flame thrower or any direct flame will not be permitted.



Adequate protection of concrete against damage by frost during the making and early curing period is absolutely essential whenever temperatures below 40°F are likely to occur within that period.

4. Construction Joints

Construction joints shall be kept to a minimum and will be permitted only where shown on the approved Plans and/or shop drawings.

In order to bond successive courses, suitable keys shall be formed at the top of the lift where construction joints are permitted and at other levels where work is interrupted. These keys shall be as indicated on the Plans. At horizontal construction joints, the pour shall be allowed to set for about 12 hours before placing concrete above same.

After concrete has been placed and before it has hardened, all laitance and foreign material shall be removed from the surface. Before placing fresh concrete adjacent to hardened concrete, the surface of the hardened concrete shall be cleaned thoroughly of any remaining laitance or foreign material, scrubbed with wire brooms and clean water, and thoroughly drenched with water until saturated. It shall be kept saturated until the new concrete is placed.

Unless otherwise specified, the top surface of the concrete shall be leveled whenever a pour of concrete is stopped; and to ensure a level, straight joint on exposed face, a strip of sheathing shall be attached to the form at the exposed face where the joint occurs. The concrete shall be carried not more than ½ inch above the underside of this strip. About 1 hour after concrete is placed, the strip shall be removed; and any irregularities in the joint line shall be leveled off with a wood float (use steel trowel at exposed face of joint). All laitance shall be removed. To avoid visible joints at chamfers, the top surface of the concrete shall be steel troweled adjacent to the chamfer using the top surface of the chamfer strip as a guide.

5. Consolidation

All concrete shall be internally vibrated unless herein noted otherwise. Vibration shall be in accordance with the following requirements:

- a. All concrete shall be deposited in the forms in its final position and shall be placed in layers of uniform thickness. All concrete shall be consolidated by vibratory methods, unless otherwise specified.

Vibration shall be internal and applied directly to the concrete, except when the use of other methods is authorized by the Commission or provided herein. The Commission will be the final judge as to which sections are unsuited for internal vibration.

The Contractor shall provide a sufficient number of vibrators to properly consolidate each batch immediately after it is placed in the forms and before the next batch is delivered, without delaying such delivery. The vibration shall be of sufficient intensity and duration to thoroughly consolidate the concrete, but it shall not be continued to such an extent as to cause segregation. Vibration shall not be continued at any one point to the extent that any localized areas of grout are formed.

Vibration shall be applied at points uniformly spaced not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be used to transport concrete in the forms or to make it flow in the forms over distances so great as to cause segregation. Vibration shall not be applied directly or through the reinforcement or forms to sections or layer of concrete which have hardened to such a degree that the concrete ceases to be plastic under vibration.

Vibration shall be supplemented by such spading, along form surfaces, in corners, and at locations impossible to reach with the vibrators, as is necessary to ensure smooth surfaces and dense concrete.

The provisions of this section shall apply to precast concrete cribbing and other precast members or units, except that if approved by the Commission the manufacturer's methods of vibrating may be used.

- b. Internal vibrators shall be of a type and design approved by the Commission. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4500 impulses per minute. The intensity of application shall be such as to visibly affect a mass of concrete of 1 inch slumps over a radius of at least 18 inches.

Internal vibration shall be applied directly to the concrete at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be inserted in and withdrawn from the concrete slowly. Internal vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

## 6. Concrete Surface

### a. General

Concrete surfaces shall be finished in accordance with one of the following designations. Unless otherwise specified, all concrete work shall have a "Grout Finish" for vertical surfaces and "Troweled Finish" for horizontal surfaces. Strict compliance with the Specifications and the intent pertaining to finished surfaces will be enforced. Any concrete structure or concrete work which exhibits surfaces with defective finish will not be accepted until finishing has been completed in accordance with the Specifications. All concrete surfaces shall be finished within 24 hours after the forms are removed. If the concrete surfaces are not finished as specified within the time limit mentioned, all other work shall be suspended until the concrete surfaces required to be finished are completed.

#### Application

#### Finished Designation

#### Structures

For all concrete surfaces  
not exposed to public view  
and not to be waterproofed

Rough Form Finish

For all concrete wall surfaces

exposed to public view	Grout Finish
Tops of footings	Float Finish
Horizontal construction joints	Left Rough
<u>Slabs &amp; Miscellaneous Paving</u>	Floated Finish

Incidental Works

Sidewalks, curb, combination curb and gutter, concrete paving, safety curb, median paving	Broom or Belt Finish
---	----------------------

## b. Rough Form Finish

Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned and, after having been kept saturated with water for a period of not less than 3 hours, shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in proportions used in the grade of the concrete being finished. Any excess mortar at the surface of the concrete due to filling form tie holes shall be struck off flush with a cloth. The mortar patches shall be cured as specified under Curing. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its length with clean and true edges.

The resulting surfaces shall be true and uniform. All surfaces shall be repaired to the satisfaction of the Commission.

## c. Grout Finish

All fins, projections, etc. shall be removed to the satisfaction of, and by means approved by, the Commission (stone, chipping hammer, sandblasting, etc.). No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accepted. Cleaning as the work progresses will not be permitted.

The surface of the concrete shall then be saturated with water and kept wet for at least 2 hours. Proceeding by sections, a grout mix of 1 part Portland cement and 1-½ parts fine sand with sufficient water to produce a grout having the consistency of thick paint shall be thoroughly rubbed onto the surface using burlap pads or cork floats completely filling all voids, pits, and irregularities. While the grout is still plastic, remove all unnecessary grout by working the surface with a rubber float or burlap. After this grout has dried sufficiently so that it will not smear, the surface shall be wiped off with dry, clean burlap so as to leave a clean uniform surface.

This surface shall then be cured as required, except that only colorless liquid curing compound will be permitted for this method.

## d. Floated Finish

After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10 foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a smooth surface. The slab shall then be refloated immediately to a uniform sandy texture.

## e. Broom or Belt Finish

Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

## 7. Curing

Except for buttresses, provisions shall be made for curing all concrete. Curing shall start as soon as concrete has set sufficiently so that curing applications will not damage the surfaces. Curing will also be required while protecting concrete against cold weather.

The following are methods to be used for curing:

- a. Two layers of burlaps shall be used. Successive strips of each layer shall be overlapped a minimum of 6 inches. The second layer shall be placed not less than 45 degrees to the first layer; or the 6 inches overlap of the second layer may be placed midway (one-half width) of this first layer. The layers of burlap shall be kept thoroughly saturated with curing water for the full time specified for curing.
- b. The material for liquid membrane-forming compounds shall have a fugitive dye or be white pigmented. The materials shall be thoroughly agitated before use and applied by sprayers.
- c. When curing concrete structural slabs, etc., burlap-polyethylene mats or white polyethylene sheets may be used atop the wet burlap on unobstructed flat and reasonably level surfaces.

The burlap-polyethylene mats or white polyethylene sheets shall be placed only on unobstructed flat and reasonably level surfaces. They will not be permitted on vertical surfaces, such as walls, columns, abutments, etc.

Adjacent mats or sheets shall be lapped no less than 1 foot. The ends shall be brought down around the sides of the concrete being cured and securely fastened to the satisfaction of the Commission to make an airtight seal that will be unaffected by wind.

The burlap-polyethylene mats shall be placed on no less than one layer of wet burlap with the burlap side of the mat facing down. White

polyethylene sheets, if used, shall be placed on no less than two layers of wet burlap.

The burlap-polyethylene mats or white polyethylene sheets shall remain in place for the same length of time as required for burlap mats. These protective coverings need not be wetted down; however, the covered burlap or cotton mats shall be kept wet for the time interval required by the Specifications.

- d. The burlap shall be thoroughly saturated just prior to placement. The requirement for keeping the concrete surfaces saturated at all times during the curing period, regardless of the covering, will be strictly enforced. This saturation of the surfaces shall be employed even in areas where there is no ready water supply. The Contractor shall furnish, at his expense, sufficient water to satisfy this requirement.

All vertical surfaces may be cured by leaving forms in place for 7 days. If forms are removed after 48 hours, then the remainder of the 7 days of cure shall be by method "b".

Immediately after the finishing operation for sidewalks and slabs, the areas of future construction joints shall be covered with two layers of wet burlap which shall extend 6 inches outside the joint area. The finished concrete surface shall then be sprayed with a liquid compound as specified in curing method "b". The material shall be applied uniformly at the rate of 150 to 200 square feet per gallon, one half applied in a longitudinal direction and the second half in a transverse direction.

After 1 day or as soon as the concrete may be walked upon without damage, the concrete shall be cured using method "a" or "c" for the remainder of the 7 day curing period.

All other horizontal surfaces shall be cured using either method "a" or "c" for a period of 7 days.

#### 8. Prevention and Removal of Stains on Concrete

The Contractor shall prevent rust of unpainted structural steel, staining by bituminous materials, or any other substance from discoloring any portion of the concrete. The Contractor, therefore, shall devise and use construction procedures or methods that prevent staining of any of the concrete. If, however, any portion of the concrete is stained, the Contractor shall remove such stains and restore the concrete to its original color without damage to the concrete all at his expense and as approved by the Commission. No chemical solvents will be allowed unless previously approved by the Commission.

### 4.0 METHOD OF MEASUREMENT

Except when used as a buttress, measurement for cast-in-place concrete of the mix number specified will be made on a unit area or volume, or a lump sum per structure basis. In establishing the breakdown between footing concrete and substructure concrete, the division line shall be the top of footing regardless of where the construction joint occurs.

#### A. Unit Price

Measurement for cast-in-place concrete, when a unit price is provided for in the Proposal, will be made on an area or volume basis for the actual amount of concrete satisfactorily placed and accepted.

B. Lump Sum

Measurement for cast-in-place concrete, when a lump sum price or prices per structure are provided for on the Proposal Form, will be made on the basis of a lump sum for all concrete included in the Project or on the basis of the number of structures satisfactorily placed and accepted.

C. Concrete for buttresses or any joint restraint will not be measured.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices shall include all materials, forms, reinforcing steel, curing materials, sealing, caulking, and dampproof or waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the Commission.

B. Unit Price

Payment for cast-in-place concrete will be made at the price bid per cubic yard for the various mix numbers specified.

C. Lump Sum

1. Payment for cast-in-place concrete will be made at the lump sum price bid for all concrete on the Project, or for all concrete in each structure or structural unit as indicated in the Contract Documents.
2. To provide for unforeseen changes in planned dimensions affecting concrete on a lump sum basis, the Contract Documents may include an item(s) for contingent concrete. This item(s) shall be used only upon written direction of the Commission and applied only to referenced structure(s). If necessary changes in the planned dimensions result in an enlargement, then the pertinent lump sum price shall be increased by an amount obtained from the product of the increase in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. Should, however, the necessary changes result in a smaller structure than planned, then the pertinent lump sum price shall be reduced by an amount obtained from the product of the reduction in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. The unit price bid on the pertinent contingent concrete item shall include cost of all concrete, reinforcing steel, expansion material, dampproofing, membrane waterproofing, form work, incidental materials, etc. and work required to complete the structure(s) as revised.

D. Concrete will not be paid for when used for joint restraint unless approved.

**\*\*END OF SECTION 03300\*\***