

500 STRUCTURES

ITEM 511 - CONCRETE FOR STRUCTURES

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511.01 Description. This item shall consist of furnishing and placing portland cement concrete or shrinkage-compensating cement in accordance with these specifications and in reasonably close conformity with the lines, grades and dimensions shown on the plans. Falsework and forms shall be in accordance with Item 508.

For prestressed concrete see Item 515.

511.02 Materials. Materials shall conform to Section 499.02 except as follows:

Aggregate; all concrete above the ground line in a given substructure unit or all concrete for any given superstructure shall be made of aggregates of the same kind and colors, except upon written permission of the Engineer.

Portland Cement; only one brand, grade or kind shall be used in a given substructure unit above the ground line or given superstructure except by written permission of the City.

Curing materials; 705.05, 705.06 (white opaque), 705.07 Type 1 or 1D.

Joint filler; 1/4 inch (6.4 mm) gray sponge 711.28, or preformed filler 705.03

Seals; preformed elastomeric compression joints seals, 705.11

511.03 Proportions. Concrete for structures shall be proportioned according to Section 499.03, using Class C or Class S as specified.

511.04 Concrete Test Specimens. On structures over 20-foot span (6.1 m), two test cylinders will be made from each 200 cubic yards (153 m³), or fraction thereof, of each class of concrete that is incorporated each day in the work. On structures of 20-foot (6.1 m) span or less, not less than two cylinders will be made for each 50 cubic yards (38 m³) of each class of concrete. Test cylinders shall be made and tested according to ASTM C 31 and C 39.

When necessary to permit early removal of falsework or to permit backfilling, concrete test beams shall be made and tested according to standard ASTM methods.

511.05 High-Early-Strength Concrete. The use of high-early-strength concrete shall be in accordance with Section 499.03. Curing and loading shall be done in accordance with Section 511.14.

511.06 Mixing of Concrete. Mixing shall be according to Section 499.06. When mixed, all concrete shall have a temperature of not more than 90° F (32° C), and the concrete shall be maintained under this temperature until deposited in the work.

When an air temperature at 60° F (16° C) or higher prevails at the time of placing concrete in a bridge superstructure (over 20 foot (6.1 m) span), the contractor shall add an approved chemical admixture (705.12 Type B or D) to the concrete.

511.07 Slump. Concrete shall have a slump such that it will be workable in the required position. It shall be of such a consistency that it will flow around reinforcing steel but individual particles of coarse aggregate when isolated shall show a coating of mortar containing its proportionate amount of sand.

The slump of concrete placed by the vibration method shall be in accordance with Section 499.03, the slump being determined according to ASTM C 143.

511.08 Placing Concrete. The Contractor shall submit according to Section 501.06 a description of the procedures he proposes to use and notify the Engineer at least two working days in advance of placing concrete. A shorter notice may be permitted if approved by the Engineer.

Superstructure concrete shall be placed only when the surface evaporation rate determined by using Figure 1 in ACI 308 is equal to or less than 0.2 pound per square foot (1.0 kg/m²) per hour. The Contractor shall determine and document the ambient

temperature, concrete temperature, deck surface temperature, relative humidity, and wind velocity, subject to verification by the Engineer. No superstructure concrete shall be placed if the ambient air temperature is 85° F (29° C) or higher or predicted to go above 85° F (29° C) during the placement regardless of the surface evaporation rate.

When a concrete deck is to be placed on continuous steel beams or girders, the placing of the concrete deck in any span shall not be started until all of the main beam or girder splices have been completed at least two piers beyond the pier or piers supporting the span in question.

Concrete for backwalls, where expansion has been provided for by a steel expansion joint, shall not be placed until the abutments have been backfilled to within one foot (0.3 m) of the bridge seat elevation and all structural steel has been erected, unless a different procedure is approved by the Engineer. The steel expansion joint shall serve as a template for the top of the backwall. If temporary bolts are used to support the backwall portion of an expansion device during the placing of the backwall concrete, these bolts must be removed as soon as possible after the concrete has taken its initial set and before a change in temperature causes superstructure movement sufficient to damage the backwall.

In order that the concrete will be finished during daylight hours, the time of starting the concreting operations shall be subject to the approval of the Engineer.

The Contractor shall furnish assurance to the Engineer of an adequate and uniform source of supply of concrete to permit proper placing and finishing, standby vibrators, and of the availability of coverings for protection in case of rain, before work will be permitted to start.

In order to facilitate water curing of the concrete deck slab, the placing of concrete shall progress upgrade. The slab may be placed in Sections, between transverse construction joints that are parallel to transverse reinforcing steel and are located near the center of any span. However, deck slabs may be placed with a finishing machine in a continuous operation from either end of a bridge to the other regardless of grade. When the placing of concrete progress downgrade, water curing shall be accomplished by use of wet burlap or mats as described in Section 511.14 Method (a).

Before placing the concrete, all forms and structural steel which will be in contact with the concrete shall be thoroughly cleaned and the space to be occupied by the concrete shall be free from all laitance, silt, dirt, shavings, sawdust, loose and built-up rust, and other debris. The methods of depositing shall be such as to insure that all reinforcing steel is completely enveloped in concrete mortar and such that this condition can be verified by inspection. The method or device used for conveying the concrete from the mixer to its place in the work shall be such as to insure against separation of the coarse aggregate from the mortar. When concrete is being deposited in shallow members, such as slabs, it shall be placed with as short a vertical drop as practicable. The concrete shall be

deposited at various places so as to maintain a surface practically horizontal over the section being placed.

When a chute is used its slope shall be such as to allow concrete of the proper consistency to flow readily without segregation. Concrete shall be deposited as near as possible to its final position. Water used for flushing the chute shall be discharged outside the forms.

Concrete shall not be dropped into the forms a distance of more than 5 feet (1.5 m). Drop chutes shall be used to limit free fall to 5 feet (1.5 m) and the delivery ends shall be as nearly vertical as practicable.

The Contractor shall designate one or more worker, preferably form carpenters, to continually inspect the forms during the placing of concrete, and any bulges or settlements shall be corrected, the concrete being removed if necessary, at the Contractor's expense.

The use of mortar topping for concrete railing caps and other similar surfaces shall not be permitted.

The use of the vibration method of placing all concrete in structures is required. The Contractor shall furnish and have in use sufficient vibration equipment of an approved type and size to properly compact each batch immediately after it is placed in the forms.

The vibrators shall generally be of a type that is applied directly to the concrete and that has a frequency of at least 4500 impulses per minute, but where inaccessibility precludes this method of vibration, the vibrators shall be applied to the forms.

The concrete shall be deposited as near its final position as possible and shall not be caused to flow long distances. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be pushed into and pulled out of the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but not continued so as to cause segregation. Care must be used not to disturb partially hardened concrete.

Such spading as is necessary to insure smooth surfaces and dense concrete shall be done along form surfaces and in corners and locations impossible to reach with the vibrators. The Engineer shall with the collaboration of the Contractor closely observe the results obtained on the first concrete placed and such alterations shall be made in the mix, as permitted by these specifications, as are necessary to secure the best results.

Decks and slabs shall be given a fog spray of water if the concrete surface is observed to be losing its sheen or if any plastic shrinkage cracks develop. Fogging shall continue until the curing materials are applied.

Fog misting shall not be used to apply water to the surface of the concrete to facilitate lubrication for finishing purposes. Fogging equipment shall have water pressure systems rated at 2400 p.s.i. (16.5 MPa) or greater and discharge approximately 2 to 3 gallons (9 to 14 L) per minute. Wide angle and sharp angle nozzles shall be used for low wind and windy conditions, respectively.

At the Contractor's option an evaporation retardant and finishing aid may be used after deck finishing and prior to the texturing operation. Any product used for such purposes shall be specifically marketed for such use (plain water is not acceptable). The product may also be sprayed over textured areas. The evaporation retardant and finishing aid shall be applied as per manufacturer's recommendations. The cure shall follow this operation as closely as possible.

511.081 Cooling of Concrete Containing Type K Cement. When the ambient temperature is expected to be too high for the placement of concrete containing Type K cement and it is not reasonable to delay the pour, the concrete shall be cooled at the plant by use of cold water, ice, or other methods approved by the project engineer. The proposed method of cooling the concrete mix shall be submitted to the project engineer a minimum of two working days prior to the pour. This provision shall in no way relieve the contractor from his obligation to pour concrete at night with no additional compensation if weather conditions allow for the pour to take place at night.

Payment for this item will only be made with prior authorization from the engineer. All equipment, material, and labor associated with this work shall be included in the unit price for Item 511, Cooling of Concrete Containing Type K Cement.

511.09 Construction Joints. When construction joints are shown on the plans, all concrete between consecutive joints shall be placed in a continuous operation. Concrete shall not be placed against the second side of any joint for at least 12 hours, or as required by 511.14, unless otherwise approved by the Engineer.

Approval of the Engineer must be obtained for the placing of any construction joint not shown on the plans or permitted by 511.08 and 511.16.

The planes on which a day's work is to terminate shall be predetermined before depositing of concrete begins. They shall in general be perpendicular to the lines of principal stress and in regions of small shear. Horizontal joints will not be permitted in concrete girders and beams. Slabs acting with concrete beams or girders shall be deposited continuously with them unless composite construction is specified.

All construction joints shall be made with bulkheads provided with keys which clear all exposed surfaces approximately one-third the thickness of the joints.

Horizontal joints in piers, abutments and retaining walls generally shall be avoided and when used shall not be located within 2 feet (0.6 m) of the normal water level.

In piers or gravity abutments requiring a construction joint, it generally shall be a keyed vertical joint extending the full height above the footer. In piers, abutments or retaining walls, the second portion placed at a vertical joint shall be placed not earlier than 24 hours after the first portion placed.

Construction joints, not shown on the plans and above ordinary low water, in abutments and retaining walls that retain earth fills shall be waterproofed on the back with a 36 inch (0.9m) strip of Type B waterproofing according to Item 512. For such construction joint below ordinary low water a mechanical water-stop shall be required. These construction joints shall be at the Contractor's expense.

Joints in cantilevered members shall be avoided.

Horizontal construction joints shall have the surface of the concrete below the joint dampened immediately prior to placing adjoining concrete.

Horizontal construction joints between bridge slabs and superimposed curbs, parapets, sidewalks and median strips, shall be placed and protected the same as the remainder of the slab. They shall be cured in accordance with Section 511.14. If method (b) is used, the membrane shall be removed prior to placing the concrete on the second side of the joint.

Care shall be exercised to avoid disturbing the bond of curb reinforcing steel protruding from the concrete. If the curb areas are used by workers when placing the deck concrete, the reinforcing steel shall be tied and/or braced to prevent its movement.

Where walls or columns support slabs or beams, the concrete in the vertical member shall be deposited up to the bottom of the supported member and a period of at least 2 hours shall elapse for settlement before placing concrete in the horizontal member.

511.10 Emergency. When the work is unexpectedly interrupted by break-downs, storms or other causes and the concrete as placed would produce an improper construction joint, the Contractor shall rearrange the freshly deposited concrete, to provide a suitable construction joint. When such a joint occurs at a section on which there is shearing stress, an adequate mechanical bond shall be provided across the joint by forming a key, inserting reinforcing steel or by some other means satisfactory to the Engineer, which will prevent a plane of weakness.

511.11 Depositing Concrete Under Water. No concrete except for cofferdam seals shall be deposited under water, unless by special permission of the City. If such permission is granted, care shall be exercised to prevent the formation of laitance. Concrete shall not be deposited until any laitance, which may have formed on concrete previously placed, has been removed. Pumping shall be discontinued while depositing foundation concrete if it results in a flow of water inside of forms. If concrete except for cofferdam seals is deposited under water, the proportion of cement used shall be increased at least 25 percent at no extra expense to the City to compensate for losses due to water.

Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket or other approved method and shall not be disturbed after being deposited.

511.12 Depositing and Curing Concrete During Cold Weather. When an atmospheric temperature of 32° F (0° C) or less exists at the time concrete is placed, or is predicted by weather forecasts to occur during the curing period, the following procedures shall apply.

The water or aggregate or both shall be heated as necessary to make the temperature of the concrete not less than 50° F (10° C) nor more than 70° F (21° C) when placed.

Concrete shall not be placed in contact with materials having a temperature of less than 32° F (0° C). If necessary, the forms, reinforcing steel and foundation materials shall be heated before the concrete is placed.

The concrete shall be protected from freezing and specified temperatures for curing shall be maintained by a heated enclosure, insulated forms or by either of these used in combination with flooding, except that insulation alone may not be used to protect and cure deck slabs less than 10 inches (254 mm) thick.

The heated enclosure shall surround the top, sides and bottom of the concrete to be placed during cold weather except that concrete surfaces which have been flooded need not be enclosed.

The concrete shall be cured by maintaining the surface temperature between 50° F (10° C) and 100° F (38° C) for a period of not less than five days except as modified below for concrete flooded with water. At the end of this curing period, the temperature shall be reduced at a rate not to exceed 20° F (7° C) in 24 hours until it is within 20° F (7° C) at atmospheric temperature.

Sufficient high-low thermometers shall be furnished and installed by the Contractor in such a manner that the surface temperature of the concrete may be readily determined. For deck slabs, the surface temperature shall include deck bottoms, deck fascia and deck top surfaces.

Removal of falsework and opening to traffic shall be not earlier than specified by Section 511.14.

- (a) When a heated enclosure is used. The enclosure and heating devices shall be as nearly complete before any concrete is placed as the placing will permit. Throughout the entire concreting operation the completion of enclosures and the application of heat shall follow the placing of concrete as closely as possible.

Heat may be supplied by any method which will maintain the required temperature continuously with a reasonable degree of uniformity in all parts of the enclosure without discoloring the concrete.

Combustion-type heating units shall be vented from the enclosure.

If dry heat, other than free steam, is used with method (a) curing, all exposed concrete shall be covered with two thicknesses of burlap as soon after placing the concrete as it can be done without marring the surface. The burlap shall be wetted and kept continuously wet and shall not be removed during the heating period, except as required for rubbing. Wood forms without liners, left in place more than two days after the placing of concrete, shall be thoroughly wet at least once each day for the remainder of the heating period. If forms are removed during the heating period, the concrete shall be thoroughly drenched with water and covered with burlap as noted above for the remainder of the heating period.

Enclosures shall be strong and wind proof, and provide adequate space to allow free circulation of air around the forms and deposited concrete.

- (b) When insulation is used. Sufficient thermometers shall be furnished and installed by the Contractor in such a manner that the surface temperature of the concrete may be readily determined. Whenever the surface temperature, as indicated by the thermometer readings, approaches 100° F (38° C), the forms or insulation shall be loosened or otherwise vented to keep the surface temperature within the specified limits. If the thermometer readings indicate that the minimum required temperature is not being maintained, the structure shall be promptly enclosed and heated as provided above or flooded as specified below.

The insulating material shall be wind and water resistant. Precautions shall be taken at edges and corners to insure that such points of extreme exposure are adequately protected. The top surface of the concrete shall be protected by a tarpaulin, or other approved waterproof cover, placed over the insulation.

- 3. When the concrete is to be flooded with water. The concrete may be flooded as soon as it can be done without damaging it. Flooding water shall be heated to a temperature of not less than 50° F. (10° C) nor more than 100° F (38° C). The heated flood water may be discontinued after 48 hours if the concrete remains flooded to a depth of 1 foot (0.3 m) above its highest elevation for at least the subsequent 120-hour period.

511.13 Removal of Forms. In order to facilitate finishing, forms on vertical surfaces which are to receive a rubbed surface finish shall be removed as soon as the concrete has hardened sufficiently that it will not be damaged.

511.14 Curing and Loading. Concrete for structures shall be cured, have the falsework removed, and be opened to traffic in not less time than is specified by the following table:

Age of Concrete in Days

	<i>Span</i> ⁽¹⁾	<i>No Beam Test</i>	<i>Beam Test</i> ⁽²⁾
<i>Removing Falsework</i>	<i>Over 10 feet (3m)</i>	<i>14</i>	<i>5</i>
	<i>10 feet (3m) or less and all pier caps</i>	<i>7</i>	<i>3</i>
<i>Traffic</i> ⁽³⁾	<i>Any</i>	<i>14</i>	<i>7</i>

1. *Span is defined as the horizontal distance between faces of the supporting elements when measured parallel to the primary reinforcement.*
2. *Applicable only when the average modulus of rupture for two (2) tests is not less than 650 pounds per square inch (4481 kN/m²).*
3. *When placing Class HP concrete for a superstructure between October 15 and March 15, open the deck to traffic no sooner than 30 days after placement.*

When the temperature of the air surrounding the concrete is above and maintained above 32° F (0° C) and below 50° F (10° C) and the provisions of Section 511.12 are not in force, the duration of the cure shall be based on a beam test, except that the curing time shall not be less than tabulated above.

When a beam test is not performed, the time specified above for removing falsework and opening to traffic shall be extended one day for each day the temperature of the air surrounding the concrete is below 50° F (10° C).

All superstructure concrete and all other concrete which is to be overlaid with concrete or sealed, shall be cured in accordance with Method (a) Water Curing. All other concrete shall be cured either by Method (a) Water Curing or Method (b) Membrane Curing; however, if method (b) is used on construction joints or areas to be waterproofed, the membrane shall be removed.

Compression rings are not to be installed on pier columns or similar items of construction for the purpose of supporting falsework or subsequent construction until after a 72 hour curing period.

No load shall be applied or other work conducted that will damage new concrete or interfere with its curing. Where work is necessary on new concrete to complete a structure, such as building forms on a footing, workers and materials shall be kept off such concrete until such time as it will not be damaged by the work in progress, but in no case shall the elapsed time between placing the concrete and working on same be less than 36 hours. No work that will interfere with the curing shall be done on concrete placed during cold weather unless insulating material to retain the heat in the mix is placed during periods in the day when the presence of workers will not interfere with the normal curing procedure. When this is done, the normal protection shall be resumed immediately after work is suspended. Proper curing shall have preference and, if necessary, workers shall be kept off so that the concrete may be thoroughly wetted and kept wet until the curing is completed.

Method (a) Water Curing. All surfaces not covered by forms shall be protected with two thicknesses of wet burlap, wet jute felt cotton mats or wet cotton mats, as soon after placing the concrete as it can be done without marring the surface and kept wet by the continuous application of water for a period of not less than 7 days. Formed surfaces shall after the removal of forms be cured in like manner for the remainder of the curing period with the entire surface of the concrete being thoroughly drenched with water and covered immediately after forms are removed. Portions of the covering material may be removed temporarily and continuous sprinkling stopped when and as necessitated by any required finishing operation.

In lieu of continuous sprinkling, wet burlap covered with white polyethylene sheeting or plastic coated burlap blankets Section 705.06 may be used. They shall be placed wet with the burlap side against the concrete. Adjoining plastic coated blankets or polyethylene sheets used to cover wet burlap shall be lapped sufficiently and held securely in place at laps and edges so that a positive moisture seal is provided. White polyethylene sheeting or plastic coated blankets containing holes or tears shall be covered with an additional covering of sheeting or blankets as directed.

Method (b) Membrane Curing. Immediately after the free water has disappeared on surfaces not protected by forms and immediately after the removal of forms, if such are removed before the end of the 7-day curing period, the concrete shall be sealed by spraying as a fine mist a uniform application of the curing material Section 705.07, Type 1 or 1D, in such manner as to provide a continuous, uniform, water impermeable film without marring the surface of the concrete.

The membrane curing shall be applied in one or more separate coats at the rate of at least 1 gallon per 200 square feet (1 liter per 4.9 m²) of surface. To insure that the proper amount of the curing material is applied, the number of gallons (liters) of curing material in the spray container shall be noted and the correct square footage (meters) for that gallonage (volume) laid off so that the area of concrete surface to be covered will be such that the approved application rate will be secured. Curing material shall be

thoroughly agitated immediately previous to use. If the film is broken or damaged at any time during the specified curing period, the area or areas affected shall be given a complete duplicate treatment of the curing material applied at the same rate as the first treatment.

Unless adequate precautions are taken to protect the surface of the membrane, workers, materials and equipment shall be kept off the membrane for the duration of the curing period.

511.15 Surface Finish. Immediately after the removal of forms, all cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges and other defects shall be cleaned, dampened and completely filled, pointed or trued with a mortar of the same proportions as used in the concrete being finished. Exposed surfaces which are not satisfactory to the Engineer because of excessive patching and/or other corrective work, shall be grout cleaned or rubbed as required by the Engineer. Other contiguous exposed surfaces on the structure shall be finished in a similar manner to the extent required to produce a uniform appearance.

On all exposed surfaces, all fins and irregular projections shall be removed with a stone or power grinder, care being taken to avoid contrasting surface textures. Sufficient white cement shall be substituted for the regular cement in the filling of holes and other corrective work to produce finished patches of the same color as the surrounding concrete.

Grout Cleaning. Where grout cleaning is called for on the plans or is necessary for corrective work, the surface, after wetting, shall be uniformly covered with a grout consisting of 1 part cement to 1 1/2 parts fine sand, Section 703.03 and sufficient water to produce a consistency of thick paint. White portland cement shall be used for all or part of the cement in the grout, as directed by the Engineer, to give the color required to match the concrete. The grout shall be uniformly applied with brushes or a spray gun, and all air bubbles and holes shall be completely filled. Immediately after the application of the grout, the surface shall be vigorously scoured with a cork or other suitable float. While the grout is still plastic the surface shall be finished with a sponge rubber or other suitable float removing all excess grout. This finishing shall be done at the time when grout will not be pulled from the holes or depressions. After being allowed to thoroughly dry, the surface shall be vigorously rubbed with a dry burlap to completely remove any dried grout. There shall be no visible film of grout remaining on the surface after this rubbing and the entire cleaning operations of any area must be completed on the day it is started. If any dark spots or streaks remain after this operation, they shall be removed with a fine-grained silicon carbide stone, but the rubbing shall not be sufficient to change the texture of the surface. Unless otherwise directed by the Engineer, grout cleaning shall be delayed until the final clean up of the project.

Rubbed Finish. Forms shall be removed, if possible, within two days after concrete is placed. Corrections shall be made as outlined above. Rubbing of concrete

shall be started as soon as the conditions will permit. Immediately before starting this work the concrete shall be kept thoroughly saturated with water for a minimum period of two hours. Sufficient time shall have elapsed before wetting down to allow the mortar used in pointing insert holes and defects to be thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse silicon carbide stone until all form marks, projections and irregularities have been removed, all voids filled and a uniform surface has been attained. The paste produced by rubbing shall be left in place at this time. No additional material other than water shall be applied to the surface. After all concrete above the surface being finished has been placed, the final finish shall be obtained by rubbing with a fine silicon carbide stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform in color. Any surfaces which have been given a rubbed finish, shall be protected from subsequent construction operations. Any surfaces not protected, shall be cleaned and again rubbed if necessary to secure a uniform and satisfactory surface.

No extra payment will be made for any type of surface finish, the cost being considered as included in the price bid for concrete.

511.16 Roadway Finish. Concrete deck slabs shall be finished in accordance with the requirements of Sections 451.09 and 451.12 except that construction joints shall not be edged, and a strip of surface 9 to 12 inches (229 to 305 mm) wide adjacent to curbs and barriers shall not be grooved. The use of a broom or artificial turf drag on concrete deck slabs may be in longitudinal or transverse direction. The requirement for use of a finishing machine may be waived by the Engineer for small bridges where their use is impractical.

The finishing machine shall be self-propelled and shall be approved by the Engineer. It preferably shall be of sufficient size to finish the full width of the decks between curbs, but not less than the projected width of the approach pavement, except for slab bridges. For slab bridges, a longitudinal construction joint may be placed in the slab on the center line of the approach pavement, or as shown on the plans; and each side placed and finished separately. The wheels of the finishing machine shall be supported on temporary riding rails adequately supported on structural steel or falsework. If such rails are placed within the roadway area, they shall be elevated a sufficient distance above the slab to permit the simultaneous finishing by hand of any portions not finished by the machine. Any rail supports which extend through the roadway area of the slab shall be made and installed in such manner as to permit their removal at least 2 inches (51 mm) below the top of the slab. Holes formed by the removal of such supports shall be filled during the final finishing of the slab. The concrete shall be delivered and distributed at a uniform and adequate rate ahead of the finishing machine by suitable mechanical equipment.

Bridge decks that are to be waterproofed with a membrane shall be given a burlap drag finish.

Straight edging shall follow the screeding as early as possible and cover the entire deck. For structures on which steel expansion dams as specified with temporary erection bolts used to support the backwall portion of the dam, the backwall concrete shall be placed after the structural steel has been erected and before the deck slab is placed. This procedure is to avoid interference by the temporary bolts with the machine finishing operation. The Contractor shall submit to the Engineer for approval, at least 15 days prior to placing of any deck slab, a complete description of the method proposed for the handling, placing and finishing of the slab, including equipment for transporting and distributing concrete, the finishing machine and complete details of supports for such equipment. Approval by the Engineer will not relieve the Contractor of the responsibility for the satisfactory performance of his methods and equipment.

When the slab is to serve as a base for a surface course, it shall be given a broom finish or as otherwise approved by the Engineer.

511.17 Sidewalk Finish. The concrete shall be struck off after placing with a template and finished with a float to produce a sandy texture.

511.18 Method of Measurement. The volume shall be the number of cubic yards (cubic meters) as determined by calculations from plan dimensions, in place, completed and accepted.

No deduction will be made for the volume of the reinforcing steel, conduits, or structural steel other than beam flanges embedded in deck slabs. No deduction will be made for the volume of any embedded timber, steel or concrete piles.

Superstructure concrete includes the concrete in deflective parapets not having a metallic railing.

511.19 Basis of Payment. Payment will be made at the contract prices for:

Item	Unit	Description
511	Cubic Yard (Cubic Meter)	Class ____ Concrete,
511	Cubic Yard (Cubic Meter)	Cooling of Concrete Containing Type K Cement.