ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: April 1, 2019 Special Provision No. 18-0399(2)

EFFECTIVE DATE: September 1, 2019

SUBJECT: Bridge Concrete.

Alabama Standard Specifications, 2018 Edition, SECTION 510 shall be replaced with the following:

SECTION 510
BRIDGES

510.01 Description.

The work under this Section shall cover the construction of bridges, or parts thereof, including members designated as mass concrete. When widening or modification of an existing facility is required, the work under this Section shall include the cutting or breaking away of portions of the existing structural material and the preparation of the exposed structural materials for joining of new materials to the lines and grades shown on the plans or as directed.

The requirements for concrete temperature monitoring, maximum allowable concrete temperatures, and the Thermal Control Plan (ThCP) are covered in this section. The requirements of this Section shall apply to any concrete element that is designated as mass concrete in the Contract Documents. A ThCP to control and monitor concrete temperatures is required for all mass concrete elements.

510.02 Materials.

(a) General.

All materials incorporated in the structure shall be new except where otherwise specified on the plans or in the proposal. The requirements set forth in the Sections listed in this Article, together with any other specifications contributing to the complete structure shall be applicable to this Section.

Section 215	Excavation for Bridges
Section 501	Structure Concrete
Section 502	Steel Reinforcement
Section 505	Piling
Section 508	Structural Steel and Miscellaneous Metals
Section 509	Treated and Untreated Timber
Section 513	Prestressed Concrete Bridge Members
Section 521	Bridge Painting

All requirements provided for Structural Portland Cement Concrete, Section 501, shall apply to mass concrete members, except where otherwise indicated by specific requirements given hereinafter in this Section or noted by plan details.

All steel reinforcement used in a cast-in-place concrete bridge deck shall be AASHTO M 31 {M 31M} Grade 60 {Grade 420}, unless otherwise specified on the plans.

(b) Material Requirements for Mass Concrete

Type III portland cement (high early strength cement) shall not be used in mass concrete.

The maximum substitution of portland cement with mineral admixtures shall not exceed 75 percent. The maximum substitution of portland cement with any one mineral admixture substitution is defined in the following table:

MAXIMUM PERCENT MINERAL ADMIXTURE SUBSTITUTION FOR PORTLAND CEMENT (substitution by weight)	
MINERAL ADMIXTURE	MAXIMUM PERCENTAGE SUBSTITUTION
Class C or Class F Fly Ash	40 %
Ground Granulated Blast Furnace Slag	75 %
Microsilica	10 %

510.03 Construction Requirements.

(a) General.

1. Bridges shall be constructed in accordance with lines, grades, dimensions, and other details shown on the plans and in conformity with these specifications.

2. Construction requirements of Sections 215, 501, 502, 503, 505, 507, 508, 509, 512, 513, 517, 520, and 521 shall also apply to this Section.

3. Concrete tolerances except for bridge deck riding surfaces shall be as follows:
   - Width and depth dimensions of girders, barrier rails, and columns shall not vary more than 1/8 inch per foot {10 mm/m} and not more than 1/4 inch {6 mm} total from plan dimensions.
   - For barrier rail, overhang, and curb, horizontal and vertical alignment shall not vary more than 1/8 inch in 10 feet {3 mm/3 m} and not more than 1/4 inch {6 mm} total from that shown on the plans.
   - The finished concrete shall be free from objectionable projections, swells, ridges, depressions, waves, holes, and other defects.

4. The requirements for curing and finishing the concrete are given in Section 501.

5. Attention is directed to the requirements of Article 107.01 concerning safety.

(b) Substructures.

1. Foundations.
   Foundations shall be prepared in accordance with the plans and Section 503.

2. Concrete and Steel Substructures.
   See construction requirements of Sections 501, 502, and 508.

3. Piling.
   See Section 505.

4. Drilled Shafts.
   See Section 506.

(c) Superstructures.

1. General.
   No superstructure load shall be placed upon finished piers or abutments until directed. Moreover, before any superstructure load is placed on concrete portions of a substructure, one of the following shall be accomplished: (1) A minimum time of 14 days, exclusive of days where four hours or more the temperature is below 40 °F {5 °C}, shall be allowed for the hardening of concrete, or (2) the concrete shall indicate a development of minimum compressive strength of 2800 psi {19 MPa} from cylinders prepared in conformity with AASHTO T 23.

2. Bearings and Anchorage.
   See Item 508.03(d)2.

3. Steel Girders.
   See Section 508.

4. Prestressed Concrete Bridge Members.
   See Section 513.

5. Cast-in-Place Concrete Girders,

See Sections 501 and 502. Camber due to dead load and vertical curvature shall be put into the falsework and formwork as required to produce the finished lines and grades shown on the plans.

6. Reinforced Concrete Bridge Decks.

a. Pre-Pour Conferences.

Pre-pour conferences shall be held between the Contractor and Project Manager prior to placing any bridge deck concrete. As a minimum, this conference shall include a discussion of the rate of pour, personnel and equipment to be used, type of finish, and curing details.

b. Placing Concrete.

In addition to the requirements given in Section 501, the following shall also apply. The rate of pour shall be controlled so that all concrete between construction joints can be placed and compacted in a continuous operation before initial set takes place in contiguous portions of the concrete. In case of breakdown of equipment or other reasons necessitating suspension of placing and compacting the concrete for a period in excess of 45 minutes for mixes without retarders or 60 minutes for retarded concrete, and part of the work involved is such that a construction joint will not be permitted, all of the previously placed concrete in that section shall be removed and replaced by the Contractor without extra compensation.

A deck pour shall not be started when it is raining or threatening rain. Should inclement weather develop during the pour, it will be the Contractor's responsibility to protect the plastic concrete so that placing and finishing operations can be satisfactorily completed without damage to the concrete or concrete surface. Should damage occur, the concrete shall be removed and replaced at the Contractor's expense. The placing of skin patches (the scabbing on of the concrete or grout) on a bridge deck will not be permitted.

All concrete deck slabs shall be placed full thickness in one operation. Unless otherwise shown on the plans, on R.C.D.G. spans, concrete in the girders and slab shall be placed in one operation.

Webwalls may be poured and allowed to set up prior to pouring the bridge deck. If a longitudinal screed is to be used for finishing the concrete in the bridge deck, the concrete for the bridge deck shall not be placed until the webwall concrete has reached a minimum compressive strength of 2800 psi {19 MPa} as determined from the testing of cylinders.

On all continuous spans, a pouring sequence will be shown on the plans. All lower numbered or lettered pours shall be made prior to proceeding to the next higher numbered or lettered pour. Adjacent pours shall not be made until after the previously placed concrete has reached an age of 24 hours.

Simple spans shall be constructed in one pour, except on simple spans over 50 feet {15 m} in length transverse slab construction joints will be permitted. On simple spans over 80 feet {25 m}, transverse slab construction joints will be required. Where slab construction joints are used on simple composite spans, construction joints shall be placed at approximately the quarter points of the span; after pouring the center portion of the span and when the concrete has reached a compressive strength of 2800 psi {19 MPa} by cylinder tests, or after four days, the end slab portions of the span may be poured.

Consideration will be given to reducing the number of construction joints specified above where transverse screeding is to be employed; however, all requests for changes to pouring sequences must be submitted in writing to the Construction Engineer for approval. If the number of construction joints is reduced, a minimum pour rate of 30 cubic yards {23 m^3} per hour may be required, and an approved retarder may be required in the deck concrete.

During the placing operation, the concrete shall be placed in strips just ahead of the screed for the entire length or width of the pour, whichever applicable. A small roll of

grout shall be kept on the leading edge of the screed so that all depressions ahead of the screed will be filled.

c. Finishing.

(1) General Screed Requirements.

All screeds shall be mechanically operated. Screeds and screed supports shall be designed so that they may be pre-set to provide the finish grade and cross-section of the concrete deck surface shown on the plans. They shall be of substantial construction so that the proper settings will be maintained throughout the pour. Screed supports shall be placed and adjusted to properly provide for the deflection of forms, falsework, and structural supporting members which will occur during the placement of concrete. Immediately before concreting operations are started, the screed shall be operated over the full length and width of the bridge segment to be paved. This test run shall be made with the screed adjusted to its finishing position. While operating the screed during this test, all aspects of the screed and supports shall be checked for proper adjustments. After the Contractor has satisfied himself that the finishing equipment has been adjusted to conform with plan and specification requirements, another test run shall be made for the Engineer for the purpose of recording slab thickness and steel clearance measurements prior to the pour being made.

(2) Longitudinal Screeds.

Longitudinal screeds shall be supported at the ends by transverse headers or by a section of slab previously poured. Screeds must be long enough to span the entire pour as required by the plans and specifications. Intermediate screed supports between approved construction joints will not be permitted. Screeding shall be accomplished by working the longitudinal screed parallel to the centerline of the road (from low side to high side on superelevated curves) in such a manner that laitance, surplus water, and inert materials are removed from the surface.

(3) Transverse Screeds.

Transverse screeds shall be of sufficient weight {mass} to strike off the plastic concrete placed in front of the screed without "riding up" on the concrete. Transverse screeds shall be supported by vertically adjustable rails set a sufficient distance from the gutter line to allow free movement of the screed from gutter line to gutter line. Supports for the screed rail shall be located a maximum of 18 inches {450 mm}, center-to-center, with the slab overhang support brackets located a maximum of 24 inches {600 mm}, center-to-center. Exceptions to the maximum allowable screed rail and support bracket spacing will be considered if the increased spacing is adequately addressed in the design calculations that are required as a part of the Working Drawings (for falsework). Satisfactory means of load distribution with minimum rail deflection shall be provided. The screed rails for any deck pour shall be completely in place for the full length of the pour and shall be firmly secured prior to making test runs and subsequently placing deck concrete. In making the test runs, a "tell-tale" device attached to the screed carriage may be used to check the proper clearance on the top mat of the reinforcing steel.

(4) Work Bridges.

Portable work bridges shall be provided and used to perform finishing and inspection work on the bridge deck after the screeding operation. Surface tolerance as described in Subitem 510.03(c)6.d shall be accomplished before grooving the deck surface.

(5) Final Finishing.

The final finish behind longitudinal screeds shall be obtained by wood floating or by broom finish. The final finish behind transverse screeds shall be obtained by either wood floating, broom finish or burlap drag. Brooms for broom finishing shall have

medium to stiff nylon bristles. The final texture shall be obtained by the cutting of transverse grooves in the cured concrete.

The bridge decks shall be grooved perpendicular to the centerline. The grooving operation shall not be started until the bridge deck has been cured in accordance with the requirements given in Section 501.

The grooves shall be cut into the hardened concrete using a mechanical saw device which will leave grooves approximately 1/8 inches {3 mm} wide and 1/8 inches {3 mm} deep. The grooves shall be unevenly spaced and randomly varying between 5/8 inches {15 mm} and 1.125 inches {30 mm}. The grooved finish shall be at right angles to the centerline of the bridge deck, regardless of skew, and shall extend across the roadway from 2 feet {600 mm} inside the face of the curb or barrier rail to 2 feet {600 mm} inside the face of the opposite curb or barrier rail. Each pass of the grooving machine shall be adjacent to the previous pass without overlapping.

All residue, slurry and other waste resulting from the grooving operation shall be continuously removed from the bridge deck so that there is never a build-up of these waste materials. Upon approval by the Engineer, these waste materials may be disposed in earthwork when earthwork is a part of the bridge construction project. The waste materials may be tilled into the earthwork so that water run-off will not transport these materials from the construction site. If the Engineer does not approve of the disposal of the waste material on the construction site, the Contractor shall remove the waste material from the project and dispose of it in accordance with all applicable laws and ordinances for disposal.

d. Surface Tolerance.

The floor shall be constructed to correct elevation, including vertical curvature, within a tolerance of 1/8 inch {3 mm}, except that camber in spans 100 feet {30 m} and longer may exceed the designated amount by 1/4 inch {6 mm} at the midpoint of span. A slight excess of camber is preferred. As soon as the surface has set sufficiently, it shall be straight-edged by the Contractor under the direction of the Engineer and all areas exceeding 1/8 inch in 10 feet {3 mm in 3 m} from the longitudinal and transverse lines shown on the plans shall be marked and corrected by approved methods. The 10 foot {3 m} straight-edge shall be lapped at least 5 feet {1.5 m} over the prior 10 foot {3 m} check.

e. Curing.

The requirements for curing are given in Section 501.

f. Drainage.

Deck drains or scuppers shall be installed in the gutters at locations and in accordance with details shown on the plans.

g. Slab Overhang.

The under surface of overhanging slabs shall be provided with a continuous "V" groove 3/4 of an inch {20 mm} in depth at a point not more than 6 inches {150 mm} from the outside face for the purpose of arresting the flow of water, and thus, preventing staining,

h. Expansion Joints.

Plates, channels, or other structural shapes shall be accurately shaped, in the shop, to conform to the section of the concrete floor. The fabrication and painting shall conform to the requirements of these specifications and/or the plans covering those items. Care shall be taken to ensure that the surface in the finished plane is true and free from warp. Positive methods shall be employed in placing the joints to keep them in correct position during the placing of the concrete. Unless otherwise shown on the plans, the joint opening shown on the plans is the opening when the temperature of the structure is 70 °F {20 °C}. Special care shall be taken to ensure that all expansion joint devices and expansion joint openings are correctly set prior to pouring the concrete adjacent to the joint.

Expansion joints shall be so constructed as to permit freedom of movement of the spans. Open joints shall be cleared of all mortar and other obstructions as soon as possible after pouring the spans.

Sealing of joints, if required, shall be in accordance with plan details.

i. Blank.

j. Barrier Rails Placed By Slip Forming.

Bridge barrier rails constructed by the use of a slip form extrusion machine shall be well compacted dense concrete meeting all the requirements of Section 501, except for the requirement for fixed forms. The forming portion of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine so that the top of the barrier can be maintained at the required grade.

Open joints shall be located as required on Standard Drawing No. I-131. Longitudinal bars shall be cut at joint locations to provide for 2 inch {50 mm} end cover. The Contractor shall be responsible for marking these locations in advance of placement of concrete so that sawed joints will be properly located.

The joints shall be sawed as soon as the concrete has hardened to the degree that tearing and raveling is not excessive, and before uncontrolled shrinkage cracking begins. This time may be as short as four hours or even less in extremely warm weather, but not over 12 hours unless authorized by the Engineer. If extreme conditions exist which make it impractical to prevent uncontrolled cracking by early sawing, the procedure shall be revised immediately to adjust the sequence of sawing.

A minimum saw cut width of 5/16 of an inch {8 mm} shall be maintained. On the inside of the barrier, the saw cut shall extend from the top to the bottom of the rail to the point of intersection with the bridge deck. On the outside of the barrier, the saw cut shall extend from the top to within 11 inches {280 mm} of the bottom of the rail.

k. Placement of Cranes on Bridge Decks.

A crane shall not be placed on a bridge deck until Working Drawings for the placement and operation of the crane are distributed by the Department. Working Drawing shall be submitted in accordance with the requirements given in Section 105. The Working Drawing submittal shall include:

(1) Specifications of the crane and/or equipment to be placed on the structure.
(2) Mobilization (wheel location) diagram of the crane (with respect to centerline of structure) as it is being mobilized for final positioning on the structure.
(3) Final positioning/usage diagram once the crane is on the structure showing the location of the outriggers, and timber mat requirements (i.e. mat thickness, width, orientation of mats), maximum load to be lifted for a particular positioning of the boom, etc.
(4) A complete stress analysis (superstructure and substructure) on all components affected by loads resulting from the use of the crane and/or equipment on the structure. The analysis shall be provided in accordance with AASHTO Allowable Stress Design Method. Mobilization analysis (item 2) as well as final positioning/usage analysis (item 3) will be required. The results of the analysis shall be noted on the submittal by a written conclusion that the placement of the crane will not damage any part of the bridge.

7. Concrete Railings, Curbs, Sidewalks, and Parapets.

In no case shall concrete railings, sidewalks, and parapets be placed until the falsework for the span has been released, rendering the span self-supporting.

The surface of all bridge sidewalks shall have a wood-float finish. No other finish will be required.

8. Grounding.

If grounding is required by the plans, each exterior girder of bridges or portions of the bridges using steel girders shall be made electrically continuous by means of copper bonding jumpers across each expansion joint. Jumpers shall be extra flexible copper conductor, No. 2 AWG or larger. They shall be exothermically welded on the inside of the web close to the bottom flange. Jumpers shall be sized to permit 10 inches {250 mm} movement between girders without straining the jumper or connections. Grounding fields shall be provided at each end of such bridges or portion of bridges. Where end of bridge terminates at an abutment, the field shall consist of one or more driven ground rods as required to give a resistance to ground not

to exceed 25 ohms. Multiple grounds or sectional ground rods will be acceptable. Connections between ends of bridge and ground field shall be copper conductor, No. 6. or larger, protected against mechanical injury in all exposed portions by galvanized steel conduit. Resistance measurements shall not be made within 48 hours after a rain shower, or until the ground is reasonably dry after prolonged rainy weather. Where steel sections of bridges terminate at intermediate bents, the grounding field shall consist of No. 2/0 standard stranded copper conductor welded to steel piling or steel reinforcing rods, whichever extends to the lowest depth, and a 2 foot {600 mm} or longer section of copperweld grounding rod extended 4 inches {100 mm} above the bent cap adjacent to end of steel section. All welds shall be exothermic. Connection between ground rod and structure shall be a No. 2 AWG or larger, extra flexible electric copper conductor with provisions for not less than 12 inches {300 mm} horizontal movement of the structure at point of connection. Reference is made to Article 836.09 for additional material requirements.

(d) Mass Concrete.

1. Temperature Recording & Monitoring

In-place concrete temperatures shall be monitored and recorded for a minimum period of 7 days after concrete placement, unless otherwise designated by the Engineer.

Temperatures shall be electronically recorded automatically by a recorder furnished by the Contractor and shall be capable of continuously recording a minimum of one reading per hour for the duration of the mass concrete temperature monitoring period. The sensors and recorder shall be accurate to within ± 2 °F {1 °C} within the temperature range of 40 °F {4 °C} to 200 °F {93 °C}. The proposed temperature sensors and recorder for the project shall be defined in the ThCP for approval by the State Materials and Tests Engineer.

Sensors shall be installed in accordance with ALDOT-455.

The concrete producer shall be responsible for controlling the concrete temperature at delivery, per ALDOT-352. The Contractor shall be responsible for controlling the concrete temperature thereafter.

2. Maximum In-Place Concrete Temperature.

The maximum in-place concrete temperature limit for mass concrete shall be 160 °F [71 °C}.

The maximum in-place concrete temperature limit may be raised to 185 °F {85 °C} if the project concrete mix design contains mineral admixtures at one of the following minimum substitution rates:

Mineral Admixture	Minimum Substitution Percentage
Class F fly ash only	25%
Class C fly ash only	35%
GGBFS	35%
Microsilica (with Class F fly ash)	5% microsilica, 20% Class F fly ash
Microsilica (with GGBFS)	5% microsilica, 25% GGBFS

3. Maximum In-Place Concrete Temperature Differential.

The maximum in-place concrete temperature differential is defined as the difference in measured temperature at the core of the member and the measured temperature at the surface. The maximum in-place concrete temperature differential for mass concrete shall be 35 °F {19 °C}

Alternatively, the Contractor may, at his expense, determine the coefficient of thermal expansion (CTE) for the project concrete mix design, per AASHTO T 336, and develop an age-dependent maximum in-place concrete temperature differential, per ALDOT-456.

4. Thermal Control Plan (ThCP)

The Contractor shall submit a written ThCP to the State Materials and Tests Engineer for approval describing the procedures that will be used during the 7-day period following concrete placement, so that the maximum in-place concrete temperatures and maximum

in-place concrete temperature differentials do not exceed the limits defined in Items 510.03(d)2 and 510.03(d)3. The ThCP shall be developed by a Professional Engineer, licensed in the State of Alabama, who shall be competent in the modeling, design, and temperature control of mass concrete. This Engineer shall be called the Thermal Control Plan (ThCP) Engineer.

The ThCP shall list actions to take when any of the temperature limits set in Items 510.03(d)2 and 510.03(d)3 are exceeded or anticipated to be exceeded. The ThCP shall be submitted at least 30 calendar days before the first intended mass concrete placement. The Contractor shall not place concrete covered by this specification until the ThCP has been accepted for completeness in writing by the State Materials and Tests Engineer and the equipment and materials necessary to facilitate the plan are on site and ready for use.

The ThCP shall include the following:

- Concrete mixture design per ALDOT-170. If the concrete mixture proportions are changed, then the ThCP shall be updated.
- The maximum in-place concrete temperature in accordance with Item 510.03(d)2 that shall be used for the project.
- The maximum in-place concrete temperature differential in accordance with Item 510.03(d)3 that shall be used for the project. If an age-dependent maximum concrete temperature differential is used, it shall be defined in tabular form, and the CTE shall be reported.
- Calculated or measured adiabatic temperature rise of the mass concrete element.
- Proposed methods to control concrete temperature at time of placement, such as pre-cooling of raw materials or concrete.
- Proposed methods to control maximum concrete temperature during curing. A mechanical cooling system may be used to control the internal temperature of mass concrete during curing but shall be designed in conformance with the ThCP. If a mechanical cooling system is used, the plans for the cooling system operation and final grouting after cooling shall be submitted to the State Materials and Tests Engineer for approval.
- Maximum concrete temperature at time of placement used during the development of the Temperature Control Plan.
- Calculated maximum concrete temperature during curing based on expected conditions and methods used to control temperature.
- Proposed methods to control concrete temperature differentials during curing.
- Calculated maximum temperature differential based on expected conditions and methods used to control the temperature difference. Submit the thermal calculation model and/or computational software with the ThCP.
- Information on the temperature sensing and recording equipment to be used and drawings of locations of temperature sensors within each placement.
- Description of the format and frequency of providing temperature data.
- List of corrective measures to be taken to reduce excessive temperatures and temperature differences, if they occur.
- Description of curing methods and duration of curing.
- Description of formwork removal procedures and method to ensure that the temperature differences at exposed surfaces will not exceed the maximum concrete temperature differential.

5. Collection and Submittal of Measured Concrete Temperatures

The ThCP Engineer must personally inspect and approve the installation of temperature monitoring devices and verify that the process for recording temperature readings is effective for the first placement of each size and type of mass concrete element. Submit to the Engineer for approval the qualification of all technicians employed to inspect or monitor mass concrete placements. For placements other than the first,

designate an employee or employees approved by the ThCP Engineer, as qualified to inspect monitoring device installation, to record temperature readings, to be in contact at all times with the ThCP Engineer if adjustments must be made as a result of the maximum concrete temperature limit or maximum concrete temperature difference limit being exceeded, and to immediately implement adjustments to temperature control measures as directed by the ThCP Engineer.

The Contractor shall notify the Engineer when the concrete temperature comes within 15 °F {8 °C} of the maximum in-place temperature limit or when the concrete temperature difference comes within 10 °F {6 °C} of the maximum in-place concrete temperature differential limit, and immediately take corrective measures to comply with the concrete temperature requirements of this specification.

The Contractor shall submit to the Engineer within three (3) days of completion of monitoring of each mass concrete element a copy of all measured temperature readings and include the measured maximum concrete temperature and maximum concrete temperature difference.

510.04 Acceptance of Mass Concrete

Construction shall not proceed on any mass concrete element until compliance with this specification has been determined and the Contractor has received written notification to continue construction from the State Construction Engineer.

If the Contractor fails to conform to any of the above temperature requirements in any one pour, the construction of any additional mass concrete elements will cease. The State Construction Engineer may direct that the concrete be removed or otherwise mitigated, at no cost to the Department. The contractor shall revise the ThCP to correct the problem and resubmit the revised ThCP to the State Materials and Tests Engineer for acceptance for completeness. Mass concrete placement shall not begin until the State Materials and Tests Engineer has approved the revised ThCP. No extension of time or compensation will be made for any rejected mass concrete element or revisions of the ThCP.

510.05 Method of Measurement.

(a) General.

The quantities of concrete, steel reinforcement, structural steel, timber, piling, and other various contract pay items which constitute the completed and accepted structure shall, unless otherwise provided herein, be measured for payment according to the specifications for the individual contract pay items provided.

Accepted work, constructed to the dimensions shown on the plans or ordered in writing, will be used to determine the quantities of the respective pay items involved, all in accordance with the provisions of the applicable Section of these specifications.

Attention is directed to the major items of work such as Section 502 for Reinforcing Steel, Section 508 for Structural Steel, Section 509 for Timber, Section 505 for Piling, etc.

(b) Item 510-A and 510-B.

1. Volumetric Measure.

The volume of accepted concrete within the neat lines of the structure as shown on the plans or revised at the written direction of the Engineer will be computed in cubic yards {cubic meters}. The method of average end areas will not be used where results obtained differ from those obtained by more accurate mathematical computation.

2. Deductions.

No deduction will be made for the volume of concrete displaced by steel reinforcement, drainage scuppers, weep holes, service pipes, conduits, anchor bolts, castings of grillages, or structural shapes and plates. No deductions will be made for chamfers of less than 3 inch {75 mm} leg measurements.

The volume of precast concrete or timber pile heads imbedded in concrete will be deducted.

3. Additional Cement or Concrete Used.

No payment will be made on account of additional cement used or additional volume of concrete used unless ordered in writing. No payment will be made for footing concrete used outside line drill limits or other neat lines shown on the plans, where no forms are used. Additional cement ordered used will be paid for as described in Section 501.

(c) Item 510-C.

Each accepted Bridge Concrete Superstructure unit will be measured for payment as a lump sum unit. Partial payments will be allowed on monthly estimates in accordance with Subarticle 510.05(c).

(d) Item 510-E.

Grooving of bridge decks, acceptably completed in accordance with Subitem 510.03(c)6.c., will be measured by the square yard {square meter}.

(e) Item 510-G and 510-H.

Each accepted Structural Seal or Substructure Mass Concrete unit will be measured by the cubic yard {cubic meter} in accordance with the method of measurement that applies to this element type as defined in either Article 503.04 or Item 510.05.

(f) Item 510-I

Each accepted Superstructure Mass Concrete unit will be measured for payment as a lump sum unit.

510.06 Basis of Payment.

(a) Unit Price Coverage.

The accepted structural concrete, measured as noted above, will be paid for under the respective unit price bid for the appropriate item or items provided for such in the proposal. Said unit price bid shall be full compensation for the concrete, complete in place, which shall be payment in full for all backfilling, compacting, disposal of surplus material, all falsework piling, falsework, forms, bracing, all materials except as specified below, and for all equipment, tools, labor, and incidentals necessary to finish and complete the items in accordance with the plans and these specifications. Non-metal expansion joints, scuppers and drains, electrical conduit and equipment, shall be included in the bid price for the concrete, unless otherwise provided on the plans or in the proposal. Steel reinforcement, metal expansion joints, and metal bearings will not be included in the price bid for the concrete but shall be paid for under the appropriate pay item. In case of widening or extension of an existing structure, the breaking away of existing concrete to the approximate lines shown on the plans and disposing of broken concrete and preparing steel reinforcement for splicing as required, will be paid for under Section 206.

The accepted mass concrete, measured as noted above, will be paid for in accordance with the unit price coverage that applies to this element type as defined in either Article 503.05 or Item 510.06. The development of the TCP and all equipment, tools, labor, and incidentals necessary to control concrete temperatures shall be included in the bid price for the concrete. All equipment, tools, labor, and incidentals necessary to measure and monitor the in-place concrete temperature as required herein shall be included in the bid price for the concrete.

No additional compensation will be allowed for constructing or placing expansion joints, scuppers, drains, weep holes, or for placing service pipes or conduits, anchor bolts, plates, castings, grillages, or metal bearings or appurtenances, as such are considered incidental to the placing of concrete or other items of the work, unless otherwise noted by the plans or proposal. Payment for grooving concrete bridge decks will be made at the contract unit price bid per square yard {square meter} which will be full compensation for furnishing the necessary equipment, tools, and labor to perform the work.

(b) Items 510-A and 510-B.

Payment for concrete measured on a cubic yard {cubic meter} basis as described above will be made at the contact unit price per cubic yard {cubic meter}, complete in place, for the various classes of concrete listed on the plans and the proposal.

(c) Item 510-C.

Payment for each accepted Bridge Concrete Superstructure unit will be made at the contract lump sum price bid for each unit, complete in place.

Partial payments will be made on monthly estimates based on the percentage of the total work performed on each unit as estimated by the Engineer.

The number of cubic yards {cubic meters} shown on the plans and in the proposal is approximate only and the lump sum amount bid for each unit will not be increased or decreased except as outlined below.

Structural steel, reinforcement and precast-prestressed concrete units are covered by other pay items.

An increase, or decrease, in the approximate quantity of surface deck area for bridge concrete superstructure required from that shown on the plans which is caused by a design change after the contract has been let will result in an increase, or decrease, in the compensation due the Contractor. This compensation will be made, either increase or decrease, as a proportional amount of the contract bid price of Item 510-C.

For any other changes in the approximate quantity of bridge concrete superstructure, price adjustments will be made in accordance with Article 104.02.

(d) Item 510-G

Payment for concrete measured on a cubic yard {cubic meter} basis as described above will be made at the contact unit price per cubic yard {cubic meter}, complete in place, for the various classes of concrete listed on the plans and the proposal.

(e) Item 510-H

Payment for each Superstructure Mass Concrete unit will be made at the contract lump sum price bid for each unit, complete in place.

The number of cubic yards {cubic meters} shown on the plans and in the proposal is approximate only and the lump sum amount bid for each unit will not be increased or decreased.

(f) Payment will be made under Item No.:

510-A Bridge Substructure Concrete - per cubic yard {cubic meter}
510-B Bridge Concrete, Class ___ - per cubic yard {cubic meter}
510-C Bridge Concrete Superstructure, __*, __**, ___*** - per lump sum
510-E Grooving Concrete Bridge Decks - per square yard {square meter}
510-G Mass Bridge Concrete Substructure - per cubic yard {cubic meter}
510-H Mass Bridge Concrete Superstructure, __*, __**, ___*** - per lump sum

* Station Number, Bridge Identification Number (BIN), Ramp Number, etc.

** Lane, if applicable

*** Approximate quantity of superstructure concrete in cubic yards {cubic meters}