ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: January 12, 2021 Special Provision No. 18-0225

EFFECTIVE DATE: November 1, 2021

SUBJECT: Portland Cement Concrete Pavement.

Alabama Standard Specifications, 2018 Edition, SECTION 450 shall be replaced by the following:

SECTION 450
PORTLAND CEMENT CONCRETE PAVEMENT

450.01 Description.

The work covered by this Section consists of constructing a pavement of Portland Cement Concrete.

450.02 Materials.

(a) References for Material Requirements.

All materials shall conform to the requirements given in Division 800, Materials.

The requirements given in the following Sections are directly applicable to the materials furnished for the concrete pavement:

Section 801 Coarse Aggregate
Section 802 Fine Aggregates
Section 804 Bituminous Materials
Section 806 Mineral Admixtures
Section 807 Water
Section 808 Air Entraining Additives
Section 809 Chemical Admixtures for Concrete
Section 815 Cement
Section 830 Concrete Curing Material
Section 832 Concrete Joint Fillers, Sealers, and Waterstop Material
Section 835 Steel Reinforcement

(b) Aggregates.

1. Fine Aggregate.

Fine aggregate shall be ALDOT Size No. 100 Concrete Sand meeting the requirements of Section 802. Sand shall be natural sand except that it may include 20 percent crushed quartzite particles. A blend of two natural sands will be permitted if a written request is submitted to the Materials and Tests Engineer for approval.

2. Coarse Aggregate.

a. Gradation.

Each component size shall be stockpiled separately at the batching plant.

b. Type of Coarse Aggregate.

Coarse aggregate shall be granite, sandstone, quartzite, or gravel with a specific gravity greater than 2.550 (specific gravity requirement applies to gravel only). Gravel with a specific gravity less than or equal to 2.550 will not be allowed.

Aggregates that tend to polish under traffic, such as limestone, dolomite, or marble, shall be permitted as noted in the following table.

ALLOWABLE CARBONATE STONE CRITERIA	
BPN 9 Value of Aggregate Source *	Maximum Allowable Percentage of Carbonate Stone
≤ 20	Not Allowed
21 through 25	30
26 through 28	35
29 through 31	40
32 through 34	45
≥ 35	50
* This value, BPN 9, is made using the British Pendulum Tester on aggregate source specimen polished for 9 hours on an accelerated polishing machine known as the British Wheel as per ASTM D 3319, ASTM E 303 and ALDOT-382.	

If limestone, dolomite, or marble are used as coarse aggregate in the percentages allowed in the table above the remainder of the coarse aggregate blend shall be granite, sandstone, quartzite, or gravel with a specific gravity greater than 2.550 (specific gravity requirement applies to gravel only). Gravel with a specific gravity less than or equal to 2.550 will not be allowed.

When parts of the carbonate stone used in the mix are from differing strata of material or coming from multiple sources that are represented by different BPN 9 values, the lowest BPN 9 value will be used.

If the Contractor requests to use a percentage of carbonate stone in excess of the value of the above table or for the total amount of carbonate stone to be greater than 50 percent, grinding as defined in Item 450.04(b)2 will not be permitted.

c. Los Angeles Abrasion Criteria for Carbonate Stone.

When carbonate stone is used in the concrete mixture design, the percent loss of the coarse aggregate by the LA Abrasion test (AASHTO T 96, Resistance to Abrasion of Small Size Aggregate by use of the Los Angeles Machine) shall not exceed 40%.

d. Micro-Deval Abrasion Criteria for Carbonate Stone.

When carbonate stone is used in the concrete mixture design, the percent loss of the coarse aggregate by the Micro-Deval test (AASHTO T 327, Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus) shall not exceed 18%.

3. Combined Aggregate Gradation.

The Contractor shall use Combined Grading Analysis to produce a well-graded aggregate in designing the concrete mixture. The Contractor shall submit the following data with any concrete mixture design:

Gradations for all coarse and fine aggregates.

- Coarseness Factor Chart.
- 0.45 Power Chart.
- Chart showing the percent of combined aggregate retained on each sieve.

4. Crushed Concrete Used as Aggregate.

Crushed concrete may be used as an aggregate if this is shown to be allowed on the plans. The crushed concrete used as an aggregate shall meet the requirements given in this Section and the requirements given in Articles 801.01, 801.02, and 801.03.

(c) Portland Cement.

The concrete producer may use Type I, Type II or Type IL cement. The concrete producer may substitute Type III Portland cement, provided prior approval is given by the Materials and Tests Engineer and it is included in the proposed mix design.

(d) Admixtures.

1. Chemical Admixture.

Any chemical admixture used in the concrete mixture shall be included in the mixture design proposal. Only approved chemical admixtures listed in List II-1, "Chemical Admixtures for Portland Cement Concrete", of the MSDSAR manual shall be used in Department concrete mixes. The dosage of chemical admixtures may be adjusted in the field to obtain the desired results, provided that the manufacturer's recommended dosage is not exceeded.

2. Mineral Admixture.

Mineral admixtures may be used in any concrete pavement mixture design except where it is specified otherwise by the plans and proposal. Substitution percentages are calculated by weight.

The maximum substitution of cement with mineral admixtures shall not exceed 50 percent. The following table shows the maximum substitution of cement with any one mineral admixture.

MAXIMUM PERCENT MINERAL ADMIXTURE SUBSTITUTION FOR CEMENT (substitution by weight)	
MINERAL ADMIXTURE	PERCENTAGE SUBSTITUTION
Class C or Class F Fly Ash	30 %
Ground Granulated Blast Furnace Slag	50 %
Microsilica	10 %

(e) Concrete Mix Design.

1. Submittal of Mix Design.

The Contractor's concrete producer shall establish the proportion of materials following the guidelines described in ALDOT-170, "Method of Controlling Concrete Operations for Structural Portland Cement Concrete". It shall be the responsibility of the concrete producer to request approval of concrete mixture design(s) for use in Department's projects. The Contractor shall submit the proposed concrete mixture no later than 65 Calendar Days after the date of Notice to Proceed. The Department shall be allowed 28 Calendar Days to complete the review and approval of the concrete mixture.

2. Mix Design Criteria.

The concrete producer shall submit a mix design meeting the following parameters:

Maximum water to cementitious material ratio of 0.45.

Maximum slump of 2.0 inches {50 millimeters} when a slip form paver, as defined in Subarticle 450.03(f), is used.

Maximum slump of 3.5 inches {90 millimeters} when fixed forms, as defined in Subarticle 450.03(e), are used. Approved Type "F" chemical admixtures may be used to chemically increase the slump of the concrete to 6.0 inches {150 mm}.

Total entrained air percentage by volume between 2.5% and 6.0%.

Minimum flexural strength of 650 psi at 28 days.

Minimum compressive strength determined by correlation with the minimum allowable flexural strength. The compressive strength shall not be less than 4,000 psi at 28 days.

For concrete mixtures using portland cement only, the concrete producer shall submit data showing that the total alkali contribution from the cement in the concrete does not exceed 4.00 lb/Yd^3 when calculated as follows:

$$lb\ of\ alkali\ per\ Yd^3 = \frac{(lb\ of\ cement\ per\ Yd^3) \times (\%\ Na_2O\ equivalent\ in\ cement)}{100}$$

3. Correlation of Compressive Strength with Flexural Strength.

In addition to the requirements listed in Item 5 of ALDOT-170, the concrete producer shall submit a correlation of the flexural strength versus the compressive strength. This submittal shall be made at the same time as the submittal of the proposed mix design.

A correlation of the flexural strength versus the compressive strength for 7- and 28-day strengths shall be made and shall be based on at least 3 tests for each age from the proposed concrete mixture. The minimum 28-day flexural strength shall be 650 psi. The flexural strength shall be obtained from beam specimens made in accordance with ASTM C 192, "Making and Curing Concrete Test Specimens in the Laboratory" and tested in accordance with the requirements given in AASHTO T 97, "Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)". The minimum allowable compressive strength (f'c) at 28 days shall be the compressive strength determined from the correlation of compressive strength with the minimum required flexural strength; but in no case shall the minimum 28-day compressive strength (f'_c) be less than 4,000 psi.

Separate correlation mix design tests shall be performed for each combination of cementitious materials and each combination of chemical admixtures proposed for use. Separate correlation mix design tests shall be performed for the different types of aggregates used. Separate correlation mix design tests shall be made for concrete for any conveying or placing method proposed which requires special properties. Changes in a mix design, other than those allowed by the Department, shall require a new mix design correlation.

(f) Steel.

Tie bars shall be deformed new billet steel; other bars shall be new billet steel. The Grade of the tie bars shall meet the requirements given in Article 835.05.

The material requirements given in Section 502 shall apply to the reinforcing steel for the concrete pavement.

Dowel bars shall be Type B meeting the requirements given in Article 835.05, unless otherwise noted by plan detail.

(g) Quality Control Plan and Maturity Meters.

1. Quality Control Plan.

The Contractor shall submit a Quality Control (QC) plan to the Materials and Tests Engineer for review. Construction shall not begin until the QC plan is accepted as being complete and has been distributed for inspection of the construction work. The Contractor shall include a description of the required Concrete Plant Laboratory as part of the QC plan. The Concrete Plant Laboratory shall meet the requirements of Section 601. No direct payment will be made for the laboratory.

2. Maturity Meters.

"Maturity Meters" may be proposed only for use in estimating the compressive strength of the concrete for opening the pavement to traffic.

The use of the maturity meters shall conform to the requirements given in ALDOT-425, “Maturity Method to Determine Early-Age Strengths of Concrete”.

The maturity meters used in establishing the Strength-Maturity relationship shall be the same ones used in estimating the early age compressive strength of the concrete in the pavement. The manufacturer's serial number of the maturity meter shall be shown on each strength-maturity relationship submitted to the Engineer.

When verification tests indicate the strength-maturity relationship is invalid, maturity testing shall be discontinued until a new strength-maturity relationship is developed. Compressive strength by testing cylinders shall be used for the determination of the early age

compressive strength until the Contractor completes testing to reestablish the correlation between the early age compressive strength and the maturity meter readings.

(h) Sampling and Inspection.

1. Availability of Plant and other Facilities for Inspection.

Preparation of the mix shall be subject to inspection at all times. The Engineer shall have access at any time to all parts of the plant and other facilities for inspecting and checking all equipment, operations, and materials involved in preparation of the concrete mix. Any unsatisfactory equipment or operation shall be changed and improved as required.

2. Mainline Pavement Lot.

A mainline pavement lot shall be defined as 528 feet, or fraction thereof, of mainline roadway lane length placed in one paving pass. The paving width may be multiple roadway lanes placed in one paving pass. A complete lot shall be removed and replaced in accordance with the details shown on the plans if the quality of the pavement in any portion of the lot is determined to be unacceptable.

Concrete shoulder pavement placed integrally with mainline roadway may be accepted using the tests for the mainline roadway pavement. The Engineer may include transitional areas of pavement adjacent to mainline lots for acceptance using the tests for the mainline roadway pavement.

A paving pass is defined as the continuous paving operation in width and length done without interruptions of more than 30 minutes.

3. Non-Mainline Pavement Lot.

Ramps, shoulders, and transitional areas are classified as non-mainline pavement. A non-mainline pavement lot shall be defined as 250 cubic yards, or fraction thereof, of ramps, shoulders, and transitional areas placed in one paving pass. A complete lot shall be removed and replaced in accordance with the details shown on the plans if the quality of the pavement in any portion of the lot is determined to be unacceptable.

The Engineer may combine ramps, shoulders, and/or transitional areas into one lot if the combined elements are placed in the same paving pass.

A paving pass is defined as the continuous paving operation in width and length done without interruptions of more than 30 minutes.

4. Table of Sampling and Testing Requirements.

SAMPLING AND TESTING REQUIREMENTS FOR ACCEPTANCE OF PORTLAND CEMENT CONCRETE PAVEMENT[1]						
	Sample Size	Sampling Methods	Sampling Location	Testing Methods	ALDOT Testing Frequency	Remarks
1. Compressive Strength	Minimum of One Set of Cylinders[2]	AASHTO T 141	ALDOT-210	AASHTO T 22 & AASHTO T 23	Minimum of 1 set per Lot	Sampled and Tested by the Department
2. Total Air Content	Minimum of One	AASHTO T 141	Same location and sample as 1	AASHTO T 152	Minimum of 1 per Lot	Sampled and Tested by the Department
3. Slump	Minimum of One	AASHTO T 141	Same location and sample as 1	AASHTO T 119	Minimum of 1 per Lot	Sampled and Tested by the Department
4. Temperature	Minimum of One	AASHTO T 141	Same location and sample as 1	AASHTO T 309	Minimum of 1 per Lot	Sampled and Tested by the Department
5. Thickness[3]	Probing Method		ALDOT-210		Minimum of 2 sets per Lot	Contractor shall perform measurements

Notes:

1. Sampling and testing frequency applies for both mainline and non-mainline portland cement concrete pavement.
2. A set of cylinders consist of two 6 in x 12 in cylinders to be tested at 28 days.

3. The Department will verify the Contractor's measurements by an alternative method for measuring thickness as indicated in Item 450.02(h)10. A set consists of two individual measurements.

5. Samples for Testing by the Department.

The Contractor shall furnish, without extra compensation, samples of materials for making test specimens and performing tests as required to comply with Departmental material testing procedures. Additional materials and increases in the frequency of testing will be required if deemed necessary by the Engineer.

The Engineer will establish the location for sampling in accordance with the requirements given in ALDOT-210, "Selecting Samples by the Random Numbers Method".

6. Sampling and Testing of Aggregates and Cementitious Materials.

Aggregates and cementitious materials shall be from approved sources accepted in accordance with the requirements given in the Department's Testing Manual.

7. Testing Concrete During Mixing and Placement.

A department certified ALDOT Concrete Technician will sample and test the properties of the concrete as it is being mixed and placed. Sampling and testing for total air content, slump, and temperature will be performed at the same time, and from the same sample that compressive strength samples are taken. Concrete that is not within the following limits during placement shall not be used:

SLUMP: Slump will be determined in accordance with AASHTO T 119, "*Slump of Hydraulic Cement Concrete*" and shall not exceed the maximum specified slump.

TOTAL AIR CONTENT: Total air content will be determined in accordance with AASHTO T 152, "*Air Content of Freshly Mixed Concrete by the Pressure Method*", Type "B". Total air content shall be between 2.0 % and 6.0 % by volume.

CONCRETE TEMPERATURE: Concrete Temperature will be determined in accordance with AASHTO T 309, "Temperature of Freshly Mixed Portland Cement Concrete". The temperature of the concrete, at the time of placement, shall not be less than 50 ºF or more than 90 ºF.

8. Concrete Cylinders for Testing Compressive Strength for Acceptance.

The Department's certified ALDOT Concrete Technician will make a minimum of one set of two 28 days concrete cylinders that will represent the lot. Concrete cylinders will be made in accordance with AASHTO T 23, "Making and Curing Concrete Test Specimens in the Field". The compressive strength of concrete cylinders at 28 days will be determined in accordance with AASHTO T 22, "Compressive Strength of Cylindrical Concrete Specimens".

The concrete cylinders shall be initially cured in a protected environment in accordance with the requirements given AASHTO T 23. The protective environment shall be available at the time of the concrete placement and shall be maintained until all specimens have been transported to the testing laboratory. The Contractor shall furnish, without extra compensation, a protected environment for all concrete test specimens. The protective environment shall consist of at least one curing box (more may be required) with a capacity to hold at least 22 test cylinders that are 6-inch x 12 inch in size. Each curing box shall be equipped with heating/cooling capabilities, automatic temperature control, and a maximum/minimum (high/low) temperature readout. The protective environment shall be approved by the Area Materials Engineer prior to beginning any concrete placement.

9. Probing Method for Determining Concrete Pavement Thickness.

The Engineer will select using ALDOT-210 a minimum of two longitudinal locations within the lot to be measured. The Engineer will then select using ALDOT-210 two transverse locations within the width of the pavement at each of the longitudinal locations selected. The Contractor shall use a probing device to determine the concrete thickness of the freshly placed concrete at each of the locations selected. The thickness measurements shall be recorded to the nearest ⅛ of an inch. The two measurements at each longitudinal location constitute one set. The Contractor shall submit the record of all reading as well as the exact location, including the station number and offset, of each reading to the Engineer by the end of the day. The average

of all the measurements within a lot will be used by the Engineer to determine the thickness of the lot.

10. Verification of Contractor's Determination of Concrete Pavement Thickness.

The Department will use the Magnetic Imaging Technology (MIT) Scan-T2 to verify the Contractor's measurements of the concrete pavement thickness.

The engineer will set targets within one foot from the location of the Contractor's measurements. The Engineer will take two readings at each target location. The average of all the MIT Scan-T2 readings within a lot will be used by the Engineer to verify the thickness of the lot. The Engineer will record the station number and offset of the location the thickness measurements are taken.

If the Contractor's average thickness of the lot varies from the verification thickness done by the Department by ± 0.10 inches, a referee core sampled in accordance with AASHTO T 24 will be extracted at a location selected using ALDOT-210 from all the measured points. The core will be measured by the Department for thickness in accordance to AASHTO T 148. If the referee core thickness agrees with the Department's verification result, the Contractor will bear the cost of coring and repairing of the core hole. If the referee core thickness agrees with the Contractor's result, the Department will bear the cost of coring and repairing of the core hole. All voids resulting from coring operations shall be filled and consolidated with the same concrete mixture used during paving. Voids shall be filled on the same day that the cores are extracted using the same concrete mixture used for paving.

450.03 Construction Requirements.

(a) Placement of Concrete.

Concrete shall be placed in one lift of concrete. Separate lifts of concrete will not be allowed.

(b) Equipment.

1. Certification of Concrete Batch Plants.

All concrete batching plants shall be certified by the National Ready-Mix Concrete Association (NRMCA) to be in conformance with the NRMCA Plant Certification Checklist. The concrete producer shall submit proof of NRMCA certification to the Area Materials Engineer prior to any batching of concrete.

All concrete batching plants used in the production of concrete pavement for the Department shall be on List I-7, "Portland Cement Concrete Producers", in the Department's Materials, Sources, and Devices with Special Acceptance Requirements manual. Concrete producers who request that their concrete batching plants be placed on List I-7 shall meet the requirements outlined in ALDOT-355, "General Information Concerning Materials, Sources, and Devices with Special Acceptance Requirements".

2. Scales.

The scales for determining the weight {mass} of aggregates, mineral admixtures, and cement shall be an integral unit of the batching plant and meeting the requirements of Subarticle 109.01(h).

3. Concrete Mixers.

Concrete may be mixed at the site of construction or at a central point. Each mixer shall have attached to it in a prominent place a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades for both mixing and agitation.

An automatic graduated measuring device, accurate within three percent shall be provided at the mixer for measuring each amount of air-entraining agent and other chemical admixtures to be added to each concrete batch requiring such admixture.

Mixers shall be equipped with an approved device for accurately measuring water within ± 1% of the reading indicated. The requirements given in Subarticle 501.03(b) apply for concrete transit mixers.

4. Spreading and Finishing Equipment.

Minimum spreading and finishing equipment shall consist of a mechanical spreader and/or strike-off screed, a finishing machine, vibrators for full width vibration of the paving slab, smoothing float, 16-foot straightedge, floats, burlap drags, and curing equipment.

5. Vibration Equipment.

Vibration equipment shall be used to vibrate the concrete for the full width and depth of the pavement without coming in contact with steel bars, other internal materials and the underlying layer. The vibration equipment shall be capable of being stopped when the vibration equipment is not moving along the pavement.

Internal (spud or tube) and surface (pan) vibrators shall be used. Spud or tube vibrators shall operate at a frequency between 5000 to 8000 vibrations per minute. Pan vibrators shall operate at a frequency between 3000 to 6000 vibrations per minute.

6. Concrete Saws.

Equipment shall be provided for the sawing of joints. An adequate number of saws shall be utilized to complete the sawing within time to prevent cracking of the concrete.

7. Forms.

Forms shall be substantial enough in size and strength to allow the proper placement and finishing of the concrete.

8. Lighting.

Lighting shall be in accordance with the requirements given in Subarticle 104.04(a).

(c) Precipitation and Temperature.

1. Precipitation.

Pavement damaged by rain or hail shall be removed and replaced in accordance with the details shown on the plans without additional compensation.

2. Temperature.

a. Range of Acceptable Concrete Temperature for Placement.

The temperature of the concrete, at the time of placement and spreading, shall not be less than 50 ºF or more than 90 ºF.

b. Cold Weather Operations.

Concrete shall not be placed on an underlying surface that is colder than 35 °F.

When concrete is placed during seasons when there is a probability of ambient temperatures lower than 40 °F, heating equipment and materials shall be available to protect the concrete from the cold weather. The heating equipment and materials shall be used to enclose the uncured concrete and keep the air temperature inside the enclosure within the allowable ranges of temperature for the minimum required amount of time.

If there is a possibility that ambient temperatures will be below 40 °F during the first three days after placement of concrete, the concrete shall be protected from cold temperatures by keeping the surface at a temperature above 50 °F for the first 72 hours after placement and above 32 °F for an additional 72 hours. After these periods of time, the protective covering shall remain in place until the temperature inside the protective covering reaches that of the surrounding atmosphere.

The Contractor shall furnish two "continuous temperature reading" thermometers for the measurement of the concrete surface temperature. The measurements shall me made as directed by the Engineer.

The aggregates and mixing water shall not be heated to a temperature in excess of 150 °F. Aggregates from frozen stockpiles shall not be incorporated into the mix. Materials entering the mixer shall be free from ice, snow, and frozen lumps. Salts, chemicals, or other materials shall not be incorporated in the concrete to prevent freezing. Care shall be taken to heat all materials uniformly and avoid hot spots that will burn or overheat the materials.

c. Hot Weather Operations.

If there is a possibility that ambient temperatures will be above 90 °F during the placement of concrete an approved retarder admixture shall be used in the concrete mixture. Cooling of the mixing water and/or aggregates or placing the concrete during the cooler part of the day may be allowed to keep the concrete below the maximum allowable temperature. In no instance shall a concrete mixture be placed when the temperature of the concrete is above 90 °F {32 °C}. Concrete shall not be placed against any surface (in particular steel surfaces) when the temperature of that surface is greater than 120 ºF. Surface watering may be used to cool the surface that the concrete will be placed on if it is at or above 120 °F, but standing water will not be allowed at the time of concrete placement.

Concrete placement will only be allowed at night if the temperature of the concrete is above 90 °F and cannot be lowered or if the temperature of the surface that the concrete will be placed on is above 120 °F and cannot be lowered.

(d) Preconditioning of Underlying Layer prior to Placement of Concrete.

All high areas of the layer under the concrete shall be corrected before the concrete is placed. Low areas shall be filled with material integral with the underlying layer (HMA or concrete pavement).

The underlying layer shall be thoroughly wetted the previous night but not less than six hours prior to placing of the concrete. The underlying layer shall be sprinkled just before the placement of the concrete so as to be uniformly moist. The method of sprinkling shall not result in mud or pools of water.

(e) Fixed Forms.

Fixed forms shall not be used for mainline pavement (including shoulders) when the total amount of concrete pavement required to be placed is greater than 10,000 square yards.

Fixed forms shall be used in areas where slip form pavers cannot be used such as areas with a sharp radius and at the transition areas of ramps.

(f) Slip Form Method.

1. Allowable and Required Use of Slip Form Method.

The slip form method shall be used when the total amount of concrete pavement required to be placed is greater than 10,000 square yards. The slip form method may be used instead of fixed forms when the total amount of concrete pavement required to be placed is less than 10,000 square yards.

2. Slip Form Paver.

The slip form paver shall be designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the paver. Concrete shall be placed so that only minor hand finishing will be necessary to provide a dense and homogeneous concrete pavement.

The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed. The vibration shall be accomplished with the required vibration equipment.

The sliding forms shall be rigidly held together, laterally to prevent spreading of the forms, and shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur.

The paver shall be operated with a continuous forward movement. All operations of mixing, delivery, and spreading concrete shall be coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately.

All tractive force applied to move the paver shall be operated by controls on the paver.

3. Edge Slump.

The edge slump shall be measured within an area that is 6 inches from the longitudinal edges of each pavement slab.

The edge of the finished surface shall not vary more than 1/4 of an inch from a 10 foot straightedge placed perpendicular (at a right angle) to the edge of the outside of the pavement slab or to the edge of a pavement slab that is adjacent to another pavement slab.

Pavements slabs where the edge slump is excess of the allowable amount (1/4 inch) shall be removed and replaced in accordance with the details shown on the plans without additional compensation.

(g) Placing Concrete.

1. Water Evaporation Rate During Placement.

Prior to and during the placement of concrete, the water evaporation rate shall be determined in accordance with the requirements given in Section 501 for bridge deck slabs. Preventive action shall be taken to eliminate plastic shrinkage cracking in accordance with the requirements given in Section 501.

2. Reduction of Evaporation during the Screeding Operations.

If the evaporation rate measured in accordance with the requirements given in Section 501 exceeds the maximum allowable rate, continuous fogging or an evaporation barrier material (monomolecular film) shall be used to maintain moisture on the surface of the pavement. Continuous fogging or an evaporation barrier shall be applied to the pavement no further than five feet behind the screeding operations.

If fogging is used, a continuous fog or mist spray shall be maintained until the curing procedures begin. Intermittent fogging is not acceptable if there is drying of the concrete surface. If water begins to pond on the pavement, the Contractor shall adjust the rate of fogging to minimize the ponding of water.

If an evaporation barrier material is used, it shall be applied immediately behind the screeding operation. The entire top portion of the concrete slab shall be covered with a uniform film of the barrier material. The rate of application and the means of application shall be in accordance with the manufacturer’s recommendations. The Contractor shall submit the manufacturer's recommended application procedures to the Engineer at least 7 days prior to the placement. Acceptable evaporation barrier products will be listed on the plans.

3. Concrete in Adjacent Slabs.

Where concrete is placed adjacent to a previously placed concrete pavement, the previously placed pavement shall have attained a compressive strength of at least 3000 psi as determined by tests of standard specimens cured under the same climatic and moisture conditions as the concrete pavement, unless other means of determining the compressive strength are allowed by the Engineer.

4. Vibrators.

Vibrators shall not come in contact with a joint assembly, the layer under the concrete or forms. Single unit vibrators shall be used along the side forms, joints, and at other locations not thoroughly vibrated by the vibrator assembly. In no case shall the vibrator be operated longer than 15 seconds in any one location. Carriage mounted vibrators shall be equipped to cut off automatically when the vibrator carriage stops. Vibration shall be completed ahead of the finishing machine screed.

(h) Expansion Joints.

Expansion joint assemblies shall be installed in proper sequence ahead of placement of concrete. Concrete shall be deposited as near to an expansion joint as possible without disturbing it.

(i) Placement of Steel.

Care shall be taken before and during paving operations to ensure that steel, including reinforcing steel, dowels and tie bars will stay within the plan tolerances after the finishing operations.

(j) Joints.

1. Establishing Location of Joints.

The Contractor shall be responsible for marking locations of joint steel in advance of placement of concrete so that sawed joints will be properly located over dowels and tie bars.

2. Sawing Concrete for Joint Construction.

All joints except expansion joints shall be prepared by sawing. Sawing shall be done with a concrete saw equipped with a guide frame or other approved device that will assure cutting of the joint within 1/4 of an inch of the designated alignment and to the required joint size shown on the plans. All vertical joints shall be constructed perpendicular to the pavement surface.

Because of the importance of sawing the joints at the proper location and at the proper time, early sawing is imperative.

All uncontrolled cracked pavement shall be removed and replaced in accordance with the details shown on the plans without additional compensation from the Department.

3. Types of Required Joints.

Joints shall be constructed of the type, dimensions, lengths, arrangement, spacing, and at the locations shown on the plan. A joint shall be a designed separation, formed by material extending full depth of the slab or a saw cut extending part way through the slab.

A contraction joint is a transverse joint located at regular intervals in a slab to control transverse cracking or at other designated sites to control longitudinal cracking.

An expansion joint is one providing space for expansion of the slab without damage. For clarity, all expansion joints, including those in intersections at any angle, are regarded as transverse joints.

A construction joint is one made necessary by interruption of more than 30 minutes in continuous placing of concrete, including a transverse joint placed at the end of a day's operation or at the point of a breakdown, or a longitudinal joint where adjacent lanes are constructed at different times.

Longitudinal joints shall be constructed coincident with or parallel to the pavement centerline. Transverse joints shall be constructed as shown on the plans.

4. Tie Bars for Longitudinal Joints.

a. Tie Bar Location and Strength.

Deformed steel tie bars shall be placed perpendicular across the longitudinal joints at the location and at the spacing shown on the plans. The required strength of the tie bars will be shown on the plans.

b. Tie Bars in Fixed Forms.

When using the fixed form method, the use of a keyway with a sectional tie bar or a straight tie bar bent against the form of the first slab constructed is acceptable.

c. Tie Bars in Slip Form Paving.

When using the slip-form method, the tie bars shall be inserted in the fresh concrete or anchored in appropriately sized holes drilled into the previously placed pavement.

Drilled holes shall not be greater than 1/8 inch larger than the diameter of the tie bar. Drilling of holes will not be allowed until the concrete has obtained a compressive strength of 2500 psi or is seven days old. Tie bars shall be anchored in the drilled holes with an approved adhesive material meeting the requirements given in Article 870.04.

Tie bars shall meet a 7200-pound, minimum, pull-out requirement. The Department will perform the pull-out tests in accordance with ALDOT-366, "Test Method for Pull Out on Steel Tie Bars Secured in Concrete with Epoxy". The Contractor shall supply the equipment necessary to perform the pull-out test. The equipment shall be suitable for the performance of the tests at the frequency specified in Section 450 of the Acceptance Sampling and Testing Schedule of the Testing Manual. There will be no direct payment for the pull-out test equipment furnished by the Contractor for use by the Department.

5. Weakened Plane Joint for Adjacent Lanes Constructed Simultaneously.

A weakened plane joint shall be constructed by sawing the concrete when adjacent lanes of pavement are constructed at the same time by the simultaneous placement of concrete. The requirements for the size and sealing of the weakened plane joint are shown on the plans. The joint shall be sealed with an approved joint sealer.

6. Dowel Bars for Transverse Joints.

Dowel bars shall be installed as shown on the plans. The dowel bars shall be installed with a supporting assembly capable of rigidly maintaining the dowel bars in the proper horizontal and vertical alignment during and after the concrete placing and finishing operations.

Dowel bars shall have the ends ground or dressed to eliminate any projections due to cutting operations.

Dowel bars at expansion joints shall have a cap or sleeve over the expansion length (length embedded in one slab) of each bar with one end of the sleeve fitting tightly around the bar and the other end closed and watertight. The cap or sleeve shall be provided with an expansion space not less than the width of the joint being constructed.

7. Transverse Expansion Joints.

The transverse expansion joints shall be constructed in accordance with the details shown on the plans. Dowels and supports shall be assembled off the underlying layer and shall be placed into position as a unit.

8. Transverse Contraction Joints.

Transverse contraction joints shall consist of planes of weakness created by sawing grooves in the surface of the pavement in accordance with the details shown on the plans. All contraction joints shall be sealed as shown on the plans.

9. Transverse Construction Joints.

Transverse construction joints shall be constructed when there is an interruption of more than 30 minutes in the concreting operations. A transverse construction joint shall not be constructed within 10 feet of an expansion or contraction joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, the excess concrete shall be removed back to the last preceding joint.

The construction joint shall be formed by placing the concrete against a header board set so as to form a joint at right angles to the pavement centerline vertically and horizontally. The board shall be shaped to the cross slope of the pavement and shall be sufficiently rigid to prevent bending or movement during finishing operations.

Grinding, in accordance with Item 450.04(b)2, will be allowed for a distance of 25 feet either side of the construction joint or header that is placed when the paving operation ends each day regardless of the type of aggregate used in the concrete mix design.

(k) Surface Smoothness and Cross Slope.

1. Measurement of Surface Smoothness and Cross Slope,

Surface smoothness shall be checked by the use of straightedges, levels and strings. The Contractor shall furnish levels, straightedges, string, and the personnel to make and record measurements as directed by the Engineer.

2. Surface Smoothness.

Surface smoothness tests shall be made continuously during and after concrete placement so that irregularities may be reduced while the concrete is still workable.

The finished surface shall not vary more than 1/4 of an inch from a 12-foot straightedge placed perpendicular (at a right angle) to the centerline of the roadway anywhere on the surface.

The surface shall not vary more than 1/4 of an inch from a 16-foot straightedge placed parallel to the centerline anywhere on the surface.

The finished surface shall not vary more than 3/8 of an inch in any 25-foot section from a taut string applied parallel to the surface. The surface shall be checked one foot inside of the edges of pavement, at the centerline, and at other points designated by the Engineer. The tolerance from the designated grade shall not exceed plus or minus 1/2 of an inch in 100 feet.

3. Cross Slope.

The required cross slope shall not vary by more than 0.20% from the required slope in any 12-foot distance over which the slope is measured. (If, for example, a 2.0% slope is required, the measured cross slope shall not be greater than 2.2% or less than 1.8%.)

Pavement that is not within the required cross slope tolerance shall be replaced in accordance with the details shown on the plans without extra compensation.

(l) Finishing.

1. Sequence of Finishing Requirements.

After the concrete has been placed, consolidated, and struck off, the finishing, floating, surface corrections, texturing, and edging shall be performed.

2. Transverse Finishing.

A finishing machine shall be used to screed the surface of the concrete to a uniform texture and to the required grade and cross slope.

3. Float Finish.

After transverse finishing, further finishing shall be performed by the means of a float.

4. Preliminary Straightedging and Surface Correction.

After the finishing has been completed and the excess water removed, but while the concrete is still workable, the surface of the concrete shall be tested by the Contractor with an accurate 16-foot floating straightedge.

Depressions in the surface shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. The surface across joints shall meet the requirements for smoothness. Straightedge testing and surface correction shall continue until the entire surface is found to conform to the straightedge and the slab conforms to the required grade and cross slope.

5. Surface Texture.

The pavement surface shall be finished with a burlap drag. The burlap drag finish shall consist of dragging longitudinally along the full width of the pavement with a seamless strip of damp burlap or cotton fabric which will produce a gritty texture. The drag shall be maintained in such condition that the resultant surface is of uniform appearance. Drags shall be maintained clean and free from encrusted mortar. Drags which cannot be cleaned shall be discarded.

Immediately after the pavement has been finished by the burlap drag, the surface shall be transversely grooved. Transverse grooving shall be produced by mechanical equipment designed for grooving plastic concrete utilizing rectangular shaped spring steel tines of uniform length that will produce clean cut transverse grooves in the hardened surface. The tines shall be spaced at intervals of at least 3/8 of an inch apart up to a maximum spacing of ½ of an inch. The tines shall produce grooves in the hardened surface which are from 0.080 to 0.130 of an inch in width and from 0.125 to 0.188 of an inch in depth.

The completed transversely grooved surface finish shall meet the groove depth requirements given in ALDOT-248, "Method of Test for Measuring the Depth of Grooves in Concrete Pavements and Bridge Decks with a Tire Tread Depth Gauge", and all straightedge requirements. Any grooved surface damaged or destroyed may be restored if the concrete is still plastic; otherwise, it shall be regrooved after the concrete has obtained its designed strength. Grooving after the concrete has hardened shall be done by equipment designed specifically for grooving pavements.

(m) Curing.

1. Duration of Curing.

Immediately after the finishing operations have been completed and as soon as marring of concrete will not occur, the entire pavement surface shall be cured for a minimum period of 72 hours.

2. Optional Curing Methods.

The Contractor shall cure the concrete by either placing an impervious membrane or by moist curing. The curing method chosen by the Contractor shall be sufficient to prevent plastic shrinkage cracking.

a. Curing by Using an Impervious Membrane.

The impervious membrane shall meet the requirements given in Section 830.

The impervious membrane material shall be applied in accordance with the requirements given in Section 830 except that the rate of application shall be a minimum of 1 gallon per 100 square feet of surface area or a greater rate if recommended by the manufacturer. The impervious membrane material shall be applied under pressure by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be thoroughly mixed. During application, the compound shall be stirred continuously by mechanical methods. Hand spraying of areas of irregular widths or shapes and on surfaces exposed by form removal will be permitted. When hand spraying is used the membrane material shall be applied in two applications.

The impervious membrane shall not be applied to the inside faces of joints to be sealed.

b. Moist Curing

Moist curing shall be either by fog spraying or by saturated burlap or burlap sheeting in accordance with the following.

1. Fog Spraying:

Fog spraying shall be done with nozzles or sprinklers designed for this purpose. When using this method, the Contractor shall maintain a complete and continuous moist condition of the concrete surface. Intermittent fog spraying is not acceptable. Care shall be taken that erosion of the surface does not occur.

2. Burlap or Burlap Sheeting:

Saturated burlap or saturated white-burlap-polyethylene sheeting may be used for curing. The burlap and white-burlap-polyethylene sheeting shall be furnished in accordance with the requirements given in Section 830. These curing materials shall be clean and free from any injurious substances that can cause deleterious effects to the concrete or cause discoloration. The burlap and burlap sheeting shall be completely saturated before being placed on the concrete and shall be maintained in that condition for the entire curing period. All edges of burlap and burlap sheeting shall extend at least 18 inches beyond the concrete surface. Where two individual sheets join, their edges shall overlap at least 12 inches. All edges and overlaps shall be secured to ensure that the concrete surface is completely covered during the entire curing period. The burlap material shall be kept in contact with the concrete surface at all times. Alternate cycles of wetting and drying will not be allowed.

(n) Sealing Joints.

Before the pavement is opened to traffic, and as early as is feasible, all joints, both longitudinal and transverse, shall be filled with joint sealing material of a type specified by the plans. The joint faces shall be clean and surface dry when the seal is applied. Suitable tools for installing the seal to the proper depth and dimensions shall be used. The joints to be sealed with Hot Poured Sealants or Cold Poured Sealants shall be sealed as outlined in Section 454. Preformed Elastomeric Joint Seals shall be installed in accordance with the manufactured recommendations and the details shown on the plans.

(o) Removal of Forms.

Forms shall not be removed from freshly placed concrete until it has set for at least 12 hours, except auxiliary forms used temporarily in widened areas. They shall be removed carefully so as to avoid damage to the pavement. After the forms have been removed, the ends of all joints shall be cleaned, after which the sides of the slab shall be covered with earth or other approved curing agent.

As soon as the side forms have been removed, any defective work shall be removed and replaced in accordance with the details shown on the plans. Any area or section so removed shall be not less than 10 feet in length and not less than the full width of the lane involved. If the area to be removed extends to a point less than 10 feet {3 m} from a joint, it shall be extended on to the joint.

(p) Reinforced Bridge End Slabs.

Special pavement slabs, reinforced as shown on the plans, shall be constructed adjacent to bridges using concrete of the same type and proportions that are in the adjoining concrete pavement. No direct payment will be made for reinforcing steel used in the bridge end slabs.

The end slabs shall be constructed in the same manner required for the construction of concrete pavement. Where the bridge end slab will be covered with a bituminous overlay, the final screeding of the surface of the concrete shall be done by any means that will leave a slightly roughened surface. Where the bridge end slab will not have a bituminous overlay, the final screeding of the surface of the concrete shall be done with a mechanical longitudinal screed and the hardened surface of the concrete shall be machine grooved in accordance with the requirements given for grooving the surface of concrete bridge decks.

(q) Protection of Pavement.

The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. Any material deposited on the pavement considered detrimental to the surface shall be removed immediately. This requirement shall include erection and maintenance of warning signs, lights, watchmen to direct traffic, pavement bridges, or crossovers, etc., as needed or directed by the Engineer.

(r) Opening Pavement to Traffic.

The Contractor shall protect the concrete pavement from vehicular traffic during the curing period. Completed portions of the concrete pavement may be opened to light construction traffic only (small pick-up trucks with four wheels and cars) when the compressive strength of the concrete pavement reaches 3000 psi but not earlier than 72 hours. Traffic shall not be parked on the pavement during the curing period and any curing compound and/or moisture removed by the traffic tires shall be replaced immediately.

The Contractor may utilize "Maturity Meter" measurements for the determination of the compressive strength of the concrete. The compressive strength required for opening the pavement to traffic shall be determined by tests of standard concrete cylinders cured under the same climatic and moisture conditions as the slab unless maturity meters are used.

The pavement may be opened to unrestricted traffic after 7 days if the 28-day compressive strength has been achieved and the Engineer has accepted the pavement without restriction.

If the ambient temperature drops below 40 ºF, the period of time that the temperature is below 40 ºF will be added to the minimum time to opening. Any part of the pavement damaged by traffic or other causes prior to its final acceptance shall be repaired or replaced at no additional cost to the Department in a manner acceptable to the Engineer.

450.04 Smoothness Requirements.

(a) Testing Device.

1. Description.

The testing device shall be an inertial profiler that satisfies the requirements of ALDOT-448, “Evaluating Pavement Profiles,” including the portable storage device(s) referenced herein. Portable storage devices containing profile measurements shall become the property of the Department at the time the measurements are taken.

b. Equipment Requirements.

The inertial profiler shall be a certified, non-contact, laser-based device capable of simultaneously measuring both wheel paths meeting all the requirements of ALDOT-448.

Portable storage device(s) for the inertial profiler shall be furnished in sufficient quantities for all calibration, test runs, and actual tests deemed necessary by the Engineer. Unless approved in advance by the Engineer, all portable storage devices provided by the Contractor will take the form of commonly available 2G USB flash drives.

(b) Testing Procedure.

1. Description.

Smoothness testing shall be conducted in accordance with the requirements given in ALDOT 448. The Contractor shall furnish the necessary certified personnel to operate the inertial profiler.

The smoothness test shall be performed as soon as practical after the pavement hardens sufficiently to prevent damage to the surface finish but no later than the next work day after placement of the concrete, unless otherwise authorized by the Engineer.

The smoothness test is considered a part of the paving operation and will be performed immediately in the proper sequence, in a satisfactory manner, even to the exclusion of other work.

Smoothness testing shall be performed and reported daily until the contractor demonstrates the ability to achieve a Mean Roughness Index (MRI) value of less than 65 in/mile. If the Contractor demonstrates the ability to achieve a MRI value of less than 65 in/mile then the Contractor may elect to perform and report the smoothness testing at a frequency he determines but not to exceed 5 working days production.

2. Smoothness Requirements.

The results of the inertial profiler tests will be evaluated by Department personnel as outlined in ALDOT-448.

If a Mean Roughness Index (MRI) value of 120 inches per mile {2.0 m/km} is exceeded in any test section of any daily paving operation, the paving operation will be suspended as soon as possible after results of the unacceptable test section are obtained. The paving will not be allowed to resume until corrective action is taken by the Contractor.

The contractor will be allowed to diamond grind and groove any test section whose Mean Roughness Index exceeds 65 inches per mile; except when the concrete mix design uses more than 50 percent carbonate stone. All diamond grinding and grooving shall be performed with no additional compensation from the Department. Diamond grinding may be separate locations of grinding or continuous grinding within a test section. Diamond grinding at any location shall be for the full width of the pavement test section.

Diamond grinding & grooving equipment, including such required to remove slurry and residue, shall meet the requirements of Section 455.

The grinding process shall produce a pavement surface that is true to grade and uniform in appearance with a longitudinal line type texture. Said line type texture shall consist of parallel longitudinal corrugations of between 50 and 60 evenly spaced grooves per foot {300 mm} with the ridges approximately 1/32 of an inch {1 mm} higher than the bottom of the grooves. The Contractor shall select an appropriate number of blades per foot, dependent upon the coarse aggregate used in the concrete pavement mixture. For concrete containing harder coarse aggregate, including granite, quartzite, sandstone and gravel, 55-60 blades per foot shall be used.

Joints and cracks shall be visually inspected to ensure that adjacent surfaces are in the same plane. Misalignment of the surface planes of adjacent sides of joints or cracks which is in excess of 1/16 of an inch {2 mm} shall be ground until the surfaces are flush.

The transverse slope of the ground pavement shall be uniform to a degree that no depressions or misalignment of slope greater than 1/4 of an inch {6 mm} in 12 feet {3.5 m} are present when tested with a 12 foot {3.5 m} straightedge placed perpendicular to the pavement centerline. Straightedge requirements do not apply outside of the ground areas.

The Contractor shall also longitudinally diamond groove any section of pavement that has been diamond ground. Grooves shall be approximately 1/8 inch {3 mm} wide and 1/8 inch {3 mm} deep, and constructed on 3/4 in {19 mm}, ±1/16 in {1.5 mm}, center-to-center spacing parallel to the centerline of the roadway. Grooves shall not be cut closer than 6 inches {150 mm} to any adjacent joint, nor shall they overlap. If diamond grinding is performed the measurement of pavement thickness for acceptance and payment will be made after diamond grinding is completed. The determination of the pavement thickness will be by coring a location determined by the Engineer using ALDOT-210. The Contractor will be responsible for cost of

coring and repairing the core hole. All voids resulting from coring operations shall be filled and consolidated with the same concrete mixture used during paving. Voids shall be filled on the same day that the cores are extracted using the same concrete mixture used for paving. Price adjustments will be made for smoothness after the diamond grinding is completed. All test sections of pavement where the Mean Roughness Index remains greater than 120 inches per mile shall be removed and replaced (in accordance with the details shown on the plans) by the Contractor without additional compensation.

The price adjustments for smoothness are given in Subarticle 450.08(b).

450.05 Tolerance in Pavement Thickness.

Pavement (main roadway, shoulders, intersections, entrances, crossovers, ramps, etc.) thicknesses will be checked by the Department for compliance with required thickness by measuring the length of cores or by the use of MIT Scan T2 device. Pavement with deficient thickness will be paid for on an adjusted unit price as described in Subarticle 450.08(b). Thickness measurements shall be made after all operations, if applicable, have been performed to improve smoothness.

Pavement that is deficient from the required thickness by more than 0.75 inches shall be replaced in accordance with the details shown on the plans at no cost to the Department.

450.06 Acceptance of Concrete Based on Compressive Strength.

Concrete cylinders, 6 inches x 12 inches in size, will be made by the Department from randomly selected concrete batches in each lot as designated by the Engineer.

The compressive strength shall be the average of two cylinder test results. If the average compressive strength of the cylinders is equal to or greater than 100 % of the required 28-day compressive strength, the concrete will be accepted with no price reduction.

If the average compressive strength of the cylinders is less than 100% of the required 28-day compressive strength, the Department may conduct a coring investigation in accordance with ALDOT-457 to determine the equivalent average 28-day in-place strength of the lot represented by the cylinders in question.

If the equivalent average 28-day compressive strength of the cores is equal to or greater than 90% of the specified 28-day compressive strength, the lot will be accepted with no price adjustment.

If the equivalent average 28-day compressive strength of the cores is less than 90% but greater than or equal to 75% of the specified 28-day compressive strength, the lot will be accepted with a price reduction, as defined in Subarticle 450.08(b).

If the equivalent average 28-day compressive strength of the cores is less than 75% of the specified 28-day compressive strength, the lot shall be removed and replaced in accordance with the details shown on the plans without additional compensation.

450.07 Method of Measurement.

The amount of concrete pavement to be paid for under this section shall be the number of square yards {square meters} of pavement completed and accepted, measured in place and calculated to the nearest square yard {square meter}. The width will be the width of the pavement shown on the typical cross section of the plans plus additional widening where called for or directed by the Engineer in writing. The width will be the outside to outside measurement of the pavement including any area covered by integral curb or concrete median strip. The length will be measured along the surface of the centerline.

Reinforced concrete bridge end slabs will be measured in square yards {square meters} and will be paid for separately.

The number of inertial profilers measured for payment will be the actual number of units ordered and accepted.

450.08 Basis of Payment, Price Adjustments and Pavement Replacement.

(a) General.

The square yardage {square meters} of concrete pavement and bridge end slab, measured as provided above, will be paid for at the contract unit price bid per square yard {square meter}, which payment shall be full compensation for furnishing and placing all materials, including any reinforcing steel and supports, anchor concrete, sleeper slab concrete, structural steel (except bridge joint

armor plates), dowels, and all other joint material, any additives, and for all materials, equipment, tools, labor, and incidentals required to complete the work (including the finishing, grooving, or tining of the surface).

No additional payment over the contract unit bid price will be made for any pavement which has an average thickness in excess of that shown on the plans.

Integral curb, measured as provided above, will be paid for at the contract unit price per linear foot {meter} which shall be payment in full for all materials and work required in completing the item.

The ordered and accepted inertial profilers, measured as noted above, will be paid for at the contract unit price bid which shall be full compensation for furnishing the unit and includes all equipment, tools, labor, calibration, maintenance, services, supplies, chart paper, and incidentals necessary to complete these items of work.

(b) Price Adjustments and Deficiencies requiring Pavement Replacement.

1. General.

The descriptions of "mainline lot and non-mainline lot" are given in 450.02(h)2 and 450.02(h)3 respectively.

Mainline lots will be designated for acceptance and payment based on smoothness, concrete strength, and pavement thickness. Non-mainline lots will be designated for acceptance and payment based on concrete strength and pavement thickness.

2. Price Adjustment based on Smoothness.

The Mean Roughness Index shall be measured as noted in Subarticle 450.04(b).

When the MRI is more than 65 inches per mile {1.0 m/km}, per section, a unit price reduction will be assessed. When the MRI is less than 40 inches per mile {0.6 m/km} per section, a unit price increase will be added. The price adjustments are given in Table 1.

TABLE I	
Mean Roughness Index Inches/Mile/Section {meters/Kilometer/Section}	Contract Price Adjustment Percent of Pavement Unit Bid Price
Under 40 {Under 0.6}	105 – (MRI / 8) {105 – (MRI / 0.12)}
40 to less than 65 {0.6 to less than 1.0}	100
65 thru 120 {1.0 thru 2.0}	100 – [(MRI – 65)/2.75] {100 – [(MRI – 1.0)/0.05]}
Over 120 {Over 2.0}	Unacceptable

Where diamond grinding is performed to bring the Mean Roughness Index to 65 inches per mile or less, payment for the test section will be a maximum of 100 % of the contract price.

3. Price Adjustment based on Pavement Thickness.

Where the thickness of pavement, measured as described in Article 450.05, is deficient from the required thickness, payment will be made at an adjusted price as shown in the following table.

PRICE ADJUSTMENT FOR DEFICIENCY IN PAVEMENT THICKNESS	
Deficiency in Pavement Thickness	Price Adjustment
Greater than 0.00" to less than or equal to 0.10"	100 %
Greater than 0.10" to less than or equal to 0.25"	90 %
Greater than 0.25" to less than or equal to 0.40"	80 %
Greater than 0.40" to less than or equal to 0.55"	70 %
Greater than 0.55" to less than or equal to 0.75"	60 %
Greater than 0.75"	Replace Lot

4. Price Adjustment based on Compressive Strength.

Payment for concrete pavement will be adjusted based on compressive strength as described in Article 450.06.

If the average equivalent 28-day compressive strength of the cores is 85% or greater but less than 90% of the specified 28-day compressive strength, the lot will be accepted with an 85% price adjustment.

If the average equivalent 28-day strength of the cores is 75% or greater but less than 85% of the specified 28-day strength, and the Engineer deems the concrete to be structurally acceptable, the lot will be accepted with a 50% price adjustment.

5. Range of Price Adjustments and Assessment of Combined Price Adjustments.

The range of price adjustment based on smoothness is 105 % to 80 %.

The range of price adjustment based on pavement thickness is 100 % to 60 %.

The range of price adjustment based on compressive strength shall be 100 % to 50 %.

If more than one price adjustment is required, the product of the price adjustments (percentage price adjustments multiplied together) will be applied to the contract price for the pavement.

6. Deficiencies Requiring Pavement Replacement.

The pavement shall be removed and replaced without extra compensation if the following price adjustments occur:

- The Mean Roughness Index is greater than 120 inches per mile per section;
- The deficiency in pavement thickness exceeds 0.75 inches;
- The equivalent average 28-day compressive strength is less than 75% of the required compressive strength;
- The product of the price adjustments for pavement thickness and compressive strength in the pavement is less than 50 %.

Other conditions of deficiency may result in a requirement that the pavement must be removed and replaced without additional compensation.

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

450-A __*__ Cement Concrete Pavement, ___ inches {mm} Thick – per square yard {square meter}
450-B Reinforced Cement Concrete Bridge End Slab - per square yard {square meter}
450-C Integral Curb - per linear foot {meter}
450-H Smoothness Testing – Certified Inertial Profiler – per Each