SECTION 32 13 13
CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SCOPE

A This work shall consist of furnishing and constructing a jointed Portland cement concrete pavement, concrete base course or concrete shoulder, with or without reinforcement, as shown on the plans or as directed by the Engineer. The work also includes curbs, curb and gutter, and integral curb and sidewalk. This work shall be done in accordance with 2026 Georgia Department of Transportation (GDOT) Standard Specifications for Construction, and as specified in the Standards of the County, City, or Township having jurisdictional authority, as well as the latest edition of Standard Specifications for Paving and Related Construction for Newton County, Department of Public Works. The types of concrete paving will be as classified in the current GDOT Standard Specifications for Construction.

1.2 GENERAL

A Governing Standards

1. AASHTO (American Association of State Highway and Transportation Officials) M33 as Revised – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
2. AASHTO M213 as Revised – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).
3. AASHTO T26 as Revised – Standard Method of Test for Quality of Water to be Used in Concrete.
4. AASHTO T96 as Revised – Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
5. AASHTO T148 – Standard Method of Test for Measuring Length of Drilled Concrete Cores
6. ACI (American Concrete Institute) 301 – Specifications for Structural Concrete.
7. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
8. ASTM (American Society for Testing and Methods) A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
9. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
10. ASTM C31/C31M – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
11. ASTM C33 – Standard Specification for Concrete Aggregates.
12. ATM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C42/C42M – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
14. ASTM C94/C94M– Standard Specification for Ready-Mixed Concrete.
15. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
16. ASTM C143/C143M – Standard Test Method for Slump of Hydraulic-Cement Concrete.
17. ASTM C150 – Standard Specification for Portland Cement.

18. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
19. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
20. ASTM C174/C174M – Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.
21. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
22. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
23. ASTM C309– Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
24. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
25. ASTM C595 – Standard Specification for Blended Hydraulic Cements.
26. ASTM C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
27. ASTM D98 – Standard Specification for Calcium Chloride.
28. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).
29. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM E29 – Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

1.3 REFERENCE STANDARDS

A ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

B ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

C ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

D ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

E ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

F ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

G ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.4 QUALITY ASSURANCE

A Perform work in accordance with 2026 GDOT Standard Specifications for Construction and as specified in the standards of the County, City, and Township having jurisdiction as well as the Standard Specifications for Paving and Related Construction for Newton County, latest edition.

B Obtain cementitious materials from same source throughout.

C Testing

1. The Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT shall make cylinders for compressive strength tests as well as slump tests for consistency and tests for air content concurrently at the job site. These tests shall be made for all exposed concrete used in commercial driveways, building construction; concrete paving projects; repairs of

public streets, sidewalks, curbs, and driveways; new curbs, sidewalks, and driveways; and/or at such locations deemed necessary by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT for quality control of concrete placed on public property.

2. A minimum of one test for slump and one test for air content shall be taken for each 25 cubic yards (19.1 cu m), or portion thereof, of concrete placed. Should test results so dictate, the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT may order additional testing to assure quality concrete. Tests for entrained air and slump of concrete may also be made by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT when concrete is being placed.
3. Air content tests shall be in accordance with ASTM C231 or ASTM C173. The concrete, when deposited in the forms for pavements or curbs, shall contain 6 percent (plus or minus 1 percent) of entrained air.
4. The consistency of concrete mixes will be determined by the slump cone test as specified in the method of test for slump of Portland Cement Concrete ASTM C143.
5. The consistency of the concrete shall not exceed the limits listed below:
   a. Concrete for street pavement including base course and curbs shall have a maximum slump of 3 inches (7.6 cm).
   b. Concrete for sidewalks and driveway paving shall have a maximum slump of 5 inches (12.7 cm).
   c. For any single batch, slump tests of individual samples taken at approximately the one-quarter and the three-quarter points of the load shall differ by not more than 1 inch (2.5 cm).
6. Compression test specimens shall be prepared in accordance with ASTM C31 with 1 set of 4 standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
7. Compressive-strength tests shall follow ASTM C39 with 1 set for each day's pour exceeding 5 cubic yards (3.82 cu m) plus additional sets for each 50 cubic yards (38.2 cu m) more than the first 25 cubic yards (19.1 cu m) of each concrete class placed in any 1 day. Test 1 specimen at 7 days, 2 specimens at 28 days, and hold 1 specimen in reserve for later testing if required.

1.5 SUBMITTALS

A The following submittals shall be provided in accordance with Section 01 33 23:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up

specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B Mix Design
1. Submit certification that concrete mix conforms to specified MDOT mixes. Submit three copies of the mix design for approval for all non-MDOT concrete mixes.

C Product Data
1. Submit data on joint filler, admixtures, and curing compounds.

1.6 DELIVERY, STORAGE, AND HANDLING

A Concrete materials shall be so furnished, handled, and stored as to preclude inclusion of foreign matter and permit easy access for inspection. Storage facilities shall be sufficient and so stocked and maintained as to assure concrete placement at the required rate without damaging delays. Handling methods and storage facilities shall be subject to the approval of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.

B Cement shall be so handled and stored as to be protected from the weather, dampness, and contamination. Cement shall be used in the same relative order as received. Cement salvaged or reclaimed from cleaning sacks, leaking containers, or discarded sacks shall not be used. Any cement which, for any reason, has become partially set, contains lumps of caked cement, or is in any way contaminated shall be rejected and shall be promptly removed from the site.

C Aggregates shall be so furnished, handled, and stored as to insure uniformity of the specified grading at the time of batching, and that the moisture content will be reasonably constant for each day's run. Aggregate requiring pre-washing shall not be used until the surplus water has disappeared and the material has a uniform and acceptable water content.

D Fine and coarse aggregates, aggregates from different sources, and various classes of coarse aggregates shall be separately stored.

PART 2 - PRODUCTS

2.1 MATERIALS

A General
1. Concrete shall be composed of a mixture of Portland cement, fine aggregate, coarse aggregate, fly ash, admixtures when specified, and water. The materials and methods used shall produce a dense, homogenous impervious, durable, and workable concrete of the highest quality and without defects of any kind.
2. The materials shall meet the requirements specified in the MDOT Standard Specifications for Construction unless otherwise indicated on the drawings.
3. For instances where an MDOT mix is not specified, provide concrete as follows unless indicated otherwise on the Drawings: Grade "A" concrete shall be used throughout the work except that Grade "C" concrete may be used for backfills, unless stronger concrete is called for on the plans.
4. Grade "A" concrete shall have a minimum compressive strength of 4,000 psi (27,579 kPa) at 28 days and shall contain not less than 6 ½ sacks of cement per cubic yard (8 ½ sacks of cement per cubic meter) of concrete. Grade "C" concrete shall have not less than 3 sacks of cement per cubic yard (4 sacks of cement per cubic meter) of concrete.

B Water

1. Water used in concrete or mortar mixtures or for curing concrete shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product. Owner furnished potable water may be used without testing.
2. For water requiring testing, the tests will be conducted in accordance with AASHTO T26. Water from sources other than City tap water shall meet the following requirements:
    a. Total solid matter, max
        1) 0.03%
    b. Organic matter, max
        1) 0.05%
    c. Alkalinity – Acidity
        1) Natural to litmus
3. Water failing to meet these requirements may be approved for use if, when comparative tests are made between the proposed water and distilled water, using an approved cement, there is no indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in mortar compressive strength.
4. The water intake shall provide for the exclusion of silt, mud, grass, or other foreign materials.

C Cement

1. Cement for pavement, base course, curbs, sidewalk, and shoulder, as called for on Plans or as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT shall be “Portland Cement” conforming to the respective requirements of the applicable ASTM specifications listed below. Cement of only one kind and type shall be used throughout the work and it shall be a standard brand of a single producer, unless otherwise specifically authorized by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
    a. Portland Cement Types I, IA, III, and IIIA shall conform to ASTM C150. The requirements for Gillmore Setting Time Test and compressive strength through the 28 day test shall apply.
    b. Portland Cement Types IS and IS-A Blast-Furnace Slag shall conform to ASTM C595.

D Fine Aggregate (Sand)

1. Fine aggregate shall be natural sand consisting of fine granular material resulting from the natural disintegration of rock or manufactured sand or a combination thereof. The sand shall consist of clean, sound, durable particles free from any adherent coating, clay lumps, or other deleterious substances, and at the time of use shall be entirely free of frozen material. Fine aggregate shall conform to the requirements of the current MDOT Standard Specifications for fine aggregates for Portland cement concrete, natural sand, Type 2NS.

E Coarse Aggregate

1. Coarse aggregate shall consist of gravel, stone or slag all of which shall conform to the current MDOT Specifications for Type 6AA. Coarse aggregate shall be used in all concrete permanently exposed to the weather.

F Admixtures

1. Admixtures include all materials other than water, aggregates, and Portland Cement that are used in the making of concrete and that are added to the batch immediately before or during the mixing.
2. Admixtures, other than Air-Entraining admixture conforming to the requirements of ASTM C260, shall not be used in the concrete without the prior written approval of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
3. Admixtures that may be used with written approval of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT are Calcium Chloride per ASTM D8, Type 1 regular flake and water reducing admixtures ASTM C494 Type A and Type D.

G Joint Materials

1. Filler for expansion joins shall be pre-molded bituminous, ASTM D1751. Filler for contraction joints shall be bituminous joint filler, AASHTO M33. Filler for curb expansion and contraction joints shall be pre-molded bituminous, ASTM D1751 or AASHTO M213 Type III.
2. Poured joint filler shall be hot-poured rubber-type compound.

H Forms

1. Pavement and curb forms shall be straight and free from distortion, and of sufficient strength to resist forces applied during the process of placing concrete against them. The forms shall be of an approved section, with a flat surface on top, and shall be of the full depth of the pavement or curb.
2. Forms for radius corners shall be steel or thin board, accurately formed to true radius, and held by bracing and stakes to maintain a true curve.

I Fill Materials

1. Earth materials excavated under this Contract, to be suitable for backfill behind the curb or integral curb and sidewalk, the filling of low places in a strip 2 feet (61.0 cm) wide and paralleling the constructed curb, and integral curb and sidewalk shall be a type that may be thoroughly compacted by the method specified. Such material, to be useable, shall be free from rubbish or debris, vegetable matter, large stones, concrete fragments or other road material, lumber, tree roots, or branches. In general, select excavated material to be suitable for backfill shall be restricted to sand or crumbly clay, unless indicated otherwise.

2.2 PROPORTIONING

A Design Mixture

1. The mixing proportions (approximately 1:2:3 mix) and water-cement ratio used shall be such as to produce a dense, homogenous, workable, and durable concrete having a minimum compressive strength of 4,000 psi (27,579 kPa) at 28 days, unless indicated otherwise on the Drawings.
2. The concrete mix design to produce a concrete of the required minimum strength shall be the sole responsibility of the Contractor, except that no less than 6 ½ sacks of cement per cubic yard (8 ½ sacks of cement per cubic meter) shall be used and the mixing water shall not be more than 5 ½ gallons (20.8 liters) per sack of cement, including the surface moisture carried by the aggregates, both fine and coarse. The maximum allowable slump shall be that consistent with the proper placement of the mix, but in no case shall the water content exceed that specified. The Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT will check the Contractor-DO NOT USE!!! Use "Contractor's Spec Term"

GT's proposed concrete design mix. Mixes which do not produce concrete of required quality shall be adjusted, at the Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT's sole expense, until all the requirements of these specifications are complied with.

3. The Grade of concrete to be used in the various parts of the work shall be as stipulated below, unless otherwise called for on the Plans.
    a. Grade "A" Use
        1) Concrete Pavement
        2) Curbs
        3) Commercial Drives
        4) Pavement Base
        5) Residential Drives
        6) Sidewalks
    b. Grade "C" Use
        1) Backfill where Called for on Plans
        2) As Directed by the Engineer
4. Grade "A" concrete may be used in the place of Grade "C" concrete, without additional cost to the Owner.
5. High-Early-Strength Concrete installation and mix design shall be subject to the approval of the Engineer for each location shown on the Plans, or as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.

PART 3 - EXECUTION

3.1 INSPECTION

A Verify compacted subgrade or granular base as applicable is acceptable and ready to support paving, curbs, curb and gutter, integral curb and sidewalk, and imposed loads.

B Verify gradients and elevations of subgrade or base are correct.

3.2 PREPARATION

A Prepare subgrade or base in accordance with the MDOT Standard Specifications for Construction unless indicated otherwise on the drawings. Replace unsuitable subgrade soils with approved suitable materials. Moisten base to minimize absorption of water from fresh concrete.

B Coat surfaces of manhole, catch basin, and other metal frames and covers with oil to prevent bond with concrete pavement.

C Notify Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT a minimum of 24 hours prior to commencement of concreting operations.

D Forming

1. Place a secure forms to correct location, dimension, profile, and gradient. Forms shall be adequately staked and braced to resist the pressure of the concrete. All forms shall be thoroughly cleaned and oiled before concrete is placed against them.
2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
3. Place joint filler vertically in position, in straight lines. Secure to formwork during concrete placement.

3.3 INSTALLATION

A Batching, Mixing, and Transporting Concrete

1. Ready-mixed concrete from an approved source shall be used unless on-the-site mixing is authorized by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. The plan and transportation equipment and the methods used for producing and delivering the ready-mixed concrete shall conform to the current ASTM Standard C94 except as otherwise modified or specified herein.
2. The plant and transportation equipment of the ready-mix concrete source shall be available for assignment to this work and shall be of adequate size and sufficient capacity to maintain a satisfactory job progress schedule. Concrete materials shall be stocked in such quantities as required to meet maximum demands.
3. A "Transit Mix Concrete Producer's Certificate," furnished by the City Engineering Department, shall be used in lieu of the certification called for in ASTM C94. Such certificate, completely filled out and signed by an authorized agent of the producer, shall accompany each truck load of ready-mix concrete and be presented to the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT or Inspector prior to unloading at the site as a condition for the use of concrete in the work. The person signing shall be one who has previously been officially designated by the producer as authorized agent and whose signature is currently on file with the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT for Owner - DO NOT USE!!! Use "Owner's Spec Term" GT.
4. The Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT's determination of "Failure to Meet Strength Requirements" of ASTM C94, shall be final and conclusive upon the Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT. Such determination will be based on tests and other factual data deemed pertinent by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
5. On-the-site batching and mixing equipment and methods, when authorized, shall be such that will produce concrete comparable in all respects to ready-mixed concrete meeting and specified requirements.

B Erection

1. Curbs of all types shall not have reinforcing steel extend through transverse expansion and contraction joints.

C Separate Type Curb Construction – Unreinforced and Reinforced Construction

1. The curbs shall be constructed in conformance with the types and details as specified on the plans. When steel reinforcement is called for on the plans, it shall be properly spaced and held in the correct position during the placing of concrete by the use of devices or methods meeting the approval of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
2. Splicing of steel reinforcement bars shall be accomplished by lapping and securely wiring the bars together. The bars shall be lapped at least 10 inches (25.4 cm), unless otherwise shown on the Plans.
3. The concrete shall be spaded sufficiently to eliminate all voids and tamped to bring the mortar to the surface.
4. Joints shall be constructed perpendicular to the surfaces of the structure and shall not vary more than ¼ inch (6.4 mm) from their designated positions.

5. Expansion joints in un-reinforced curb shall be 1 inch (2.54 cm) thickness, with curb size pre-molded bituminous fiber filler, shall be placed through the curb at the end of the street returns at 50 feet (15.2 m) intervals, or at such lesser distances when necessary to retain the 50 food (15.2 m) interval between existing expansion joints remaining.
6. Expansion joints in reinforced curb shall be 1 inch (2.54 cm) thickness, with curb size pre-molded bituminous fiber filler, shall be placed through the curb at the end of street returns and in line with all expansion joints in the abutting pavement.
7. The curb shall be constructed in uniform sections of a length not longer than 10 feet (3.1 m) except when otherwise shown on the plans. Provide separation joints at 10 food (3.1 m) intervals between expansion joints. Separation joints shall be formed by a steel template 1/8 inch (3.2 mm) in thickness, of a width equal to the required width of the curb, and depth of at least 2 inches (5.1 cm) greater than the required depth of the curb, set vertically within the forms and at right angles to the curb face. Finding of separate type curb shall be as specified for Reinforced Curb and Gutter.

D Reinforced Integral Curb and Gutter Construction

1. The reinforced integral curb and gutter shall conform to the cross-section shown on the plans. The reinforced integral curb and gutter shall be constructed to the grade shown on the Drawings, unless otherwise directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. Integral curb shall be constructed monolithic with the pavement slab. The curb material shall be placed before the pavement has started its initial set, and shall be of the same mix and be identical to the concrete in the pavement.
2. The curb and gutter forms shall be substantial and so placed and held as to be unyielding during the placing, compaction, and curing of the concrete.
3. The concrete shall be carefully placed to avoid segregation and shall be sufficiently spaded or vibrated to eliminate all voids and taped to bring the mortar to the surface.
4. The longitudinal bards called for on the plans shall be properly spaced and held in correct position during the placing of concrete by use of bar chairs, hangers, or other devices approved by the Engineer. Longitudinal bars shall end 2 inches (5.1 cm) from each expansion or contraction joint.
5. Splicing of steel reinforcement bars shall be accomplished by lapping and securely wiring the bars together. The bars shall be lapped at least 10 inches (25.4 cm).
6. Expansion joints of ½ inch (1.3 cm) thickness, with curb size pre-molded bituminous fiber filler shall be placed through the curb at 60 foot (18.1 m) intervals, or at such lesser distances when necessary to retain the 60 foot (18.1 m) intervals between existing expansion joints remaining.
7. The bottom of the pre-molded filler shall be set 1 ½ inches (3.8 cm) below the bottom of the pavement. The joint shall be free from concrete and the end of the joint cleaned of hardened concrete as soon as the forms are removed.
8. During installation, the joint shall be held in place by an approved installing device which shall be securely staked. The top edge of the filler shall be protected, while the concrete is being placed, by a metal channel cap of at least 10 gage (3.5 mm) thickness material having flanges not less than 1 ½ inches (3.8 cm) in depth. The channel cap shall be shaped to the contour of the pavement and shall extend over the filler from gutter line to edge of pavement. A pre-molded filler of the full depth, width, and cross-section of the

curbs shall be placed at the channel cap end and shall make a positive separation between curb and gutter sections.

9. Reinforced integral curb and gutter shall be constructed in uniform sections of a length not longer than 20 feet (6.1 m). Provide separation joints at 20 foot (6.1 m) intervals between expansion joints shall be formed by a steel template, 1/8 inch (3.2 mm) thickness, of a width equal to the required width of the curb and gutter and depth of at least 2 inches (5.1 cm) greater than the required depth of the curb, set vertically within the forms and at right angles to the curb face.
10. The edges and back top edge of the curb and all transverse joints and planes of weakness shall be rounded with an approved finishing tool having a radius of ¼ inch (6.4 mm). The face of the curb, at the top of all curb and at the bottom of the integral curb, shall be rounded with approved finishing tools having the radii shown on the plans. When the concrete has set sufficiently to prevent slumping the face form shall be removed and the exposed surfaces of the concrete curb or curb and gutter shall be finished smooth and even by means of a moistened wood float, followed by a light brushing, using either a broom, brush, or burlap. The top of curb shall not vary more than 3/16 inch in 10 feet (4.7 mm in 3.1 m) when checked with a 10 foot (3.1 m) straightedge. The balance of the exposed surfaces shall not vary more than 3.8 inch (9.5 mm) from the alignment and typical cross-section.
11. Water shall not be added to the concrete surface as an aside to finishing, except in isolated instances where a delay in finishing has occurred and evaporation has caused a loss of surface moisture. Water added in these instances shall be minimal and then only when approved by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
12. Honeycombed areas and minor defects shall be filled with mortar, prior to applying membrane curing compound. Use mortar conforming to Type R-2 per the MDOT Standard Specifications for Construction unless indicated otherwise on the drawings.

E Integral Curb and Sidewalk

1. Integral curb and sidewalk shall conform to the cross-section shown on the plans and shall be constructed in a similar manner to curbs specified herein. Sidewalk portion shall have a broomed finish.

F Road Pavement Joints

1. All transverse joints in the concrete pavement shall extend entirely through the integral curb. The edges of the transverse joint in the curb shall be rounded with an approved finishing tool having a radius of ¼ inch (6.4 mm).
2. Joints in the integral curb shall be sealed with Hot-Poured Rubber-Asphalt type compound as specified in the MDOT Standard Specifications for Construction.
3. Transverse contraction joints per MDOT Road Standard Plan shall be placed at the locations shown on the plans and elsewhere at maximum intervals of 25 feet (7.6 m) between expansion joints. The minimum distance between any load transfer joints shall be 12.5 feet (3.8 m).
4. Expansion joints per MDOT Road Standard Plan, and expansion joints with load transfer assemblies shall be placed at locations shown on the plans and at locations as follows:
   a. At the “spring lines” of street returns.

b. At the P.C. and P.T. of horizontal curves where the degree of curvature is 2 degrees 30 minutes or more. These joints may be omitted during the period from September 15th to April 15th, as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
c. Where necessary to relieve horizontal pressures at sharp vertical curves where shown on the plans or as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.
d. During the period from September 15th to April 15th, expansion joints shall be spaced at maximum intervals of 315 feet (96.0 m), this includes a full-width expansion joint for any portion of multiple-lane pavement placed during this period.
e. End-of-pour-joints shall be placed at the location of full width pavement and the start of non-reinforced temporary transition tapers as shown in MDOT Road Standard Plan, or as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.

G Concrete Base Course Joints

1. All joints shall conform to the details and position shown on the plans, with the following exceptions:
   a. Joints in Unreinforced Concrete Base Course:
      1) Sawed transverse contraction joints shall not be required.
   b. Joints in Reinforced Concrete Base Course:
      1) A load transfer unit shall not be required for transverse contraction joints. The pavement reinforcement shall be continuous through the joint.
   c. Joint Filler:
      1) Joints shall not be filled with poured joint filler. Pre-molded joint filler shall be placed with its top edge ½ inch (1.3 cm) below the pavement surface.

H Reinforcement

1. Pavement reinforcement shall be placed as specified in the MDOT Standard Specifications for Construction, except that adjacent sheets or mats shall be lapped approximately 1 foot (30.1 cm) and that pavement reinforcement shall stop 6 inches (15.2 cm) from all expansion or contraction joints.
2. On the outside of 13.5 foot (4.1 m) lanes, pavement reinforcement for a 12 foot (3.7 m) lane shall be used with no reinforcement for the outside 1.5 feet (45.7 cm) of pavement and curb.
3. Tie-bars shall be epoxy-coated. Damaged areas shall be repaired before placing concrete. Bent tie-bars shall be inspected after straightening, and any damaged epoxy coatings shall be repaired before embedment in concrete.
4. Expansion-anchored lane-ties shall be of the size and spacing shown on plans. They shall be either the self-drilling flush type, pre-drilled flush type, or the pre-drilled torque type. Expansion-anchored lane-ties shall replace broken bent lane tie-bars in longitudinal bulkhead joints at the Contractor’s expense.
5. Load transfer assemblies used in 13.5 foot (4.1 m) lane widths shall be 11.5 feet (3.5 m) long. They shall be placed in the inside 12 feet (3.6 m) of the outside curb lane.

I Placement

1. The concrete shall be distributed or spread as soon as placed. The concrete shall be deposited on the subgrade in such a manner as to require as little re-handling as possible. Any additional spreading required shall be done by means of shovels. The method and manner of placing shall be such as to avoid segregation and separation of the materials. The concrete shall be distributed to such depth and sufficiently above grade so that when consolidated and finished, the surface shall conform to the required finished grade. The concrete along the faces of the forms and adjacent to joints shall be consolidated and compacted to fill all voids and insure a dense smooth surface.
2. The depositing and spreading of the concrete shall be continuous, as far as possible, between transverse joints. In the case of a temporary shutdown, the concrete at the unfinished end of the slab shall be covered with wet burlap. In the event of an unavoidable interruption of the work continuing more than ½ hour, a construction joint shall be placed provided the section is 10 feet (3.1 m) or more in length between joints. Sections less than 10 feet (3.1 m) in length shall not be permitted, and if constructed shall be removed.
3. The entire area of the pavement shall be so consolidated as to ensure a minimum of voids. The concrete shall be struck off with a screed to the cross-section and thickness shown on the plans. The screed shall be set on side forms and upon a temporary center form or guide.
4. In all cases the minimum thickness of the pavement shall be the thickness shown on the plans.
5. Cement mortar gathered from the surface of the concrete already placed shall not be used for filling boot tracks or stony areas. Such areas shall be dug out, refilled with concrete, and worked smooth.
6. After striking off, the surface shall be finished to a gritty texture by means of a wooden float. If a metal float is used for final finishing, no more than two passes may be made over the surface.

J Texturing of Concrete Pavement

1. Texturing of Concrete pavement shall be in accordance with the MDOT Standard Specifications for Construction, except as follows:
   a. As soon as the concrete has set sufficiently to maintain a texture, the concrete surface shall be dragged longitudinally with a stiff fiber artificial grass carpet.
   b. Under unusual conditions, the following texturing method may be utilized, if approved by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT:
      1) As soon as all excess moisture has disappeared and while it is still possible to produce a uniform surface of gritty texture, the pavement surface shall be dragged longitudinally using a Monsanto Astroturf Mat, or approved equal, to a degree of texturing as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. The astroturf mat shall be suspended from a movable bridge and shall be in full longitudinal contact with the pavement surface for a minimum distance of 3 feet (91.4 cm). This method of texturing shall apply to concrete pavement only, not to concrete base course.

2) The texturing mat shall be kept free from accumulations of concrete mortar by removing the mat from the movable bridge and flushing the mat with water, or by other means approved by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. The texturing mat shall be replaced when the mortar accumulations harden and cannot be removed.

K Sawing Joints

1. Joints shall be sawed in accordance with the details shown on the plans and in accordance with the current MDOT Standard Specifications for Construction.

L Texturing (Finishing)

1. When the water sheen has practically disappeared, the pavement surface shall be textured (finished) by use of an approved broom or brush. The texturing operations shall produce uniform corrugations approximately 1/16 inch (1.6 mm) in depth and approximately at right angles to the centerline of the pavement. Texturing shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operations. The finished surface shall be free from rough or porous areas, irregularities and depressions resulting from texturing operations and shall meet the approval of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. Brooms or brushes for texturing the pavement surface shall be of such material and design that they will be capable of producing uniform corrugations of the specified depth.
2. Final surface finishing of concrete base courses shall be as specified above except the pavement shall be rough broom finished.

M Form Removal

1. Pavement forms shall not be removed from freshly placed concrete until it has set for at least 24 hours. After the form pins have been removed, the forms shall be carefully removed so that no damage will be done to the edge of the pavement.
2. After the forms have been removed, the ends of all concrete joints shall be cleaned and all honeycombed areas pointed. Such honeycombed areas shall be covered with wetted burlap until the pointing has been completed, after which the area shall be cured as specified below.

N Patching of Transverse and Longitudinal Joints

1. The patching of transverse and longitudinal joints shall conform to the specific requirements of the MDOT Standard Specifications for Construction on concrete pavement and construction.

O Protection

1. Fresh concrete pavement and integral curb shall be protected from rain and freezing, and the Contractor shall make this possible by keeping available sufficient covering material. The exposed surface of the concrete shall be protected from premature drying for a period of seven days after pouring.
2. Sufficient barricades and lights shall be provided to prevent traffic upon the concrete pavement for seven (7) days or for three (3) days if high-early strength concrete was used, unless such interval shall be modified when deemed necessary by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT.

P Curing

1. After finishing operations have been completed and immediately after the free water has left the surface, the surface of the slab shall be completely coated and sealed with a uniform layer of membrane curing compound in accordance with the current MDOT Standard Specifications for Construction and as specified herein. The compound shall be thoroughly stirred to a uniform consistency in the drum just prior to transfer of the compound to the membrane spraying equipment. Curing compound shall not be thinned.
2. The curing compound shall be applied at a minimum rate of 1 gallon per 200 square feet (1 liter per 4.9 square meters) of surface. For miscellaneous concrete pavement over one lane in width, where a manually operated pressure-type sprayer is used, the compound shall be applied from a foot bridge. If rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT will be required to apply a new coat of material to the affected areas equal in curing value to that specified for the original coat.
3. Curing of concrete base courses shall be ass specified above except that transparent membrane curing compound shall be used.
4. All traffic, either foot or otherwise, will be considered as injurious to the film of the applied compound. A minimum of foot traffic will be permitted on the dried film as necessary to properly carry on the work, such as sawing joints, provided any damage to the film is immediately repaired by another application of compound. If fixed-forms are removed during the curing period, the entire area of the sides of the slab shall be coated with curing compound immediately after removal of the forms. Approved hand-spray equipment will be permitted for the application of the curing compound on the sides of the slab and for repairing damaged areas.
5. Failure to provide proper curing will be considered as sufficient cause for immediate suspension of the concreting operations.
6. When approved by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT, curing compound may be omitted when cold-weather protection is used during the curing period.

Q Cold-Weather Protection

1. No concrete shall be placed after November 1, and prior to May 1, without specific written authorization of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. Without exception, all costs associated with placing concrete in cold weather shall be the responsibility of the Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT.
2. If the authorization is given to place concrete during this period and the use of high-early strength concrete was not originally specified, the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT may require the use of high-early strength concrete at no extra cost. In any case, concrete shall be adequately protected when necessary from cold weather and freezing and precaution s taken to prevent any damage to the concrete from low temperatures.
3. Frozen concrete or concrete otherwise damaged from cold weather shall be removed and replaced with sound concrete at the Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT’s expense. When low air temperatures are probably, a plan and method for

protecting the concrete during its early stages shall be adopted, subject to the approval of the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT and in conformity with the limiting requirements herein. Only such methods shall be used that will maintain reasonably uniform temperatures and provide proper moisture conditions for curing. All required materials, special equipment and facilities needed to provide the adequate provisions shall be readily available before the low temperature actually occurs.

4. The subgrade shall not be frozen when pouring concrete. When necessary to excavate below subgrade to remove frozen material, the excavated space below the subgrade shall be refilled with unfrozen crushed stone, gravel or sand, but not with clay or loam. If such suitable materials are not available for backfill, then concrete shall be used for the full depth of the excavation.
5. Whenever it is anticipated that the air temperature at the point of concrete placement is likely to be 40 degrees F (4.4 degrees C) or lower during the 24-hour period following the pouring, or below 30 degrees F(-1.1 degrees C) during the succeeding seven days, protective measures shall be taken.
6. At times when prevailing air temperatures will produce concrete of less than 65 degrees F (18.3 degrees C), mixing water shall be heated. Concrete materials entering the mixture shall be free of lumps, frost, snow, or ice. When necessary, the concrete materials shall also be heated so as to produce a concrete having a temperature of not less than 65 degrees F (18.3 degrees C), not more than 90 degrees F (32.2 degrees C) and as near 70 degrees F (21.1 degrees C) as possible at the time of pouring. The heating of the materials shall be done in a manner and by such methods as will keep the materials clean and free from injurious substances. The heating of the mixing water and aggregates shall be controlled so that there will be no large differences in temperature form batch to batch. The maximum temperature for the heated water and fine aggregate shall not exceed 150 degrees F (65.6 degrees C), and that of the heated coarse aggregate shall not exceed 100 degrees F (37.8 degrees C). Salt or other chemicals shall not be added to prevent freezing.
7. Calcium chloride shall be added to concrete mixture to accelerate the hardening of the concrete under conditions stipulated below. The calcium chloride shall be added to the concrete mixture only in solution in water and not in dry flake form. The maximum amount of calcium chloride that may be added is 2 percent of the weight of the cement in the batch, or slightly less than 2 pounds (0.9 kilograms) per standard sack of cement.
8. The solution shall be made up on the basis of 4 pounds of flake calcium chloride in 1 gallon (0.48 kilograms in 1 liter) of hot water. The solution shall be considered as part of the total allowed concrete mixing water, unless authorized by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. Thus, if a 1 percent calcium chloride mix is needed, 1 quart (0.95 liters) of the solution is added per bag of cement. If a 2 percent calcium chloride is needed, then 2 quarts (1.9 liters) of solution is added per bag of cement.
9. Concrete which will be deposited when the predicted air temperature is in a range listed below, shall be prepared in accordance with the provision stipulated for the applicable range.
    a. 40 degrees to 30 degrees F (4.4 degrees C to -1 degrees C):
        1) 1 percent calcium chloride added to concrete mix.

b. 28 degrees F (-2.2 degrees C) and rising:
   1) 1 percent calcium chloride added to concrete mix and heated mixing water used.
c. 35 degrees F (1.7 degrees C) and rising:
   1) Either or both of above requirements may be omitted.
d. 40 degrees F (4.4 degrees C) or lower before dark:
   1) 1 percent calcium chloride added to concrete mix for concrete that will be poured after 1:00 p.m., to accelerate setting to allow completion of finishing operations and covering within daylight hours.

10. Concrete when being placed shall have a temperature within the range specified. Forms shall be free of ice, snow and frost at the time of pouring concrete and the subgrade shall not be frozen. The poured concrete shall be protected to provide for a minimum of 3 Days with a minimum temperature of 55 degrees F. If concrete is “high early” concrete, 2 days will be permitted. Additionally, the maximum allowable rate of cooling once temperature protection is removed is 1) Maximum of 5 degrees F in any one hour and 2) Maximum allowable drop of 50 degrees F in first 24 hours.
11. Marsh hay or straw shall be used for a protective covering unless another equally effective means is approved by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. Where necessary to maintain the required minimum temperatures, the hay or straw shall be covered with tarpaulins, or other approved materials, securely weighted against displacement by wind.
12. A high-low thermometer shall be furnished and installed as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT to record the maximum and minimum temperature of the concrete. Periodic inspections shall be made to assure the protective covering is properly maintained in place. Any concrete damaged by freezing or overheating shall be removed and replaced with sound concrete at the Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT’s expense.

R Backfilling

1. After the concrete has gained sufficient strength, the remaining excavated areas shall be backfilled with approved material, compacted thoroughly, and left in a neat condition. Provide suitable backfill as specified herein if excavated material is insufficient in quantity or unsuitable for backfill.
2. Compaction shall be to at least 95 percent of the maximum unit weight.

S Cleaning

1. Any concrete spilled on the pavement or structures shall be removed and the pavement or structures thoroughly cleaned before the concrete sets. Spilled concrete shall not be washed into sewers or drains. The site of the work shall be restored to a neat and clean appearance, including the removal of excess earth, material, forms, and equipment.

3.4 FIELD QUALITY CONTROL

A Before final acceptance of the pavement, cores will be taken from the pavement after placement to determine the compressive strength at 28 days, the thickness of the pavement, and the depth of pavement reinforcement below the pavement surface. The Contractor-DO NOT USE!!! Use "Contractor's Spec Term" GT shall be required to hire a testing laboratory, to perform testing of the installed concrete pavement.

B The frequency of coring will be based on pavement units. The width of a unit is a lane. The width of each lane is determined by mandatory and/or optional joints indicated on the cross sections shown on the plans, except that thickened edges of lanes will not be included in the lane widths. The length of a unit will be 250 linear feet (76.2 linear meters) or any fraction thereof.

C Coring the Pavement

1. An initial 6 inch (15.2 cm) core shall be taken from each prescribed unit through the entire thickness of the pavement at such times and locations as directed by the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT. The cores shall be drilled and handled in accordance with ASTM C42.

D Measuring and Testing the Core

1. Each core shall be measured for thickness of concrete and depth of steel reinforcement and tested for compressive strength at 28 days after placement.
2. The measurement for length of core, depth of reinforcement, and the averaging of measurements when more than one core is taken from a unit, will be reported to the nearest 0.1 inch (3 mm) in accordance with the Rounding-Off Method of ASTM E29.

E Measurement for Thickness of Pavement

1. The length of a core for determining pavement thickness shall be determined by average measurements of the core in accordance with AASHTO T148.
2. When averaging core lengths, measurements which are in excess of specified pavement thickness by more than 0.2 inches (5.1 mm) will be considered as the specified thickness plus 0.2 inches (5.1 mm).

F Measurement for Depth of Reinforcement

1. Measurements for depth of reinforcement will be made from the top surface of the core to the top of the longitudinal bar or wire. If a core does not include a section of pavement reinforcement, an additional core will be taken not less than 10 feet (3.1 m) nor more than 10 feet (3.1 m) ahead of the core. This additional core will be used for the determination of the depth of pavement reinforcement and not for the measurement of pavement thickness.

G Determination of Compressive Strength

1. The compressive strength at 28 days after placing shall be determined according to ASTM C42. The core shall be classified in accordance with the results of the measurement for concrete thickness, the depth of steel and the compressive strength in accordance with the ranges indicated in Tables 1, and 2.
2. The Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT shall be furnished with a certified report of such measurements and tests. After making such measurements and tests, the cores shall be delivered to the Engineer-DO NOT USE!!! Use Design Professional's Spec Term GT for further checking and tests.

Table 3 - Classification of Cores for Pavement Deficient in Thickness

Core Type	Deficiency in Thickness Determined by Cores, Inches (mm)
A	0.2 (5 or less)
B	0.3 (6 to 9)
B	0.4 (10 to 12)
B	0.5 (13 to 15)
B	0.6 to 1.0 (16 to 26)
C	1.1 (27) and over

Table 4 - Classification of Cores for Reinforced Concrete Pavement where Reinforcement is out of Tolerance.

Depth Range of Reinforcement, inches (mm)

Core Type	Pavement Thickness		
	7 ½ - 8 ½ (190 – 219) inches (mm)	8 ½ - 9 ¾ 220 – 249 inches (mm)	9 ¾ - 11 250 – 279 inches (mm)
Z	0 – 1 (0 – 24)	0 – 1 (0 – 24)	0 – 1 (0 – 24)
X	1 – 2 (25 – 49)	1 – 2 (25 – 49)	1 – 2 1/4 (25 – 59)
W	2 – 4 (50 – 99)	2 – 4 ¼ (50 – 110)	2 1/4 – 5 ¼ (60 – 134)
X	4 – 5 (100 – 124)	4 1/4 – 5 1/2 (111 – 139)	5 1/4 – 6 ¼ (135 – 159)
Y	5 – 6 (125 – 152)	5 1/2 - 7 1/4 (140 – 184)	6 1/4 – 8 ¼ (160 – 209)
Z	6 & over (165 & over)	7 1/4 & over (185 & over)	8 1/4 & over (210 & over)

a. When a core length measures 1/10 inch (3 mm) or more over the plan thickness, the maximum depth range will be increased by ½ of the excess core length over the plan thickness. For each core, the increase will be rounded off to the nearest 1 mm in accordance with rounding-off method of ASTM E29 and then added to the range shown.

H Additional Coring Requirements for Pavement Deficiencies

1. When the initial core from a pavement unit is classified as Type AW, no additional cores will be taken from that pavement unit.
2. When the initial core from a pavement unit is classified as other than Type AW, additional cores will be taken. The additional cores will be measured only for the defect that required the taking of the additional cores. Additional coring requirements for the various core types will be as follows:
   a. When core measurements indicate the core to be one of Types AX, AY, BW, BX, and BY, two additional cores will be taken within the pavement unit. When the coring is being done on a linear foot (meter) basis, one additional core will be taken not less than 10 feet (3.1 m) nor more than 300 feet (91.4 m) in each direction from the initial core.

b. If the measurements of the 2 additional cores lie within the Type AW, AX, AY, BW, BX, or BY range, no further cores will be taken within this pavement unit. Any adjustment to the contract price will be in accordance with the General Conditions.

c. When core measurements indicate the core to be one of Types AZ, BZ, CW, CX, CY, and CZ, additional cores will be taken randomly within the pavement unit but spaced at 10 foot (3.1 meter) longitudinal intervals in each direction from the initial C and/or Z core until, in each direction, a core is obtained which is no longer in a C and/or Z range. The second core so obtained which is not in a C and/or Z range will be used only for determining the extent of the area having a deficiency in the C and/or Z range. The procedure to be followed after the first core is obtained will be dependent on the classification of the core, with any adjustment to the contract price in accordance with the General Conditions.

END OF SECTION