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SECTION 02600 – PAVEMENT

SECTION 02600

PAVEMENT

PART 1 – PRODUCTS

1.01 BASE COURSE:

The following base course alternates will be allowed as directed by the plans:

Compacted Thickness	Type
3"	Hot Mix Asphaltic Concrete (Collector & Arterial Streets)
8"	Graded Aggregate

A. Hot Mix Asphaltic Concrete – Shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphaltic cement in a central mixing plant. The gradations, asphalt content and stabilities shall be the following:

Square Sieve	% Passing by Weight
1"	100
3/4"	85 – 100
3/8"	55 – 75
No. 8	38 – 44
No. 200	4 – 7
Asphalt Cement	5 – 7%
Minimum Marshall Stability @ 50 Blows	1,500 lbs.

B. Graded Aggregate Base Course – The aggregate shall consist of processed and blended crushed granite stone. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings and other foreign material and shall be durable and sound. Aggregate shall meet the applicable requirements of Section 800, Coarse Aggregate, of the Georgia Highway Department Specifications. The material shall meet the following gradation and other requirements:

Sieve Size	% Passing by Weight
2"	100
1-1/2"	95 – 100
1"	70 – 100
½"	50 – 80
No. 4	30 – 55
No. 30	12 – 31
No. 200	6 – 15

	Percent
Clay	0 to 10
Volume Change	0 to 15
Liquid Limit	0 to 25
Plasticity Index	0 to 6

1.02 PRIME AND TACK COATS:

A. Prime Coat – The prime coat shall consist of spraying the base course with low viscosity liquid asphalt, such as RC-30 or RC-70, on the prepared surface of the base and allowing the asphalt to penetrate as far as possible.

B. Tack Coat – The tack coat shall consist of spraying the base course with AC-20 or AC-30, Asphalt Cement. When the temperature in the shade is 70° F or above an emulsion, such as CRS-2h or CRS-3, may be used.

1.03 SURFACE COURSE:

A. The surface course shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphalt cement in a central mixing plant. An antistripping agent shall be added to the asphalt-cement in the preparation of the hot-mix asphalt concrete when "hydrophilic" aggregates are used. The gradations, asphalt content and stabilities for "E" Mix shall be the following:

Square Sieve	% Passing by Weight
3/4"	100
½"	85 – 100
3/8"	70 – 85
No. 8	44 – 48
No. 50	10 – 25
No. 200	4 – 7
Asphalt Cement	5 – 7%
Minimum Marshall Stability @ 50 blows	1,500 lbs.

The gradations, asphaltic content and stabilities for "F" Mix shall be the following:

Square Sieve	% Passing by Weight
½	100
1/4	90-100
No. 4	55-75
No. 8	44-50
No. 50	14-25
No. 200	4-7
Asphalt Cement	5.25-7.50%
Minimum Marshall @ 50 Blows	1,500 lbs.

1.04 PAVEMENT FABRIC:

A. Fabric used for underlayment shall be equivalent to Phillip's Petromat.

1.05 TRAFFIC LINE PAINT:

A. Traffic Line Paint - Shall conform to Section 870.03 of the Standard Specifications for Road and Bridge Construction, Department of Transportation, State of Georgia. The color shall be at the direction of the Owner or as specified in the plans.

PART 2 - EXECUTION & TESTING

2.01 TESTS:

The following tests will be made in accordance with the DOT Specifications or other specified methods. Compaction tests shall be made at the Owner's direction and expense. Failed tests shall be rescheduled at the Owner's direction and retesting shall be paid for by the Contractor.

A. Subgrade Compaction - One (1) test per 250 square yards. 100% Standard (ASTM Test D-698).

B. Base - One (1) test each per 250 square yards.

1. Field Determination of Compaction.

C. Asphaltic Concrete - One (1) test each for 250 tons of asphaltic concrete. These tests shall conform to the Georgia Department of Transportation's Standards for roads and bridges.

1. Asphalt extraction and aggregate test; one set for each 250 tons of asphaltic concrete.

2. Marshall Stability Tests; stability not less than 1,500 lbs. for surface course. One test for each 250 tons of asphaltic concrete.

D. All design mixes heretofore specified.

2.02 PAVEMENT SYSTEM'S LOCATION, GRADE, AND ALLOWABLE TOLERANCES:

A. The locations and grades of pavement are shown on the drawings. The grade as given on the drawings is the finished pavement grade and allowance will be made for the thickness of pavement when preparing the subgrade.

B. Surfaces - The finished surfaces of pavements shall conform to the lines, grades and cross sections shown. The finished surfaces of pavement shall not vary more than 1/8 inch above or below the planned grade lines or elevations established at the job site. The finished

surfaces of new abutting pavements shall coincide at their juncture. Where a new pavement abuts an existing pavement, a transition pavement strip shall be installed to the juncture of the new and existing pavement. The finished surface of pavements shall have no abrupt change of 1/8-inch or more and shall not deviate from the testing edge of an accepted 10-foot straightedge more than 1/8-inch.

C. Thickness -

1. Permissible Deviation - For asphaltic concrete wearing surfaces, will be up to 1/8-inch of the required thickness. Deviation in base courses will be up to 3/8-inch.

2. Pavements Deficient in Thickness - When measurement of any core indicates that the pavement is deficient in thickness, additional cores will be drilled at 25-foot intervals along the centerline of the lane on each side of the original deficient core until the cores indicate that the deficiency in thickness is less than 1/8-inch. Pavement areas deficient in thickness shall be removed and replaced with pavement of the indicated thickness. If the Contractor believes that the cores and measurements taken are not sufficient to indicate fairly the actual thickness of the pavement, additional cores and measurements will be taken, provided the Contractor will bear the extra cost of drilling the cores and filling the holes in the pavement as directed.

2.03 FIELD QUALITY CONTROL:

A. Equipment - All equipment, tools and machines, used in the performance of the work required by this section of the specifications shall be subject to the acceptance of the Owner and shall be maintained in satisfactory working condition at all times.

1. Bituminous Distributor - The distributor shall have pneumatic tires of such width and number that the load produced on the base surface shall not exceed 650 pounds per inch of tire width. It shall be so designed and equipped as to distribute the bituminous material uniformly at even heat in variable widths of surface at readily determined and controlled rates ranging from 0.05 to 2.0 gallons per square yard, with a pressure range of from 25 to 75 pounds per square inch and with an allowable variation from any specified rate not exceeding ten percent (10%). Distributor equipment shall include an independently operated bitumen pump, tachometer, pressure gauges, volume measuring devices, a thermometer for reading the temperature of tank contents and a hose attachment suitable for applying bituminous material to spots missed by the distributor. The distributor shall be equipped for circulation and agitation of the bituminous

material during the heating process.

2. Power Brooms and Power Blowers – Blowers and brooms shall be of the power type and shall be suitable for cleaning the surfaces to which the prime or tack coat is to be applied.

B. Weather Limitations – The prime or tack coat shall be applied only when the base course or pavement is dry or contains moisture not in excess of the amount that will permit uniform distribution and the desired penetration and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application. The prime or tack coat shall only be applied when the atmospheric temperature in the shade is 55 degrees F. or above.

C. Preparation of Surface – Immediately before applying the pavement course, if the underlying surface is sufficiently bonded, all loose material, dirt, clay or other objectionable material, shall be removed from the surface to be treated with a power broom or blower supplemented with hand brooms, as directed by the Engineer. After the cleaning operation and prior to the application of the pavement course, an observation of the area to be treated will be made by the Engineer to determine its fitness to receive the bituminous coating. That portion of the surface prepared for immediate treatment shall be dry and in satisfactory condition.

2.04 SEQUENCE OF CONSTRUCTION:

A. Prior to the placement of the base material the roadbanks/esplanade shall be stabilized to the satisfaction of the Engineer.

B. Prior to the placement of the finish surface (asphalt) the base material must be approved by the Engineer and:

1. Graded Aggregate: Shall be allowed to set for a period of at least forty-eight hours and no longer than ten days before the finish surface is applied.

2.05 PROOF ROLLING:

A. Shall be required on the subgrade of all streets where designated by the Engineer. Proof rolling shall be done after water lines have been lowered, house services installed and sewers backfilled. The operation shall be in accordance with methods described in Section 221 of the DOT Specifications.

2.06 GRADED AGGREGATE BASE COURSE:

A. Aggregate shall be placed with an accepted spreader in accordance with Georgia Department of Transportation Standard Specifications. (The spreader shall contain a hopper, an adjustable screed and be so designed that there will be a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform density.) Spreaders are not required on curb

and gutter road sections.

The base or subbase aggregate shall be thoroughly wetted to optimum moisture (± 1-1/2%) content as determined by ASTM D-698.

B. Excavation - The existing subgrade shall be leveled to the lines and grades shown on the plans.

1. Subgrade Preparation - Prior to constructing the graded aggregate base course, the subgrade shall be cleaned of all foreign substances. At the time of construction of the base course, the subgrade shall contain no frozen material. The surface of the subgrade shall be checked by the Owner or his representative for adequate compaction and surface tolerances. Ruts or soft yielding spots that may appear in areas of the subgrade course having inadequate compaction and areas not smooth or which vary in elevation more than ½-inch above or below the required grade established on the plans shall be corrected to the satisfaction of the Owner or his designated representative.

C. Compaction - While at Optimum moisture (± 1-1/2%), the aggregate base shall be rolled with rollers capable of obtaining the desired density. The rolling shall continue until the base is compacted to a maximum laboratory dry density of 100% of ASTM D-698.

In-place density of the compacted base will be determined in accordance with the Sand Cone Method, ASTM D-1556 or Nuclear Method, ASTM D-2922. At the option of the Contractor, vibratory, flatwheel and other rollers accepted by the Engineer may be used to obtain the required compaction.

D. Surface Finish Tolerances - The surface of the completed base shall not show any deviation in excess of 1/4-inch when tested with a 10 foot straight edge. Deviation in thickness of the base shall be up to, but not including, 3/8-inch of the required thickness.

E. Maintenance - The base shall be maintained in a condition that will meet all specification requirements until the work is accepted.

2.07 PAVEMENT FABRIC:

A. Fabric shall be placed on the base where directed by the Engineer and installed in accordance with the manufacturer's recommendations.

2.08 BITUMINOUS PRIME/TACK COATS:

A. Bituminous Prime Coat - Bituminous material for the prime coat shall be applied in quantities of not less than 0.15 gallons nor more than 0.30 gallons per square yard of

base course. Any prescribed application shall be divided, if necessary, into two (2) applications to avoid flowing off the surface. All irregularities in the base surface shall be corrected prior to application of the prime coat.

The prime shall only be applied when the base course is only slightly damp and when the temperature of the air in the shade is 55°F or above.

B. Bituminous Tack Coat - Bituminous material for the tack coat shall be applied in quantities of not less than 0.08 gallons nor more than 0.15 gallons per square yard of base course. The entire surface to be paved shall be coated with the tack coat.

The tack coat shall only be applied when the base is dry and when the temperature has not been below 35°F. for 12 hours immediately prior to application. The tack coat shall only be applied when the temperature of the air in the shade is 55°F. or above.
Work shall be planned so that no more tack coat than is necessary for the day's operation is placed on the surface. All traffic not essential to the work should be kept off the tack coat.

In places where the distributor bars cannot reach, it will be necessary to apply the tack coat with a hand spray attached to the distributor by a hose. When hand spray methods are used, care should be taken to give the surface a very light application of the asphalt.

2.09 ASPHALTIC CONCRETE BASE AND SURFACE COURSES:

A. Mixing Plants - Asphaltic Concrete shall be mixed in central plants conforming to the applicable requirements of Section 400 of the Standard Specifications of the Georgia State Highway Department.

B. Equipment -

1. Bituminous-Materials Spreaders - Shall be self-propelled type equipped with hoppers, tamping or vibrating devises, distributing screws, adjustable screeds, equipment for heating the screeds and equalizing devices. The spreader shall be capable of spreading hot bituminous mixtures without tearing, shoving or gouging, while producing a smooth finished surface, confining the edges of the strips to true lines without the use of stationary side forms and placing the course to the required thickness. Spreaders shall be designed to operate forward at variable speeds and in reverse at traveling speeds of not less than 100 feet per minute. The use of a spreader that leaves indented areas or other objectionable irregularities in the fresh-laid mix during operation will not be permitted.

2. Steel-Wheel Rollers - Shall be the self-propelled, three-wheel and tandem types, weighing not less than 20,000 pounds each. The three-wheel rollers shall have a minimum weight of 300 pounds per inch of width in the rear wheel. The wheels shall be equipped with adjustable scrapers, water tanks and sprinkling apparatus that will be used for keeping the wheels wet to prevent the bituminous mixture from sticking to the wheels. The rollers shall be capable of reversing without backlash and shall be free from worn parts. The roller wheels shall have no flat or pitted areas and no projections that will leave marks in the pavement. Three-axle tandems will be permitted in lieu of two-axle tandems if accepted by the Engineer.

3. Heavy Pneumatic-Tired Rollers - Shall be self-propelled and shall consist of two axles on which are mounted multiple pneumatic-tired wheels in such a manner that the rear group of wheels will not follow in the tracks of the forward group but will be so spaced as to give essentially uniform coverage with each pass.

   The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be smooth and shall be capable of being inflated to a minimum pressure of 90 pounds per square inch. Construction of the roller shall be such that each wheel can be loaded to a minimum of 4,500 pounds.

4. Light Pneumatic-Tired Rollers - Shall consist of two axles on which are mounted not less than nine pneumatic-tired wheels in such manner that the rear group of tires will not follow in the tracks of the forward group but will be so spaced as to give essentially uniform coverage with each pass. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted with not less than 4.5 tons of ballast. The tractor and other towing equipment shall also be equipped with pneumatic tires. The tires on both rollers and towing equipment shall be smooth and of a type that will not leave tire prints in the surface being rolled. The use of a self-propelled roller meeting the above requirements will be permitted.

5. Blowers and Brooms - Shall be of the power type and shall be suitable for cleaning the surface to be paved.

6. Small Tools - Shall consist of rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heater for heating small tools, wood sandals, stilt sandals of standard type and

other small tools, as may be required. A sufficient number of small tools shall be available at all times for use in constructing the bituminous pavements efficiently. The lutes shall be constructed of metal and shall consist of a plate or sheet, 36" by 4", attached to a handle properly braced and with sufficient strength to adequately compact the free edge of the surface course. Hand tampers shall weigh not less than 25 pounds and shall have a tamping face not larger than 50 square inches.

C. Weather Limitations - Bituminous courses shall be constructed only when the base course, binder course or the existing pavement is dry and when the weather is not rainy. Unless otherwise directed, asphaltic courses shall not be constructed when the air temperature in the shade is below 40 degrees F.

D. Preparation of Base - The surface of the base course will be checked by the Engineer for adequate compaction and surface tolerances as specified in applicable base course or subbase course sections. Any ruts or soft yielding spots that may appear in the base course, any areas having inadequate compaction or any deviations of the surface from the requirements specified for the base course shall be corrected by loosening the affected areas, removing unsatisfactory material and adding accepted material where required, then by reshaping and recompacting to line and grade to the specified density requirements, as directed.

E. Grade Control - The lines and grades shown on the contract drawings for each pavement category of the contract shall be established and maintained by means of line and grade stakes placed at the site of the work by the Contractor.

F. Transportation of Bituminous Mixture - Transportation of bituminous mixture shall be from the paving plant to the site in trucks having tight, clean, smooth beds that have been coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of the mixture to the truck bodies. Each load shall be covered with canvas or other accepted material of ample size to protect the mixture from the weather and to prevent loss of heat. Deliveries shall be made so that the spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate accepted artificial lighting is provided. The mixture shall be delivered to the area to be paved in such manner that the temperature at the time of dumping into the spreader will not be less than 235 degrees F. Any loads that are below minimum temperature, that have crusts of cold unworkable material or that have been wet excessively by rain will be rejected. Hauling over freshly laid material will not be permitted.

G. Placing –

1. Surface Preparation of Underlying Course – Prior to the laying of the surface course, the underlying base shall be cleared of all foreign or objectionable matter with power blowers, power brooms or handbrooms, as directed.
2. Spraying of Contact Surfaces of Structures – Contact surfaces or previously constructed base shall be sprayed with a tack coat.

3. Number of Courses – The surface course shall be laid in one course.

4. General Requirements for Use of Mechanical Spreader – Asphalt mixtures having temperatures less than 235 degrees F. when dumped into the mechanical spreader will be rejected. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course will be smooth and continuous without tears and pulling, and of such depth that, when compacted, the surface will conform with the cross section, grade, and contour indicated. Unless otherwise directed, the placing shall begin along the centerline of areas to be paved on a crowned section or on the high side of areas with a one way slope, and shall be in the direction of the major traffic flow. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet, except where the edge lanes require strips less than 10 feet to complete the area. Each strip laid before a succeeding strip shall be of such a length that sufficient heat will be retained to make the strip readily compatible so that a joint can be obtained that will conform to the requirements for texture, density and smoothness.

5. Shoveling, Raking and Tamping After Machine Spreading – A sufficient number of shovelers and rakers shall follow the spreading machine adding or removing hot mixture and raking the mixture as required to obtain a course that when completed will conform to all requirements specified herein. Broadcasting or fanning of mixture over areas being compacted will not be permitted. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected. Any irregularities in alignment left by the mechanical spreader shall be corrected by trimming directly behind the machine. Immediately after trimming, the edges of the course shall be thoroughly compacted by tamping liberally with the metal lute specified herein. Distortion of the course during tamping will not be permitted.

6. Hand Spreading in Lieu of Machine Spreading - In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. The mixture shall be dumped on accepted dump boards or at an adjacent accepted area outside the area to be paved and shall be distributed into place from the dump boards or from the accepted area by means of hot shovels. The mixture shall be spread with hot rakes in a uniformly loose layer of a thickness that, when compacted, will conform to the required grade and thickness. During hand spreading, each shovelful of mixture shall be carefully placed by turning the shovel over in a manner that will prevent segregation. In no case shall the mixture be placed by throwing or broadcasting from a shovel. The loads shall not be dumped any faster than can be properly handled by the shovelers and rakers. Rakers not equipped with stilt sandals shall not be permitted to stand in the hot mixture while raking the course.

H. Compaction of Mixture - Compaction of mixture shall be effected by the three-wheel rollers, the tandem rollers, the light pneumatic-tired rollers and the heavy self-propelled pneumatic-tired rollers, specified hereinbefore. Rolling of the mixture shall begin as soon after placing as the mixture will bear the roller without undue displacement. Delays in rolling freshly spread mixture will not be tolerated. The rolling shall continue until the surface mixture is compacted to a minimum 100% density of AASHTO T-230. Compaction rolling shall be compacted before the surface temperature drops below 185 degrees F. Field density will be determined by AASHTO T-191 or T-238.

I. Patching Deficient Areas - Any mixture that becomes contaminated with foreign material or is in any way defective shall be removed. Skin patching of a area that has been rolled will not be permitted. Holes of the full thickness of the course shall be cut so that the sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with tack coat bituminous materials. Fresh paving mixture shall be placed in the holes in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. The paving mixture shall be compacted to the density specified herein. The Contractor shall provide competent workmen capable of performing all work incidental to correction of deficiencies and defects.

J. Joints -

1. General - The joints (paper joints) between successive days' work or joints that have become cold because of any delay, shall be carefully made in such a manner as to insure a continuous bond

between old and new sections of the course. All joints shall present the same texture, density and smoothness as other sections of the course. All contact surfaces of previously constructed pavements that have become coated by dust, sand or other objectionable material shall be cleaned by brushing or shall be cut back with an acceptable power saw, as directed. All the surfaces against which the new material is to be placed shall be sprayed with a thin, uniform coat of bituminous material. The material shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

2. Transverse Joints - The roller shall pass over the unprotected end of a strip of freshly laid material only when the laying is to be discontinued or when delivery of mixture is interrupted to the extent that the material in place may become cold. In all cases, the edge of the previously laid pavement shall be cut back to expose an even vertical surface for the full thickness of the course. In continuing the placement of the strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling that will conform to the required density and smoothness specified herein. When required, the fresh mixture shall be raked against the joints, thoroughly tamped with hot tampers, smoothed with hot smoothers and followed by rolling. In all cases, the transverse joints in adjacent lanes shall be offset a minimum of two feet (2').

3. Longitudinal Joints - When the edges of the previously placed strip have become cooled, cold, irregular, honey combed, poorly compacted, damaged or otherwise defective, all unsatisfactory sections of joints shall be cut back to expose a clean sound surface for the full thickness of the course, as directed. When required, fresh mixture shall be raked against the joint, thoroughly tamped with hot tampers, smoothed with hot smoothers and then rolled.

K. Protection of Pavement - After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled and hardened. In no case shall the non usage be less than six hours.

2.10 STONE STABILIZATION FOR STREETS:

A. Earth streets disturbed by the Contractor's operations shall be stabilized where required by the Engineer. This work will consist of placing graded aggregate at the rate of 250 pounds per square yard on compacted subgrade, and uniformly spreading and compacting the aggregate to an approximate depth of 3-inches. Placement shall conform

to Section 310 of the Standard DOT Specifications, except that harrow and blade mixing will be permitted. The aggregate shall conform to the following (percent by weight):

Passing 1-1/2" Sieve	100%
Passing 3/4" Sieve	60 - 90%
Passing #10 Sieve	25 - 45%
Passing #60 Sieve	10 - 30%
Passing # 200 Sieve	0 - 15%

2.11 ADJUST EXISTING VALVES, INLETS AND MANHOLES:

A. Existing inlets, manholes, or valve boxes shall be adjusted by the Contractor to the new grade lines and elevations. All adjustments to structures in areas proposed for pavement shall be accomplished prior to construction of the surface course.

The existing castings shall be removed and, if suitable, reinstalled after adjustments to the structures. Other materials necessary for this work, such as mortar, grout, concrete, brick, and other approved materials, shall meet the requirements of these specifications for materials in new structures of the same type.

The Contractor shall furnish all materials and labor and perform all excavation and backfilling and other work necessary to complete the item.

1. Adjust Existing Frames - Adjustment to grade of existing frames shall include raising or lowering the upper portion of the structure, including any necessary sleeve extensions, adjustable manhole rings, gaskets, mortar, masonry or other approved material, to bring the frame to the required grade.

2.12 REMOVE AND REPLACE PAVEMENT:

A. Pavement removed and replaced shall be done in accordance with the latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled by means of flagmen.

The edges of the pavement shall be cut to a neat straight line with a masonry saw. The backfill shall be compacted to 100% density and a concrete base course of 5,000 psi placed on the fill. The concrete base shall be placed within 24 hours after the utility line is installed. A temporary wearing surface may be used provided it presents a smooth surface. The final wearing surface shall be 1-1/2-inch asphaltic concrete, Type "F".

2.13 STRIPING OF PAVEMENT MARKINGS

A. Striping shall consist of furnishing and applying traffic markings with paint or thermoplastic in accordance with the contract drawings and specifications, and the

requirements of the current Federal and State "Manual On Uniform Traffic Control Devices."

B. SPECIFICATIONS FOR PAVEMENT MARKINGS MARKED WITH PAINT

1. Equipment - The traveling traffic stripe painter shall be adaptable to traveling at a uniform, predetermined rate of speed both uphill and downhill in order to produce a uniform application of paint. The paint machine shall be of the spray type, capable of satisfactorily applying the paint under pressure with a uniformity of feed through nozzles spraying directly upon the pavement. Each machine shall be capable of applying three separate stripes, either solid or skip, in any specified pattern by utilizing 3 adjacent spray nozzles at the same time. Each paint tank shall be equipped with a mechanical agitator. Each nozzle shall be equipped with satisfactory cutoff valves which will apply broken or skip lines automatically. Each nozzle shall have a mechanical bead dispenser that will operate simultaneously with the spray nozzle and distribute the beads in a uniform pattern at the rate specified. Each nozzle shall also be equipped with suitable line guides consisting of metallic shrouds or air blasts.

   Hand painting equipment shall consist of suitable brushes, templates and guides necessary to produce satisfactory results.

   Cleaning equipment shall consist of the necessary brushes, brooms, scrapers, grinders, high pressure water jets and air blasters required to satisfactorily remove all foreign matter from the surfaces to be painted without damage to the underlying pavement.

   The traveling traffic striper painter shall also be equipped with paint meters which will indicate the amount of paint dispensed from each tank. Small, portable applicators or other special equipment may also be required.

2. Cleaning of Surface - All surfaces to be painted shall be thoroughly cleaned of dust, dirt, grease, oil and all other foreign matter before application of the paint.

3. Alignment - Traffic stripes shall be of the length, width and placement specified. On sections where no previously applied markings are present, the Contractor shall establish control points satisfactory to the Owner, spaced at intervals that will insure accurate locations of the stripe.

4. Application - Traffic stripe paint shall be applied by machine except for special areas and markings

that are not adaptable to machine application, in which case hand application will be permitted.

No paints shall be applied to areas of pavement when:

(1) Any moisture or foreign matter is present on the surface;

(2) The air temperature in the shade is below 50° F; or

(3) Wind conditions are such as might cause dust to be deposited on the prepared areas or to prevent satisfactory application of the paint and beads.

Painting shall be done only during daylight hours and all painted areas shall be dry enough before sunset to permit crossing by traffic. All protective devices shall be removed not later than sunset to allow free movement of traffic at night.

Traffic stripe paint shall be thoroughly mixed in the shipping container before placing in the machine tank. The paint machine tanks, connections and spray nozzles shall be thoroughly cleaned with thinner before starting each day's work.

The minimum wet film thickness for all painted areas shall be 15 mils.

5. Protective Measures – When painting is done under traffic, the Contractor shall furnish and place all warning and directional signs necessary to direct, control, and protect the traffic during the striping operations. Warning signs shall be set up before the beginning of each operation and extra signs shall be kept well ahead of the painting equipment. When necessary, a pilot car shall be used to protect both the traffic and the painting operation. The freshly painted stripe shall be protected by cones or other satisfactory devices. All stripes damaged by traffic, or pavement marked by traffic crossing wet paint, shall be repaired or corrected as specified below.

6. Tolerance and Appearance – No stripe shall be less than the specified width. No stripe shall exceed the specified width by more than ½ inch. The alignment of the stripe shall not deviate from the intended alignment by more than one inch on tangents and on curves up to and including one degree. On curves exceeding one degree, the alignment of the stripe shall not deviate from the intended alignment by more than 2 inches.

Continued deviation from stated dimensions will be cause for stopping the work and removing the nonconforming stripe(s).

All stripes and segments of stripes shall present a clean cut, uniform and workmanlike appearance. All markings which fail to have a uniform, satisfactory appearance, in either day or night hours, shall be corrected by the Contractor at their expense.

7. Corrective Measures – All traffic stripes which fail to meet the Specifications, permissible tolerances, and appearance requirements, or are marred or damaged by traffic or from other causes, shall be corrected at the Contractor's expense. All missed areas, drip and spattered paint shall be removed to the satisfaction of the Owner. In all instances, when it is necessary to remove paint, it shall be done by means satisfactory to the Owner, which do not damage the underlying surface of the pavement. When necessary to correct a deviation which exceeds the permissible tolerance in alignment, that portion of the stripe so affected shall be removed, plus an additional 25 feet in each direction, and a new stripe then painted in accordance with these specifications.

8. Acceptance – All sections of painted stripe, words, and symbols which have dried to the extent that the paint will not be picked up or marred by the tires of vehicles, and which have been placed in reasonably close conformity with the Plans and Specifications, will be accepted and the Contractor will be relieved of the responsibility of maintenance on such sections.

C. SPECIFICATIONS FOR PAVEMENT MARKINGS MARKED WITH THERMOPLASTIC

1. Thermoplastic Plastic Stripe shall consist of solid or broken (skip) lines, words and/or symbols of the type, color and the location shown on the plans. It is the intent of these specifications that short lines which are defined to be crosswalks, stop bars, arrow symbols and crosshatching shall be extruded. All other lines, unless otherwise specified, shall be sprayed.

2. Equipment: The material shall be applied to the pavement by an extrusion method wherein one side of the shaping die is the pavement and the other three sides are contained by or are part of suitable equipment for heating and controlling the flow of material, or it shall be applied by spray techniques. Either method shall be applied as to assure continuous uniformity in the dimension of the stripe. The type of application at each

location shall be designated by the Engineer.

Each spray application machine must be equipped with an automatic counting mechanism capable of recording the number of linear feet of material applied to the roadway surface with an accuracy of 0.50%.

The equipment shall be constructed to provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the shaping die or gun shall be constructed such as to prevent accumulation and clogging. All parts of the equipment which come in contact with the material shall be so constructed as to be easily accessible and exposable for cleaning and maintenance. The equipment shall be constructed so that all mixing and conveying parts up to and including the shaping die or gun maintain the material at the plastic temperature with heat transfer oil or electrical element controlled heat. No external source of direct heat will be allowed.

The equipment shall be so constructed as to insure continuous uniformity in the dimensions of the stripe. The applicator shall provide means for cleanly cutting off stripe ends squarely and shall provide a method of applying “skip” lines. The use of pans, aprons, or similar appliances which the die overruns will not be permitted under this Specification. The equipment shall also be capable of producing varying widths of traffic markings.

Glass spheres applied to the surface of the completed stripe shall be applied by an automatic bead dispenser attached to the striping machine in such a manner that the beads are dispensed almost instanteously upon the installed line. The glass sphere dispenser cutoff shall be synchonized with the automatic cutoff of the thermoplastic material.

Special kettle(s) shall be provided for melting and heating the thermoplastic material. The kettle(s) must be equipped with automatic thermostatic control devices so as to provide positive temperature control and prevent over-heating of the material. The applicator and kettle(s) must be so equipped and arranged as to satisfy the requirements of the National Fire Underwriters.

Applicators shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

The applicator equipment to be used on roadway installations shall consist of either hand equipment or truck mounted units depending on the type of marking required.

The hand equipment shall have sufficient capacity to hold 150# of molten material and shall be sufficiently maneuverable to install crosswalks, lane, edge, and center lines; arrows and legends. The truck-mounted unit for lane, edge, and center lines shall consist of a mobile self-contained unit carrying its own material capable of operating at a minimum speed of 5 miles per hour while installing striping.

3. Application

Thermoplastic Traffic Stripe shall not be applied when the pavement temperature in the shade is 40°F or below.

For all extruded thermoplastic, and where directed by the Engineer for sprayed thermoplastic on old asphaltic concrete pavements where the aggregates are exposed, and on all Portland Cement Concrete pavement as directed by the City Traffic Engineer, to insure optimum adhesion, the Contractor shall apply a binder-sealer material prior to the actual thermoplastic installation. The binder-sealer material will form when applied with conventional mobile spray painting equipment, a continuous film over the pavement surface which will dry rapidly and mechanically adhere to the pavement surface. The binder-sealer shall be that product currently in use and recommended by the thermoplastic material manufacturer as shown in the Qualified Products List. To insure optimum adhesion, the thermoplastic material shall be installed in a melted state at a temperature consistent with the manufacturer's recommendations, but less than 375°F.

The material, when formed into traffic strips, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall bond itself to the old line in such a manner that no splitting or separation takes place.

Longitudinal lines shall be off-set at least two inches from construction joints of Portland Cement Concrete pavements.

Crosswalks, stop bars, and symbols shall have a minimum thickness of 3/32" at the edges and a maximum thickness of 3/16" at the center.

Minimum average film thickness of .090" **for lane lines and .060" **for edge lines shall be maintained on all markings unless otherwise noted on the Plans. This is to be computed on the basis of the amount of material used each. The glass sphere top coating must be must be applied by means

of a pressure type spray gun designed specifically for this purpose, and which embed the spheres into the line surface to at least one-half their diameter. The glass spheres shall be applied at the rate of 14 pounds of spheres to each 100 square feet of compound. It shall be the responsibility of the Contractor to supply all of the necessary auxiliary vehicles required for this operation.

*Minimum Average Film Thickness (Inches) for 4" Wide Strip - Lane Line

$$\frac{\text{Pound Used}}{\text{Total Linear Feet}} \times 0.270$$

**Minimum Average Film Thickness (Inches) For Edge Lines

$$\frac{\text{Pounds Used}}{\text{Total Linear Feet}} \times 0.135$$

4. Cleaning: All pavement areas to be striped shall be thoroughly cleaned. Cleaning may be accomplished by the use of hand brooms, rotary brooms, air blasts, scrapers or other approved methods which leave the paving surface thoroughly clean and undamaged. Particular care shall be taken to remove all vegetation and road film from the area to be striped.

5. Acceptance: Segments of the Thermoplastic Traffic Stripe Project which have been placed in conformance with the Plans and Specifications may be accepted, if satisfactory, thirty (30) days after completion of all work required in that segment and the Contractor will be relieved of any further maintenance on such segments.

6. Certification: The producers of the Thermoplastic compound and glass spheres shall furnish to the City 6 copies of certified test reports showing results of all tests specified herein, and shall further certify that the materials meet all requirements of this Section. Final acceptance, however, will be contingent upon satisfactory test results of samples obtained after delivery.

7. Warranty: The Contractor shall transfer to the City the warranty on Thermoplastic materials issued by the Manufacturer. The Contractor shall also furnish the City the normal warranty for application. These warranties shall specify the guaranteed retainage of material for a stated period beginning with the application date.

PART 3 – PERVIOUS PAVEMENT

3.01 SCOPE OF WORK:

The work to be completed under this section includes the furnishing of all labor, materials, and equipment necessary for construction of the pervious concrete pavement subjected to light traffic loading as recommended by the Georgia Concrete and Products Association and the Georgia Department of Transportation (GDOT) Standard Specifications for Construction of Roads and Bridges.

3.02 TEST PANELS:

Contractor is to place, joint and cure two test panels, each to be a minimum of 225 sq. ft., at the required project thickness to demonstrate to the Engineer's satisfaction that in-place unit weights can be achieved and a satisfactory pavement can be installed at the site location.

D. Test panels may be placed at any of the specified portland cement pervious locations. Test panels shall be tested for thickness in accordance with ASTM C 42; void structure in accordance with ASTM C 138; and for core unit weight in accordance with ASTM C 140, paragraph 6.3.

E. Satisfactory performance of the test panels will be determined by:

1. Compacted thickness no less than 1/4" of specified thickness
2. Void Structure: 13% minimum, 20% maximum
3. Unit weight plus or minus 5 pcf of the design unit weight

F. If measured void structure falls below 15% or if measured thickness is greater than 1/4" less than the specified thickness or if measured weight falls less than 5 pcf design unit weight, the test panel shall be removed at the contractor's expense and disposed of in an approved landfill.

G. If the test panel meets the above mentioned requirements, it can be left in-place and included in the completed work.

3.03 CONCRETE MIX DESIGN:

Contractor shall furnish a proposed mix design with proportions of materials to Owner prior to commencement of work. The data shall include unit weights determined in accordance with ASTM C 29 Paragraph 11, "Jigging Procedure."

3.04 MATERIALS:

A. Cement: Portland Cement Type I or II conforming to ASTM C 150 or Portland Cement Type 1P or IS conforming to ASTM C 595.

B. Aggregate: Use Georgia Department of Transportation (GDOT) No. 89 coarse aggregate (3/8 to No. 50) per ASTM D 448. If other gradation of aggregate is to be used, submit data on proposed material to owner for approval.

C. Air Entraining Agent: Shall comply with ASTM C 260.

E. Admixtures:

Type A Water Reducing Admixtures – ASTM C 494
Type B Retarding – ASTM C 494
Type D Water Reducing/Retarding – ASTM C 494

Also, a hydration stabilizer can be utilized and is recommended in the design and production of pervious concrete. This stabilizer suspends cement hydration by forming a protective barrier around the cementitious particles, which delays the particles from achieving initial set. The admixture's primary function should be as a hydration stabilizer, however, it must also meet the requirements of ASTM C 494 Type B Retarding or Type D Water Reducing/Retarding admixtures.

3.05 PROPORTIONS:

A. Cement Content: For pavements subjected to vehicular traffic loading, the total cementitious material shall not be less than 600 lbs. per cu. yd.

B. Aggregate Content: The volume of aggregate per cu. yd. shall be equal to 27 cu. ft. when calculated as a function of the unit weight determined in accordance with ASTM C 29 "Jigging Procedure." Fine aggregate, if used, should not exceed 3 cu. ft. and shall be included in the total aggregate volume.

C. Admixtures: Shall be used in accordance with the manufacturer's instructions and recommendations.

D. Mix Water: Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. (Mix water yielding a cement paste with a dull-dry appearance has sufficient water for hydration.)

3.06 SUBGRADE PREPARATION AND FORMWORK:

A. Subgrade Material: The top 6 inches shall be composed of granular or gravely soil that is predominantly sandy with no more than a moderate amount of silt or clay.

B. Subgrade Permeability: Prior to placement of Portland Cement Pervious Pavement, the subgrade shall be tested for rate of permeability by double ring infiltrometer, or other suitable test of subgrade soil permeability. The tested permeability must reasonably compare to the design permeability.

C. Subgrade Support: The subgrade shall be compacted by a mechanical vibratory compactor to a minimum density of 92% of a maximum dry density as established by ASTM D 1557 or AASHTO T 180. Subgrade stabilization shall not be permitted. If fill material (embankment) is required to bring the subgrade to final elevation, it shall be clean and free of deleterious materials. It shall be placed in 8 inch maximum layers, and compacted by a mechanical vibratory compactor to a minimum density of 92% of a maximum dry density as established by ASTM D 1557 or AASHTO T 180.

3.06.4 Subgrade Support: The subgrade shall be compacted by a mechanical vibratory compactor to a minimum density of 92% of a maximum dry density as established by ASTM D 1557 or AASHTO T 180. Subgrade stabilization shall not be permitted. If fill material (embankment) is required to bring the subgrade to final elevation, it shall be clean and free of deleterious materials. It shall be placed in 8 inch maximum layers, and compacted by a mechanical vibratory compactor to a minimum density of 92% of a maximum dry density as established by ASTM D 1557 or AASHTO T 180.

3.07 MIXING, HAULING AND PLACING:

A. Mix Time: Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.

B. Transportation: The portland cement aggregate mixture may be transported or mixed on site and should be used within one (1) hour of the introduction of mix water, unless otherwise approved by an engineer. This time can be increased to 90 minutes when utilizing the hydration stabilizer specified in Section 205.

C. Discharge: Each mixer truck will be inspected for appearance of concrete uniformity according to Section 304. Water may be added to obtain the required mix consistency. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following any addition of water to the mix. Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practicable and such that fresh concrete enters the mass of previously placed concrete. The practice of discharging onto subgrade and pulling or shoveling to final placement is not allowed.

D. Placing and Finishing Equipment: Unless otherwise approved by the Owner in writing, the contractor shall provide mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force. The pervious concrete pavement will be placed to the required cross section and shall not deviate more than _ 3/8 inch in 10

feet from profile grade. If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort shall be used immediately following the strike-off operation. After mechanical or other approved strike-off and compaction operation, no other finishing operation will be allowed. If vibration, internal or surface applied, is used, it shall be shut off immediately when forward progress is halted for any reason. The contractor will be restricted to pavement placement widths of a maximum of fifteen (15') feet unless the contractor can demonstrate competence to provide pavement placement widths greater than the maximum specified to the satisfaction of the Engineer.

E. Curing: Curing procedures shall begin within 20 minutes after the final placement operations. The pavement surface shall be covered with a minimum six (6) mil thick polyethylene sheet or other approved covering material. Prior to covering, a fog or light mist shall be sprayed above the surface when required due to ambient conditions (temperature, wind, and humidity). The cover shall overlap all exposed edges and shall be secured (without using dirt or stone) to prevent dislocation due to winds or adjacent traffic conditions.

Cure Time:
1. Portland Cement Type I, II or IS – 7 days minimum
2. Portland Cement Type I or Type 1P – 10 days minimum
3. No truck traffic shall allowed for 10 days (no passenger car/light trucks for 7 days).

F. Jointing: Transverse control (contraction) joints shall be installed at 20 foot intervals. They shall be installed at a depth of 1/4 the thickness of the pavement. Longitudinal control joints shall be installed at the mid-point if the constructed lane width exceeds 15 feet. These joints can be installed in the plastic concrete or saw cut. If saw cut, the procedure should begin as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking (normally after curing). Transverse construction joints shall be installed whenever placing is suspended a sufficient length of time that concrete may begin to harden. In order to assure aggregate bond at construction joints, a bonding agent suitable for bonding fresh concrete to existing concrete shall be brushed, rolled, or sprayed on the existing pavement surface edge. Isolation (expansion) joints will not be used except when pavement is abutting slabs or other adjoining structures.

3.08 TESTING, INSPECTION AND ACCEPTANCE:

A. Laboratory Testing: The Owner will retain an independent testing laboratory. The testing laboratory shall conform to the applicable requirements of ASTM E 329, Standard Recommended Practice for Inspection and Testing Agencies

for Concrete, Steel, and Bituminous Materials as Used in Construction, and ASTM C 1077, Standard Practice for Testing Concrete and Concrete Aggregates for Use in Construction, and Criteria for Laboratory Evaluation, and shall be inspected and accredited by the Concrete Advisory Board of Georgia, Inc. or by an equivalent recognized national authority.

The agent of the testing laboratory performing field sampling and testing for concrete shall be certified by the American Concrete Institute as a Concrete Field Testing Technician Grade I, or by a recognized state or national authority for an equivalent level of competence.

B. Testing and Acceptance: A minimum of one (1) gradation test of the subgrade is required every 5,000 square feet to determine percent passing the No. 200 sieve per ASTM C 117.

A minimum of one test for each day's placement of pervious concrete in accordance with ASTM C 172 and ASTM C 29 to verify unit weight shall be conducted. Delivered unit weights are to be determined in accordance with ASTM C 29 using a 0.25 cubic foot cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 29 Paragraph 11, "Jigging Procedure." The unit weight of the delivered concrete shall be _ 5 pcf of the design unit weight.

Test panels shall have two cores taken from each panel in accordance with ASTM C 42 at a minimum of seven (7) days after placement of the pervious concrete. The cores shall be measured for thickness, void structure, and unit weight. Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than 1/4 inch less than the specified thickness. After thickness determination, the cores shall be trimmed and measured for unit weight in the saturated condition as described in Paragraph 6.3.1 "Saturation" of ASTM C 140, "Standard Methods of Sampling and Testing Concrete Masonry Units." The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with a damp cloth, then weighed immediately. Range of satisfactory unit weight values are _ 5 pcf of the design unit weight.

After a minimum of 7 days following each placement, three cores shall be taken in accordance with ASTM C 42. The cores shall be measured for thickness and unit weight determined as described above for test panels. Core holes shall be filled with concrete meeting the pervious mix design.