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SECTION 02100

CLEARING

PART 1 - PRODUCTS

NONE IN THIS SECTION.

PART 2 - EXECUTION

2.01 CLEARING:

- A. Clearing shall consist of the felling, and cutting of trees into sections, and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, fences, rubbish and other objectionable material occurring within the area of construction, except such trees and vegetation as may be indicated or directed to be left standing. Only those trees, shrubs, lawns, sidewalks, fences, etc. that fall within the limits of construction or that interfere with proper construction practices shall be removed. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter. Limbs and branches to be pruned shall be cut to Natural Target Pruning standards by a certified arborist. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations, by the erection of timber 4' high chain link fencing barriers. Such barriers must be placed and be approved by the Owner before construction operations can proceed. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installation, and to those under construction, and so as to provide for the safety of employees and others.

2.02 TREE REMOVAL:

- A. Where indicated or directed, trees and stumps shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots. Trees shall be disposed of as hereinafter specified.

2.03 DISPOSAL:

- A. Disposal of trees, branches, snags, brush, stumps, etc., resulting from the clearing and grubbing shall be the responsibility of the Contractor and shall be disposed of

by removal from the site of this work. All costs in connection with disposing of the material will be at the Contractor's expense. All liability of any nature resulting from the disposal of the cleared and grubbed material shall become the responsibility of the Contractor. The disposal of all materials cleared and grubbed will be in accordance with the rules and regulations of the local, State, and Federal authorities.

2.04 GRUBBING:

- A. Grubbing shall consist of the removal and disposal of stumps, roots larger than ½ inch in diameter, and matted roots from the designated grubbing areas. This material, together with logs and other organic or metallic debris not suitable for foundation and subgrade purposes, shall be excavated and removed to a depth of not less than 18-inches below the original surface level of the ground in embankment areas and not less than 2-feet below the finished earth surface in excavated areas. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

2.05 EXISTING TREE PROTECTION:

A. SITE DEVELOPMENT PROJECTS:

The following requirements pertain primarily to site development projects such as Community Centers, Fire Stations, and other projects that require Tree Quality Points:

1. Tree Protection Zones shall be established and maintained on a site for all trees which are to be awarded Tree Quality Points. A Tree Protection Zone shall be defined as one foot lateral radius per inch diameter breast height (dbh) surrounded by a 4' high chain link fence. All tree protection shall be done in compliance with Section VII-A of the City of Savannah's Land Clearing and Tree Protection Ordinance. Tree Protection shall be installed and inspected by the City's Ordinance Administrator prior to issuance of a Land Clearing permit. Where pervious paving is allowed inside the Tree Protection Zone, it shall comply with ASTM Standards for testing and acceptance. Water compaction and hand rolling with a one ton maximum roller only shall be permitted in the installation of pervious paving within Tree Protection Zones. No vibratory equipment shall be used to finish paving. No crusher run or other impervious materials shall be used in the subbase. The Ordinance Administrator shall be notified 24 hours prior to a pour or installation. See Section 02600, Part 3 for "Pervious Concrete Specifications."

2. The required minimum number of Tree Quality Points shall be maintained on site at all times. Any loss of Tree Quality Points that drop the site below its required minimum shall be replaced in accordance with Section VII-C of the Land Clearing and Tree Protection Ordinance. All planting shall be done in accordance with ANSI A300-1995 Standards.
3. No trenching, root raking, grading, driving or parking, storage or disposal of construction materials shall occur within any Tree Protection Zone at any time during clearing or construction of the project.
4. Trenching is not allowed within Tree Protection Zones. Tunneling shall replace trenching in all Tree Protection Zones. Tunneling shall be performed at the minimum depth of 24" below existing grade.

B. PROJECTS WITHIN CITY RIGHT-OF-WAYS

1. The following requirements pertain to Street Paving, Sidewalks, Water and Sewer, and Drainage Projects:

Tree Protection Zones for all Street Paving, Sidewalk Construction, Water and Sewer, and Drainage Improvement Projects shall be established and maintained in compliance with Section VII of the Tree Protection Ordinance to all reasonable extents possible. All demolition, excavation, and construction within Tree Protection Zones shall be performed by hand or with light equipment whenever possible. Clean cuts to roots shall be made at all times. Wound dressing is not recommended.

All cuts and pruning shall be done according to ANSI A300-1995 standards. All debris shall be pulled away from trunks during demolition to minimize root damage and compaction. All excavation shall be filled to original levels and tamped to original firmness. Contractor shall notify Park and Tree Department immediately if any roots 3/4" diameter or larger are damaged so that an inspection can be made to determine impact and whether the root(s) should be cut or the design modified. For street paving projects where tree replacement is required, the minimum replacement shall be one canopy tree per 40 linear feet of frontage. All planting shall be done in accordance with ANSI A300-1995 Standards.

2. Violations, Remedies and Penalties for Projects in which Tree Quality Points are Applicable

Encroachment into a Tree Protection Zone that results in 50% or greater loss of root system, cambium, limbs, or a combination of the above shall result in 100% loss of Tree Quality Points for the tree. Loss of less than 50% shall result in a proportional reduction of Tree Quality Points, subject to the judgment of the Administrator. If

the Administrator determines that tree protection has failed to the extent that a tree meets removal criteria, the Park and Tree Department shall remove the tree, if on City property, and the contractor shall replace the Tree Quality Points (TQP) lost in accordance with Section VII of the Ordinance. The Contractor shall also reimburse the Owner for removal costs.

2.06 REMOVE AND REPLACE FENCE:

- A. Where existing fences must be removed, the materials shall be removed neatly and stored carefully. Reinstallation of the fence shall match the line and height of the existing fence, except as directed by the Engineer, when fences are to be replaced. The existing materials may be used, provided they are not damaged. Any damaged materials shall be replaced with new material equal to and matching in appearance the existing material. Fences that are required for security of private or public property shall be reinstalled before the end of the workday in which they were removed.

2.07 REMOVE AND REPLACE MAILBOXES:

- A. Where existing mailboxes must be removed, they shall be removed neatly and stored carefully or installed in a temporary location as directed by the Engineer. Reinstallation of the mailboxes shall match their previous location and height. The existing materials shall be used, provided they are not damaged. Any damaged materials shall be replaced with new material equal to and matching in appearance the existing material.

2.08 REMOVE AND REPLACE SHRUBS AND GROUNDCOVERS:

- A. Shrubs and groundcovers that are to be retained shall be preserved and protected. Items that must be disturbed or relocated shall be carefully removed so as to prevent damage to the root systems, stored, and replanted as soon as possible after construction in the area is completed. Heeling in, mulching and regular watering are minimum preservation treatments.

2.09 REMOVE AND REPLACE SIGNS:

- A. Where existing signs must be removed, they shall be removed neatly and stored carefully or installed in a temporary location as directed by the Engineer. Reinstallation of the signs shall match their previous location and height. The existing materials shall be used, provided they are not damaged. Any damaged materials shall be replaced with new material equal to and matching in appearance the existing material.

End of Section

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SECTION

EARTHWORK

PART 1 - PRODUCTS

1.01 MATERIALS:

- A. General: Where the terms "approved", "suitable", "unsuitable" and similar designations are used in specifications section pertaining to earthwork, it means earth or material designated as being approved, suitable or unsuitable for their intended use by the soils technician of the Engineer.
- B. Suitable Soil Materials are defined as those complying with ASTM D-2487 soil classification groups: GW, GP, GM, SM, SW, and SP.
- C. Unsuitable Soil Materials are defined as those complying with ASTM D-2487 soil classification groups GC, SC, MH, ML, CL, CH, OL, OH, PT. Clays, silts, and organic soils will be considered as unsuitable materials. Excess water in materials will be a basis for establishing unsuitable material regardless of gradation.
- D. Backfill and Fill Materials shall be suitable soil materials, free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter. Suitable materials for earth fill shall generally be composed of sands, clay-sand and silt-sand mixtures and shall be approved by the soils technician or the Engineer prior to being incorporated in fills.
- E. Borrow shall consists of sand or sand clay soils capable of being readily shaped and compacted to the required densities, and shall be free of roots, trash and other deleterious material.

PART 2 - EXECUTION

2.01 TOP SOIL

- A. Contractor shall strip and stockpile topsoil.
- B. Topsoil shall be placed to a depth of 4" over all disturbed areas.
- C. Any remaining topsoil will be hauled off site and disposed of at the Contractor's expense.

- D. Additional topsoil shall meet Georgia Department of Transportation Specification 893.1. Any additional topsoil which is required to repair disturbed areas and complete the contract shall be provided by the Contractor at his expense.

2.02 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. All excavation shall be in conformity with the lines, grades and cross sections shown on the Plans or established by the Engineer. All suitable material removed in the excavation shall be used as far as practicable in formation of embankment, subgrades and shoulders and at such other places as may be indicated on the Plans or directed by the Engineer.
- C. Unauthorized Excavation consists of removal or loosening of materials beyond indicated subgrade elevations or dimensions without specific directions of the Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, and as specified herein shall be at Contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavations by extending indicated bottom elevation of footing or base to the bottom of the excavation, without altering required top elevation.

Elsewhere, backfill and compact unauthorized walls, fill unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Engineer.

- D. Additional Excavation: When excavation has reached required subgrade elevations and unsuitable materials exist, carry excavations deeper and replace excavated materials as directed by the Engineer. Dispose of unsuitable material as directed by the Engineer.

The Contractor shall dispose of unsuitable and surplus materials except where the Engineer permits the use of such fill slopes, or unless specific disposal areas are shown on the Plans.

- E. Dewatering: Prevent surface water and subsurface or ground water flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of roadway subgrades and foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

The Contractor will be responsible for all damage incurred in handling water conditions.

- F. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and to minimize erosion. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
- G. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending of sufficient distance from footings and foundations to permit placing and removal of concrete framework, installations to permit placing and removal of concrete framework, installation of services, other constructions, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

- H. Proper drainage shall be maintained at all times.
- I. Perform excavation within the critical root zones of large trees to remain by hand or by other approved means which will not result in twisting, tearing, breakage or other injury to roots remaining on the tree. Protect existing trees and shrubs at all times during earthwork operations. No trees shall be removed without prior approval of the Park and Tree Department.

2.03 BORROW

- A. Shall be excavated and hauled by the Contractor from his own sources and shall meet the requirements as specified.
- B. Borrow shall be procured by the Contractor.
- C. Contractor shall bear all expenses in developing borrow sources including drying material, haul roads, excavation and hauling.

2.04 GROUND SURFACE PREPARATION FOR FILL

- A. All vegetation such as roots, brush, heavy sods, heavy growth of grass, decayed vegetation matter, rubbish, and other unsuitable material within the areas to be filled shall be stripped and removed prior to beginning the fill operation.
- B. Sloped ground surfaces steeper than 1 vertical to 4 horizontal, on which fill is to be placed shall be plowed, stepped, benched or broken up as directed, in such a manner that the fill material will bond with the existing surface.
- C. Surfaces on which fill is to be placed and compacted shall be wetted or dried as may be required to obtain the specified compaction.

2.05 FILL

- A. Shall be reasonably free from roots, organic material, trash and stones having maximum dimensions of 6 inches.
- B. Shall be placed in successive horizontal layers of 8 inches (4 inches for hand tamped compaction) in loose depth for the full width of the cross-section and compacted as required with heavy compaction equipment.

2.06 FINISH GRADING

- A. All areas covered by the project including excavated and filled sections and adjacent transition areas shall be smooth graded and free from irregular surface changes.
- B. Degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, supplemented with hand raking and finishing, except as otherwise specified.

- C. The finished surface of unpaved areas shall be not more than 0.05' feet above or below the established grade or designed cross-section. Grading shall be done in order that no ponding will occur.
- D. Ditches shall be finished smooth to reduce erosion and permit adequate drainage.

2.07 DISPOSAL OF WASTE MATERIAL

- A. All vegetation, roots, brush, sod, broken pavements, curb and gutter, rubbish, and other unsuitable or surplus material stripped or removed from the limits of construction shall be disposed of by the Contractor.

2.08 PROTECTION

- A. Protect existing trees and shrubs at all times during earthwork operations. No trees shall be removed without prior acceptance of the Owner.
- B. The Contractor shall be responsible for protection of below grade utilities shown on the drawings or indicated to him by the Owner at all times during earthwork operations.
- C. Graded areas shall be protected from traffic, erosion, settlement, or any washing away that may occur from any cause prior to acceptance.
- D. Any repair or reestablishment of grades prior to final acceptance shall be at the Contractors expense.

PART 3 - TESTING

3.01 COMPACTION TESTING

- A. General: Compaction of earth fill and all pavement subgrades shall be performed to the percentage of maximum standard of modified dry densities and to the depths as indicated below:
 - A. Roadway Subgrades: 100% Standard (ASTM Test D-698) Compact top 12" in Parking areas and top 15" in Driveways.
 - B. Subgrades under pavement removed and replaced for utility installations: 100% Standard (ASTM Test D-698) to 12 inch depth.

C. Structural Fill under all structures, slabs and steps: 98% Standard (ASTM Test D-698). Compact top 12 inches of subgrade and each layer of fill.

D. Subgrade below Sidewalks and Curb and Gutters: 97% Standard (ASTM Test D-698) Compact top 6 inches.

E. Unpaved Areas to be grassed, sodded or landscaped: 90% Standard (ASTM Test D-698) full depth.

All other areas not described above: as directed by the Engineer.

B. Moisture Control: All compaction shall be performed at material moisture contents within 3 percentage points, plus or minus, of optimum. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Remove, and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing until moisture content to a satisfactory value.

C. Field Density Tests: Tests shall be made in accordance with ASTM Method D-1556 and/or ASTM 2922. Minimum testing frequency shall be based on the most stringent of the following requirements (as applicable). Additional tests may be required by the Engineer in areas he deems critical.

- One every layer of fill,
- One every 200 cubic yards of fill,
- One every 250 square yards of roadway subgrade of fill
- One every building subgrade
- Areas where degree of compaction is in question

If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, additional compaction and testing will be required.

D. Proof Rolling: Proof rolling of the subbase or subgrade of all areas of new road paving will be required. Equipment shall have a minimum axle load of 6,000 pounds and a maximum axle load of 15,000 pounds or as determined by the Engineer.

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SECTION 02270 - EROSION AND SEDIMENTATION CONTROL

PART 1 - PRODUCTS

1.01 CHEMICALS FOR DUST CONTROL:

- A. Calcium Chloride, Anionic Asphalt Emulsion, Latex Emulsion or Resin-in-Water Emulsion may be used for dust control.

1.02 SILT FENCE FABRIC:

- A. Silt fence fabric shall be a woven fabric certified to meet FHWA's Task Force 25 minimum roll average per ASTM-D-4354. The geotextile fabric shall be a woven sheet of plastic yarn, of a long chain synthetic polymer composed of at least 85% by weight propylene, ethylene, amide, ester, or vinylidene chloride, and shall contain stabilizer and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra-violet and/or heat exposure. The fabric should be finished so that the filaments will retain their relative position with respect to each other. The fabric shall be free of defects, rips, holes, or flaws.

The fabric shall meet the following requirements:

Woven Fabrics

Grab Strength	90 lbs.
Mullen Burst Strength	250 lbs.
UV Resistance	90%
Permittivity	15 gal/min/sf.

Product shall be equivalent to EXXON GTF-180 Fabric or AMOCO Woven Construction Fabric No. 1380.

Silt fencing shall not be placed in waterways or areas of concentrated flow. Type "C" wire-reinforced silt fence shall be used where fill slopes exceed 3:1.

1.03 GABIONS:

- A. Gabions shall be constructed of heavy galvanized steel wire mesh with a zinc coating of triple hexagon weave. The mesh wire diameter for the galvanized gabions shall be 2.2 mm (.0866") \pm 2-1/2%; the mesh edge wire shall be not less than 2.7 mm - 2-1/2%. The lacing wire for binding the netting units together shall be 2.2 mm (.0866") + 2-1/2%.

Geotextiles are recommended to be used behind all gabion structures and shall be specified in accordance with AASHTO M288-96 Section 7.5, "Permanent Erosion Control

Requirements."

1.04 HAY BALES:

- A. Hay bales rectangular in shape shall be bound with wire or nylon to securely contain the material. Pine straw bales may be used in lieu of hay bales. Bales shall be placed in a single row, lengthwise, on the contour and embedded in the soil to a depth of four (4) inches. Bales must be securely anchored in place by stake or bars driven through the bales.

1.05 PLASTIC FILTER FABRIC:

- A. Plastic filter fabric shall be a pervious sheet of plastic yarn, of a long chain synthetic polymer composed of at least 85% by weight propylene, ethylene, amide, ester, or vinylidene chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra-violet and/or heat exposure. The cloth should be finished so that the filaments will retain their relative position with respect to each other. The cloth shall be free of defects, rips, holes, or flaws. During shipment and storage, the filter fabric shall be wrapped in a protective material. The fabric shall meet the following requirements.

Woven Fabrics:

Tensile Strength (any direction)	200 lbs.
Bursting Strength	400 psi
Elongation Before Breaking	15%
Permittivity	4 gal/min/sf

Product shall be equivalent to EXXON GTF-400E or AMOCO Woven Construction Fabric No. 2002.

- B. Seams - Fabric may be sewn together with thread of a material having the same chemical requirements as the material forming the fabric or shall be bonded by cementing or by heat. The strength of the seams shall be equal to that of the unaged fabric. Fabrics to be used under Rip-Rap are allowed to be bonded or sewn together forming sections not less than six feet wide.

1.06 SHEET PILING:

- A. Sheet piling shall be treated timber (0.5 CCA), steel (minimum 3/8-inch thick), or other material accepted on a case by case basis by the Engineer for the site at which the piling is used.

1.07 STONE:

- A. Stone shall be hard quarry, granite or field stone and shall be of such quality that the stone will not disintegrate on exposure to water or weather. The stone size, type and weight shall be as shown in conjunction with the structure with which it is associated. The stone shall be accepted by the Engineer prior to delivery.

1.08 TREATED TIMBERS:

- A. Treated timbers (0.5 CCA) shall be a nominal 4" by 4" and of varying length to accommodate the size of the proposed structure.

1.09 RIP-RAP:

- A. Rip-rap shall be hard quarry or field stone, and shall be of such quality that they will not disintegrate on exposure to water and weather. The stone shall range in weight from a minimum of 25 pounds to a maximum of 150 pounds. At least 50 percent of the stone pieces shall weigh more than 60 pounds. The stone pieces shall have a minimum plane dimension of 12 inches. The stone analysis, source and other pertinent data shall be submitted for review by the Engineer prior to delivery. The filter fabric for permanent Rip-rap shall be Mirafi 140N or equivalent. Rip Rap shall not be placed on slopes steeper than 1.5 horizontal to 1.0 vertical.

PART 2 - EXECUTION

2.01 GENERAL:

- A. Every effort shall reasonably be employed by the Contractor to control erosion with the use of, but not limited to, terraces, grassing, and silt fencing during the project. All erosion and sedimentation control measures or facilities, whether temporary or permanent, shall be continuously maintained by the Contractor so as to be effective, or as ordered by the Owner.

2.02 BUFFER ZONE:

- A. Buffer zone is an undisturbed zone or "green belt" surrounding the site, bordering streams or environmentally sensitive areas. Contractors shall not trespass on or in these areas unless he has prior acceptance by the Owner. Trespass in these areas will not be permitted unless there is no alternative method to accomplish the task. Cost shall not come into consideration in the evaluation of this type of request.

2.03 CONSTRUCTION EXIT:

- A. Construction exits shall be located at the exits of the project to remove mud from the tires of all vehicles leaving the site. The construction exit shall consist of a minimum of six (6) inch thick pad of washed stone meeting Section AASHTO M288-96, Section 7.4, Stabilization Requirements. The aggregate size shall be in accordance with National Stone Association R-2 (1 ½"-3 ½" diameter in size and of the necessary length to accomplish the task for which it is intended. The pad may require periodic top dressing with 2" of similar stone. Geotextiles are required and a Separation/Stabilization fabric to keep the aggregate stone from becoming contaminated with subgrade soils. The geotextile shall be based on AASHTO M288-96 Specifications. The entrance area must be excavated to a depth of 3 inches and be cleaned of all vegetation and roots. Geotextile underliner must be placed the full length and width of the entrance.

2.04 DISTURBED AREA STABILIZATION:

- A. Vegetative cover will be placed on completed areas. This vegetative plan will be carried out on road cut and fill slopes, shoulders, and other critical areas created by construction. Plant grass seed as soon as construction in an area is completed. Planting will be made to control erosion, to reduce damage from sediment and runoff to downstream areas and to improve the safety and beauty of the development area.

Due to grading and construction, the areas to be treated are mainly subsoil and substrate. Fertility is low and the physical characteristics of the exposed material are unfavorable to all but the most hardy plants.

Conventional Seeding Equipment - Grade, shape and smooth where needed to provide for safe equipment operation at seeding time and for maintenance purposes. The lime and fertilizer in dry form will be spread uniformly over the area immediately before seedbed preparation. A seedbed will be prepared by scarifying to a depth of 1 to 4 inches as determined on site. The seedbed must be well pulverized, smoothed and firmed. Seeding will be by either a cultipacker-seeder, drill, rotary seeder, mechanical seeder, hand seeder or hydro-seeding. Seed will be distributed uniformly over a freshly prepared seedbed and covered lightly. Within 24 hours after seeding, with exception to hydro-seeding, straw or hay mulch will be spread uniformly over the area, leaving about 25 percent of the ground surface exposed. Mulch will be spread with blower-type mulch equipment or by hand and anchored immediately after it is spread. A disk harrow with the disk set straight or a special packer

disk may be used to press the mulch into the soil.

The per acre application rates are as follows using conventional seeding equipment on slopes less than 3:1:

<u>Soil Treatment</u>	<u>Application Rate/Acre</u>
Agricultural limestone	4000 #/acre
Fertilizer, 10-10-10 (with micro-nutrients)	1500 #/acre
Mulch, straw or hay	4000 #/acre

2.	<u>Seed Species</u>	<u>Application Rates/Acre</u>	<u>Planting Dates</u>
	Hulled common bermuda grass	10 #	3/1 - 9/30
	Rye grass	50 #	10/1 - 2/28
	Hay mulch for Temporary cover	4000 #	N/A

Top-dressing: Apply when plants are 2 to 4 inches tall

Fertilizer (Ammonium Nitrate 33.5%) at 300 #/acre

If the project extends in to the second year, fertilizer shall be applied at the rate of 800 #/acre.

2.05 DUST CONTROL ON DISTURBED AREAS:

- A. Dust raised from vehicular traffic will be controlled by wetting down the access road with water or by the use of a deliquescent chemical, such as calcium chloride, if the relative humidity is over 30%. Chemicals shall be applied in accordance with the manufacturer's recommendations. Calcium chloride, anionic asphalt emulsion, latex emulsion or resin-in-water emulsion may be used for dust control.

2.06 DOWNDRAIN STRUCTURE:

- A. Downdrain structures shall be constructed where shown on the drawings and elsewhere as necessary to carry runoff down slopes to prevent the formation of rills or gullies. Downdrain structures shall be a paved chute, steel or plastic pipe, or sectional pipe at the discretion of the contractor. Outlets of downdrains shall outfall into stabilized areas only. Soil around the inlet shall be compacted to prevent the pipe from being washed out by seepage. Rock rip-rap or other suitable materials shall be placed at the outlet for stabilization.

2.07 GABIONS :

- A. Gabions shall be of the size shown on the drawing and as dimensioned in the details on the plans. The gabions shall be laced together along the perimeter of all surfaces and filled with 4" to 8" diameter stone in 3 lifts, with two connecting wires placed between each lift. Care shall be taken to protect the vertical panels from being bent during filling.

2.08 SEDIMENT BARRIER:

- A. Sediment barrier shall be constructed of hay bales (pine bales) anchored and embedded into the soil to prevent washout or water washing under the barrier. A minimum of two (2) re-bars, steel pickets or 2" x 2" stakes shall be used per bale and shall be long enough to extend through the bale and be driven into the ground a minimum of 1-1/2 feet. Where two (2) rows are called for, the bales shall be staggered. Bales shall be embedded in the soil to a depth of 4 inches.

Bales shall be placed in a single row, lengthwise, on the contour and embedded in the soil to a depth of four (4) inches. Bales must be securely anchored in place by stakes or bars driven through the bales.

2.09 SILT FENCE:

- A. Silt fence shall be placed at the approximate location shown on the plans and installed in accordance with the Georgia Erosion and Sediment Control Manual recommendations. Type "C" wire-reinforced silt fence shall be used where fill slopes exceeds 3:1. Silt fence shall not be placed in waterways or areas of concentrated flow.

2.10 STONE PLACEMENT:

- A. The minimum thickness or depth of the stone layer shall be shown on the drawings or the detail with which the device is associated. When used with a plastic filter fabric, the stone placing shall begin in a trench at the bottom of the slope with the filter fabric wrapped in stone. The entire mass of stone shall be placed so as to be in conformance with the lines, grades, and thickness shown on the drawings.

2.11 RIP-RAP :

- A. Rip-rap shall be placed in accordance with the notes on the drawings. Any rip rap that shall be permanent shall have an underlayment of filter fabric.

2.12 STORM DRAIN OUTLET PROTECTION:

- A. Storm drain outlets shall be paved or have a rock or other energy dispersion device associated with it, as called for on the drawings. The length shall be a minimum of six (6) times the pipe diameter and placed on a 1% grade unless otherwise specified on the drawings.

To prevent undermining of the rip-rap apron a separation geotextile shall be used beneath the entire length of apron. The geotextile shall be specified in accordance with AASHTO M288-96, Section 7.5, "Permanent Erosion Control Requirements".

2.13 INLET SEDIMENT TRAP:

- A. The Contractor shall erect silt fence or hay bales at and around inlets under construction. Existing inlets in paved areas shall be protected by the use of concrete blocks wrapped with filter fabric as per detail. Sufficient quantities of selected devices shall be utilized to completely protect the entire length of the inlet. Contractor may alternately construct a temporary baffle in the inlet on the effluent pipe per detail providing that accumulated sediment be removed after each erosion event.

2.14 SITE RESTORATION:

- A. The site shall be restored in a manner suitable to accommodate the erosion control device or system of devices for the use which they are intended.

2.15 TOPSOIL:

- A. If topsoil is stripped and stored on site to be used after construction, the stockpile side slopes shall be 2:1 or flatter. Stockpiled topsoil shall not obstruct natural drainage. Topsoil replacement shall be spread at minimum of 4" thickness.

2.16 SITE SAFETY:

- A. The Contractor shall incorporate and utilize all necessary fencing and other safety barriers as necessary, or directed by Owner, to prevent trespassing into potentially dangerous areas of the erosion control area.

END OF SECTION

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SECTION 02400

STORM DRAINAGE

PART 1 – PRODUCTS

1.01 PIPE:

- A. Round Concrete Pipe – Shall be reinforced Class III and shall conform to ASTM Specification C -76 or AASHTO Specification M 170.
 - 1. Joints – Shall be water tight flexible rubber gasket and shall meet ASTM Specification C-443
 - 2. Filter Fabric – Mirafi 140N or equivalent.
 - 3. Concrete pipe shall be designed with no lifting holes. The lifting holes will jeopardize the structural integrity and hydraulic capacity of the pipe once installed.
 - 4. A minimum depth of 12 inches cover is required for RCP Class III.

- B. Reinforced Concrete Elliptical Culvert and Storm Sewer Pipe – Shall be reinforced Class He-III, or VE-III, and shall conform to ASTM Specification C -507 or AASHTO Specification M-207.
 - 1. Joints – Shall be water tight flexible rubber gasket and shall meet ASTM Specification C-443
 - 2. Filter Fabric – Mirafi 140N or equivalent.
 - 3. Concrete pipe shall be designed with no lifting holes. The lifting holes will jeopardize the structural integrity and hydraulic capacity of the pipe once installed.
 - 4. A minimum depth of 12 inches cover is required for RCP Class III.

- C. Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe – Shall be reinforced Class A-III, and shall conform to ASTM Specification C -506 or AASHTO Specification M-206.
 - 1. Joints – Shall be water tight flexible rubber gasket and shall meet ASTM Specification C-443

2. Filter Fabric – Mirafi 140N or equivalent.
 3. Concrete pipe shall be designed with no lifting holes. The lifting holes will jeopardize the structural integrity and hydraulic capacity of the pipe once installed.
 4. A minimum depth of 12 inches cover is required for RCP Class III.
- D. Plastic Pipe - To be used for subgrade drainage shall be rigid heavy duty corrugated polyethylene perforated pipe manufactured by Advance Drainage Systems (ADS), or accepted equivalent, and shall conform to AASHTO M-252. The use of coiled tubing is not permitted and will be rejected.

1.02 DRAINAGE STRUCTURES:

- A. Details – See Plans.
- B. Concrete – Reinforced and non-reinforced.
1. Shall have a compressive strength of 3,000 PSI in 28 days. Concrete shall be ready mixed conforming to ASTM-C-94.
 2. Reinforcing steel shall conform to ASTM A-615, Grade 60. Mesh reinforcing shall conform to ASTM-A1064. Reinforcing shall be covered by a minimum 1" of concrete for covers and 1 ½ "for walls and flooring and 3" where concrete is deposited directly against the ground.
 3. Preformed Expansion joint filler materials shall conform to ASTM Specification D-1751, or shall be resin impregnated fiberboard conforming to the physical requirements of ASTM Specification D-1752.
- C. Mortar:
1. Mortar used at connections of pipe and drainage structures shall be composed of one part by volume of Portland cement and two parts of sand. The Portland cement shall conform to ASTM C-150, Type I or II. The sand shall conform to AASHTO Standard M-45 and shall be of an accepted gradation. Hydrated lime shall conform to ASTM C-141, Type A. The quantity of water in the mixture shall be sufficient to produce a workable mortar, but shall in no case exceed

7 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies and organic impurities. The mortar shall be used within 30 minutes from the time the ingredients are mixed with water.

- D. Brick Masonry – Brick shall conform to ASTM Specification C-62, Grade SW or C-55, Grade P-I or P-II. Mortar for jointing and plastering shall consist of one part Portland cement and two parts fine sand. Lime may be added to the mortar in the amount not more than 25% of the volume of cement. The joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with ½ -inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course, and for round structures, brick shall be laid radially with every sixth course a stretcher course.
- E. Pre-cast – Shall be constructed in accordance with ASTM C-478 and conform to the details on the project drawings.
 - 1. Joints – Shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O-Ring or Type A or B “Tylox” conforming to ASTM C-443 and mastic shall be “Ram-nek”, or equivalent, with primer. The primer shall be applied to all contact surfaces of the manhole joint at the factory in accordance with the manufacturer’s instructions.
 - 2. Steps – Shall be aluminum alloy equivalent to Neenah R-1982-W or polypropylene equivalent to M.A. Industries PS-1-PF. The steps shall be installed at the manhole factory and in accordance with the recommendations of the step manufacturer. Manholes will not be acceptable if steps are not installed accordingly, and properly aligned vertically.
 - 3. Leaks – No leaks in the manhole will be acceptable. All repairs made from inside the manhole shall be made with mortar composed of one part Portland cement and two parts clean sand; the mixing liquid shall be straight bonding agent equivalent to “Acryl 60”.

1.03 DRAINAGE CASTINGS:

- A. General - This specification is applicable for gray and ductile iron construction castings. All castings shall be manufactured in the United States of America by Neenah Foundry Company, U.S. Foundry &

Manufacturing Corporation, East Jordan Iron Works, Inc. or approved equal. All manufacturers shall be approved suppliers and be able to demonstrate that there is an acceptable quality control program at the producing foundry, prior to supplying castings.

- B. Material - Gray iron castings for heavy duty applications shall be manufactured from iron conforming to ASTM A48, Class 35B of AASHTO M306, or as requested by the purchaser. Gray iron castings for sidewalk or pedestrian applications shall be manufactured from iron conforming to ASTM A48, Class 30B or 35B, or as requested by the purchaser. Ductile iron castings shall conform to ASTM A536.
- C. Manufacture - Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage, cracks and other surface defects. Castings shall be ground smooth and well cleaned by shot blasting. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision to prevent rocking. As-cast dimensions may vary within accepted foundry tolerances as outlined in the Iron Castings Handbook published by the American Foundry Society. Nominally, casting dimensional tolerances shall be +/- 1/16" per foot. All published casting weights are average and approximate values and shall vary +/- 5%. Castings shall be furnished painted or unpainted as specified by the purchaser.
- D. Proof Load Testing - Traffic service castings shall have a first article proof load test conducted and the results of that proof load shall be made available upon request. The proof load shall be conducted in accordance with the method and procedure that is outlined in AASHTO M306. The casting shall be tested on a suitable and calibrated load testing machine and the casting shall hold a 40,000 pound proof load for one minute without experiencing any cracks or detrimental permanent deformation.
- E. Inspection - Inspections shall be in accordance with AASHTO M306. Results of these tests shall be furnished to the purchaser upon request. The heat or production date and product numbers shall be cast on the casting. This information shall be used for casting traceability and testing.
- F. Marking - All castings shall be identifiable and show, at a minimum, the following: name of the producing foundry, "Made in USA" as country of origin, ASTM material designation, individual part number, cast or heat date. In addition, at a minimum, the top or traffic side of all castings shall be clearly marked "Storm" and "City of Savannah" with "Dump No Waste Drains to River" or "Waterways" or "Drains to River" in flush cast letters. This includes all manhole covers, grates, and similar castings.

Refer to casting specifications and details as found in the City of Savannah's *Standard Details for Drainage*.

Note: Particular attention should be made to the specific "Savannah Coastal" casting image required on Inlet Manhole Covers.

- G. Sampling - Random checks on the castings may be conducted. These random checks would be conducted in accordance with AASHTO M306.
- H. Records - Test results for each lot of castings shall be maintained by the foundry for a minimum of seven years and shall be made available upon request.

Certification/Standards Compliance

ASTM A48 Material

ASTM A536 Material

AASHTO M306 Product Performance/Quality

ISO 9001:2008 Quality Assurance

- I. Quality Assurance - System of manufacturing quality assurance must conform to the requirements of ISO 9001:2008 and be certified by a third party.

1.04 PRE-CAST BOX CULVERTS:

- A. Pre-cast box culvert sections shall conform to ASTM specification C1577.
- B. Details – See Plans.
- C. Concrete - Mix design shall have a minimum compressive strength of 5,000 psi. The concrete mix design shall conform to ASTM C150 for cement and ASTM C33 for aggregates.
- D. Reinforcing Steel - shall conform to ASTM A185/A or A497/A.
- E. Joints and Gaskets - shall be watertight and conform to ASTM C1677-09.
- F. Filter Fabric – Mirafi 140N or equivalent.
- G. Box culvert sections shall be designed with no lifting holes.

1.04 STONE BACKFILL:

- A. Shall be graded crushed granite with the following gradation:

<u>Square Opening Size</u>	<u>Weight</u>	<u>Percent Passing By</u>
1"		100%
3/4"		90% to 100%
3/8"		0% to 65%
No. 4		0% to 25%
No. 100		0% to 10%

1.05 SAND BACKFILL:

- A. Shall be clean sand free from clay and organic material as described in Section 02200-1.01-D. Not more than 10% shall pass the No. 100 sieve.

1.06 BORROW:

- A. Where it is determined by the Engineer that sufficient suitable material is not available from the site to satisfactorily backfill the pipe to at least 2 feet above the top of the pipe, the Contractor shall furnish suitable sandy borrow material to accomplish the requirements. The material shall not have more than 60% passing the No. 100 sieve, nor more than 20% passing the No. 200 sieve.

PART 2 – EXECUTION & TESTING

2.01 LOCATION AND GRADE:

- A. The vertical and horizontal location of the sewer and ditches and the position of all manholes and other structures are shown on the drawings. The grade line as given on the profile or mentioned in these specifications means the invert or bottom of the inside of the pipe or bottom of ditch.

The Contractor shall be responsible for the proper location and grade of drainage pipe, culverts and other structures. Pipe and box culvert lines shall be straight and show a uniform gradient between manholes. The following descriptions of pipe related work shall also apply to all drainage structures including manholes, inlets, box culverts, junction boxes and other underground features.

2.02 EXCAVATIONS:

- A. Excavated material shall be piled a sufficient distance from the trench banks to avoid overloading to prevent slides or cave-ins, following OSHA trench safety techniques and requirements.
- B. Remove from site all material not required or suitable for backfill.
- C. Grade as necessary to prevent water from flowing into excavations.
- D. Remove all water accumulating in the excavation from surface flow, seepage or otherwise, by pumping or other accepted method.
- E. Provide bracing and shoring as necessary for the protection of the work and safety of personnel.

2.03 TRENCHING:

- A. The width of trenches at any point below the top of the pipe shall not be greater than the outside diameter of the pipe, plus 2' – 0" for pipes measuring through 30-inches, and 3' 0" for pipes greater than 30-inches box culverts and other structures, to permit satisfactory jointing and through tamping of the bedding material under and around the structures. Shoring and bracing where required shall be placed within the trench width as specified. Care shall be taken not to over-excavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this re-design and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the owner.
- B. Removal of Unstable Material – Where wet or otherwise unstable soil, incapable of supporting the pipe, as determined by the Owner, is encountered in the bottom of the trench, such material shall be removed to the depth required and replaced to the proper grade with select material, compacted as provided in Paragraph 2.08, "BACKFILLING", hereinafter.

2.04 BRACING AND SHORING:

- A. The sides of all trenches and other excavations shall be securely held by skeleton or solid sheeting and bracing, as required to protect the adjoining property and for safety.

2.05 BEDDING:

- A. The bedding surface for pipe and other structures shall provide a firm foundation of uniform density throughout the entire length of pipe or extent of structure. The excavation bottom shall be dewatered by whatever means and methods are necessary before installing pipe or other structures. Depending on the nature of the soil and other conditions, Contractor shall use well points or other means such as sumps and sump pumps to remove all water from the bedding surface. Pipe shall be carefully bedded in a soil foundation that has been accurately shaped and rounded to conform to the lowest one-fourth (1/4) of the outside portion of circular pipe, or to the lower curved portion of arch pipe for the entire length of the pipe. When necessary, the bedding shall be tamped to compact it to 95% modified proctor density (ASTM 1557). Bell holes and depressions for joints shall be only of such length, depth and width as required for properly making the particular type joint.
- B. Stone Backfill – Where, in the opinion of the Engineer, the subgrade of the pipe trench is unsuitable material, the Contractor shall remove the unsuitable material a minimum of six inches (6”) deep and furnish and place stone backfill in the trench to stabilize the subgrade. The stone shall be ¾-inch graded but variations in the gradation will be permitted upon acceptance by the Engineer. Attention is invited to the fact that the presence of water does not necessarily mean that stone backfill is required. If well points or other types of dewatering will remove the water, the Contractor shall be required to completely dewater the trench in lieu of stone backfill. Stone backfill will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Pipe shall be carefully bedded in the stone as specified above. Crushed concrete or other aggregates cannot be substituted for natural stone.
- C. Sand Backfill - Where in the opinion of the Engineer, the character of the soil is such that the material even though dewatered is unsuitable for pipe bedding, an additional foot of excavation shall be made and replaced with clean sand furnished by the Contractor.

2.06 PLACING PIPE AND PRE CAST BOX CULVERT SECTIONS:

- A. Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipe lines shall be laid to the grades and alignment indicated. Proper equipment shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid when trench conditions or weather are unsuitable for such work.

Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall have been checked before backfilling. When storm drain pipe terminates in a new ditch, the headwall or end section together with ditch pavement, if specified, shall be constructed immediately as called for on the plans. Ditch slopes and disturbed earth areas shall be grassed and mulched as required.

The Contractor will be responsible for maintaining these newly constructed ditches and take immediate action subject to acceptance to keep erosion of the ditch bottom and slopes to a minimum during the life of the contract. No additional compensation will be given to the Contractor for the required diversion of drainage and/or dewatering of trenches. Grassing of the completed earth surface of the trench backfill shall conform to the technical specification for Grassing.

- B. Concrete Pipe – Laying shall proceed upgradient with the spigot ends of bell and spigot pipe pointing in the direction of the flow.
- C. Each box culvert section shall be carefully examined before being laid, and defective or damaged sections shall not be used. Box culvert lines shall be laid to the grades and alignment indicated. Proper equipment shall be provided for lowering sections of box culvert into trenches. Under no circumstances shall box culverts be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.
- D. Pre-cast Box Culverts – Installation shall proceed upgradient with tongue ends of tongue and groove box culverts pointing in the direction of the flow.

2.07 JOINTS IN PIPES AND BOX CULVERTS:

- A. Concrete Pipe – Flexible watertight joint shall be made with rubber-type gaskets for concrete pipe. The design of joints and the physical requirements for rubber-type gaskets shall conform to ASTM Specification C-443.
 - 1. Installation of Filter Fabric at Joint – After each joint is joined together; the Contractor shall place two layers of Mirafi 140N or equivalent filter fabric around the joint a minimum width of four feet, centered on the joint.
- B. Pre-cast Box Culverts – Flexible watertight joint shall be made with rubber-type gaskets for concrete box culverts. The design of joints and

the physical requirements for rubber-type gaskets shall conform to ASTM Specification C1677-09.

1. Installation of Filter Fabric at Joint – After each joint is joined together; the Contractor shall place two layers of Mirafi 140N or equivalent filter fabric around the joint a minimum width of four feet, center on the joint. The two layers of fabric shall wrap around all four sides of the box culvert joint.

2.08 BACKFILLING:

- A. After the bedding has been prepared and the pipe installed, select material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of the pipe in layers not exceeding six-inches (6”) in compacted depth. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to insure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compaction shall continue until the fill has reached an elevation of at least 12-inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical tampers or rammers in layers not exceeding 8-inches. Soil density relations tests and moisture density relations tests may be performed by a testing firm or laboratory and shall be taken as directed in conformance with the compaction requirements specified in subparagraph “COMPACTION” hereinafter. Deficiencies shall be corrected by the Contractor without additional cost to the owner, any sheeting and/or portions of bracing used shall be left in place. Untreated sheeting shall not be left in place beneath structures or pavements.
- B. For pipe placed in fill sections, the backfill material and the placement and compaction procedures shall be as specified above and in subparagraph “COMPACTION” hereinafter. The fill material shall be uniformly spread in layers longitudinal on both sides of the pipe, not exceeding six inches (6”) in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12-inches above the top of the pipe shall extend a distance of not less than twice the outside diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12-inches above the top pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8-inches.

- C. In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert at any stage of the construction shall be at the Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at the expense of the Contractor.

2.09 DETECTION TAPE:

- A. Metal Detectable Tape – Marking tape shall be a corrosion resistant, detectable marking tape designed for use in the protection and location of nonmetallic or low metal content underground piping. The tape shall consist of solid aluminum foil which is incased in chemically inert polyethylene plastic that will not degrade when exposed to acid, alkalies and other destructive surfaces commonly found in soil. The solid foil core shall be encased in a protective jacket that allows the visual inspection of the aluminum core on one side to ensure continuity. The tape shall be 6.0 mil thick total thickness (the aluminum portion of the tape is only 0.35 mil thick) and 3 inches wide with tensile strength of 2800 PSI. A continuous warning message repeated every 24" to 36" shall be imprinted on the tape surface. The tape shall contain an opaque color concentrate designating the color code appropriate to the line being buried. Safety precaution green with "Caution – buried storm sewer below" or similar markings on tape. The contractor shall place the tape over the installed drainage pipes at a depth not to exceed 18 inches below the finished surface. The metallic tape shall be equivalent to terra-tape by Griffolyn Co. Inc of Houston Texas.

2.10 COMPACTION:

- A. Soil and compaction tests shall be made by a testing laboratory accepted by the Owner and 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. Laboratory compaction characteristics of the soil shall be made in accordance with ASTM D-1557. In-place density tests shall be made in accordance with ASTM D-1556, D-2922 or D-5195. Results of the tests shall be furnished to the Owner by the testing laboratory.

The minimum number of tests required shall be:

Backfill in traffic areas 1 per 100 lf or less for each 2' of depth or portion thereof. (Minimum of 2 for any line segment.)

Backfill in non-traffic areas 1 per 200 lb or less for each 6 feet of depth or portion thereof.

The minimum percent of compaction of the backfill material (in accordance to ASTM D-1557) shall be the following:

In traffic areas 98% for the top 12" of backfill under the pavement base; 95% below the 12" line.

In non-traffic areas 95%

2.11 DRAINAGE STRUCTURES:

- A. Drainage structures shall be constructed of the materials specified for each type and in accordance with the details shown on the drawings.

2.12 MANHOLES:

- A. Manholes shall be constructed where shown on the drawings or where directed by the Owner. The channel in the bottom of the manholes shall be smooth and properly shaped. Special care must be exercised in laying the channel in adjacent pipes to grade. The tops of manholes shall be built to grades designed by the Owner. Manhole sections with either honeycomb defects; exposed reinforcing; broken/fractured tongue or groove; or cracked walls will be subject to rejection by the Engineer for use on the project. When mastic sealant is used, improperly applied primer will also be cause for rejection.

2.13 LEAKAGE:

- A. All visible leaks shall be repaired, regardless of the amount of leakage.

2.14 CONNECT PIPE TO EXISTING STRUCTURES:

- A. The Contractor shall connect the system to the existing structure where indicated. A hole not more than 4-inches larger than the outside diameter of the new pipe shall be cut neatly in the structure and the new pipe laid so that it is flush with the inside face of the structure. The annular space around the pipe shall be filled with a damp, expanding mortar or grout, combined with bricks and/or brick fragments, as necessary to make a watertight seal.

2.15 CLOSING PIPE:

- A. When the work or pipe laying is suspended, either for night or at other times, the end of the sewer must be closed with a tight cover. The Contractor will be held responsible for keeping the sewer free from obstructions.

2.16 REGRADE EXISTING DITCH:

- A. Designated existing ditches shall be regarded and shaped to provide a bottom with a uniform slope, without depressions that hold water, and that conforms to the plan grades. The side slopes shall be smooth and uniform, dressed by hand if necessary, conforming to the indicated slopes.

2.17 CONSTRUCT NEW DITCHES:

- A. New ditches as shown on the construction drawings shall be graded and shaped to provide a bottom with a uniform slope, without depressions that hold water, and that conforms to the plan grades. The side slopes shall be smooth and uniform, dressed by hand if necessary, conforming to the indicated slopes. Ditches with side slope greater than 3:1 (Horizontal: Vertical) shall be stabilized by means of woven jute fabric engineered for erosion control and soil stabilization, or approved equal.

2.18 CLEANING:

- A. Prior to televising and before acceptance of the storm systems, all storm lines shall be cleaned to the satisfaction of the Engineer. Where any obstruction occurs, the Contractor will be required to clean the lines by means of flushing and rods and swabs or other instruments.

2.19 TELEVISIONING:

- A. After the completion of cleaning, all constructed storm lines must be televised prior to acceptance. Accordingly, all storm lines that are installed within accepted public right-of-ways and easements will be televised, including the first section of private lines between manholes that are connected to the public lines. In addition, storm lines from stormwater detention basins to the City system shall be televised. No lines shall be televised within 30 days of installation. If televising is performed by City personnel, contractors will be charged a standard fee, and will be responsible for preparing the lines to insure that they are cleaned and free of debris prior to televising. Details and procedures of this program are included in the "Televising Procedures Manual"

developed by the City's Water Quality Control Department who will be providing the television services. Contractors will be responsible for becoming familiar with this manual.

2.20 RECORD DATA:

- A. As required under Section 1500, Paragraph 54, of the General Conditions, the Contractor is required to keep accurate, legible records of the vertical and horizontal location of all new storm lines and structures during construction. These records shall be made available to the Engineer before his final review for incorporation into Record Drawings. Final payment to the Contractor will be withheld until all such information is received and accepted.

END OF SECTION

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SECTION 02485 - GRASSING

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SECTION 02485

GRASSING

PART 1 - PRODUCTS

1.01 MATERIALS GENERAL:

- A. The Contractor shall, at the time of delivery, furnish the Engineer invoices of all materials, received in order that the application rate of materials may be determined.

1.02 FERTILIZER:

- A. 10-10-10, commercial fertilizer of accepted type, conforming to state fertilizer laws.

1.03 LIME:

- A. Lime shall be agricultural grade, ground limestone and shall conform to the requirements of the Georgia Department of Agriculture. Lime to be added based on soil tests.

1.04 SEED:

- A. All seed shall conform to all State Laws and to all requirements and regulations of the Georgia Department of Agriculture.
- B. The several varieties of seed shall be individually packaged or bagged, and tagged to show name of seed, net weight, origin, germination, lot number, and other information required by the Department of Agriculture.
- C. The Engineer reserves the right to test, reject, or accept all seed before seeding.
- D. Mixtures of different types of seed called for in the seeding schedule shall be weighted and mixed in the proper proportions at the site of the work in the presence of the Engineer.

1.05 SEEDING SCHEDULE:

- A. Hulled Bermuda Seeds are to be used at a rate of 40 pounds per acre, and at a depth of 1/4 to 1/8 inch. Pure line seed to be 82% by weight, with a maximum weed seed of 0.50%.
- B. In shaded areas, or other areas as directed by the Owner or Engineer, the Contractor shall use a mixture of hulled Bermuda seed at a rate of 25 pounds per acre and carpet seed at a rate of 30 pounds per acre.

- C. Temporary grassing shall consist of annual rye grass seed at a rate of 75 pounds per acre.
- D. In areas where existing grasses are to be matched, the Contractor shall sow the seed at the rate recommended by the seed distributor.

1.06 STRAW MULCH:

- A. Straw mulch material shall consist of straw or hay. Straw shall be stalks of wheat, rye, barley, oats, or other accepted straw. Hay shall consist of timothy, peavine, alfalfa, coastal bermuda or other grasses from accepted sources. These materials shall be reasonably dry and shall be reasonably free from mature seed-bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Sandbur, Wild Garlic, Wild Onion, Wild Mustard, Crotonaria, Pigweed, Witchweed and Coclebur. The Contractor shall also comply with all State and Federal domestic plant quarantine regulations.

1.07 EXCELSIOR MULCH:

- A. Excelsior mulch shall consist of wood fibers cut from sound, green timber. The average length of the fibers shall be 4 to 6 inches. The cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to the natural grain of the wood so as to cause splintering of the fibers when weathering in order to provide adherence to each other and to the soil.

1.08 WOOD CELLULOSE FIBER MULCH:

- A. Wood cellulose fiber mulch shall be made from wood chips particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogenous slurry. The mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate the underlying soil. The mulch shall be heat processed so as to contain no germination or growth-inhibiting factors. It shall be dyed (non-toxic) an appropriate color to facilitate metering of material.
- B. Suppliers shall be prepared to certify that laboratory and field testing of their project has been accomplished, and that it meets all of the foregoing requirements based upon such testing.
- C. Weight specifications for this material from suppliers and for all applications shall refer only to air dry weight of fiber material. Absolute air dry weight is

based on the normal weight standard of the Technical Association of the Pulp and Paper Industry for wood cellulose and is considered equivalent to 10% moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air dry weight content.

1.09 SOD:

- A. Sod shall be densely rooted, good quality centipede grass, free from noxious weeds. The sod shall be obtained from areas where the soil is reasonably fertile. The sod shall be raked free of all debris and the grass mowed to two inches before cutting. The sod shall contain practically all of the dense root system and not be less than one (1) inch thick. Sod shall be cut in uniform strips not less than twelve (12) inches in width and not less than twenty-four (24) inches in length.

1.10 PRODUCT REVIEW:

- A. The Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

PART 2 - EXECUTION

2.01 STAND OF GRASS:

- A. Before acceptance of the seeding performed for the establishment of permanent vegetation, the Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the winter weather and be capable of re-establishment in the spring.
- B. Before acceptance of the seeding performed for the establishment of temporary vegetation, the Contractor will be required to produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or the establishment of permanent vegetation is to commence.

2.02 SEEDING DATES AND RATES OF APPLICATION:

- A. Seeding shall be performed during the periods and at the rates specified in the seeding schedules. Seeding work may, at the discretion of the Contractor, be performed throughout the year using the schedule prescribed for the given period. Seeding work shall not be conducted when the ground is frozen or excessively wet. The Contractor will be required to produce a satisfactory stand of grass regardless of the period of the year the work is performed.

2.03 PREPARATION:

- A. The areas to be seeded or sodded shall be made smooth and uniform and shall conform with the finished grade and cross section shown on the plans or as otherwise designated. Minor shaping and smoothing of uneven and rough areas outside the graded section shall be performed as directed by the Engineer in order to provide for more effective erosion control and for ease of subsequent mowing operations.
- B. The areas to be grassed, if not loose, shall be loosened to a minimum depth of 3 inches before agricultural lime, fertilizer, seed or sod is applied. The areas to be seeded shall be cleared of stones larger than 2-1/2-inches, in any dimension, roots, and other debris.

2.04 APPLYING LIME AND FERTILIZER:

- A. Following advance preparation and placing selected material for shoulders and slopes when called for in the contract, lime if called for based on soil tests and fertilizer shall be spread uniformly over the designated areas and shall be thoroughly mixed with the soil to a depth of approximately 2 inches. Fertilizer shall be applied at the rate of 500 pounds per acre for the initial application, unless otherwise directed by the Engineer. Lime shall be applied at the rate determined by the soil test. Unless otherwise provided, lime will not be applied for temporary seeding. In all cases where practicable, acceptable mechanical spreaders shall be used for spreading fertilizer. On steep slopes subject to slides and inaccessible to power equipment, the slopes shall be adequately scarified. Fertilizer may be applied on steep slopes by hydraulic methods as a mixture of fertilizer and seed. When fertilizer is applied in combination seed and fertilizer drills, no further incorporation will be necessary. The fertilizer and seed shall be applied together when the method of seeding (Wood Cellulose Fiber Mulch) is used. Any stones larger than 2-1/2 inches in any dimension, larger clods, roots, or other debris brought to the surface shall be removed.

2.05 SEEDING:

- A. Seed shall be sown within 24 hours following the application of fertilizer and lime and preparation of the seedbed as specified in Section 2.04. Seed shall be uniformly sown at the rate specified by the use of acceptable mechanical seed drills. Rotary hand seeders, power sprayers or other satisfactory equipment may be used on steep slopes or on other areas that are inaccessible to seed drills.
- B. The seeds shall be covered and lightly compacted by means of a cultipacker or light roller if the drill does not perform this operation. On slopes inaccessible to

compaction equipment, the seed shall be covered by dragging spiked chains, by light harrowing or by other satisfactory methods.

- C. Apply water with fine spray immediately after each area has been sown.
- D. Do not sow seed when ground is too dry, during windy periods or immediately following a rain.
- E. All seeded areas seeded with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 2 tons of straw per acre.

2.06 SEEDING (EXCELSIOR MULCH):

- A. Seed shall be sown as specified in Section 2.05. Within 24 hours after the covering of seed, excelsior mulch shall be uniformly applied at the rate of 2 tons per acre. The mulch may be applied hydraulically or by other acceptable methods. Should the mulch be placed in a dry condition, it shall be thoroughly wetted immediately after placing. The Engineer may require light rolling of the mulch to form a tight mat.

2.07 SEEDING (WOOD CELLULOSE FIBER MULCH):

- A. After the lime has been applied and ground prepared as specified in Section 2.04, wood cellulose fiber mulch shall be applied at the rate of 1,500 pounds per acre in a mixture of seed and fertilizer. Hydraulic equipment shall be used for the application of fertilizer, seed and slurry of the prepared wood pulp. This equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which will provide an even distribution of the slurry on the various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.

The seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by the hydraulic seeding method specified herein. The materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be so regulated that the amounts and rates of application shall result in a uniform application of all materials at rates not less than the amount specified. Using the color of the wood pulp as a guide, the equipment operator shall spray the prepared seedbed

with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream so as to fall like rain, allowing the wood fibers to build upon each other until an even coat is achieved.

2.08 SODDING:

- A. Sod shall be placed between March 1st and December 1st.
- B. Sod shall be placed within 48 hours of cutting.
- C. Sod shall be moist when laid and placed on moist ground. The sod shall be carefully placed by hand, beginning at the toe of slopes and working upwards. The length of the strips shall be at right angles to the flow of surface water. All joints shall be tightly butted and end joints shall be staggered at least 12 inches. The sod shall be immediately pressed firmly into the ground by tamping or rolling. Fill all joints between strips with fine screened soil. Sod on slopes shall be pegged with sod pegs to prevent movement. The sod shall be watered, mowed, weeded, repaired or otherwise maintained, to insure the establishment of a uniform healthy stand of grass until acceptance.

2.09 MAINTENANCE:

- A. Maintain seeded and sodded surfaces until final acceptance.
- B. Maintenance shall consist of providing protection against traffic, watering to ensure uniform seed germination and to keep surface of soil damp, and repairing any areas damaged as a result of construction operations or erosion.

2.10 ACCEPTANCE:

- A. Before release of the performance bond on the seeding and sodding performed for the establishment of permanent vegetation, the Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the winter weather and be capable of reestablishment in the spring.

END OF SECTION

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SECTION 02600

PAVEMENT

PART 1 - PRODUCTS

1.01 BASE COURSE:

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

<u>Compacted Thickness</u>	<u>Type</u>
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:

<u>Square Sieve</u>	<u>% Passing by Weight</u>
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:

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

	<u>Percent</u>
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:

<u>Square Sieve</u>	<u>% Passing by Weight</u>
3/4"	100
1/2"	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:

<u>Square Sieve</u>	<u>% Passing by Weight</u>
1/2	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 ($\pm 1-1/2\%$) 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 $\frac{1}{2}$ -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 ($\pm 1-1/2\%$), 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 devices, 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 instantaneously upon the installed line. The glass sphere dispenser cutoff shall be synchronized 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 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

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

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

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

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 gravelly 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 $\frac{3}{8}$ 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.

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Section 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01-Scope

1.01.1-These specifications cover cast-in-place concrete for use in buildings, sidewalks, curb and gutters, foundations, and other related items.

1.01.2-The following subjects are considered outside of the scope of these specifications:

1. Precast concrete products.
2. Heavy duty paving concrete
3. Terrazzo
4. Insulating Concrete
5. Lightweight concrete

1.02-Americans with Disabilities Act-All concrete structures shall be designed and constructed to meet the requirements of the U.S. Department of Justice, Americans with Disabilities Act, Rev. July >97. This law requires that all new places of public accommodations and commercial facilities be designed for persons with disabilities. Required guidelines for curb ramps and other handicapped related structures shall be as specified in U.S. Department of Justice, ADA Design Guide.

1.03-Design of Concrete Structures shall be performed and stamped by a Professional Engineer registered in the State of Georgia. In no instance shall a concrete sidewalk be less than 4" thick nor a driveway less than 6" thick. The Engineer shall refer to City of Savannah Standard Construction Details for minimum design requirements of various structures.

1.04-Construction Loads Construction loads shall not exceed what the member is able to carry safely and without damage. The Contractor is responsible for providing all supplemental support necessary to protect the structure until the concrete has reached it's specified design strength.

1.05-Referenced Standards and Specifications

1.05.1-The most recent issue of each standard or specification shall be used. The following abbreviations may be used to reference the publishing organization:

ACI - American Concrete Institute, P.O. Box 9094,
Farmington Hills, MI 48333-9094.

ASTM - American Society for Testing and Materials,
100 Barr Harbor Drive, P. O. Box C700, West
Conshohocken, PA 19428-2959.

AASHTO - American Association of State Highway and
Transportation Officials 444 North Capital
Street, N.W., Suite 225, Washington DC 20001

CRSI - Concrete Reinforcing Steel Institute, 933
North Plum Grove Road, Schaumburg, IL 60173.

PART 2 - MATERIALS FOR CONCRETE

2.01-Cements

Portland cement shall conform to ASTM C 150. Portland blast furnace slag cement or portland pozzolan cement shall conform to ASTM C 595.

2.02-Admixtures

2.02.1-Admixtures to be used in concrete, when required or permitted, shall conform to the following appropriate specifications:

2.02.1.1-Air-entraining admixtures, ASTM C 260

2.02.1.2-Water-reducing, retarding, and accelerating admixtures, ASTM C494

2.02.1.3-Pozzolanic admixtures, ASTM C 618

2.02.1.4-Fiber reinforcement: fiber reinforcement shall be 1/2" or 3/4" collated, fibrillated polypropylene fibers meeting the requirements of ASTM C 1116, para. 4.1.3, Type III.

2.02.1.5-Admixtures used in the work shall be of the same composition as those used in establishing the concrete proportions.

2.03- Water

Mixing water for concrete shall meet requirements of ASTM C 94.

2.04-Aggregates

2.04.1-Aggregates for normal weight concrete shall meet the requirements for ASTM C 33 unless otherwise specified.

2.04.2—Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall meet the appropriate grading requirements of the applicable ASTM specifications.

PART 3 - PROPORTIONING

3.01— General Concrete for all parts of the work shall be of the specified quality and capable of being placed without excessive segregation. When hardened, concrete shall develop all characteristics required by these specifications and the contract documents.

3.02—Strength The specified compressive strength of the concrete (**f'c**) for each portion of sidewalks and curb and gutters shall be a minimum of 3000 psi unless a greater strength requirement is indicated on the contract drawings or herein. Driveway and road paving shall have a compressive strength of not less than 5000 psi. Strength requirements shall be based on 28-day compressive strength unless a different test age is specified. The compressive strength of the concrete shall be determined by ASTM C39.

3.03—Durability

3.03.1—Concrete shall be air entrained and shall conform to the air content limits of ACI 301-99 Table 4.2.2.4.

3.03.2—The water-cement ratio shall not exceed 0.53 by weight.

3.03.3—For all concrete in which aluminum or galvanized metal is to be embedded, it shall be demonstrated by test that the mixing water of the concrete, including that contributed by the aggregates and any admixture used, will not contain a deleterious amount of chloride ion.

3.04—Slump The concrete shall be proportioned and produced to have a slump of 4 inches or less. A tolerance of up to 1 inch above the maximum indicated shall be allowed for one batch in any five consecutive batches tested. The slump shall be determined by ASTM C 143.

3.05—Maximum size of coarse aggregate The nominal size of the aggregate shall not be more than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between

reinforcing bars. See ASTM C 33 for tolerance on oversize for various nominal maximum size designations.

3.06- Admixtures

3.06.1-The amount of calcium chloride shall not exceed 2 percent by weight of cement. The amount of calcium chloride shall be determined by the method of described in AASHTO T260.

3.06.2-For all concrete which will remain in contact with aluminum or galvanized metal, the limitation of Section 3.3.3 shall apply unless protective measures acceptable to the Engineer are provided.

3.06.3-All admixtures shall be used in accordance with the manufacturer's instructions except as otherwise specified.

3.06.4-Where fiber reinforcement is called for, it shall be added to the concrete in the manner and rate recommended by the manufacturer. Unless otherwise prohibited by the manufacturer, the minimum rate of application shall be 1 lb. of polypropylene fibers per cubic yard of concrete.

3.06.5-In the Historic District, a color additive equal to Lambert #4685 shall be added to all concrete sidewalks at the rate of 2 2 pounds per cubic yard in order to match the color of existing sidewalks.

3.07- Mix Design The Contractor shall **submit** proposed concrete mix designs for each type of concrete in the project. Proposed concrete proportions shall be subject to acceptance by the Engineer based on demonstrated ability to produce concrete meeting all requirements of the specifications. Concrete proportions shall be established on the basis of previous field experience as specified in ACI 301, Section 4.2.3 with materials to be employed in the work; or if field test results are not available, select the required test strength from Table 4.2.2.3.b of ACI 301-99. Contractor is not authorized to batch any concrete for use in this project until mix design has been approved by the Engineer.

PART 4 - FORM WORK

4.01-Form Work General Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall have sufficient rigidity to maintain

specified tolerances. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the **Contractor**.

4.02-Earth as Forms Earth cuts shall not be used as forms for vertical surfaces unless specifically allowed by the Engineer.

The Contractor is responsible for ensuring that all earth cuts meet OSHA trenching regulations.

4.03-Form Release Before placing the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an acceptable coating material that will effectively prevent absorption of moisture, prevent bond with the concrete, and not stain the concrete surfaces.

4.04-Form Removal Under no circumstances shall formwork be removed prior to 24 hours after placement of concrete.

4.05-Formwork Tolerances for formed surfaces shall be in compliance with ACI 117.

4.06-ACI Formwork Standards Adherence Unless otherwise specified, formwork shall meet the requirements of ACI 301-99, Chapter 2.

PART 5 - REINFORCEMENT

5.01- Reinforcing Bars shall be deformed except spirals, which may be plain bars. Reinforcing bars shall be Grade 60 conforming to one of the following specifications: ASTM A 615, ASTM A 616(including supplementary requirement S1), ASTM A 617, ASTM A 706. If called for on plans, reinforcing bars shall be epoxy-coated in accordance with ASTM A775

5.02-Welded Wire Fabric shall be fabricated from smooth or deformed wire and shall conform to the wire size and wire spacing required or indicated on the contract drawings. Welded wire fabric shall conform to one of the following specifications:

- ASTM A 185, except welded intersections shall be spaced not farther apart than 12 inches in the direction of the principal reinforcement.

- ASTM A 497, except welded intersections shall be spaced not farther apart than 16 inches in the direction of the principal reinforcement.

5.03-Bar Supports

5.03.1—Wire bar supports shall be in accordance with Class 1, maximum protection, or Class 2, moderate protection in Chapter 3 of the CRSI Manual of Standard Practice.

5.03.2—Precast concrete brick bar supports may used to support rebar mats or welded wire mesh in slab-on-grade construction.

5.04—Welding of reinforcing bars or welded wire fabric is specifically **prohibited**.

5.05—Fabrication of reinforcing bars shall be in accordance with the standard fabricating tolerances in ACI 117.

5.06—Placing Reinforcement

5.06.1—Reinforcement shall be placed within the tolerances specified in ACI 117 and guidelines specified in ACI 301 Section 3.3 Minimum concrete cover for reinforcement shall be as required in Table 3.3.2.3 of ACI 301.

5.06.2—Field bending of bars partially embedded in concrete shall not be permitted unless specifically accepted by the Engineer.

5.07—Sidewalks shall be reinforced by one of the following methods:

5.07.1—Welded wire mesh located 2" from the top surface of the concrete. Minimum size of mesh shall be 6"x6" - W2.9 x W2.9.

5.07.2—Concrete shall be fiber reinforced.

5.07.3—Deformed reinforcing bars providing no less than 0.25 square inches per foot (each way).

PART 6 - JOINTS AND EMBEDDED ITEMS

6.01—Construction Joints shall be located and detailed on the contract drawings. Unless otherwise indicated on the drawings, all reinforcement shall be continued across the joints.

6.02— Contraction Joints

6.02.1—Sawcut joints shall be located and detailed as indicated on the contract drawings. Cutting shall be

timed properly with the set of concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates being dislodged by the saw. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking.

6.02.2—Tooled Control Joints in sidewalks shall be provided at a spacing not greater than 10 feet on center or twice the width along it's length.

6.03—Expansion Joints

6.03.1—Expansion joints shall be located as shown on the contract drawings but shall be spaced no further apart than 80 feet along a sidewalk or curb and gutter.

6.03.2—Reinforcement or other embedded metal items bonded to the concrete (except dowels in floors bonded on only one side of joints) shall not be permitted to extend continuously through any expansion joint.

6.03.3—Premolded expansion joint filler shall conform to one of the following specification: ASTM D 994, ASTM D 1751, or ASTM D 1752.

6.04—Joint Sealant All expansion joints shall be sealed per detail on project drawings. Other joints to be sealed will be indicated on the project drawings. Joint sealant shall meet the requirements of ASTM C 920, Type S or M, Grade P, Class 25.

6.05—Curb and Gutter sections shall be constructed in sections of uniform length not to exceed 10 feet in length or be less than 5 feet in length. If slip-form or extruded construction is used, contraction joints shall be located at intervals no greater than 10 feet by sawing the hardened concrete at the proper time. The depth of the saw-cut shall be one-fourth of the thickness of the curb and gutter section. The maximum width of the cut shall be 1/4 inch and shall be sawed no later than 24 hours after the pour.

PART 7 – PRODUCTION OF CONCRETE

7.01—Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise provided in this chapter. Plant equipment and facilities shall conform to "Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.

7.02—Concrete produced by **on-site** volumetric batching and continuous mixing shall be batched and mixed in accordance with

and shall conform to all requirements of ASTM C 685.

PART 8 - PLACING OF CONCRETE

8.01 Preparation

8.01.1—Form work shall be completed; snow, ice and water shall be removed; reinforcement shall be secured in place; expansion joint material, anchors, and other embedded items shall be positioned; and the entire preparation shall be accepted by the Engineer or his representative prior to placing concrete.

8.01.2—The subgrade shall be well drained and of adequate and uniform load bearing capacity. The minimum in-place density of the subgrade soils shall be as required in the specifications.

8.01.3—Concrete shall not be placed on frozen ground. The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing it shall be raised and maintained above 50 F long enough to remove all frost from the subgrade.

8.01.4—Subgrades shall be moist at the time of concreting. If necessary, they shall be dampened with water in advance of concreting, but there shall be no standing water on the subgrade nor any muddy or soft spots when the concrete is placed.

8.02—Conveying and Placing

8.02.1—Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

8.02.2—The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

8.02.3—Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited which has hardened sufficiently to cause the formation of seams or planes of weakness within the

section. If a section cannot be placed continuously, construction joints shall be located as indicated on the contract documents or as permitted by the Engineer. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed which the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior acceptance has been obtained by the Engineer.

8.02.4—Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.

8.02.5—All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Use of vibrators to transport concrete within forms shall not be allowed. A spare vibrator shall be kept on the job site during all concrete placing operations.

8.02.6—Unless adequate protection is provided and acceptance is obtained from the Engineer, concrete shall not be placed during rain, sleet, or snow.

8.02.7— Except as below, the temperature of the plastic concrete, as placed, shall be no lower than 55 F and no higher than 90 F. The air temperature shall be **at least 35 degrees F** and rising when concrete is mixed and placed. When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40 degrees F for more than three successive days, deliver concrete to meet the requirements of Table 4.2.2.7 of ACI 301-99.

8.02.8 - Protection. Immediately after placement protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Protection measures shall conform to Section 5.3.6.5 and 4.2.2.7 of ACI 301-99.

PART 9 - REPAIR AND REPLACEMENT

9.01-Repair of Surface Defects: All honeycombed and other defective concrete shall be removed down to sound concrete and patched. When chipping away loose or defective material, no featheredging will be permitted.

9.02-Tie holes shall be plugged with patching mortar unless stainless steel, noncorrosive, or acceptably coated ties are used.

9.03-Saw Cuts Where a portion of an existing concrete driveway or sidewalk is removed, the existing section shall be cut to a minimum depth of 4-inches with a suitable saw prior to breaking out pavement.

PART 10 - SURFACE FINISHES

10.01-Formed Surfaces of concrete shall be given the finishes specified below unless the contract documents specify otherwise:

Rough form finish - For all concrete surfaces not exposed to public view

Smooth form finish - For all concrete surfaces exposed to public view.

Public View - Defined as any surface of the finished concrete that may be seen by a person without excavating soil.

10.01.1-Rough form finish - No selected form facing materials shall be specified for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with texture imparted by the forms.

10.01.2-Smooth form finish - The form facing material shall produce a smooth, hard, uniform texture on the concrete. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. All fins shall be completely removed. No later

than the day following form removal, the concrete surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced.

10.01.3- Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

10.02- Slab Finishes

Unless otherwise specified on the contract documents, the following finishes shall be used as applicable:

Broom or belt finish - For sidewalks and garage floors and ramps.

Floated Finish - For surfaces intended to receive roofing, waterproofing membranes, or sand bed terrazzo.

Troweled finish - For floor intended as walking surfaces or for reception of floor coverings.

Non-solid finish - For exterior platforms, steps, and landings; and for exterior and interior pedestrian ramps.

10.02.1- Floated Finish: After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. All high spots shall be cut down and all low spots filled during this procedure. The slab shall then be refloated immediately to a uniform sandy texture.

10.02.2- Troweled finish: The surface shall first be float-finished as specified in Section 10.2.1. It shall next be power troweled, and finally hand troweled. The first troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional troweling shall be done by hand after the surface has

hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks, uniform in texture and appearance and shall be plane to required tolerances.

10.02.3- Broom or belt finish: Immediately after the concrete has received a float finish as specified in Section 10.2.1, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

10.02.4- Non-slip finish: Crushed ceramically bonded aluminum oxide or other specified selected abrasive particles shall be blended with Portland cement in the proportions recommended by the manufacturer of the aggregate. The surface shall be given a float finish in accordance with Section 10.2.1. Approximately two-thirds of the blended material for required coverage shall be applied to the surface by method that insures even coverage without segregation. Floating shall begin immediately after application of the first "dry shake". After this material has been embedded by floating, the remainder the blended material shall be applied to the surface at right angles to the previous application. A second floating shall follow immediately. The rate of application of such material shall be not less than 25 lb. per 100 square feet.

10.02.5- Slab finishing tolerances: Unless otherwise called out in the contract documents, finishes shall be true planes within 1/4 inch in 10 feet as determined by a 10-ft. straightedge placed anywhere on the slab in any direction. The maximum variation in elevation for a level slab shall not exceed 3/4 inches over the entire slab.

PART 11 - CURING AND PROTECTION

11.01- General: Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.

11.02- Preservation of Moisture

11.02.1- For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:

11.02.1.1- Ponding or continuous sprinkling.

11.02.1.2- Application of absorptive mats of fabric kept continuously wet.

11.02.1.3- Application of waterproof sheet materials conforming to ASTM C 171.

11.02.1.4- Application of a curing compound conforming to ASTM C309 in accordance with manufacturer's recommendation. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proven that the curing compound will not prevent bond.

11.02.2- Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal the concrete shall be cured until the end of the time prescribed in Section 11.2.3 by one of the above methods.

11.02.3- Curing in accordance with the above requirements shall be continued for at least 7 days in the case of all concrete except high-early strength concrete for which the period shall be at least 3 days.

11.03- Temperature Control. When the mean daily outdoor temperature is less than 40 F, the temperature of the concrete shall be maintained between 50 and 70 F for the required curing period of Section 11.2.3. Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

PART 12 - TESTING

12.01- Owner Paid Testing. Field sampling and testing shall be performed by an independent testing lab hired and paid for by the Owner. Samples of concrete shall be taken at random locations and at such times to represent the quality of the materials and work throughout the project. The laboratory shall provide the necessary labor, materials, equipment, and

facilities for sampling the concrete and for casting, handling and storing the concrete samples at the site of work. Sampling of plastic concrete will be in accordance with ASTM C172. Samples for pumped concrete shall be taken at the hose discharge point. Samples for other concrete shall be taken at the hopper of concreting equipment or transit mix truck.

12.02-Contractor Paid Testing The Contractor shall pay for the following services when required:

12.02.1- All testing, test results, or certifications required to verify that a proposed material item or mix design meets the requirements of the specifications.

12.02.2- Additional testing and inspection required because of changes in materials or proportions requested by the Contractor.

12.02.3- Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements. For example, if compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C 42 and any other load tests acceptable to the Engineer. Costs of such tests will be borne by the Contractor.

12.03-Test Scheduling To facilitate testing and inspection, the Contractor shall advise the Owner and the designated testing agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of quality tests and inspection of forms.

12.04-Strength Tests

12.04.1-General: The strength of the concrete will be verified by the testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site.

12.04.2-Frequency: As a minimum, one set of four standard cylinders shall be cast of each class of concrete based on the most stringent of the following requirements as applicable:

- For each 50 cubic yards or less
- For each 100 feet of sidewalk
- For each 200 feet of curb and gutter

- For each 4000 square feet of surface area
- For each day a pour is made

12.04.3-Lab testing: Testing of specimens for compressive strength shall be in accordance with ASTM C39. Tests shall be made at 7 and 28 days from time of casting. Two test cylinders from each group of four shall be tested at the end of 7 days and two shall be tested at the end of 28 days. Each strength test result shall be the average of the strengths of two test cylinders (cast from material taken from a single load of concrete) at 28 days.

12.04.4-Acceptance of Concrete Strength: The strength level of the concrete will be considered satisfactory so long as the average of all sets of three consecutive strength results equal or exceed the specified strength **f'c** and not more than 10% of the strength test results shall have values less than this value. No individual strength test shall be less than the specified strength **f'c** by more than 500 psi.

12.05-Slump Tests: The slump shall be as specified when measured in accordance with ASTM C 143. Samples for slump determination shall be taken from the concrete during placing. Tests shall be made at the beginning of concrete placing operations and at subsequent intervals to insure that the specification requirements are met. When concrete is pumped, slump tests shall be taken from concrete at the discharge end of the pump hose. Slump tests shall also be performed whenever standard cylinders are cast.

12.06-Temperature and Air Content Tests: Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Whenever standard cylinders are cast, temperature tests shall be performed. Air content tests shall be in accordance with ASTM C 231 and shall be measured whenever standard cylinders are cast.

PART 13 - FLOWABLE FILL

The mixture of dry material per cubic yard shall be 50 pounds cement, 600 pounds fly-ash, and 2,500 pounds sand. Depending on the slump requested for the specific job, water added shall be 65 gallons (541 pounds) for a 6-inch slump, to 55 gallons (458 pounds) for a 3-inch slump. One cubic yard of 6-inch slump will contain more than 27 cubic feet due to the additional water. Unconfined compressive strength will be 80 psi at 7 days and 150 psi at 28 days.

PART 14 - GROUT-FILLED FABRIC MAT

Grout-filled fabric mat (revetment) shall be one of the following:

- 1 HYDROTEX™ Filter Point Forms (FP400) as manufactured by Hydrotex Synthetics, Inc.; 74 Perimeter Center East, Suite 7420; Atlanta, Georgia 30346-1803, Tel: 1-800-225-0023; or
- 2 Fabriform Filter Point (8" FP) as manufactured by Construction Techniques, Inc., P.O. Box 360007, Cleveland, OH 44136, Tel: 1-800-563-5047; or
- 3 **Owner**-approved equivalent.

The **Contractor** shall adhere to all recommendations published in the respective manufacturer's Construction & Quality Control Manual or similar publication.

END OF SECTION 03300