

STANDARD SPECIFICATIONS

for

ROADWAY AND DRAINAGE SYSTEMS



CITY OF DAWSONVILLE, GEORGIA

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**CITY OF DAWSONVILLE, GEORGIA
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Dawsonville, Georgia 30534
Office: (706) 265- 3256**

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SECTION 1: GENERAL CONDITIONS**1.01 Scope and Intent**

The work covered by this Section of the Specifications consists of all materials and work necessary for clearing, excavating, trenching, backfilling, grading, and installing stormwater piping, roadways and sidewalks within the City of Dawsonville.

1.02 Cleaning Up

Before the work shall be considered complete, all material not used and rubbish of every character must be removed from the streets and placed at point designated by the City; all streets, sidewalks, curbs, fences and other private or public facilities and structures disturbed must be essentially in as good condition as existed before the work was done. Any subsequent settlement of backfill or pavement over trenches shall be replaced by the Contractor and the surfaces brought to grade.

SECTION 2: CONTROL OF MATERIALS**2.01 Structural Steel**

The following inspections are required for structural steel:

- A. Any Quantity: Field inspection for rust, shape, and dimensions
- B. 25 to 200 Tons: Independent shop inspection and certified copies of mill tests
- C. For Structures and Buildings: See ASTM A-36

2.02 Concrete Reinforcement Steel

The following inspections are required for structural steel:

- A. Up to 50,000 Pounds: Field inspection for rust, shape, and dimensions
- B. 50,000 Pounds and Up: Independent laboratory inspection as follows:
 - 1. Billet Steel - ASTM A-615
 - 2. Roll Steel - ASTM A-616
 - 3. Cold-Drawn Steel Wire - ASTM A-82
 - 4. Wire Fabric - ASTM A-185

2.03 Concrete Work

- A. Concrete of the respective classes for bedding, blocking, walks, roads, headwalls, piers, and other miscellaneous structures shall be as called for in the work to which they pertain.
- B. Cement: Cement shall satisfy the requirements of ASTM C150, Type I or Type II, as amended to date.
- C. Aggregate: Aggregate shall satisfy the requirements of ASTM C33, as amended to date.
- D. Water: Water shall be fresh, clean, and free from injurious amounts of oil, acid, alkali, and organic materials.
- E. Mixing: Mixing shall be accomplished at a central mix plant unless prior approval is given by the Engineer for mixing on the job site.
- F. Concrete from a Central Mix Plant: Concrete supplied from a central mix plant shall have 28-day compressive strengths not less than those listed below:
 - Class A: 3,000-psi
 - Class B: 2,200 psi
 - Class C: 1,500 psi

- G. Concrete Mixed on Jobsite: Concrete mixed on the jobsite shall have 28-day compressive strengths as above and shall contain not less than the following quantities of cement per cubic yard.
- Class A: 564 pounds (6 bags)
 - Class B: 470 pounds (5 bags)
 - Class C: 376 pounds (4 bags)
- H. Concrete Cylinders: Concrete cylinders for testing purposes shall be made in accordance with the procedure described in ASTM C31 as amended to date. Compression tests shall be made at the age of 7 days and 28 days by the testing laboratory as per ASTM C39 as amended to date. Testing shall be done by a laboratory approved by the Engineer. All costs of testing will be paid by the Contractor. Each test shall consist of at least 4 specimens: 2 for field control and 2 for laboratory control. One initial test will be required and then 1 test for each 100 yards thereafter.
- I. Placing of Concrete: Concrete shall be placed in daylight. Concrete mixed at a central plant shall be transported to the jobsite as per ASTM C94 as amended to date. Concrete when placed shall be compacted with mechanical, internal-vibrating equipment and/or with hand spading with a slicing rod. No concrete shall be placed when the atmospheric temperature is below 35° F. If the temperature drops below 35° after concrete is placed, the Contractor shall enclose, heat and protect the concrete. Earth fill shall not be placed on concrete until concrete has been allowed to set for 24 hours.
- J. Form Work: Form work, where required, shall be built to conform to the shape, lines and dimensions of the concrete work as shown.
- Forms shall be set to line and grade and shall be braced, tied, and secured in a manner which will withstand placing of the concrete, and which will maintain shape and position. Forms shall be tight and be substantially assembled to prevent bulging and the leaking of concrete. Joints shall be arranged vertically or horizontally. Temporary openings shall be arranged, where required, at the bottoms of wall forms and elsewhere to facilitate cleaning and inspecting. Lumber used once in forms may be reused once nails are removed and surfaces are thoroughly cleaned. Wall sleeves, inserts and openings required in concrete work shall be properly set in form work. Chamfer strips shall be placed in forms for all exterior corners.
- K. Removing Forms: Under normal conditions, the time elapsing before the forms may be stripped shall not be less than the following:
- Slabs: 14 days

- Columns and Pedestal: 7 days
- Walls and Vertical Faces Not Supporting Other Work: 2 days

L. Finishing: All exposed concrete work shall be kept wetted with water and shall be rubbed with a carborundum stone of medium fineness or with other equally as good abrasive to bring the surface to a smooth texture and to remove all form and other marks. The paste formed by the rubbing may be rubbed down by floating with a canvas float, a carpet-faced float, cork float or dry burlap.

SECTION 1: CLEARING**1.01 Description of Work**

The extent of route clearing is the minimum degree of clearing necessary to install utilities and appurtenances, and such additional clearing as may be shown on the drawings or required by other documents. Route Clearing operations include, but are not limited to, the following:

- A. Protecting existing improvements, vegetation, and persons
- B. Protecting above-grade and underground improvements
- C. Removing trees and other vegetation
- D. Removing above-grade improvements
- E. Removing underground improvements
- F. Restoring damaged improvements

1.02 Protection of Existing Improvements

Existing improvements shall be protected. Provide barricades, coverings, or other types of protection necessary to prevent unnecessary damage to existing improvements. Protect improvements on adjoining properties as well as those along the project route. Restore improvements damaged by this work to their original condition as acceptable to the owners or other parties or authorities having jurisdiction. Any property line monuments (such as iron pins) removed or disturbed by clearing operations shall be replaced by a Georgia registered land surveyor.

1.03 Protection of Existing Trees and Vegetation

Existing trees and other vegetation shall be protected against unnecessary cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction material within drip lines, excess foot or vehicular traffic, or parking of vehicles or equipment within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

1.04 Protection of Existing Utilities, Persons and Property

Prior to commencing other work, accurately locate above and below ground utilities and structures which may be affected by the Work, using whatever means be appropriate. Mark the location of existing utilities and structures, not otherwise readily visible, with flagging, stakes, barricades, or other suitable means. Barricade open excavations and post warning lights for safety of persons. Operate warning lights during hours from dusk to dawn each day. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damage caused by settlement, lateral movement, undermining, washout and other hazards.

1.05 Disposal of Waste Material

All waste materials resulting from clearing operations shall be disposed of in accordance with applicable regulations of the Georgia Department of Natural Resources, Environmental Protection Division.

SECTION 2: TRENCHING AND BACKFILLING**2.01 Description of Work**

Trenching consists of removal and disposal of material encountered to obtain required sub-grade elevations, usually, but not necessarily limited to that incidental to installation or modification of underground pipelines and appurtenances. Unauthorized trenching consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific authorization of the City. Do not permit any hazardous condition to result from trenching and backfilling operations. Pavement removal and replacement is specified in Division III, Sections 4.08 and 4.09.

2.02 Use of Explosives

Explosives are not permitted on site or for use in work without prior written permission from the City. Use explosives only as legally permitted and when other work methods are impractical. Contractor assumes sole responsibility for handling, storage, and use of any explosive materials

2.03 Stability of Excavation

Slope sides of excavations to comply with Subpart P of Part 1926 of the Occupational Safety and Health Act as amended. Shore and brace or use a trench box where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

2.04 Bracing and Shoring

Take precautions and provide necessary bracing and shoring to guard against movement or settlement of existing improvements or new construction. Contractor is entirely responsible for strength and adequacy of bracing and shoring, and for safety and support of construction from damage or injury caused by the lack thereof or by movement or settlement. Use work methods and provide temporary facilities as necessary to prevent washing, erosion, siltation or dust damage, or hazard to persons and property, within and outside the work area. Place excavated material compactly alongside the trench, and keep such material trimmed up so as to present the least practicable inconvenience to the public.

Provide portable trench boxes and materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition. Provide trench boxes and/or shoring and bracing to comply with Subpart P of Part 1926 of the Occupational Safety and Health Act as amended.

2.05 Construction Along Highways, Streets and Roadways

The Contractor shall install pipelines and appurtenances along highways, streets, and roadways in accordance with the applicable regulations of the Georgia Department of

Transportation and the City with reference to construction operations, safety traffic control, road maintenance and repair.

- A. Protection of Traffic: The Contractor shall provide suitable signs, barricades, and lights for protection of traffic in locations where traffic may be endangered by construction operations. All highway signs removed due to construction shall be replaced as soon as the conditions permit. No highways, streets or roadways shall be closed without first obtaining permission from the proper authorities. Before any roadway is blocked, the Contractor shall notify the City/Engineer. The Contractor must obtain approval from the City before street signs are removed and reinstalled.
- B. Construction Operations: The Contractor shall construct all work along highways, streets and roadways using the following sequence of construction operations so as to least interfere with traffic:

1. Stripping: Where the pipeline is laid along road shoulders, all sod, topsoil, and other material suitable for shoulder restoration shall be stripped and stockpiled for replacement.
2. Trenching, Laying and Backfilling: The Contractor shall open trenches, install pipeline, and backfill. The trench shall not be opened any further ahead of pipe laying operations than necessary for proper laying operations, and trenches shall be progressively backfilled and consolidated. Excess material shall be removed immediately behind the laying operations.

The Contractor shall install pipelines across highways in accordance with the applicable regulations of the Georgia Department of Transportation and railway authorities.

3. Shaping: The Contractor, immediately after completing backfilling operations, shall reshape any damaged cut and fill slopes, side ditches and ditch lines, and shall replace topsoil, sod and any other materials removed from shoulders in accordance with the requirements of and to the full and complete satisfaction of the Georgia Department of Transportation and the City. The Contractor, when installing pipelines and appurtenances, will be required to provide sufficient personnel and equipment to simultaneously carry out all of the above operations.

If required to accommodate Contractor's operation, construction easements shall be obtained. The Contractor shall pay all costs of any construction easements.

- C. Excavated Material: Excavated material shall not be placed along highways, streets, and roadways in such a manner as to obstruct traffic. No scattered

excavated material shall be allowed to remain on the pavement, and all such material shall be kept swept away.

- D. Drainage Structures: All side ditches, culverts, cross drains, and other drainage structures shall be kept clear of excavated material and be free to drain at all times.
- E. Maintaining Highways, Streets, Roadways and Driveways: The Contractor shall furnish a road grader, which shall be available for use at all times, for maintaining highways, streets, and roadways upon which work is being performed. All such highways, streets, and roadways shall be maintained in suitable condition for movement of traffic until completion and final acceptance of the work.
- F. Encroachment Permits: All costs for obtaining required Georgia Department of Transportation permits shall be paid by the Contractor. The Contractor shall be responsible for fully understanding and knowing all Department of Transportation regulations and conditions relating to pipeline installation.

2.06 Excavation for Trenches

Excavation of pipe trenches shall include all excavation of every description and whatever substance encountered and shall include disposal of all rock excavation and shall include disposal of excess earth excavation not required for backfilling of trenches. The area directly surrounding the excavation shall be graded to direct storm water runoff away from the trench.

- A. Depth of Trenches: The minimum cover over the top of the pipe shall be 4' foot unless otherwise directed by the Engineer. Where obstructions are encountered, minimum depth may be changed to avoid interference.
- B. Width of Trenches: Trenches shall be excavated sufficiently wide to allow proper installation of pipe, fittings, and other materials and to not less than 6" clear of the outside barrel of the pipe on any side at any point.
- C. Bell Holes: Bell holes of ample depth and width shall be excavated in pipe trenches at the location of each joint to permit the joint to be properly made.
- D. Crushed Stone Stabilization: Wherever the subgrade is by nature too soft or mucky in the opinion of the Engineer for the proper installation of the pipe, the Engineer may order the Contractor to undercut the trench and backfill with crushed stone or gravel, $\frac{3}{4}$ " in size and less. The stone shall be placed and brought to the grade required for the particular location and compacted.

2.07 Existing Underground Utilities and Obstructions

Where unforeseen underground utilities or obstructions are encountered, minimum depth of cover or the location and alignment may be changed upon written approval of the Engineer to avoid interference. The Contractor is responsible for determining the exact

location of all utilities before beginning construction. Damage to existing utility lines, services, poles, and structures shall be repaired or replaced by the Contractor at his own expense.

The Contractor shall furnish and have available at all times an electronic pipe and cable locator in working order for the purpose of locating existing pipelines or other obstructions in the way or are along the route of the new work.

2.08 Backfilling

Backfill excavations as promptly as work permits. Use acceptable trench excavated soil material, free of stumps, trees, roots, muck, trash, and other objectionable matter. The Contractor shall furnish all equipment and labor, and when necessary, the material, required for backfilling the pipeline trenches as follows:

- A. Selected Backfilling: All trenches shall be backfilled immediately after pipes are laid therein, and joints have been inspected by the Engineer unless other protection of the pipeline is directed. Selected backfill material shall consist of finely divided earth stone dust, sand, crushed stone, or other approved material carefully placed about the pipe and up to a height of at least 12" above the top of the pipe barrel, and in uniform layers not exceeding 6" in thickness, each layer thoroughly compacted with proper hand tools in a manner which will not disturb and/or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe and in a manner which will prevent injurious side pressures. If suitable select materials are not available from the trench excavation, the Contractor will be required to obtain the select materials elsewhere.

When testing for leaks in open trenches, backfilling shall not be done until after all testing has been completed and all leaks eliminated.

- B. General Backfilling: After selected backfill material has been placed and tamped, the remainder of the trench may be backfilled with general excavated material provided such material does not contain more than 1/3 broken rock of which no single stone or boulder shall be larger than can easily be removed with a hand shovel. Backfill material shall be placed in uniform layers not exceeding 12" in thickness; each layer shall be thoroughly compacted with heavy-duty power tamping tools of the full satisfaction of the Engineer. The use of pneumatic power "Jumping Jack" tampers will not be permitted. Wherever the trenches have not been properly filled or if settlement occurs, they shall be refilled, smoothed off, and made to conform to the surface of the ground. Backfilling shall be carefully performed, and the original surface restored to the full satisfaction of the Engineer. Surplus material shall be disposed of by the Contractor.
- C. Outside Streets, Roads, etc.: At locations outside streets, roads, walks or other traveled ways open to vehicular or pedestrian travel, the backfill material shall be

windrowed and maintained in a suitable manner to concentrate and pond rainfall runoff over the trench. After sufficient settlement has been obtained, the Contractor shall complete surface dressing, remove surplus material, and clean up in accordance with these Specifications. Wherever the trenches have not been properly filled or if settlement occurs, they shall be refilled, smoothed off, and made to conform to the surface of the ground. Backfilling shall be carefully performed, and the original surface restored to the full satisfaction of the Engineer. Surplus material shall be disposed of by the Contractor.

- D. Areas Requiring Pavement Replacement: Mechanical tamping will be required of all backfilling of excavated portions. After backfilling and tamping as described above is completed the top 6" of the ditch shall be backfilled with compacted crushed stone, ASTM C33 gradation #67 or #57 as amended to date, with sufficient fines for compaction. Further compaction shall be accomplished by leaving the backfilled trench open to traffic while maintaining the surface with stone. Settlement in trenches shall be refilled with stone and such maintenance shall continue until replacement of pavement is authorized by the Engineer.

2.09 Surfacing of Trenches in Unpaved Streets and Driveways

Where pipelines are constructed on unpaved streets, roads or driveways, the surfacing material shall be stripped and windrowed separately from the general material excavated from trenches. After the line has been installed and the backfill completed within 6" of the original street grade, the salvaged surface shall be replaced. This work shall be considered as general cleanup along with the removal of surplus excavation materials from the street surface and the restoring of the topsoil surfacing outside trench limits to its original condition.

2.10 Surfacing of Trenches in Paved Streets and Driveways

Where trenches are in paved streets and driveways, the remaining 6" of backfill up to the traveled surface shall be made with crushed stone, ASTM C33 Gradation #67 or #57 as amended to date, with sufficient fines for compaction. Trenches shall be compacted and maintained until pavement is replaced.

2.11 Excavation Along Roadway

Where necessitated by traffic conditions, remove from the roadway the first material excavated from a working length of trench so that further excavation is immediately used for backfilling, and thereby avoid stockpiling of material upon the roadway. Afterward, return first excavated material if needed for final backfilling. Maintain all streets, alleys, sidewalks, pipe crossings, fire hydrants, water and gas valves, and other utilities accessible for their intended use except while the work is steadily advancing in the immediate vicinity of each such facility. Keep every drain, gutter, culvert, sewer, and

surface drainage route encountered, open for both temporary and permanent flow unless other effective provision for drainage is made.

2.12 Dewatering

Perform earthwork in a manner to prevent surface water and minimize subsurface or ground water from flowing into excavations, and to prevent water from flooding project work and surrounding area. Do not allow water to accumulate in excavations. Remove water using dewatering methods which will prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of sub-grades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other de-watering system components necessary to convey water away from excavations. Limit opening of additional trench length to that which can be de-watered with available equipment or methods.

2.13 Material Storage

Locate and retain materials away from edge of trench.

2.14 Excavation Length

Limit open trench excavation to a maximum of 300 feet ahead of completed backfill.

2.15 Removal of Unsatisfactory Soil Materials

To the extent necessary, over-excavate those soil materials which are unsatisfactory in the opinion of the City and backfill with approved materials.

2.16 Compaction

Control soil compaction during construction providing minimum percentage of density specified for each area classification. Percentage of Maximum Density Requirements: Achieve not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for each layer of soil material-in-place as determined by ASTM D 698 (Standard Proctor) test procedures:

- A. Rights-of-Way: Conform with the more stringent requirements of the permit issuing authority and the requirements herein.
- B. Roadways: Under and within five feet horizontal distance of traffic using surfaces, compact each layer of backfill and fill material to 95 percent of maximum dry density.
- C. Walkways: Under and within two feet horizontal distance of paved walks, compact top 6-inches of subgrade and each layer of backfill and fill material to 95% of maximum dry density.
- D. Driveways and Parking Lots: Under and within two feet horizontal distance of traffic using surfaces, compact each layer of backfill and fill material to 95 percent of maximum dry density.

- E. Lawn or Unpaved Areas: Compact each layer of backfill or fill material to 85 percent of maximum dry density.
- F. Spoil Areas: Compact each layer of backfill or fill material to 85 percent of maximum dry density.

2.17 Grading

Uniformly grade areas within limits of earthwork, including adjacent transition areas. Smooth and compact finished surface within specified tolerances, with uniform levels or slopes between points where elevations are shown, or between such points and existing grades, or between existing grades.

- A. Grading Outside Structures: Grade finished areas adjacent to structures to drain away from structures (except drainage inlets), and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
- B. Grassed or Landscaped Areas: Finish areas to within not more than 0.10 feet above or below the required elevations.
- C. Walks and Pavements: Shape surface of areas under walks and pavements to line, grade and cross-section, with finish surface not more than 1 ½-inch above or below the required subgrade elevation.

SECTION 1: STORM SEWER INSTALLATION**1.01 Description of Work**

- A. Foundation preparation
- B. Furnishing and laying gravity storm sewer pipe.
- C. Furnishing and/or constructing drainage structures and appurtenances.
- D. Cleaning constructed work
- E. Related Work Specified Elsewhere:
 - 1. Route Clearing
 - 2. Trenching and Backfilling
 - 3. Pavement Removal and Repair

1.02 Job Conditions

- A. Traffic Control: Schedule and conduct Work in a manner which will minimize inconvenience to vehicular and pedestrian traffic. Provide flaggers, barricades, warning signs, warning lights, and other warning means as appropriate. Flaggers, when utilized, must hold a valid Georgia D.O.T. flagging certificate. Maintain traffic on all roads and streets which must be crossed by sewer lines. All traffic controls during construction must conform to Part VI of the Manual on Uniform Traffic Control Devices, ANSI D6.1e.
- B. Weather Limitations: Conduct all operations during weather conditions appropriate to the work being performed.

1.03 Quality Assurance

- A. Manufacturer Experience: Furnish manufactured products produced by firms having regularly produced such items as specified herein which have proven satisfactory in actual service over at least a two-year period, as determined by the City.
- B. Imperfections: Regardless of tolerances permitted by industry standards specified herein, the City may reject pipe or precast structures at the manufacturing plant or project site, which have cracks, chips, blisters, lack of smooth interior or exterior surface, evidence of structural weakness, porosity, joint defect, significant variation from theoretical shape, or other imperfection which might, in the opinion of the City, contribute to a reduced functional capability, accelerated deterioration, or reduced structural strength.
- C. Repairs: Do not use patched or repaired pipe or precast structures unless each individual length or element has been approved and marked for repair by the City

at the manufacturing plant. Repairs, other than at the manufacturing plant, are not permitted.

1.04 Approved Products

- A. Reinforced Concrete Drainpipe: Reinforced Concrete pipe shall be used for all storm drainage pipe were indicated on the drawings. Pipe may be either ball and spigot or tongue and groove.
1. Testing and Stamping: All pipe, joint materials, and made-up joints shall be tested by an independent laboratory approved by the Engineer. Pipe shall be stamped with laboratory's stamp. Such stamp shall be an indication that it was accepted in accordance with applicable ASTM Specifications, and that it was inspected and accepted in accordance with the requirements of this Section for special tests and for pipe quality. The results of required independent laboratory tests shall be promptly submitted to the Engineer.
 2. Pipe shall be as follows and shall conform to the following ASTM Specifications:
 - a. Size 18-inch and Larger: All pipe shall be reinforced and shall be 'B' wall. Pipe 18-inch" and above shall be furnished in lengths of at least 8' foot.
 - b. Cement and Coarse Aggregate: Cement shall be Type II or approved equal. Coarse aggregate shall be crushed granite or limestone.
 - c. Wire Reinforcement: Wire reinforcement used in the pipe shall conform to the standard Specifications.
 - d. Steam Curing: Steam curing of concrete pipe shall conform to the standard Specifications except when temperatures fall below an average of 40° F. Curing shall be continuous for 24-hour period, except for the interval when forms and/or rings are removed.
 - e. Minimum Crushing Strength: All pipe, when tested by the 3-edge bearing method in accordance with ASTM C 497, shall be minimum strength (defined as the load to produce a 0.01-inch crack for reinforced pipe) of not less than the following values:

MINIMUM STRENGTHS, POUNDS PER LINEAR FEET

Reinforced Pipe

Pipe Size	Table 3		Table 4 or 5
	Class III	Class IV	Class V
15"		2,500	3,750
18"	2,025	3,000	4,500
21"	2,360	3,500	5,250
24"	2,700	4,000	6,000
30"	3,375	5,000	7,500
36"	4,050	6,000	9,000
42"	4,725	7,000	10,500
48"	5,400	8,000	12,000
54"	6,075	9,000	13,500
60"	6,750	10,000	15,000
66"	7,425	11,000	16,500
72"	8,100	12,000	18,000

- f. Absorption: Absorption shall not exceed 6% when determined in accordance with ASTM C 497.
- g. Joints: Pipe may have O-ring rubber gasket type joints conforming with the applicable provisions of ASTM C 443, or pipe may be tongue and groove with mastic or mortar joint.
- h. Repaired Pipe: Repaired and patched pipe will not be acceptable unless each individual pipe, so repaired or patched, shall have first been inspected and approved by the Engineer for repair and patching at the pipe plant.
- i. Shear Loading Test: Made-up gasketed joints shall be tested for shear loading at a total load of 100 pounds per inch of diameter including the weight of the pipe, water, and test apparatus.

B. Corrugated Steel Drainpipe: Corrugated steel drainpipe shall be furnished and constructed in accordance with the Department of Transportation, State of Georgia, Standard Specifications Constructions of Roads and Bridges, latest edition, and these Specifications. Pipe shall be galvanized and fully bituminous coated with a paved invert filling the corrugations for at least 25% of the circumference. The bituminous coating shall be a minimum thickness of 0.05", measured to the crest of corrugations. Pipe corrugations shall be 2-2/3" x 1/2". Band shall be in accordance with WW-P-405-B 3.3.4.2. The projections of the

bands shall conform substantially to the shape and depth of the pipe corrugations and shall be in circumferential rows with no less than seven projections per row. Required nuts and bolts shall be furnished with the band. Culvert pipe shall be 16-gauge through 24-inch diameter, 14 gauge for 30-inch and 36-inch diameter, 12 gauge for 42-inch through 54-inch diameter, 10 gauge for 50-inch through 72-inch diameter, and 8 gauge for 78-inch and 84-inch diameter.

The pipe shall have a duct tape (a type that will adhere and leave the heat number legible when removed) placed over one complete heat number before the bituminous coating is applied. This tape shall be located as close to the end of the pipe as the heat number will allow and from under the paved invert. All individual joints of pipe require this procedure.

Copies of certified mill test reports showing heat numbers, the chemical analysis and weight of spelter coated for each heat, lift of coil number, case, size, and type of material used to fabricate this pipe will be mailed to the Engineer, City and Contractor within 5 calendar days of the delivery date of the pipe. Each copy will reference pipe size, number of sections, date of actual delivery to the job so that a positive identification can be made.

- C. Corrugated Plastic Pipe: Corrugated flexible conduit with slip-on joints made of polyethylene conforming with ASTM F 405 and F 449. Subject to compliance with requirements, firms offering products which may be incorporated in the work include, but are not limited to, the following: ADS Inc. Hancor Inc.

1.05 Pipe Foundation

- A. Foundation for Reinforced Concrete Pipe: Unless otherwise indicated, lay pipe in trenches and on foundations prepared as selected by the Contractor in conformance with the bedding class, trench width and depth, and pipe size tabulated below:

Pipe Size Inches	Maximum Trench Width Ft-in.	Maximum Trench Depth in Feet					
		Class C Bedding			Class B Bedding		
		Conc. Cl. 3	Conc. Cl. 4	Conc. Cl. 5	Conc. Cl. 3	Conc. Cl. 4	Conc. Cl. 5
18	3-3	9	15	30	12	24	30
21	3-6	9	16	30	13	26	30
24	4-0	10	16	30	13	23	30
27	4-0	11	19	30	15	29	30
30	4-6	11	18	30	14	25	30
36	5-6	11	17	29	14	23	30
42	6-0	12	16	26	15	21	30
48	7-0	12	18	28	15	23	30
54	7-6	13	18	29	16	24	30
60	8-6	13	19	28	16	23	30

- B. Foundation for Corrugated Plastic: Unless otherwise approved, lay corrugated plastic pipe in trenches, or fills using not less than Class C Modified Bedding and in conformance with the maximum fill depth and pipe size tabulated below:

Pipe Size Inches	Maximum Fill Depth for Corrugated Plastic Pipe in Feet
18	11
24	7

- C. Foundation for Bituminous Coated Corrugated Aluminum Pipe: Unless otherwise approved, lay corrugated plastic pipe in trenches, or fills using not less than Class C Modified Bedding and in conformance with the maximum fill depth and pipe size tabulated below:

Maximum Fill Depth In Feet For Bituminous Coated Corrugated Aluminum Pipe With Wall Thickness

Pipe Size Inches	0.06 In. (16 Ga.)	0.075 (14 Ga.)	0.105 (12 Ga.)	0.135 (10 Ga.)	0.164 (8 Ga.)
18	30	30	52	54	56
24	22	22	39	41	42
30	18	18	31	32	34
36	15	15	26	27	28
42		26	43	43	44
48			40	41	43

1.06 Bedding

- A. Coarse Granular Material For Pipe Bedding: Crushed stone, crushed gravel, natural gravel, or crushed shell meeting ASTM C 33, and having No. 67 gradation (3/4 inch to No.4 sieve).
- B. Fine Granular Material For Pipe Bedding: Uniformly graded natural or manufactured sand composed of hard, durable particles with 100 percent passing a No.4 sieve, not more than 25 percent passing a No. 100 sieve, and containing no more than 25 percent total of silt and clay.
- C. Class B Bedding: Class B Bedding may be achieved by either of the following two construction methods:
- Shaped Bottom with Tamped Backfill: Shape bottom of trench excavation to conform to a cylindrical surface with a radius at least 2” greater than the radius to the outside of the pipe and with a width sufficient to allow six-tenths of the width of the pipe barrel to be bedded in fine granular material fill placed in the shaped excavation. Carefully place and compact backfill at sides of pipe to a thickness of at least 12” above top of pipe. Limit use of this bedding method to trenches with firm bottom and sides.

2. Compacted Coarse Granular Bedding With Tamped Backfill: Bed pipe in compacted coarse granular material placed on a flat trench bottom. Thickness of granular bedding must be at least one-fourth the outside pipe diameter, but not less than 4-inch thick under pipe barrel and extend at least halfway up the pipe barrel at the sides. Carefully place compacted backfill above the granular material up a minimum depth of 12-inches over the top of pipe.
- D. Class C Bedding: Class C Bedding may be achieved by either of the following two construction methods:
1. Shaped Bottom: Bed pipe with ordinary care in an earth foundation formed in the trench bottom by a shaped excavation which fits the pipe barrel with reasonable closeness for a width of at least 50 percent of the outside pipe diameter. Place compacted fill to a minimum depth of 6-inches above top of pipe.
 2. Compacted Coarse Granular Bedding with a Tamped Backfill: Bed pipe in compacted granular material placed on a flat trench bottom. Thickness of granular material must be at least 4-inches under the barrel and must extend one-tenth to one-sixth of the outside diameter up the pipe barrel at the sides. Place compacted backfill above the granular material to a minimum depth of 6-inches over top of pipe.
- E. Class C Modified Bedding: Class C Modified Bedding is defined as bedding pipe on a bedding blanket of sandy material roughly shaped to fit bottom of pipe. Thickness of bedding blanket must be not less than 0.1 of the nominal pipe diameter. Place compacted backfill above bedding blanket to a minimum depth of 12- inches over the top of pipe.

1.07 Pipe Laying

When either bituminous coated corrugated aluminum or corrugated plastic pipe is used, pipe installation must be observed by a Georgia registered professional engineer engaged by the contractor or developer. Upon completion of the pipe installation and prior to acceptance by the City, the observing engineer is to furnish to the City a certification that the storm drainage pipe has been installed in accordance with the approved plans and these specifications. Acceptance by the City will not be considered without the engineer's certification. Clean interior of pipe and all joints before laying.

When pipe laying activity is not in actual progress, tightly cover open ends of sewer. Avoid permitting mud or other material from entering sewer at all times.

Avoid damage or shock in handling pipe and accessories. Inspect each length of pipe and reject any defective piece. Carefully protect pipe in place from damage or displacement

until backfilling operations are complete. Lay and joint pipe in strict conformance with manufacturer's written recommendations as submitted to and accepted by the City.

Where cement joints are used, provide wet burlap or earth protective cover for joints immediately after initial grout set. Maintain protective cover until joint is covered by backfilling.

Lay all pipe upgrade with spigots pointing downgrade. Control geometric position of pipe as necessary to ensure that pipe and fittings accurately conform with required grade and alignment after sewer is completed. Prevent water from accumulating or running in trench during pipe laying operations, and until the trench or excavation has been backfilled.

Remove and re-lay any length of pipe which does not accurately conform with required line or grade, is crushed, or is excessively deflected.

1.08 Pipe Connections

Make all pipe connections with standard fittings, manholes, structures, or special construction detailed on Drawings.

At manholes and structures, neatly cut all connecting pipe flush with inside surface, and provide flexible pipe joint within 18-inches of outer surface. Make pipe connections to manholes and structures by laying pipe in mortar bed or concrete. Use supplemental materials and techniques as required to obtain watertightness. Do not connect any flow to new work until authorized by the City.

1.09 Line Cleaning

Avoid permitting dirt, rubbish, surplus construction material, and other foreign matter to enter structures or pipe during construction. Use whatever means may be necessary to obtain a clean and internally smooth sewer system prior to final acceptance.

1.10 Leakage and Infiltration

Entire storm sewerage system shall be made as watertight as practicable. All visible points of ground water infiltration leakage shall be eliminated.

1.11 Storm Water Infrastructure Dedication

1. The developer and or owner shall provide video inspection and mandrel inspection prior to dedication to the City.
2. Video and mandrel inspection and necessary repairs shall be completed prior to installation of final asphalt pavement wear course.

A. Scope

This test method describes the equipment and procedures for video inspection of storm and side drainpipe. This test method is used in conjunction with the GDOT Specification 550 (Storm Drainpipe, Pipe Arch Culverts, and Side Drainpipe).

B. Apparatus

1. **Camera Inspection Equipment:** Provide a pipeline inspection camera having the following features:

- a. Configured properly in the pipe both vertically and horizontally and having the ability to pan and tilt to a 90 degree angle with the axis of the pipe and rotate 360 degrees.
- b. Low barrel distortion camera.
- c. Color image with a minimum standard resolution of 720 x 480 pixels.
- d. Equipped with sufficient lighting to provide a clear image of the full circumference of the pipe.
- e. Capable of recording the station, milepost, distance along the invert of the pipe, or other indicators of location superimposed on the video.
- f. Capable of moving through the entire length of the pipe.
- g. Capable of measuring cracks greater than 1/16" and joint separations greater than 0.5".
- h. Software capable of generating a report that included the following:
 - Actual recorded length and width measurement of all cracks within the pipe.
 - Actual recorded separation measurement of all pipe joints.
 - Pipe ovality report.
 - Deflection measurements and graphical diameter analysis report in terms of x and y axis. E. Flat analysis report.
 - Representative diameter of pipe.
 - Pipe deformation measurements, leaks, debris, or other damage or defects.
 - Deviation in pipeline and grade, joint gaps, and joint misalignment.

2. **Laser Deflection Measuring Device:** Provide a laser deflection measuring device, for use of flexible pipe up to 48 inch in diameter, capable of measuring deflection to an accuracy of 0.5% or better and a repeatability of

0.12% or better. Reference of the equipment calibration are ASTM E 691 and ASTM E 177.

3. **Mandrel:** Provide a mandrel device which are rigid, nonadjustable, odd numbered legged (9 minimum) having the following:
 - a. Length not less than 7/16 of its nominal diameter.
 - b. Diameter at any point shall not be less than the diameter specified in Section C.3 Mandrel.
 - c. Diameter, whether fixed or variable, shall be verified with a proving ring or other method per the manufacturer's' guidelines.
4. **Manual Inspection Measuring Devices:** Use contact or non-contact distance instruments.

C. Procedure

Ensure pipe is clear of water, debris and/or obstructions. Complete the video inspection and any necessary measurement prior to placing the final surface over any pipe. Notify the engineer a minimum for 7 days in advance of inspection.

1. Pipeline Video Inspection for Defects and Distresses:

- a. Begin at the outlet end and proceed through to the inlet at a speed less than or equal to 30 ft/minute. The distance shall have an accuracy of 1' foot per 100 feet. Remove blockages that will prohibit a continuous operation.
- b. Document locations of all observed defects and distresses including cracking, exposed reinforcing, steel, sags, joint offsets, joint separations, deflections, improper joints/connections, blockages, leaks, rips, tears, buckling, deviation from line and grade, and other anomalies not consistent with a properly installed pipe.
- c. During the video inspection provide a continuous 360-degree pan of every pipe joint.
- d. Identify and measure all cracks greater than 1/16-inch and joint separations greater than 1/2- inch. When cracks exceed 1/16- inch and extend more than 12-inch make repairs in accordance with manufacturer recommendation. Crack with displacement will require pipe replacement. Repair or replace pipe joint separation greater than 1-inch.
- e. Video inspections are conducted from junction to junction which defines a pipe run. A junction is defined as a headwall, drop inlet, manhole, junction box, or other structure than disturbs the continuity of the pipe. Each pipe run must be on a separate video file and all locations are to be referenced from the nearest junction relative to that pipe run.

- f. Record and submit all data as per Section D Reporting.

2. Pipeline Laser Inspection for Deflection:

- a. Calibrate the laser deflection measuring device according to the manufacturer's specifications. Provide all calibration data and applicable manufacture's recommendations for calibration and use to the Engineer.
- b. Measure the deflection occurring at the point the projected laser and at a minimum interval of -.1 feet along the pipe.
- c. All deflection measurements are to be based on the AASHTO Nominal Diameter. Refer to Section C.5.
- d. Inspect at a speed that will provide proper data acquisition to effectively measure the maximum deflection. The inspection speed shall be less than or equal to 30 ft/minute. The laser projection head shall be positioned so that the laser ring fills minimum 75% of the monitor screen height.
- e. Laser inspections are conducted in the same manner as Section C.1.e.
- f. Record and submit all data per Section D. Reporting.

3. Mandrel Testing:

- a. Mandrel Testing will be used for deflection testing if the video measurements are called into question or if limitations in the laser deflection measuring device are exceeded.
- b. Use proving ring or other method recommended by the mandrel manufacturer to verify mandrel diameter prior to inspections. Provide verification documentation for each size mandrel to the Engineer.
- c. All deflections measurements are to be based on the AASHTO Nominal Diameters. Refer to Section C.5.
- d. Begin by using a mandrel set 7.5% deflection limit. Place the mandrel in the inlet end of the pipe and pull through the outlet end. If resistance is met prior to completing the entire run, record the maximum distance achieved from the inlet side, then move the mandrel and continue the inspections from the outlet end of the pipe toward the inlet end. Record the maximum distance achieved from the outlet side. Replace pipe exceeding 7.5 % deflection.
- e. If no resistance is met at 7.5% then the inspection is complete.
- f. Record and submit all data as per Section D. reporting.

4. Manual Inspection Measurements:

- a. Alternate method of video inspection and deflection testing when there is available access, or the pipe is greater than 48-inches in diameter. For all pipe considered a confined space, provide entry for all project personnel according to OSHA requirements.
- b. Physical measurements may be taken after installation and compared to the AASHTO Nominal Diameter if the pipe is per Section C.5. When this method is used, determine the smallest interior diameter of the pipe as measured through the center point of the pipe (D2). Take the D2 measurement at the most deflected portion of the pipe in question and at intervals no greater than 10 feet through the run. Calculate the deflection as follows;

$$\% \text{Deflection} = [(\text{AASHTO Nominal Diameter} - D2) / \text{AASHTO Nominal Diameter}] * 100\%$$

- c. Video and lase inspect as per Sections C.1 and C.2.
- d. Record and submit all data as per Section D. reporting.

5. AASHTO Nominal Diameters and Maximum Deflections Limits:

These deflection limits are the maximum allowable deflection on any axis within the pipe and not just in the XY plane.

Base Pipe Diameter	AASHTO Nominal Diameter	Maximum Deflection Limit (7.5%)
(Inches)	(Inches)	(Inches)
15	14.76	13.65
18	17.72	16.39
24	23.62	21.85
30	29.53	27.32
36	35.43	32.77
48	47.24	43.70
54	53.15	49.16
60	59.06	54.63

D. Reporting

Submit all recorded information to the Engineer on standard forms along with the complete video inspection on DVD in digital format. The forms included in this method shall be used for reporting the inspection information. Ensure

all video pipe runs on the DVD have the station, milepost, distance into the drain or other indicators of location superimposed on the video. Submit one copy of the paper inspection, DVD, and one electronic copy of report.

1. **Pipe Video Inspection Report:** The Pipeline video Inspection Report shall include the “Pipe Video Inspection Summary Report” form, the “Individual Pipe Video Inspection report” form(s), and the report(s) generated by the inspection software for each pipe run.
 - a. Individual Pipe Video Inspection Report Form: Complete Project Information, Inspector Information and Pipe Information. Under Inspection information record each defect/distress and joint along with its distance from the inspection entrance software and reference the page number associated with the still image of the joint, distress/defect along with any additional information.
 - b. Pipe Video Inspection Summary Report Form: This page is to be used as the cover sheet for the completed video inspection report. Complete Project Information, Inspector Information, and Pipe Information.
2. **Pipeline Deflection Inspection Report:** The Pipeline Deflection Inspection Report shall include the “Pipe Deflection Inspection Summary Report” form, the “Individual Pipe Deflection Inspection Report” form(s) and the report(s) generated by the inspection software for each pipe run.
 - a. Individual Pipe Deflection Inspection Report Form: Complete Project Information and Inspector Information. Under Inspector Information, record each joint location along with the beginning and ending locations where the deflection exceeds 7.5%. Attach a copy of any supportive information generated from the inspection software and reference the page number where more detailed deflection information may be conveyed.
 - b. Pipe Deflection Inspection Summary Report Form: This page is to be used as the cover sheet for the completed deflection inspection report. Complete Project Information, Inspector Information, and Pipe Information.

PIPE VIDEO INSPECTION SUMMARY REPORT

INSPECTOR INFORMATION

Inspecting Contractor: _____

Operator Name: _____ **Project Name:** _____

Inspecting Contractor Signature: _____ **Date:** _____

PIPE INFORMATION

Beginning Sta.	Ending Sta.	Dia.	Material	Length	Under Pavement	Cracks > 1/8 "	Joint Separations >1/2-inch	Pass / Fail

PIPE DEFLECTION INSPECTION SUMMARY REPORT

INSPECTOR INFORMATION

Inspecting Contractor: _____

Operator Name: _____ Project Name: _____

Inspecting Contractor Signature: _____ Date: _____

PIPE INFORMATION

Beginning Sta.	Ending Sta.	Dia.	Material	Length	Under Pavement	Greater than 7.5 %	Pass / Fail

SECTION 2: GRASSING

2.01 General

The extent of grassing consists of those areas which are disturbed by operations of the Contractor and are not covered over by improvements, except where specifically noted otherwise, together with any additional areas shown on the drawings or designated by the City. Grassing operations include, but are not limited to, the following: Ground preparation, Seeding, Liming, Fertilizing, Mulching, Watering, and Maintenance of Grassed Areas.

2.02 Quality Assurance

Use grassing materials with certificates of inspection as required by governmental authorities. Comply with regulations governing grassing materials.

2.03 Grass Seed

Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified below:

Common Name:	Sowing Rate lbs per acre	Min % Germ.	Min % Purity	Max % Weed
Bermuda Grass, Common	8	70	90	2

2.04 Soil Amendments

- A. Lime: Natural limestone containing not less than 85 percent of total carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 25 percent passes a 100-mesh sieve.
- B. Fertilizer: Standard commercial grade fertilizer conforming to the standards of the Association of Official Agricultural Chemists. Provide either grade 4-12-12, 6-12-12 or 5-10-15 at Contractor's option.
- C. Nitrogen: Standard commercial grade nitrogen conforming to state fertilizer laws. Provide in either granular or liquid form at Contractor's option.
- D. Water: Water used to produce grass is to be free of excess and harmful chemicals, acids, alkalies and all other substances which are harmful to plant growth.
- E. Wood Cellulose Fiber Mulch: Green colored wood cellulose fiber containing no germination or growth inhibiting ingredients, and suitable for uniform application by hydraulic mulching equipment. Mulch material to have the following packaged properties:

Property	Nominal Value
Percent Moisture Content	9.0% ± 3.0%

Percent Organic Matter (Oven Dried Basis)	99.2%±8.8%
Percent Ash Content	08%±02%
pH	4.8% ±0.5%
Water Holding Capacity (g/1000g)	1,150 Minimum

- F. Natural Mulch: At Contractor's option, either threshed rye, oat or wheat straw or Bermuda grass hay free of noxious weed seeds.
- G. Asphalt: Homogeneous emulsified asphalt meeting ASTM D 977 which contains no agents harmful or toxic to plant growth.

2.05 Execution

These Specifications set forth minimum operations and material applications which are acceptable. However, a satisfactory stand of grass must be obtained by using supplemental methods and/or materials as may be required.

- A. Grassing By Private Property: Where grassing is required between curbs and sidewalks or behind sidewalks in areas adjacent to private residential or commercial property, the City may change the type of grassing required to match any type of grass which may be planted and growing on the adjacent lawn.
- B. Ground Preparation: Plow area to be grassed to a depth of not less than 4-inches. After plowing disk and harrow area until soil is well pulverized to a depth of at least 4-inches. Completed surface must be smooth, uniform, loose and free of large clods, boulders, stumps, large roots, debris, and other similar undesirable matter.
- C. Lime and Fertilizer Application: Spread lime uniformly over the ground surface at the rate of 1,000 pounds per acre. Spread fertilizer uniformly over the ground surface at the rate of 1,000 pounds per acre. Once lime and fertilizer are placed, blend into top 4-inches of soil with suitable harrows, rotary tillers, or other appropriate equipment. Restore surface areas to line and grade.
- D. Application of Nitrogen: Make two applications of nitrogen to all grassed areas using mechanical spreading equipment. Apply at a uniform rate of not less than 70 pounds per acre per application. Make both applications only when weather conditions will permit uniform and even distribution and when moisture conditions will not cause harm to grass. Place first application of nitrogen when young grass reaches a height of at least one inch. Make the second application of nitrogen between 30 and 45 days after the first application.
- E. Seeding: Sow seed within 24 hours following completion of placing lime and fertilizer using mechanical equipment that produces uniform application of seed. Once seed is sown, roll seeded areas before placing mulch. Sow seed only when

weather conditions permit uniform distribution of seed and ground is not frozen, wet, or otherwise non-tillable.

F. Mulching: Mulch all grassed areas using either wood cellulose fiber mulch or natural mulch with bituminous treatment at the following rates:

1. Wood Cellulose Fiber Mulch: 1,500 pounds per acre
2. Natural Mulch-Bituminous Treated: 3/4 inch to 1 1/2 inch deep over entire area with sufficient asphalt material to hold mulch in place

Apply mulch only when weather conditions will permit uniform distribution of mulch. Exercise care at all times to protect the public, adjacent property, bridges, pavements, curbs, sidewalks, and all other structures.

G. Water: Water grassed areas as required to obtain specified grass coverage.

H. Required Coverage: Grassed areas will be considered acceptable when a viable stand of grass covers at least 98 percent of the total area with no bare spots exceeding one square foot and the ground surface is fully stabilized against erosion.

I. Maintenance: Maintain grassed areas until the later of (1) final project acceptance, or (2) the required grass coverage is achieved. Maintain grassed areas by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, acceptable stand of grass free of eroded or bare areas. Mow areas as required to keep grass not more than 8-inches above ground surface until grassing work is accepted.

J. Final Inspection and Acceptance: When the grassing work is completed, including maintenance, the City will, upon request, inspect to determine acceptability. Where inspected work does not comply with the requirements, replace rejected work and continue specified maintenance until re-inspected by the City and found to be acceptable.

SECTION 3: GRADED AGGREGATED BASE AND SUBBASE**3.01 Sampling and Testing**

Provide quality control testing during construction as necessary to ensure the entire base or subbase including all courses meets contract requirements. Remove and reconstruct, or otherwise correct work which falls below specified density or is outside other specified limits. Provide quality control testing by an approved testing laboratory during construction as necessary to ensure the entire or subbase including all courses meets contract requirements. Remove and reconstruct, or otherwise correct work which falls below specified density or is outside other specified limits.

- A. Minimum quality control testing to be provided by the contractor consists of the following:
1. Moisture-density relationship curve for graded aggregate to be used on project.
 2. One-in-place density test (ASTM D 1556 or other method approved by the Engineer) per 1,200 square yards of base or subbase.
 3. One thickness measurement normal to base or subbase surface per 1,200 square yards of base or subbase.
 4. One surface tolerance measurement using a 15' foot straight edge per 250 square yards of base or subbase.

After completing street earthwork operations and before beginning street base construction, the developer shall file a copy of the quality control test results demonstrating compliance with these requirements with the City. At any time during the construction process, representative(s) of the City may request to review, and the developer shall provide quality control test results.

3.02 Aggregate Properties

Graded aggregate shall meet standards set forth in the Georgia Department of Transportation Specifications for Coarse Aggregate, Section 800.

3.03 Execution

Clear and grub entire street right-of-way before commencing street earthwork construction. For specific technical requirements reference is made to Georgia DOT Specifications. Combustible material generated from clearing and grubbing operations may be burned only when authorized and permitted by the Dawson County Fire Marshall.

Complete utility and drainage earthwork before starting street subgrade construction. Ensure that subgrade and subbase conform to specified compaction, line and grade and thickness requirements before commencing graded aggregate construction. Responsibility for placing the specified graded material lies with the Contractor. Approval by the

engineer of material, source of supply, etc. in no way relieves the Contractor of his responsibility of providing the specified graded aggregate material.

Place homogeneously and uniformly mixed graded aggregate on prepared subgrade or subbase. Spread material to a uniform depth not exceeding the thickness indicated on the Drawings nor 6-inches after compaction. Where graded aggregate base or subbase is indicated more than 6-inches in thickness, construct base or subbase in two or more courses of approximately equal thickness.

Control graded aggregate compaction during construction providing no less than minimum percentage of density specified. Achieve not less than 100 percent of maximum dry density as determined by ASTM D 698 (Standard Proctor) for each course of material-in-place.

After compaction, shape surface to required line, grade, and cross section. Compact loosened material until the surface is smooth, closely knit, free from cracks, conforming to required line, grade and cross section. Obtain a finished surface with no variation from design requirements in excess of ¼ -inch when measured with a 15' foot straightedge.

Maintain graded aggregate base or subbase in a smooth, true to grade, compacted condition until it is covered by other construction.

Achieve compacted thickness which is no more than ½ inch less than the required thickness at any point. Correct any area deficient by more than ½ inch by adding additional graded aggregate and rebuilding the base or subbase to the required thickness in accordance with this section.

SECTION 4: PAVEMENT REMOVAL AND REPAIR**4.01 Scope**

Pavement referred to under this Section, refers to asphaltic, cementitious, brick, cobble, or other large stone pavement materials together with underlying construction, irrespective of its composition. The extent of pavement work under these sections consists of the removal of pavement and repair of all pavement removed or damaged in the course of constructing the Project. Pavement patching includes repair of paved roads, streets, highways, walkways, driveways, patios, slabs on grade, and parking lots together with walls, curbing, gutters and headers, and other pavements and appurtenances. City of Dawsonville Standard Details associated with this specification are 28.1, 29.1, 38.1, 39.1 and 40.1.

4.02 Traffic Control

Schedule and conduct work in a manner which will minimize inconvenience to vehicular and pedestrian traffic. Provide flaggers, barricades, warning signs, warning lights, and other warning means as appropriate. Traffic Control: Immediately after new base construction, cover pavement cut with steel plates or similar devices of sufficient thickness to span the cut without noticeable deflection. Maintain plates in place for not less than 24 hours and not more than 7 days and until the concrete base has gained sufficient strength to withstand traffic loads. Traffic may resume after installation of metal plates. Traffic control devices in lieu of cover plates are permitted for pavement work longitudinal to the street centerline in excess of 20 feet. Use traffic barricades, warning signs and lights, flagmen, and other means as appropriate to continuously control traffic 24 hours per day. Use devices such that at least 12 feet wide, one-way through traffic access is provided at all times.

4.03 Weather Limitations

Conduct all operations during weather conditions appropriate to the Work being performed.

4.04 Grade Control

Establish and maintain lines and elevations which will ensure finished pavement having desirable appearance, function, and strength.

4.05 Submittals

Submit detailed material descriptions when requested by the Engineer.

4.06 Materials

For products not described below, use materials and gradations which have locally exhibited a satisfactory record of previous usage, and which for finished visible surfaces

will permit obtaining appearance, color and texture reasonably matching remaining adjacent pavement of the same type.

- A. Asphalt Concrete: Bituminous plant mixture of asphalt cement and aggregates complying with Superpave mixtures specified in Section 828, Hot Mix Asphaltic Concrete Mixtures of the Georgia Department of Transportation, "Standard Specifications for Road and Bridge Constructions".
- B. Graded Aggregate Base: Uniform graded aggregate material complying with Section 815 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Construction".
- C. Bituminous Tack Coat: Asphalt material complying with Section 413, topics 413.01 through 413.04 of the Georgia Department of Transportation "Standard Specifications for Road and Bridge Construction".
- D. Portland Cement Concrete: Concrete mix of Portland cement, aggregates, water, and air entraining admixture to produce the following properties: 3500 psi minimum compressive strength at 28 days per ASTM C39, 4-inches maximum slump per ASTM C143, and air content between 3% and 6%.
- E. Cold Mix: Cold Mix shall not be used for pavement patches.

4.07 Execution

- A. Pavement Cuts: Saw cut trench edges in paved areas to neat, straight lines before starting to break the pavement slab. City of Dawsonville Standard Details No. 28.1 and 29.1 shall be used.
- B. Backfill Placement: Place trench backfill materials in layers not more than 6-inches compacted thickness. Commence backfill immediately after utility is installed. Complete new replacement base construction immediately after trench backfill.
- C. Inspection: Examine areas and conditions under which pavement patching will be conducted, giving special attention to stability of subbase. Do not proceed with pavement patching work until unsatisfactory conditions have been corrected.
- D. Preparation: Saw cut any ragged edges of existing pavement, or in the case of concrete work, remove existing pavement to nearest joint. Remove all loose material from underlying and adjacent surfaces.
- E. Strength and Stability: Use materials and construction techniques as necessary to obtain strength, stability, and durability of pavement patch at least equal to that of remaining adjacent pavement of the same type. As a minimum, conform with pavement patch details, if any, required elsewhere by the Contract Documents; and where such details are not provided, accomplish pavement patching utilizing

strengths, thickness, etc. not less than that of remaining adjacent pavement of the same type.

- F. Placing: Construct pavement using methods and equipment in general use for the type of work being performed. Monitor performance and repair or replace materials regularly to maintain smooth traffic surface until placement of permanent pavement surface materials. At Contractor's time selection prior to substantial completion, remove cold mix and bond breaker paper and provide new permanent pavement surface materials. If performance or maintenance of cold mix patch is unsatisfactory in the opinion of the City or Engineer, remove materials and provide new permanent pavement surface materials within 72 hours of notice by the City or Engineer. Upon removal of the metal plates or similar devices, provide new pavement surface in accordance with one of the following options:

- Immediately apply new permanent pavement surface materials indicated or immediately apply bituminous cold mixture over bond breaker paper over new base.
- Plates or other traffic control devices may be used before the permanent pavement surface is installed.

Contractor assumes all responsibility for maintaining repairing and or replacing concrete base that may be damaged during curing period.

For existing surface of Portland cement concrete, furnish new Portland cement concrete structure thickness, including base and pavement surface, of not less than 8-inches; except for sidewalks which shall be not less than 4-inches thick.

Provide not less than 8-inches thickness of new graded aggregate base for replacement of asphalt concrete pavement at driveways, sidewalks, and parking lots.

For repair of asphalt concrete pavement, clean base and adjacent surfaces and apply bituminous tack coat or bituminous prime (as appropriate) to such surfaces before placing new asphalt concrete surface.

- G. Finish: Accomplish pavement repair using materials and techniques which result in visible, finished surfaces having appearance, color, and texture reasonably matching remaining adjacent pavement of the same type. Do not permit the finished surface to have dips, objectionable roughness or discontinuity or non-draining areas. Do not create any unsafe pavement condition.
- H. Repairs: If pavement patch or adjacent pavement settles or shows evidence of other distress resulting from the Work, cut pavement out, repair subgrade, and reconstruct patch. Do not place additional pavement material on top of unsatisfactory previously repaired surfaces. At expense of Contractor, repair any

pavement which he damages beyond that minimum amount necessary to construct the Work.

4.08 Removing Pavement

The Contractor shall remove pavement as necessary for installing the new pipelines and appurtenances and for making connections to existing pipelines.

- A. Marking: Before removing any pavement, the pavement shall be marked for cuts neatly paralleling pipelines and existing street lines. Tunneling will be permitted under existing sidewalks, curbs, and gutters, but not under pavement.

Power saws shall be used to cut all types of pavement along marked lines. The pavement shall be sawed to a depth of at least 2" or deeper if directed by the Engineer.

- B. Machine Pulling: No pavement shall be machine pulled until completely separated along the marked cuts.
- C. Damage to Adjacent Pavement: The pavement adjacent to pipeline trenches must not be disturbed or damaged. If the adjacent pavement is disturbed or damaged due to any cause, such as caving ditch banks, indiscriminate use of construction machinery, etc., the Contractor shall remove the damaged pavement and shall replace at his own expense.
- D. Stone or Precast Concrete Curb: The Contractor shall remove and replace or tunnel under any stone or precast concrete curb encountered.

4.09 Replacement Pavement

Upon completion of backfilling and consolidation of the backfill, the Contractor shall furnish all materials and labor and shall replace all pavement removed for construction of the pipelines and appurtenances. The Contractor shall also remove and replace at his own expense any and all pavements adjacent to pipe trenches which may have been disturbed or damaged as the result of construction operations.

In the event weather conditions do not permit the permanent replacement of pavement immediately subsequent to the completion of pipeline construction, the Contractor will be required to maintain temporary surfacing until such time as the weather is suitable for paving operations. Any such delay will not be counted against the contract time for completion, provided that all other work to be performed under the Contract is completed within the specified time.

- A. The various types of pavement removed shall be replaced as follows:
1. Pavement Replacement: Street pavement shall be replaced in accordance with the applicable provisions of the Standard Specifications Construction of Transportation Systems, Georgia Department of Transportation, latest revision, and with the City of Dawsonville Standard Details.

2. Base: The base for the asphaltic concrete pavement shall be 8-inches of concrete.
 3. Asphaltic Concrete: The concrete base shall be poured to the proper level after which it shall be primed and sealed in accordance with the appropriate standard specification. The wearing course shall consist of 2-inches of Superpave plant-mixed asphaltic concrete, conforming to the provisions of Section 400 of the Georgia Department of Transportation Specifications.
- B. Sub-Grade Preparations: Under trench paving the sub-grade shall be thoroughly compacted by approved mechanical compaction equipment to 95% as determined by Modified Proctor Test. At least two (2) compaction tests shall be made between manhole reaches equal to or less than 200' feet long. At least three (3) compaction tests shall be provided for manhole reaches greater than 200' long. These tests shall be conducted by an approved soils testing company and shall be performed by an experienced soils technician. The costs of all tests shall be paid by the City.
- C. Pavement Preparation: Before replacement of pavement, the pavement should be cut back at least 12-inch on each side of the trench or to visible overbreak's, whichever is greater, to a depth of 2-inch with a concrete saw. No cutback will be required on bituminous surface treatment pavement to insure a straight vertical edge for the patch. After making the saw cut, the pavement to be removed should be broken into small pieces and removed. The broken edge below the saw cut is left fairly rough and irregular but is approximately a vertical plane to provide an aggregate interlock between the patch and the existing pavement. The sub-base material should be carefully placed and shaped. Water should be added to provide a damp but not wet sub-base before the concrete base or soil cement base is placed. The new concrete base should then be poured, or soil cement base placed before this surface dries out. The base should be placed with care, making sure it is worked back into all corners.
- D. Concrete Base: After the concrete base has cured, the concrete surface and vertical edges of the existing paving must be clean and dry before the tack coat is applied. The tack coat should be applied to the surface of the new concrete base and brushed into the corners and on to the vertical edges of the old pavement to provide a bond and seal out water. The asphalt surface material should be immediately placed after the surface of the tack coat has dried to the point it is sticky to the touch.
- E. Soil Cement Base: In lieu of the concrete base as described above, a soil cement base material consisting of approximately 12% Portland Cement by volume and a friable local material must be used. The minimum depth for the soil cement

should be 12-inch. This material should be placed in at least two (2) layers with no layers to exceed 6-inch in depth and compacted to 100% compaction. In lieu of the bituminous tack coat, a bituminous prime should be lightly sprayed or mopped onto the soil cement base as soon as it is completed.

- F. Asphalt Surface: The asphalt surface material should be immediately placed after the surface of the bituminous prime has cured. A short period of time is required for the prime to penetrate into the base material.
- G. Replacement of Concrete Curb and Gutter, Street, Driveway and Sidewalk: Concrete curb and gutter, street, driveway, and sidewalk shall be replaced with Class 'A' 3,000 psi concrete of the same thickness and dimensions as was removed.

SECTION 5: ROADWAY AND WALK INSTALLATION**5.01 Roadway Surfacing**

All paved access roads and parking areas, where shown on the Drawings, shall have a crushed stone base course, asphalt binder course and asphalt wear course. The compacted depth of the base course shall be 8-inch and widths shall be as shown. Binder course shall be 2-inch 19 mm or 12.5 mm asphalt course and topping wear course shall be 1½-inch “9.5 mm. Materials and construction methods shall conform to *the Standard Specifications for Highway Construction of the Georgia Department of Transportation* as follows:

- Section 310: Graded Aggregate Construction
- Section 412: Bituminous Prime
- Section 400: Hot Mix Asphaltic Concrete Construction
- Section 828: Hot Mix Asphaltic Concrete Mixtures

5.02 Quality Assurance

- A. The developer shall provide quality control testing during base and pavement construction as necessary to ensure the entire pavement structure meets the minimum requirements of these Regulations. The minimum quality control testing to be provided consists of the following:
1. Moisture-density relationship curve for each base material used on project.
 2. For soil cement base, conduct mix design to determine Portland cement content (percent of dry weight of the soil) to achieve a minimum compressive strength of 300 psi at seven days when testing in accordance with ASTM D 1632 and D 1633.
 3. One in-place density test (ASTM D 1556 or other method acceptable to the City) per 1,200 square yards or fraction thereof of base. (4.9 (e) (2) and
 4. One thickness measurement normal to base surface per 1200 square yards or fraction thereof of base.
 5. For base course, one surface tolerance measurement using a 15’ foot straight edge per 250 square yards or fraction thereof of base.
 6. One asphalt extraction (ASTM D 2172) and aggregate gradation analysis (ASTM C 136) per 2400 square yards or fraction thereof of surface course and per 2400 square yards or fraction thereof of binder course (if any). Obtain samples for extraction and gradation tests in accordance with ASTM D 979.
 7. One density and compacted thickness measurement per 1200 square yards or fraction thereof of each course placed. Density determined to be made in

accordance with ASTM D 1188. Remove not less than 3-inch diameter nor larger than 12-inch square test specimens. Repair test specimen holes with full depth application of fresh hot asphaltic plant mix.

8. For asphalt extraction, one surface tolerance measurement using 15' foot straight edge per 250 square yards or fraction thereof of surface course.
- B. Base and/or paving construction which falls below specified minimum quality control limits shall be removed, reconstructed, and re-tested until compliance with specified requirements is achieved.
 - C. Report test results in writing to the Engineer promptly (normally same day tests are made). The Engineer and/or City may perform sampling, surveying, inspection or testing activity during construction for his use, but such activity does not relieve the Contractor from his responsibility to achieve specified results.
 - D. After completing base and paving construction, the developer shall file a copy of the quality control test results demonstrating compliance with these Regulations with the City. At any time during the construction process, representative(s) of the City may request to review and the developer shall provide quality control test results.
 - E. The City may perform compaction, surface tolerance and thickness check tests on graded aggregate work when the Contractor indicates such work meets contract requirements. If these tests demonstrate work fails to meet contract requirements, it is the Contractor's responsibility to determine the extent to which the deficiency is present, to correct the deficiency, and to demonstrate by tests made by an approved testing laboratory, compliance with contract provisions in the deficient area. Check testing activity by the City does not relieve the Contractor from his responsibility to achieve specified results. All costs of determining the extent to which a deficiency is present and of retesting to demonstrate compliance with specified results are to be assumed by the Contractor. The City will pay all other check testing costs.

5.03 Sidewalk

Per GDOT section 441, walks shall be constructed of Class 'A' concrete (3,000 psi), shall be 4-inch deep and 5' foot wide unless otherwise specified. Transverse contraction joints shall be formed with a tool designed for forming a groove $\frac{1}{3}$ the depth of the sidewalk, and on not more than 10' foot centers. All edges shall be rounded with a $1\frac{1}{4}$ edger. Expansion joints shall be located on not more than 60' foot center each side of all driveways and at abutting concrete structures.

5.04 Sidewalk Crossing Driveways

Sidewalks crossing driveways shall be constructed of Class 'A' concrete (3,000 psi), shall be 6-inch deep for residential and 8-inch for commercial and 5 foot wide unless otherwise specified. Transverse contraction joints shall be formed with a tool designed for forming a groove $\frac{1}{3}$ the depth of the sidewalk, and on not more than 10 foot centers. All edges shall be rounded with a $1\frac{1}{4}$ edger. Expansion joints shall be located every 60 foot, abutting concrete structures and at each side of driveway connections. Valley gutters shall be installed according to Georgia Department of Transportation details.

5.05 Excavation

Excavation for roadways and walks shall be made to the lines, grades and typical sections approved by the City. Proper allowances shall be made for specified thickness of roadbed and walkway below the finish grade shown. Should rock be encountered in the subgrade, the road shall be excavated to a depth of 6" below subgrade and the resulting space backfilled with suitable material.

5.06 Existing Paved Surfaces

All existing paved surfaces shall be protected and repaired if damaged.

5.07 Curb and Gutter

Concrete used for curb and gutter construction shall have a minimum 3,000 psi compressive strength at 28 days (ASTM C 39); a 2 inch to 4-inch slump (ASTM C 143) and, 3 to 6 percent air content (ASTM C 231 or C 173) and shall comply with ASTM C 94.

Construct curb and gutter true to line, grade and cross section on properly prepared subgrade. Apply Georgia DOT Type 2 membrane curing compound.

Protect completed curb and gutter work from damage until dedication to the City. As soon as the curb and gutter will not be damaged, backfill, compact, stabilize and grass adjacent ground to achieve design line and grade.

Acceptably repair or replace broken or defective curbs and gutters.

5.08 Shoulders

Shoulders shall be constructed of selected topsoil in accordance with typical sections approved by the City and shall be grassed as specified elsewhere.

5.09 Construction on Embankments

Where roadways are constructed on fill, the embankment shall be placed in layers not over 6" deep as measured before compaction and be thoroughly rolled to a density of 98% of the Standard Proctor Dry Density with sheepsfoot or pneumatic tired roller. The work shall be executed in a manner which will ensure that no places too steep to roll are left in the

embankment. Portions inaccessible to the roller shall be rammed by hand. All materials shall be visibly damp. Water shall be applied as directed to obtain close adhesion between layers and all parts of the material.

Sheepsfoot roller shall be of self-cleaning type, have feet projecting 7" from the shell and be of a weight so that the load of each tamper foot with the drum empty will be not less than 100 pounds per square inch of area in contact with a plane surface. Rolling shall be executed until the feet leave no appreciable imprint when the shell is filled to a maximum weight.

Pneumatic tired rollers shall be suitable for ballast loading which will give a compression, under working conditions, of not less than 325 pounds per inch width of tire tread. Forward and rear tires shall make separate tracks. Compaction shall be equivalent to that required for the sheepsfoot roller.

Within the limits of the roadbed, the fill shall be constructed of selected clay materials from excavation and borrow and be free from stones larger than 4" in diameter within the last 10'foot of vertical fill. Slopes of roadway outside the above limits may be constructed of alternate layers of rock and clay; in no case shall rock be allowed in nests. The stones shall be uniformly distributed over the preceding clay layers, and the voids shall be completely filled with clay so as to form a solid compaction embankment.