

SECTION III - CONSTRUCTION METHODS

PART 1 - SITE WORK

1.01 Clearing and Site Grading

Where the lines are to be constructed in wooded areas, permanent easements shall be fully cleared and grubbed. Cleared materials shall be disposed of off of the construction site. Disposal shall be made in accordance with all local and state laws. Trees cut down on the construction site shall be hauled away from the site for proper disposal. Stumps and roots of all trees cut down outside of the excavation area shall be removed. Ground surfaces shall be graded so as to promote proper drainage and allow mowing by vehicular equipment.

All rough grading shall be completed to within 6" of finished grade prior to the installation of any pipeline or pipeline appurtenance.

1.02 Earthwork-General

Explosives and Blasting

A permit is required from the City Fire Department prior to any blasting or use of explosives.

Explosives for blasting shall be stored, handled, and used in accordance with the North Carolina Department of Transportation Standard Specifications-latest revision, all local regulations, and practices outlined in the "Blaster's Handbook" published by E.I. Dupont de Nemours and Company, Inc. Blasting shall be conducted so as not to endanger persons or property, and shall be covered or otherwise satisfactorily confined. The blaster shall be responsible for, and shall make good, any damage of whatever nature caused by blasting or accidental explosions. The blaster shall have an insurance policy with appropriate liability coverage (covering blasting and use of explosives) of \$1,000,000 per occurrence.

No blasting will be allowed in an existing water or sewer easement without written permission from Utilities Management. CCTV inspection of the lines prior to and after blasting may be required. The CCTV inspection shall be done at no cost to the City.

Removal of Water

The bottom of all excavations shall be free from water when pipe is laid in the excavation, when concrete is placed and until work is carried above the groundwater level and is safe from flotation.

If any of the subgrade or underlying materials is disturbed by movement of groundwater, surface water, or any other reason, it shall be replaced with crushed stone or gravel.

Clean Up of Site

At the completion of the work, all debris and excess construction materials shall be removed and the right-of-way and easements shall be left clean and presentable.

All property irons shall be restored by a registered land surveyor.

All disturbed areas shall be stabilized in accordance with the NC Sedimentation and Erosion Control Ordinance.

1.03 Excavation

General

All excavation shall be made in such a manner, and to such widths, as will give ample room for properly constructing and inspecting the structures they are to contain, and for such sheeting, timbering, pumping, and drainage as may be required within the limits shown in the Standard Details.

Except where otherwise specified, excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade, or damage to adjacent areas. Intercept and collect surface runoff both at the top and bottom of cut slopes.

All excess excavated material and all excavated material which is unsuitable shall be removed from the site and replaced with suitable material.

Sheeting and Bracing

Place and maintain such sheeting and bracing as may be required to support the sides of the excavation, or to protect pipes and structures from possible damage, to provide safe working conditions and meet all OSHA requirements. OSHA requires banks more than five feet high (or less than five feet high when hazardous ground movement is expected) to be shored, laid back to a stable slope or by other means protected. OSHA requires the sides of trenches in hard or compact soil to be shored or supported when the trench is more than five feet deep and eight feet in length. OSHA requires trenches over four feet deep to have ladders or stairs every 50 feet. The Contractor shall be responsible for the adequacy of all sheeting and bracing used, and for all damage resulting from sheeting and bracing failure or from placing, maintaining, and removing it. All sheeting and bracing shall be removed upon completion of the work. Portable trench boxes or sliding trench shields may be used. The City may permit sheeting to be left in place at the request and expense of others for the purpose of preventing injury to structures or property. Any sheeting or bracing left in-place shall be cut off at least 2-feet below the finished ground surface.

Rock Excavation in Trenches

All rock encountered within the limits of trenches shall be excavated. Rock shall be excavated so that generally there will be a clear space of at least 12-inches from the outside barrel of the pipe to the side of the trench. Isolated points of rock shall not come nearer than 6-inches to the pipe. At the trench bottom, the rock shall not come nearer than 6-inches to the pipe. In addition, sufficient rock shall be removed at joints to facilitate proper installation. Rock shall be fully removed at least 15-feet in advance of the laying of pipe.

Protection of Subgrade for All Excavations

To minimize the disturbance of the bearing materials and provide a firm foundation:

- (1) Should disturbed soil or material with natural low bearing capacity be encountered, excavation shall be carried out below subgrade in limited areas. Stabilization of these areas shall be done with backfill or coarse aggregate as required. Soils disturbed through the operations shall be excavated and replaced with backfill or coarse aggregate, as required.
- (2) Provide positive protection against penetration of frost into materials below the bearing level during work in winter months.

1.04 Backfilling

Backfill shall be placed in layers not to exceed 6-inches loose and compacted with tampers to 95 percent of Standard Proctor AASHTO-T99 density, excepting backfill under structures, which shall be compacted to 98 percent of Standard Proctor Density, and the top 6-inches of trenches which shall be compacted to 100 percent as shown in the Standard Details. Backfill in the roadways shall be tamped to NCDOT requirements.

Pipe trenches shall be backfilled as soon as possible after pipe installations.

Where sheeting is used, use all reasonable measures to prevent the loss of support of the pipe or backfill when the sheeting is removed. If significant volumes of soil cannot be prevented from clinging to the extracted sheets, the voids shall be continuously backfilled as rapidly as possible. Thereafter limit the depth below subgrade that sheeting will be driven in similar soil conditions or employ other appropriate means to prevent a loss of pipe support. Sheeting embedded in granular fill or backfill materials shall be left in place, in accordance with Item 1.03, Part 1 of this section.

1.05 Pipe Laying

General

Pipe laying shall in all instances be accomplished in a workmanlike manner laid true to line and grade with bell ends facing (up-grade) in the direction of laying. The various pipes shall be handled, belled-up and laid in accordance with the manufacturer's requirements and good engineering practices.

Joint deflections shall not exceed 75% of the manufacturer's recommended maximum deflection.

Pipe Bedding

- (a) Type I - Shaped Bottom Bedding: Shall be so the pipe bears uniformly upon undisturbed native earth. Hand excavation is required to shape the trench to conform to the pipe barrel and the pipe bells. The pipe bells are not to support the pipe. Clean backfill shall be placed and carefully and uniformly tamped by hand to a 95% density so as to eliminate the possibility of lateral movement around the pipe (and completely under the pipe haunches) in uniform layers not exceeding six (6)-inches loose to a depth of 1'-0" above the top of pipe.

The remaining backfill shall be placed as described in Item 1.04 of this section.

- (b) Type II - Granular Material Embedment: For Type II bedding, the trench bottom is undercut a minimum of six (6- inches below the pipe barrel grade and filled with an No. 67 stone and backfilled with clean backfill as shown in the standard detail, placed in 6-inch loose layers and compacted to 95%.
- (c) Type III - Granular Material Embedment: For Type III bedding, the trench bottom is undercut a minimum of six (6)-inches below the pipe barrel grade and filled with an No. 67 stone to an elevation such that the pipe will be completely and uniformly bedded, as shown in the standard detail.
- (d) Concrete Encasement and Cradles: Shall be as shown in the standard details, with Class A (3000 psi) concrete a minimum of 6" all around the pipe.

1.06 Installation Limitations

The following are limitations and bedding requirements for supportive strength and shall be adhered to at all times.

- (a) Type I Bedding, or greater, shall be used for all DIP and RCP (RCP allowed for storm water only), unless conditions of poor (saturated) soil or rock are present.
- (b) Type II Bedding, or greater, shall be used for all PVC water pipe, unless conditions of poor (saturated) soil or rock are present.
- (c) Type III Bedding shall be used for all PVC sanitary sewer, gravity and force main pipe, or when conditions of poor (saturated) soil or rock are present when installing lines normally requiring less bedding.
- (d) Ductile Iron Pipe: Installation of Ductile Iron Pipe with more than twenty (20)-feet of cover use Type II - Granular Embedment. More than thirty (30) feet of cover use Type III - Granular Embedment. This is regardless of ground water and/or soil conditions.

For water and sewer lines having 3.00-feet and less or 15.00-feet and more of cover, use Ductile Iron Pipe.

1.07 Final Grading and Landscaping

Fertilizing, seeding, and mulching of any and all areas disturbed during construction will follow within seven (7) working days of the installation of each run of pipe (being from manhole to manhole or 300 feet of water line). Disturbed areas shall be landscaped in a manner that allows the area to be easily mowed and maintained. All plantings shall be maintained by the installer for a period of one (1)-year after the completion of the work. Seeding shall be accomplished in accordance with the requirements of the Sedimentation and Erosion Control Practices of the State.

SECTION III - CONSTRUCTION METHODS

PART 2 - WATER

2.01 Installation

Water lines shall be installed in accordance with Part 1 of this section, and in accordance with the Standard Details and design criteria.

2.02 Fire Hydrant Locations

As a general rule, hydrant spacing shall not exceed 800 feet. In closely built areas, hydrant spacing shall not exceed 500 feet unless otherwise directed by the authorized fire official within the municipal jurisdiction and approved by Utilities Management. Hydrants should be located as close to street intersections as possible with intermediate hydrants along the street length to meet the area's requirements. The final location of all hydrants is subject to approval by the Fire Marshal.

2.03 Taps

1. Individual water service connections to an existing public water main shall be made by the City at the expense of the property owner or developer at whose request the tap was made.
2. Individual water service connections to a newly constructed water main shall be made by an approved licensed, bonded utility contractor or plumber using standards described in this manual and under supervision of the City, at the expense of the property owner or developer that is constructing the new water main.
3. Taps made to an existing public water main in order to extend a new water main shall be made by an approved licensed, bonded utility contractor or plumber using standards described in this manual and under supervision of the City, at the expense of the property owner or developer that is constructing the new water main.
4. All taps to active water mains shall be "live" or "wet" taps unless approved in advance by Utilities Management.

SECTION III - CONSTRUCTION METHODS

PART 3 - SEWER

3.01 Installation

Sewer lines shall be installed in accordance with Part 1 of this section, and in accordance with the Standard Details and design criteria.

3.02 Service Connections to Sewer System

Sewer connections shall be made by the City, at the expense of the property owner or developer, or at the option of the City, by an approved, licensed, bonded utility contractor or plumber, in accordance with the standards of this manual. The City shall inspect all taps.

1. Sewer service connections shall be made on the sewer main. Service connections to manholes must be approved in advance by Utilities Management.
2. Where making a service connection directly to an existing main line, the following shall apply:
 - (a) On VCP, cut hole in pipe using appropriate saw; use glue or 100% silicone adhesive/sealant and clamp wye-service saddle over hole.
 - (b) On PVC, cut hole in pipe using appropriate saw; use glue or 100% silicone adhesive/sealant and clamp wye-service saddle over hole.
3. The lateral shall be installed from the main line to the edge of the right-of-way. Stub-outs shall be provided for every property abutting the line. The location of the end of the lateral shall be formed with a clean-out in accordance with the standard detail.
4. The service connections shall be located by distances from manhole to manhole. The distances shall be recorded on a reproducible medium and submitted to the City for their records.
5. Sewer laterals shall be a minimum of 4" (60' or longer shall be 6") diameter and be PVC (Schedule 40) or Ductile Iron Pipe. No material transitions on laterals between PVC and DIP will be allowed.
6. Stub outs may be required on sanitary sewer outfalls on a case by case basis.
7. Tie-ins to the laterals shall be made at the existing tail piece section at the bottom of the stack. Tie-ins to the stack are not permitted unless approved in advance by a written waiver from Utilities Management.

SECTION III - CONSTRUCTION METHODS

PART 4 - STORM DRAINAGE

4.01 Installation

Storm drainage shall be installed in accordance with Part 1 of this section, and in accordance with the Standard Details and design criteria.

SECTION III - CONSTRUCTION METHODS

PART 5 - ROADS

5.01 General

All work shall be done in a workmanlike manner by contractors experienced in road installation.

Any contractor working in a public street right-of-way shall do so in accordance with the "Manual on Uniform Traffic Control Devices, Part VI".

5.02 Installation of Subgrade

The subgrade shall be stabilized by the addition and mixing of stabilizer aggregate with the top 2-1/2-inch of subgrade in accordance with NCDOT Item 510-4.

Stabilizer aggregate shall conform to NCDOT Item 908-1 and shall be applied at a rate of 250 pounds per square yard of subgrade stabilized. Following application of stabilizer aggregate, the subgrade shall be formed true to crown and grade and shall be compacted with a minimum of four passes of a 15-ton vibratory roller at a moisture content that will result in densities that are at least 95 percent of Standard Proctor Compaction as specified in AASHTO T99 Standard Specifications, except for the top 6-inches which shall be compacted to 100 percent of Standard Proctor.

5.03 Installation of Base Course

Granular base course shall conform to NCDOT Item 910-1. The finished base course of all paving shall be to the thickness shown in the standard details and formed true to crown and grade and shall consist of one layer compacted to 100% of the density obtained by compacting a sample in the laboratory in accordance with AASHTO T180 at optimum moisture content.

If the base course has been opened to traffic of any kind or contaminated by sediment, it shall be cleaned of foreign material and then subsequently regraded, shaped and proof rolled to the true line and grade before application of the next course.

5.04 Installation of Asphalt Concrete Intermediate Course

H-binder course, when required by the standards, shall be placed immediately upon the final preparation of the base course.

The asphalt concrete intermediate course shall be placed to a minimum finished thickness as shown in the standards. This course shall be laid with a self-propelled mechanical spreader appropriate to the job and shall be placed at a temperature between 225 degrees F and 300 degrees F.

After spreading, the mixture shall be allowed to lay for as long a time as is necessary for proper curing, before the compacting operations are begun. Compaction shall be by the use of self-propelled rollers as outlined in NCDOT Specifications, Section 610-11 under "Compaction". During the compaction operation, light grading shall be done as required to maintain the surface true to design cross-section. In confined areas inaccessible to rollers, mechanical rammers shall be used to compact the course. In all cases, the material shall be compacted to 94% laboratory density as determined by the Marshall test method.

Upon the completion of the compaction operation, the surfaces shall remain closed to traffic for a minimum of 12 hours, after which it may be opened to traffic.

At no time shall the mixture be placed on a base course that has become softened by rain, weaves under the equipment, or is otherwise defective for any reason whatsoever.

5.05 Installation of Asphalt Concrete Surface Courses

Prior to placement of the asphalt concrete surface courses, the intermediate course or base course shall be inspected for damage or defects, and same repaired. The surface of the intermediate course or base course shall be thoroughly cleaned and ready for next surface course. The asphalt concrete surface courses shall be applied and compacted in the same manner as the asphalt concrete intermediate course previously described except that the asphalt concrete surface course shall be applied in one 1-1/2-inch or 2-inch layer(s). Compacted density shall be 95% laboratory density as determined by the Marshall method of test. The top surface course shall be neat, uniform and free from evidence of construction traffic.

5.06 Junction With Other Paving

Where new pavement abuts existing pavement, the existing pavement shall be cut back to insure obtaining the specified compaction of the new pavement courses and interlocking adjoining courses. Existing subbase courses shall be cut back from the subgrade level of the new pavement on a one-on-one slope into the existing pavement, and the bituminous courses of the existing pavement shall be removed for an additional 6-inches back from the slope. The edge of the existing bituminous courses shall be saw cut straight and true. The faces between new and existing bituminous courses shall receive an application of tack coat.

5.07 Maintenance and Acceptance

All paved surfaces shall be maintained until the roads have been accepted by the City or State. The paved areas will not be accepted until after completion of all phases of the work, including all necessary transportation, hauling, and severe usage of the paved areas and all administrative requirements have been met.

The City shall require any and all tests it deems necessary to ensure the pavement, curb and gutter, sidewalks and appurtenances have been installed in accordance to the standards and specifications. The owner/developer shall supply all tests at no cost to the City.

5.08 Placement of Concrete

Materials and placement of concrete will be in accordance with the NCDOT specifications, latest revision. Machine placement of curb and gutter is acceptable. Straight forms shall not be used when forming curb and gutter in curves.

No concrete shall be placed until the depth of the excavation and character of the foundation material, the adequacy of the forms and falsework, and the placing of reinforcement and other embedded items have been inspected and determined satisfactory.

Concrete shall be placed in daylight unless an adequate lighting system is provided.

In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of forms. Hardened concrete and foreign matter shall be removed from tools, screens, and conveying equipment.

The temperature of the concrete shall not be greater than 90 degrees F nor less than 50 degrees F at the time of placing.

No concrete shall be used which does not reach its final position in the forms within a 20 minute interval between batches, or 90 minutes from the plant.

Surfaces other than foundations on which concrete is to be placed shall be thoroughly cleaned and wetted immediately before placing concrete in order to facilitate bonding.

Placing of concrete shall be so regulated that the pressures caused by the wet concrete shall not exceed those used in the design of the forms.

The external surface of all concrete shall be thoroughly worked during the placing by means of tools of an approved type. During the placing of concrete, care shall be taken that the methods of compaction used will result in a surface of even texture free from voids, water, or air pockets, and that the coarse aggregate is forced away from the forms in order to leave a mortar surface.

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement.

If additional concrete is to be placed against hardened concrete, care shall be taken to remove all laitance and to roughen the surfaces of the concrete to ensure that fresh concrete is deposited upon sound concrete surfaces.

The operation of depositing and compacting shall be conducted so as to form a compact, dense, impervious, concrete of uniform texture which shall show smooth faces on exposed surfaces. If any section of concrete is found porous, has been plastered, or is otherwise defective, it shall be repaired or removed and replaced in whole or in part as directed by the City.