



Standard Specifications

Public Services Department

July 2022

Table of Contents

1 Section 1 - General..... 5

1.1 Permits 5

1.1.1 Town of Leland Permits 5

1.1.2 State and Federal Permits..... 5

1.2 Maintenance of Traffic..... 6

1.3 North Carolina Department of Transportation Standard Specifications for Roads and Structures, Latest Edition..... 6

2 Definitions and Abbreviations..... 7

2.1 Definitions..... 7

2.2 Abbreviations 7

3 Materials 9

3.1 Precast Concrete Manholes and Storm Drainage Boxes 9

3.2 Cement Bricks 9

3.3 Cement..... 9

3.4 Mortar 9

3.5 Gray Iron Castings Including Manhole Frames and Covers, Drop Inlet Frames and Grates, and Catch Basin Frames and Grates 10

3.6 Reinforced Concrete Pipe 10

3.7 Polypropylene Pipe (PP)..... 10

3.8 High Density Polyethylene Pipe (HDPE)..... 10

3.9 Reinforced Concrete Flared End Section 10

3.10 Concrete Membrane Curing Compound..... 10

3.11 Expansion Joint Filler for Concrete Construction..... 11

3.12 Aggregate Base Course 11

3.13 Asphaltic Concrete Base Course 11

3.14 Asphaltic Concrete Surface Course 11

3.15 Geo-Textile Fabric 11

3.16 Brick Pavers and Aggregate Concrete..... 11

4 Section 4 – Excavation, Grading, and Backfill 12

4.1 Excavation Requirements 12

4.2 Delivery, Storage, and Handling..... 12

4.3 Dewatering..... 13

4.4 Grading and Sloping Banks..... 13

4.5	Tree Removal	13
4.6	Safety Regulations.....	14
4.7	Quality Control.....	14
4.8	Proof Rolling.....	15
4.9	Fill Material	16
4.10	Unclassified Excavation.....	16
4.11	Undercut Excavation.....	16
4.12	Testing and Approval of Subgrade.....	17
4.13	Compaction Density.....	17
4.14	Protection of Trees.....	18
4.15	Seeding and Restoration.....	18
5	Section 5 – Asphalt Paving and Roadway Bases	22
5.1	General.....	22
5.2	Transportation of Asphalt.....	22
5.3	Placing of Asphalt Surface Course.....	22
5.4	Compaction of Asphalt Riding Surface Course	23
5.5	Joints Between Hot Asphalt and Cold Asphalt.....	23
5.6	Protection and Testing of Newly Laid Asphalt Riding Surface	23
5.7	Tack Coat.....	23
5.8	Base Course Materials	24
5.9	Asphalt Pavement Milling.....	25
5.10	Bridges	26
6	Section 6 – Concrete Curb and Gutter, Sidewalks, Driveways, and Curb Ramps	27
6.1	General.....	27
6.2	Subgrade for Sidewalks and Curbs.....	27
6.3	Finishing and Curing of Concrete	27
6.4	Sampling and Testing.....	28
6.5	Curb and Gutter	28
6.6	Concrete Sidewalks and Driveways	29
6.7	Concrete Curb Ramps	30
6.8	Contraction Joints	30
6.9	Temperature Limitations on Concrete Placement.....	31
7	Section 7 – Storm Drainage Systems	32

7.1	General.....	32
7.2	Preconstruction Activities	32
7.3	Storm Drainage Pipe Installation	33
7.4	Catch Basins, Storm Drainage Manholes, Drop Inlets, and Interference Manholes Installation.....	34
7.5	Pipe Removal or Abandoning Pipe by Filling with Flowable Fill	35
8	Section 8 – Pavement Markings, Street Name Signs, and Traffic Control Signs.....	36
8.1	Paving Marking Plan.....	36
8.2	General for All Types of Pavement Markings	36
8.3	Premarking or Temporary Pavement Markings.....	36
8.4	Thermoplastic (Alkyd/Maleic) Pavement Markings.....	37
8.5	Heated-In-Place Thermoplastic.....	37
8.6	Painted Pavement Markings for Parking Lots and Private Streets	37
8.7	Street Name Signs	38
8.8	Traffic Control Signs	38
8.9	Mailbox Kiosks	38

1 Section 1 - General

1.1 Permits

It is the responsibility of the Owner to ensure that any applicable permits from the Town, State, and Federal Governments are obtained prior to construction of any project. Below is a list of permits generally required but may not include all permits or approvals required.

1.1.1 Town of Leland Permits

A. Construction Plan Approval

Details, plans, and specifications must be submitted to the Town for review and approval prior to construction as required by the Town of Leland Code of Ordinances.

B. Town Encroachment Permit

For any construction activity within Town right-of-way including roadway construction, utility installation, and storm drainage improvements, requires a Town of Leland Encroachment Permit. The Owner or Owner's representative responsible for the construction activity must submit a completed application and receive approval prior to construction.

C. Town Driveway Permit

A Town of Leland Driveway Permit is required for any connection to Town-owned roads or right of way. The Owner or Owner's representative responsible for the construction activity must submit a completed application and receive approval prior to construction.

D. Town Stormwater Permit

The owner is responsible for submitting a completed stormwater permit application along with all the require supporting documentation to the Town for review and approval in accordance with the Town's Stormwater Ordinance.

1.1.2 State and Federal Permits

To avoid unnecessary delays, all applications for state or federal permits shall be based upon plans and specifications prepared by a North Carolina licensed Professional Engineer for the proposed project approved by the Town. If changes to the plans and specifications are required by the permitting agencies, the revised plans and specifications must be submitted to the Town for review and approval.

A. NCDEQ Erosion and Sediment Control Permit

The Owner is required to obtain an Erosion and Sediment Control Permit in accordance with NCDEQ requirements. A copy of the permit must be provided to the Town prior to construction.

B. U.S. Army Corps of Engineers and NCDEQ Wetland and Stream Permits

Appropriate permits for impacts to jurisdictional streams, wetlands and riparian buffers is required for all projects. Permits shall be for all impacts associated with the entire project. A copy of the permit must be provided to the Town prior to construction.

C. NCDOT Encroachment and Driveway Permits

- i. When any part of the project will encroach on NCDOT right of way, an encroachment form must be submitted and approved by NCDOT prior to construction. A copy of the approved NCDOT Encroachment must be provided to the Town prior to construction. The Owner is responsible for any permitting fees charged by NCDOT.
- ii. Driveway Permits must be obtained prior to the installation of any driveway cuts to be made on a State maintained road.

1.2 Maintenance of Traffic

When construction occurs in a vehicular traffic zone or in an area where pedestrian traffic may occur, traffic control devices must be erected, maintained, relocated, and removed in accordance with the plans, specifications, NCDOT Supplement to the MUTCD, and the MUTCD. This requirement shall apply for all construction occurring on public streets, including construction or repairs by utility companies.

Any traffic control requirements within Town of Leland right-of-way must be reviewed and approved by the Town prior to construction or any lane closure.

Once construction is completed and the area is safe for vehicular or pedestrian traffic, all temporary traffic control measures shall be removed.

1.3 North Carolina Department of Transportation Standard Specifications for Roads and Structures, Latest Edition

The latest revision of the Standard Specifications for Roads and Structures of the North Carolina Department of Transportation shall apply unless otherwise specified herein.

2 Definitions and Abbreviations

2.1 Definitions

CLEARING AND GRUBBING - Clearing and grubbing shall mean the cutting, removal, and satisfactory disposal of all vegetation and surface debris in the project area shown to be removed on the approved plans.

CODE OF ORDINANCES – Town of Leland Code of Ordinances.

DETAILS – Town of Leland Standard Details.

EASEMENT – An interest in land granted to the Town by the property owner.

ENGINEER – A person employed by the Town, or a firm hired by the Town, to perform Engineering on a project and authorized to act on behalf of the Town.

INSPECTOR – A person employed by the Town, or a firm hired by the Town, to perform inspection on a project and authorized to act on behalf of the Town.

NCDOT STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES – The latest edition of the NCDOT Standard Specifications for Roads and Structures

PROJECT ENGINEER – The licensed designer of record for a specific set of plans or project.

RIGHT OF WAY – The area which has been deeded or will be dedicated to the Town by a property owner for the public use.

SELECT FILL - Select fill shall mean an approved borrow material transported to the site, placed on the approved base in appropriate lifts (no greater than 10”), graded, and compacted in accordance with Section 4.

TOWN - Town of Leland

UTILITY SYSTEM OWNER – The owner and/or entity responsible for operation and maintenance of any utility located within the right of way or easement.

UNCLASSIFIED EXCAVATION - Unclassified excavation shall refer to the removal of all materials regardless of nature or composition between the existing earth surface and the proposed subgrade elevations for the proposed work.

UNDERCUT EXCAVATION - Undercut excavation shall refer to the removal of undesirable material and replacement with suitable native borrow or select backfill material below finished subgrade or below existing grade in areas where embankment is proposed. The need for and extent of undercut excavation shall be as determined by the Engineer or their designee in conformance with Section 225-4 of the NCDOT Standard Specifications.

2.2 Abbreviations

AASHTO American Association of State Highway and Transportation Officials

ASTM American Society for Testing and Materials

ETJ Town Extra Territorial Jurisdiction
MUTCD Manual on Uniform Traffic Control Devices
NCDEQ North Carolina Department of Environmental Quality
NCDOL North Carolina Department of Labor
NCDOT North Carolina Department of Transportation
NC PE North Carolina Registered Professional Engineer
NC PLS North Carolina Professional Land Surveyor
OSHA United States Occupational Health and Safety Administration

3 Materials

3.1 Precast Concrete Manholes and Storm Drainage Boxes

Precast concrete manholes and storm drainage boxes shall be constructed with 4,000 psi concrete, a minimum of 6" thick walls, and a 6" extended monolithic base meeting ASTM Standard Specification C-478. Precast concrete manholes and boxes shall be placed on a minimum of 6" #57 stone. All castings including manhole frames and covers, drop inlet frames and grates, and catch basins frames and grates shall conform to Town standard details. The precast manholes and boxes shall meet the standards for an HS-20 loading. The reinforcing steel shall conform to ASTM A-185 Steps if required shall be Copolymer Polypropylene Plastic steps as manufactured by one of the following or approved equal.

American Step Company SPI 10 NCR
Neenah Foundry Co. No. R-1980-I
MA Industries PS-1 DIS

A pipe connection to the manhole or storm drainage box shall consist of an approved continuous boot of 3/8 inch minimum thickness neoprene conforming to ASTM C-923. Boots shall be either cast into the manhole wall or storm drainage box or installed into a cored opening using internal compression rings. The installed boot shall result in a water-tight connection meeting the performance requirements of ASTM C-443. Boot shall be as manufactured by one of the following or approved equal:

Quik LOK
Kor N Seal
Press Seal

The non-extruding joint sealant used between the precast concrete sections shall conform to ASTM C-990.

3.2 Cement Bricks

Whole cement bricks shall be allowed for interference manholes provided the bricks are uniform in structure with true and even faces. Any cement brick with a defect may not be used in any fashion.

3.3 Cement

Portland Cement shall meet the requirements of ASTM C-150 Type I or III latest revisions.

3.4 Mortar

Mortar shall be prepared from cement, sand, and water from a source approved by the Engineer. The mortar shall be in conformance with Section 1040-9 of the NCDOT Standard Specifications for Roads and Structures. The mortar shall be mixed thoroughly, and water added as needed to meet the consistency required.

3.5 Gray Iron Castings Including Manhole Frames and Covers, Drop Inlet Frames and Grates, and Catch Basin Frames and Grates

All gray iron castings for manholes, drop inlets, catch basins, and associated appurtenances shall conform to the ASTM requirements for gray iron castings. The dimensions of the gray iron castings shall be as shown on the plans or as shown on the Town Standard Details.

All catch basin castings and drop inlet castings shall be stamped with “Drains to Waterway Do Not Dump”. All storm drainage manhole castings shall be stamped with “Storm Sewer”.

3.6 Reinforced Concrete Pipe

Reinforced concrete pipe used for storm drainage shall be NCDOT Class III and conform to the latest revision of ASTM C-76. Where the pipe cover is approved by the Engineer to be less than 2 feet, NCDOT Class IV reinforced concrete pipe shall be used. Precast concrete pipe joint sealant shall meet AASHTO M-198 standards.

3.7 Polypropylene Pipe (PP)

Polypropylene pipe shall be corrugated pipe and conform to the latest version of AASHTO M 330 and the latest version of the NCDOT Road and Structures Standard Specification Section 1032-9. The pipe shall be smooth walled on the inside of the pipe. Pipe shall be installed in accordance with manufacturer's requirements and recommendations.

3.8 High Density Polyethylene Pipe (HDPE)

High density polyethylene pipe shall be double walled corrugated pipe and conform to the AASHTO Standard M294 latest revision and the NCDOT Road and Structures Standard Specification Section 1032-7. The pipe shall be smooth walled on the inside of the pipe. Pipe joints shall be in accordance with the manufacturer's recommendations. Approved manufacturers of HDPE pipe include one of the following or approved equal:

Advanced Drainage Systems
Lane
Pacific Corrugated Pipe

3.9 Reinforced Concrete Flared End Section

Reinforced concrete flared end sections shall be manufactured in accordance with Section 1032-6 of the NCDOT Standard Specifications for Roads and Structures, latest revision.

Reinforced concrete flared end sections shall meet AASHTO M 170 and Section 1077 of the NCDOT Standard Specifications for Roads and Structures, latest revision. Reinforce all concrete flared end sections and use air entrained concrete in pipe flared end sections with a strength of 3,500 psi when tested in accordance with AASHTO T 22.

3.10 Concrete Membrane Curing Compound

The membrane curing compound used in concrete curing shall be white and as specified in AASHTO Specification M-148-49.

3.11 Expansion Joint Filler for Concrete Construction

Expansion joint filler for concrete construction shall be bituminous, preformed, non-extruding joint filler, as specified in Section 3 A of these Technical Specifications.

3.12 Aggregate Base Course

The aggregate base course (ABC Stone) shall consist of an approved aggregate produced in accordance with the requirements contained in Sections 520, 1006, and 1010 of the NCDOT Standard Specifications for Roads and Structures for aggregate base courses.

3.13 Asphaltic Concrete Base Course

The asphaltic concrete base course shall be NCDOT Asphalt Mix B25.0C unless otherwise approved by the Engineer. Type B25.0C shall conform to the general, material, and construction specification contained in Section 610 of the NCDOT Standard Specifications for Roads and Structures.

3.14 Asphaltic Concrete Surface Course

The asphaltic concrete surface course shall be NCDOT Asphalt Mix S9.5B unless otherwise approved by the Engineer. Type S9.5B shall conform to the general, material, and construction specification contained in Section 610 of the NCDOT Standard Specifications for Roads and Structures.

3.15 Geo-Textile Fabric

All geo-textile fabrics shall be on the NCDOT Approved Products List and conform to Section 1056 of the NCDOT Standard Specifications for Roads and Structures.

3.16 Brick Pavers and Aggregate Concrete

The Town does not accept concrete pavers, aggregate concrete, or similar type materials in Town owned streets or sidewalks.

4 Section 4 – Excavation, Grading, and Backfill

4.1 Excavation Requirements

- A. Excavation, either undercut or unclassified, shall include the removal of soil, and gravel, brick, block, stumps, root mat, broken concrete curb or pavement, foundations, rubbish, or other debris objectionable to the Engineer or their designee for sub-base of pavements, structures, embankments, or other facilities. All excavation shall be in conformance with Section 225 of the NCDOT Standard Specifications for Roads and Structures.
- B. Excavation shall also include stockpiling of materials, which in the opinion of the Engineer are suitable for backfill and embankment material. Also included in the excavation shall be removal, transportation, and disposal of spoil material.
- C. All unclassified excavation material suitable for reuse in roadway fill, embankments, trenches, etc. shall be used prior to use of select fill material.
- D. Select fill shall include suitable material, transportation to site, placement in proper lifts, and compaction to densities specified in this Section.
- E. The Contractor shall immediately notify the Engineer and cease related excavation activities upon the discovery of graves, wells, fuel tanks, and hazardous or non-hazardous waste disposal sites.
- F. Excavation, backfill, and compaction for roadways, walkways, driveways, structures, recreational facilities, landscaping, etc. shall be constructed to the horizontal alignment and elevations as shown on the plans, as detailed in these specifications, and as needed to meet the requirements of the work.
- G. The Contractor shall provide all materials, labor equipment, tools, etc., and perform all required work and services necessary for and incidental to providing excavation, backfill, and compaction.
- H. Care shall be exercised by the contractor to prevent excessive excavation or undercutting not directed by the Engineer. In the event such undercutting takes place, the areas will be backfilled and compacted with material to the compaction densities specified in this Section by the contractor at no additional cost to the Town.
- I. Clearing and grubbing shall be conducted in a manner to prevent damage to vegetation that is shown on the approved plans to remain. A NCDEQ Erosion and Sediment Control Permit is required for all projects that disturb one acre or more.

4.2 Delivery, Storage, and Handling

- A. Contractor shall only use approved truck routes for hauling of equipment, select material for bedding or backfill, excess or spoil dirt for disposal, etc. Approval for hauling shall be obtained

from appropriate governing agency (NCDOT, Town of Leland Public Services Department, private property owner, etc.) prior to start of work.

- B. Where necessary for the Contractor to remove and/or purchase select fill material from a borrow site, said site shall comply with requirements for a permitted quarry operation as set by the Land Resources Division of the NCDEQ.
- C. Soil stockpiles shall be protected to prevent erosion in accordance with the NCDEQ Erosion and Sediment Control Permit.
- D. No stockpiling of backfill, spoil, aggregate, or other construction material or debris shall be permitted on a Town-maintained Street open to vehicular traffic without an approved plan for signing, barricading, and detouring as necessary.

4.3 Dewatering

- A. Where conditions are such that running or standing water occurs in the bottom of the excavation or the soil displays a "quick" tendency, the water shall be removed by pumps, temporary ditches, well points, or pervious underdrain bedding as necessary.
- B. The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of any and all water entering the excavation.
- C. Where, in the opinion of the Engineer or their designee, the occurrence of running or standing water or wetness in the excavation or subgrade is due to a permanent condition such as a spring, perched water table, subsurface drainage, or proximity to a natural watercourse, the Engineer may require the installation of subsurface drainage. Subsurface drainage shall be installed in accordance with the latest edition NCDOT Standard Specifications for Roads and Structures, the latest edition Town of Leland Stormwater Design Manual, and as directed by the Engineer.

4.4 Grading and Sloping Banks

Where it is necessary to slope banks, all sloping shall be done within the right of way or easement. In grading these banks, a maximum slope of three (3) to one (1) will be held. In the event that fill is required at the property line, this fill will be extended level with the top of the sidewalks (or level with the final grade at the property line where sidewalk is not installed) at least one (1) foot behind the property line and then carried on a maximum of three (3) to one (1) slope back on the property until it intersects the property grade. Sloping in either cut or fill sections shall be accomplished on straight grades as near as possible and fine grading and cleaning shall be done with a hand rake. This surface shall be prepared in such a manner that it is ready for fertilizing and seeding when completed.

4.5 Tree Removal

Trees within the project area that conflict with the required improvements including trees with roots systems damaged to the extent that the tree will not survive shall be removed. Trees shown to be retained shall be protected accordingly.

4.6 Safety Regulations

The Contractor shall require all construction to adhere to the rules, regulations, and interpretations of the NCDOL and OSHA relating to occupational safety and health standards for the construction industry including, but not specifically limited to Title 29, Code of Federal Regulations, Section 1926, Subpart P regarding "Excavations, Trenching, and Shoring" as recorded in the Federal Registry.

4.7 Quality Control

A. Weather and Temperature Limitations

- i. Excavation, backfill, and compaction for establishment of subgrade elevation shall not be performed during rainy weather or use wet or frozen material.
- ii. Any areas of completed subgrade that are damaged by elements such as rain, sleet, snow, hail, or freeze/thaw conditions shall be reconditioned, reshaped, and compacted in accordance with the approved Plans and Specifications.

B. Alignment and Smoothness Test

- i. Locations for alignment and smoothness testing shall be at random locations specified by the Engineer or their designee. The contractor shall be responsible for supplying two competent workers to assist the Engineer or their designee in testing.
- ii. The top surface of the in place and compacted subgrade shall not show any deviations in excess of one tenth (0.10") inch when checked for departure from cross-sections as shown on the plans when checked with either a stringline and ruler or grade rod and level.
- iii. Any deviation in excess of the above amount shall be corrected by the Contractor by loosening, adding, or removing material, reshaping, and compacting as directed by the Engineer at no additional cost to the Town.

C. Compaction Densities

- i. Backfill shall be placed in lifts no greater than ten (10) inches in depth and compacted at plus or minus two (2%) percent of optimum moisture content and shall yield the following minimum compaction densities, when tested in accordance with AASHTO T99-90, or latest edition:
 1. Areas within five (5) feet of roadways, other pavements, and structures shall be compacted to a depth of 8 inches below the finished surface of the subgrade with a minimum soil density equal to at least one hundred (100%) percent from the initial subgrade or undercut excavation in conformance with Section 500 – 2-c of the NCDOT Standard

Specifications for Roads and Structures. Any fill or excavated areas greater than a depth of 8-inches shall be backfilled and compacted to a minimum soil density of ninety-five (95%) in accordance with Section 235 – 3-c of the NCDOT Standard Specifications for Roads and Structures.

2. All other areas shall have a minimum soil density of ninety (90%) percent from initial subgrade or undercut excavation.
 - ii. Compaction test shall be taken at random locations set by the Engineer to check for compliance with the above required densities. Optimum moisture and density tests shall be performed by the AASHTO T99 method using a 5.5-pound rammer and 12” drop. In situ moisture content and density compaction tests shall be by the sand-cone in accordance with AASHTO T 191 or shall be conducted by nuclear methods in accordance with AASHTO T 238 and T 239 for density and moisture content, respectively.
 - iii. A minimum of two sample sites shall be performed per job site. For roadways, at least two sample sites shall be tested for each block of proposed street or two samples per 1,000 feet, whichever is greater. Additional test sites may be required for larger structures or for changing soil conditions in the project area. The Contractor shall provide smooth, level surfaces at locations and depths as designated by the Engineer or their designee for testing.
 - iv. Tests shall be performed by a licensed Geotechnical Testing Firm approved by the Engineer.

4.8 Proof Rolling

- A. All roadway subgrades shall be tested for bearing capacity by proof rolling with a fully loaded dual or triple rear axle dump truck. Truck shall be sufficiently loaded with ballast to provide a minimum gross weight of thirty (30) tons and a maximum gross weight of fifty (50) tons.
- B. Subgrade shall be tested for conformance with alignment and grade in accordance with Subsection 3.B above prior to proof rolling.
- C. Truck shall make sufficient passes over roadway subgrade to test entire surface of subgrade. Truck shall be operated at a speed between two hundred and twenty-five (225) and three hundred (300) feet per minute.
- D. Engineer or their designee must be present to document and approve all proof rolling.
- E. Proof rolling must be performed within ten (10) days of placement of stone or pavement. If precipitation occurs after proof rolling but prior to placement of stone or asphalt, then the surface will need to be proof rolled again.

4.9 Fill Material

- A. All backfill materials shall be approved prior to use by the Engineer or their designee. All backfill materials shall be consistent with typical cross-sections as shown on plans. The use of select fill material shall be authorized by the Engineer only after depletion of suitable on-site borrow material.
- B. Acceptable select native (on-site) and/or borrow material shall be provided free of the following: organic matter, construction material, lumps, or rocks larger than six (6") inches in their greatest diameter with no more than 15% of the lumps or rocks greater than two (2") inches in their greatest diameter, frozen or excessively wet material, debris, or other objectionable materials which would hinder placement, compaction, and consolidation of the backfill material.
- C. Select fill material shall meet the following soil and gravel classifications as covered in ASTM D2321 and restated below:
 - i. Class I - Angular, one quarter to one- and one-half inch (1/4" to 1 1/2") graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells. Examples: #57 and #67 crushed, washed stone in accordance with NCDOT SSRS Table 1005-1.
 - ii. Class II - Coarse sands and gravels with maximum particle size of one and one half (1 1/2") inch, including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP (Unified Soil Classification System) are included in this class.
 - iii. Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC (Unified Soil Classification System) are included in this class.

4.10 Unclassified Excavation

- A. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the plans or directed by the Engineer.
- B. The Engineer or their designee will designate materials that are unsuitable. The contractor shall furnish disposal areas for the unsuitable and/or excess material except where the Engineer permits the use of such material in the widening or flattening of fill slopes.

4.11 Undercut Excavation

- A. When the Engineer determines that the native soil materials in areas where fills are to be placed are undesirable in their location or condition, the Engineer may require the contractor to remove the undesirable material and backfill with approved material properly compacted.

- B. When the Engineer determines that the finished graded cross-section contains materials which are undesirable in their location or condition, the Engineer may require the contractor to remove the undesirable material and backfill with approved material properly compacted to the finished graded section.
- C. The contractor shall conduct undercut operations such that excavation and hauling operations cause the least disturbance and destruction to the unstable and surrounding subgrade materials.
- D. In some instances, the Engineer may require excavation and hauling of waste material to proceed in one direction and back-dumping, spreading, and compacting of replacement material to be performed in the opposite direction.

4.12 Testing and Approval of Subgrade

- A. After all excavation, undercutting, and backfilling have been completed, the subgrade shall be properly shaped and compacted to conform with the lines and grades as shown on the approved plans or as directed by the Engineer. All areas not conforming to the cross section shown on the plans shall be brought to a firm, unyielding condition before any base course, surface course, or pavement is placed thereon.
- B. Compact all material to a depth of 8 inches below the finished surface of the subgrade to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T 99. Compact the subgrade at a moisture content which is approximately that required to produce the maximum density indicated by the above test method. Dry or add moisture to the subgrade when required to provide a uniformly compacted and acceptable subgrade.
- C. A tolerance of $\pm 1/2$ inch from the established grade will be permitted after the subgrade has been graded to a uniform surface. Subgrade tolerance of $\pm 1/4$ inch from the established grade is required for subgrade under concrete pavement mainline lanes. Perform the grading operation such that the maximum difference between the established grade and the graded subgrade within any 100-foot section is $1/2$ inch for normal subgrade and $1/4$ inch for subgrade for concrete pavement.
- D. Provide and maintain ditches and drains to drain the subgrade satisfactorily. Where previously approved subgrade is damaged by natural causes, hauling equipment or other traffic, restore the subgrade to the required lines, grades, typical sections, and density.

4.13 Compaction Density

All soft and yielding material, boulders, loose stones, or any other unsuitable materials in the subgrade which will not readily compact shall be removed and replaced with suitable material which shall then be thoroughly compacted. All roots, stumps, and other perishable matter encountered in the preparation of the subgrade shall be removed to a depth of not less than two feet below the surface of the

pavement, unless otherwise directed by the Engineer or their designee. Any portion of the subgrade inaccessible to the roller or rolling equipment shall be thoroughly compacted with hand or mechanical tampers.

4.14 Protection of Trees

Only where it is found to be absolutely necessary shall trees be removed. Those trees to be removed shall be designated by the Engineer. The Contractor shall take all possible precautions to ensure that all other trees are not damaged. Trees that are skinned shall be trimmed and bare spots coated with asphaltum based tree paint as directed by the Engineer.

4.15 Seeding and Restoration

A. NCDEQ Erosion and Sediment Control Permit

For projects with a disturbed area of one acre or more, the Owner is required to obtain an Erosion and Sediment Control Permit in accordance with NCDEQ requirements. The project shall be seeded and restored in compliance with the approved Erosion and Sediment Control Permit.

Projects that disturb less than one acres are still required to meet all NCDEQ erosion control requirements.

B. Seeding and Restoration

i. General

All areas that have been disturbed shall have the soil prepared to receive seed including, but not specifically limited to the following: fine grading, liming, and fertilizing as shown on the approved plans.

ii. Materials

a. Lime

Lime shall be dolomitic agricultural grade ground limestone containing not less than ten (10%) percent magnesium oxide.

b. Fertilizer

For grasses, the fertilizer shall be the standard commercial product with a ratio of nitrogen to phosphorous to potassium of 1:1:1 such as 10-10-10. For mixtures of grasses and legumes, the ratio shall be ½:1:1 such as 5-10-10.

c. Seeds

Seed shall be certified seed or equivalent based on North Carolina Board of Agriculture and Consumer Services. All seed shall be furnished in sealed standard containers and meet the requirements of Section 1060-4 of the NCDOT Standard Specifications for Roads and Structures. All seed mixture shall be appropriate for the growing season in which the seed will be planted. The proposed seed mixture must be submitted to the Town for approval before planting any seed.

d. Mulch

Mulch shall be dried grain straw supplied in bound bales or similar material designed to hold the seed in place and provide moisture so the seed will germinate.

e. Rolled Erosion Control Products (Matting)

1. In lieu of straw and tack, matting for erosion control meeting the requirements of Section 1060-8 of the NCDOT Standard Specifications for Roads and Structures should be used. The matting should be installed per Section 1631 of the NCDOT Standard Specifications for Roads and Structures.
2. The matting should be placed immediately following seeding and provide a smooth soil surface free from stones, clods, or debris that will prevent the contact of the matting with the soil. The required line, grade, and cross section of the area covered must be maintained.
3. Unroll matting in the direction of the flow of water and apply without stretching so that it will lie smoothly but loosely on the soil surface. Bury the up-channel or top of slope end of each piece of matting in a narrow trench at least 6" deep and tamp firmly. Where one roll of matting ends and a second roll begins, overlap the end of the upper roll over the buried end of the second roll so there is a 4" overlap. Metal staples shall be used in sufficient quantity to hold the matting in place and prevent movement. When excelsior or straw matting is used, install product with netting on the top side.

iii. Fine Grading and Seed Bed Preparation

- a. The ground surface shall be cleared of stumps, stones, roots, cables, wire, grade stakes, and other materials that might hinder proper grading, tillage, seeding, or subsequent maintenance operations.

- b. The area should be graded to eliminate rough spots and low areas where ponding may occur. Maintain smooth uniform grade. The finish ground level should be firm and sufficient to prevent sink holes and pockets when irrigation is applied.
 - c. Grades on the area to be seeded shall be maintained to a true and even condition. Maintenance shall include any necessary repairs to previously graded areas.
 - d. All graded areas shall be thoroughly tilled to a depth of at least four (4) inches by plowing, disking, harrowing, or other approved methods until the condition of the soil is acceptable. On sites where soil conditions are such that high clay content and excessive compaction cause difficulty in effectively pulverizing lumps and clods, the Contractor shall use the rotary tillage machinery, until the mixing of the soil is acceptable and no clods or clumps remain larger than one-half ($\frac{1}{2}$) inch in diameter. After being graded, the seedbed shall be lightly compacted with a land roller, such as a cultipacker, before and after seeding.
- iv. Fertilizing and Seeding
- a. Lime shall be uniformly applied at a rate of four thousand (4000) pounds per acre prior to beginning of tillage operation.
 - b. Fertilizer shall be incorporated into the upper three to four (3-4) inches of prepared seedbed just prior to the last tillage operation, but in no case shall be applied more than three (3) days prior to seeding. Fertilizer shall be applied at a rate of one thousand (1000) pounds per acre. If a hydraulic seeder is used, seed shall not be mixed with fertilizer more than thirty (30) minutes before application.
 - c. The seed mixture should be applied at the rate specified in the approved shop drawing. The seed mixture should be raked in lightly.
 - d. Roll seeded area with roller not exceeding one hundred and twelve (112) pounds and apply water with fine spray immediately after seeding.
 - e. Seeded areas shall be mulched with four thousand (4000) pounds of mulching material per acre or approximately ninety (90) pounds per thousand (1000) square feet.
 - f. If a mechanical type seeding equipment is used, the process shall obtain a uniform distribution of seed and mulch that meet the requirements outlined above.

- v. Mulching material shall be either tacked with asphalt emulsion or crimped into the soil with a disc harrow.
- vi. Emulsified asphalt shall be applied at a rate of two hundred (200) gallons per ton of straw or approximately nine (9) gallons per 1000 square feet.
- vii. The Contractor shall maintain surfaces and supply additional topsoil, lime, fertilizer, seed, mulch, tack, weed killer, etc. as necessary, including areas affected by erosion.
- viii. The Contractor replant damaged grass areas showing root growth failure, deterioration, bare or thin spots, and eroded areas, which occur during the one (1) year Warranty period. Seeded areas shall be accepted when vegetation has been properly established.

C. Sodding

- i. The installation of all sod at the locations shown on the plan or as directed by the Engineer shall be in conformance with Section 1664 of the NCDOT Standard Specifications for Roads and Structures.
- ii. The type of sod used shall match the surrounding grassed areas or as shown on the plans.
- iii. Bring the area to be sodded to a firm uniform surface at such elevation that the surface of the complete sodding conforms to the finished grade and cross section as shown on the plans.
- iv. Place sod firmly and carefully by hand within 24 hours after soil preparation is completed and accepted by the Engineer. Pack each piece of sod tightly against the edge of adjacent pieces so that the fewest possible gaps will be left between the pieces. Close unavoidable gaps with small pieces of sod. Stake sod in place by driving stakes flush with the sod. Tamp or roll carefully and firmly by acceptable means. If rolled, roller shall weigh 150 lbs. per foot of roller width and take extreme care to prevent the installed sod from being torn or displaced.
- v. Water carefully and thoroughly after sod has been placed and tamped. Contractor shall perform watering as directed until final acceptance. Application of water may be made by the use of hydraulic seeding equipment, farm type irrigation equipment, or by other acceptable means.

5 Section 5 – Asphalt Paving and Roadway Bases

5.1 General

- A. The asphalt paving course shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphaltic concrete in an approved plant and placed and compacted on a prepared asphaltic concrete base or stone base course to the depth shown on the approved plans.
- B. An asphalt design mix prepared in accordance with the NCDOT Standard Specifications for Roads and Structures, latest edition must be submitted to the Engineer for approval prior to the placement of any asphalt paving. Unless otherwise shown on the plans or approved by the Engineer, the surface course shall be NCDOT S9.5B.
- C. The contractor is required to have a certified Roadway Technician with each paving operation at all times. This person is responsible for monitoring all roadway paving operations and directly supervising all quality control processes and activities. Provide a certified nuclear gauge operator when nuclear density control is being used.

5.2 Transportation of Asphalt

Transportation of the asphalt from the asphalt plant to the site shall be in trucks having tight clean beds and beds coated with a liquid to facilitate the discharge of the asphalt from the truck. Each load shall be covered in accordance with NCDOT regulations. The asphalt shall be delivered to the job site in a manner to prevent the temperature of the asphalt at the time the asphalt is dumped into the spreader from being between 260- and 310-degrees Fahrenheit based upon the NCDOT Asphalt QMS Manual. Any load with a temperature less than 260 degrees Fahrenheit will be rejected and must be removed from the job site. A delivery ticket with the empty weight of the truck, weight of the truck loaded, date and time the truck was loaded, and the asphalt plant location must be provided to the Town Inspector on the project.

5.3 Placing of Asphalt Surface Course

- A. No asphalt surface course shall be laid unless the air temperature is a minimum of forty (40) degrees Fahrenheit and rising. Prior to delivery of surface course materials, the base course shall be completed and approved by the Engineer for placement of the surface course. The base course shall be cleaned of all extraneous material and kept free of traffic except for essential vehicles.
- B. Immediately prior to placement of the riding surface course, contact surfaces of curbs and gutters, manholes, and water valve boxes shall be painted with a thin uniform coating of tack. The riding surface course shall be laid by an approved type of paving machine and finished to the grade shown on the approved plans. The riding surface course shall be placed in manner to provide positive drainage from the asphalt to the curb and gutter or roadway shoulder.

5.4 Compaction of Asphalt Riding Surface Course

The compression and compaction of the riding surface course shall be accomplished by the use of ten (10) ton tandem rollers and the rollers shall be kept in continuous operation during the placement of the asphalt riding surface course until the asphalt has cooled. The rolling shall start longitudinally at the side and proceed to the center with overlapping trips. The rolling shall be performed in a manner to eliminate any roller marks and properly seal the asphalt riding surface course.

Surface Smoothness:

1. Base Course – 1/4” in 10 feet.
2. Surface Course – 1/8” between any two contact points, 10-foot straight edge.

5.5 Joints Between Hot Asphalt and Cold Asphalt

Joints between old and new pavements and between successive days’ work shall be carefully made in such a manner as to ensure a continuous bond between the new and old section of asphalt. All contact surfaces of previously constructed pavements shall be coated with a thin uniform tack coat just before the new asphalt is placed.

5.6 Protection and Testing of Newly Laid Asphalt Riding Surface

Sections of newly placed asphalt riding surfaces shall be barricaded to prevent vehicular traffic until the asphalt has sufficiently cooled to allow vehicular traffic without damage to the pavement. Any damage caused by allowing vehicular traffic on newly paved streets prior to the pavement being sufficiently cooled will be responsibility of the Contractor to repair.

Core samples of the newly installed asphalt riding surface will be taken by a geo-technical firm. The minimum number of asphalt core samples shall be as follows:

Area of Asphalt	Number of Asphalt Core Sample
0-2,000 Sq. Yd.	1
2,001 to 4,000 Sq. Yd.	2
4,001 to 6,000 Sq. Yd.	3

One additional test for every additional 2,000 Sq. Yd. or part thereof.

Additional samples may be required as directed by the Engineer. The Contractor is responsible for patching the core hole locations with asphalt.

5.7 Tack Coat

A tack coat of NCDOT CRS-1h shall be applied to existing pavement surfaces, manholes, curb and gutter contact surfaces, and water valve boxes, as directed by the Engineer, immediately prior to placing the riding surface course. The tack coat shall be uniformly applied and not exceed 1/10 gallon per square yard. Any excess tack coat that stains the top of the curb and gutter, manholes, or water valves boxes shall be removed at the contractor’s expense.

5.8 Base Course Materials

A. Aggregate Base Course

- i. The aggregate base course shall consist of fine and coarse aggregate that meet the requirements of Section 520 of the NCDOT Standard Specifications for Roads and Structures, latest edition.
- ii. The aggregate material shall be placed on the subgrade with a mechanical spreader box capable of placing the material to a uniform loose depth and without segregation; except, for areas inaccessible to a mechanical spreader box, the aggregate material may then be placed by other methods approved by the Engineer. In addition, as approved by the Engineer, place by end dumping aggregate on approved sandy subgrade soils to provide a working platform and reduce wheel rutting of the subgrade. When allowed, end dumping will be limited to a uniformly spread thickness of 2 to 3 inches prior to placing the remaining aggregate thickness with a mechanical spreader box.
- iii. Machine compact the layer of base within 48 hours after beginning placement of a layer of the base. Maintain each layer to the required cross section during compaction and compact each layer to the required density before placing the next layer. Compact the base material at a moisture content which is approximately that required to produce a maximum density. Dry or add moisture to the material when required to provide a uniformly compacted and acceptable base. If it is necessary to add water after the material is placed, scarify the material, and add water uniformly throughout the full depth of the layer of the base course material. Density determination will be based on Section 520-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.
- iv. Shape the final layer of base material in accordance with the lines, grades, and typical section as shown on the plans. Construct the base course so that it is smooth, hard, dense, unyielding, and well bonded upon completion. A broom drag may be used in connection with the final finishing and conditioning of the surface of the base course. Traffic shall be kept off of the aggregate base course during the time between final compaction and placement of the asphalt layer.

B. Aggregate Concrete Base Course

- i. Asphalt concrete base course or binder course shall be in accordance with Section 610 of the NCDOT Standard Specifications for Roads and Structures latest edition. NCDOT B25.0C or I19.0C shall be used as the asphalt binder course unless otherwise approved by the Engineer. Asphalt base courses shall not be installed unless the atmospheric temperature is at a minimum of thirty-five (35) degrees and rising.
- ii. Prior to the construction of the base course, the previously constructed subgrade shall be dry and clean of all foreign substances. The subgrade shall be proof rolled and any

- areas rutting, or other soft spots shall be removed, and suitable material installed and compacted.
- iii. All visible stumps in roadway subbase area shall be removed and the area backfilled and compacted.
 - iv. For all areas under a proposed roadway, the top 12 inches of subbase, and the entire base course shall be compacted to a density of 100% maximum Standard Proctor dry density as determined by AASHTO method T99. For that portion of fill under roadways and extending at a slope of 1 to 1 beyond the back of curb, compact to a density of NO LESS THAN 95% of the maximum Standard Proctor dry density as determined by AASHTO method T99. Fill material shall be placed in lifts of 8 inches or less of uncompacted soil. No base material shall be placed until the subgrade has been inspected and approved by the Engineer or their designee.
 - v. The asphalt base shall be compacted by rolling as outlined in Section 5 D above. The compacted thickness of the asphalt base shall be as shown on the approved plans.

5.9 Asphalt Pavement Milling

A. Description

- i. The Contractor shall perform the work covered by this section including, but not limited to, milling and re-milling the pavement at locations, depths, widths, and typical sections indicated in the contract; cleaning the milled surface; loading, hauling, and stockpiling the milled material for use in recycled asphalt mixtures; and disposal of any excess milled material. All work shall be performed in accordance with Section 607 of the NCDOT Standard Specifications for Roads and Structures.

B. Construction Methods

- i. Mill the existing pavement to restore the pavement surface to a uniform longitudinal profile and cross section in accordance with typical sections shown in the plans. Where indicated in the contract, remove pavement to a specified depth and produce a specified cross slope. Mill intersections and other irregular areas unless otherwise directed by the Engineer. The Contractor may elect to make multiple cuts to achieve the required depth of cut or cross slope required by the plans.
- ii. Establish the longitudinal profile of the milled surface by a mobile string line on the side of the cut nearest the centerline of the road. Establish the cross slope of the milled surface by an automatic cross slope control mechanism or by a second skid sensing device located on the opposite edge of the cut. The Engineer may waive the requirement for automatic grade and cross slope controls where conditions warrant.

- iii. Operate the milling equipment to prevent damage to the underlying pavement structure, utilities, drainage facilities, curb and gutter, paved surfaces outside the milled area, and any other appurtenances. Produce milled pavement surfaces that are reasonably smooth and free of excessive scarification marks, gouges, ridges, continuous grooves, or other damage. Repair any leveling or patching required as a result of negligence by the Contractor with hot asphalt plant mix in a manner acceptable to the Engineer. Coordinate the adjustment of manholes, meter boxes and valve boxes with the milling operation in accordance with Article 858-3 of the NCDOT Standard Specifications for Roads and Structures including a temporary asphalt ramp.
- iv. When necessary, the contractor may remove the top section of a utility and use a bridge steel plate placed to cover the entire width of the structure, ensuring no debris is dropped inside the structure. Backfill with compacted material and hot mix asphalt as a temporary riding surface as well as any further necessary requirements of the utility owner. This steel plate must be capable of carrying any traffic load carried by the facility. Where necessary, double reference the location of each structure that has been removed and maintain a map of their location. Construct a temporary ramp of asphalt plant mix to extend a minimum of 3 feet around raised structures before opening to traffic.
- v. The Engineer may require re-milling of any area exhibiting laminations or other defects. Thoroughly clean the milled pavement surface of all loose aggregate particles, dust, and other objectionable material. Disposing or wasting of oversize pieces of pavement or loose aggregate material will not be permitted within the right of way.
- vi. Conduct pavement removal operations so as to effectively minimize the amount of dust being emitted. Plan and conduct the operation so it is safe for persons and property adjacent to the work including the traveling public.

5.10 Bridges

The Town does not accept any type of bridge, including bottomless culverts, on Town owned streets or sidewalks.

6 Section 6 – Concrete Curb and Gutter, Sidewalks, Driveways, and Curb Ramps

6.1 General

All concrete shall meet the minimum strength requirement as shown in approved plans or otherwise included in these specifications. Concrete shall be placed in a manner to avoid segregation of the materials and shall not be dropped a distance of more than five (5) feet.

6.2 Subgrade for Sidewalks and Curbs

The subgrade for sidewalks and curbs shall be constructed true to grade and cross sections. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent roadway or street and shall be placed and compacted to conform with applicable requirements of the above paragraph. All roots, stumps, and other perishable matter encountered at the subgrade shall be removed to a depth of not less than four (4) inches below the subgrade and undercut, filled, and compacted with select material. Excavation to an elevation slightly above finished subgrade shall be completed prior to setting of forms. The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade until the concrete is in place. The subgrade shall be wet down sufficiently in advance of the placing of the concrete to insure a firm and moist condition. In cold weather, the subgrade shall be so treated, protected, and prepared as to produce a satisfactory subgrade entirely free from frost when the concrete is deposited.

6.3 Finishing and Curing of Concrete

A. Finishing

- i. Concrete for curb and gutter, sidewalks, driveways, and curb ramps shall have a broom finish. This finish shall be accomplished by the following methods: the surface shall be screeded and tamped so that the aggregate is below the surface of the concrete, floated to bring the surface to the required finished slope, steel troweled to create an even smooth surface, and broomed with a fiber-bristle brush to create the broomed finish.

B. Curing

- i. Curing shall be accomplished by the application of an approved pigmented membrane-forming curing compound over the entire exposed concrete surface. The curing compound shall be designed to prevent damage to the concrete by preventing the loss of moisture, rapid temperature changes, damage by rain or flowing water for a period of three days. After the final finish and immediately after the free surface moisture has disappeared, the contractor shall use a mechanically operated application device to apply the curing compound at a minimum application rate of 0.0067 gal/sf. An inline flow-metering device should be provided to ensure the proper application rate per Section 700-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

- ii. Where a mechanically operated application device cannot be used, the Contractor shall apply the curing compound in two (2) coats by hand operated pressure sprayer at a coverage rate of one hundred (100) square feet per gallon per Section 700-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

C. Protection from Inclement Weather and Other Damage

- i. The Contractor shall protect concrete from heat or cold, to maintain temperature between 50- and 70-degrees Fahrenheit. The concrete must be protected from rainfall or running water by covering the concrete with an appropriate waterproof material. The Contractor shall be responsible for protecting the concrete from damage caused by construction equipment. The Contractor shall protect fresh slab work from foot or vehicular traffic damage.

6.4 Sampling and Testing

All sampling and testing of concrete shall be in accordance with ASTM and ACI standards and performed by an approved geo-technical firm. When the Engineer directs that the concrete be tested, no less than three (3) cylinders shall be taken at any one time. Unless otherwise directed, a minimum of one cylinder shall be taken for the determination of the concrete strength at seven (7) days and a minimum of two (2) cylinders taken for the determination of concrete strength at twenty-eight (28) days. The concrete used in the testing shall be considered incidental to the project and provided at no cost to the Town.

6.5 Curb and Gutter

A. General

- i. Concrete for curb and gutter shall have a strength after twenty-eight (28) days of at least 3,000 psi. The alignment of the curb and gutter shall be established by the means of off-set stakes.

B. Construction of Curb and Gutter

i. Forms

- a. Forms shall be of wood or metal, straight and free from warp, and of sufficient strength to resist springing during the process of depositing and consolidation of the concrete. All forms must be clean and coated with a material to prevent the concrete from adhering to the form.
- b. All forms must be set on true grade and alignment and braced such that will not move when the concrete is placed. Metal templates with the shape of the curb section shown in the approved plans shall be set in paces provided in the forms and shall not be more than ten (10) feet apart. Templates may be adjusted so as to prevent short sections of curb if a proved by the Engineer or their designee. Concrete shall not be placed in forms until the forms and

subgrade have been inspected and approved by the Engineer or their designee.

ii. Machine Poured Curb and Gutter

- a. Curb and gutter may be placed using an approved curb and gutter machine or slip form paving machine. All equipment shall be self-propelled, and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement to grade and cross-section in one complete pass without the use of side forms. The paver shall vibrate or tamp the concrete for the full width and depth of the layer being placed.
- b. The contractor is responsible for setting the alignment and grade guides for the machine in accordance with the manufacturer's recommendations. The Engineer or their designee must inspect and approved the subgrade and alignment and grade guides prior to the placement of any concrete. The curb and gutter machine must also utilize a template capable of producing the desired curb and gutter section.
- c. The concrete shall be finished in conformance with the requirements for a broom finish as outlined in the sections above.

iii. Backfilling Curb and Gutter

- a. Allow a minimum of three (3) days from the date concrete was poured to remove forms. Immediately after the removal of forms for curb and gutter, sidewalks, and driveways, the space between the back of the curb and sidewalks shall be backfilled, smoothed off and maintained to prevent the accumulation of standing water.

6.6 Concrete Sidewalks and Driveways

- A. Sidewalks and driveways shall be constructed with concrete having a strength after twenty-eight (28) days of at least 3,000 psi. The alignment and grade of the sidewalks and driveways shall be as shown on the approved plans. Curing and finishing of the sidewalks and driveways shall be in conformance with Section 6 C of these Technical Specifications.
- B. Forms shall be of wood or metal, straight and free from warp, and of sufficient strength to resist springing during the process of depositing and consolidation of the concrete. The width of the forms for sidewalks and driveways shall be equal to the full depth of the sidewalks. Forms shall be securely staked and braced true to line and grade. No aggregate sidewalks are permitted.
- C. Do not remove forms from freshly placed concrete for at least 12 hours after placement and until the concrete has hardened sufficiently to resist spalling, cracking or any other damage. Repair any honeycombed areas along the sides or edges of the slab by filling with mortar

immediately after the forms have been removed. Use mortar consisting of one part cement to 2 parts fine aggregate.

6.7 Concrete Curb Ramps

- A. Concrete curb ramps shall be constructed with concrete having a strength after twenty-eight (28) days of at least 3,000 psi. The alignment and grade of the curb ramps shall be constructed in accordance with the Standard Detail for type of curb ramp shown on the plans. All concrete curbs ramps must be ADA compliant when completed. The location and alignment of the curb ramp shall be as shown on the approved plans.
- B. Forms shall be of wood or metal, straight and free from warp, and of sufficient strength to resist springing during the process of depositing and consolidation of the concrete. The width of the forms for the curb ramps shall be the proper height and width. Forms shall be securely staked and braced true to line and grade.
- C. Do not remove forms from freshly placed concrete for at least 12 hours after placement and until the concrete has hardened sufficiently to resist spalling, cracking or any other damage. Repair any honeycombed areas along the sides or edges of the slab by filling with mortar immediately after the forms have been removed. Use mortar consisting of one part cement to 2 parts fine aggregate.
- D. Curing and finishing of the curb ramps shall be in conformance with Section 6 C of these Technical Specifications. Metal or wooden forms of the proper height for the application may be used. All forms must be clean and coated to prevent the concrete from adhering to the form.
- E. Raised detectable warning devices shall be installed in accordance with the Town of Leland Standard Details and Standard Specifications. The raised detectable warning devices must be installed same day when used on a freshly placed curb ramp. The detectable warning devices shall be red in color unless matching previously constructed curb ramps in a neighborhood. Detectable warning devices shall be installed per manufacturers requirements. Acceptable detectable warning device manufacturers include one of the following or approved equal:

Truncated Dome Depot
Interstate Products
Tuftile

6.8 Contraction Joints

- A. Contraction joints shall be provided uniformly to separate the concrete and shall be cut in a straight line to a depth equal to at least one-third (1/3) of the total concrete slab thickness. The joint shall be one-fourth inch (1/4") in width.
- B. A one-half inch (1/2") expansion joint filled with joint filler shall be placed between all sidewalks and adjoining backs of curbs and between the intersection of two (2) sidewalks and between all

sidewalks and driveways. Filled expansion joints shall be placed in curb and gutter at the distances shown on the Town Standard Detail for the type of curb and gutter specified.

- C. Sidewalks constructed adjacent to buildings shall be separated from the building with a similar joint. The maximum distance between transverse expansion joints shall be fifty (50) feet. The joint filler shall extend the full depth of the concrete and shall be one-fourth (1/4) of an inch below the finished surface of the sidewalk.
- D. Joint fillers and joint sealer shall conform to Section 1028 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

6.9 Temperature Limitations on Concrete Placement

Concrete placement should not occur when any of the following conditions exist.

- 1. A descending air temperature at the location of the concrete paving operation and away from artificial heat reaches 35°F. Paving may resume when the weather forecast is projected to reach a high of 40°F on that day's operation and the morning ambient temperature is above 32°F.
- 2. The subgrade or base course is frozen.
- 3. Aggregates to be used in the mix contain frozen particles.
- 4. Air temperature in the shade is 90°F and rising or the concrete temperature is greater than 95°F.
- 5. If the nighttime temperature will be below 32°F, thermal blankets or plastic shall be used to maintain the temperature at the proper level.

It is the responsibility of the contractor to monitor the conditions above and ensure that concrete pavement is installed only when conditions allow.

7 Section 7 – Storm Drainage Systems

7.1 General

- A. All public and private storm sewers and associated appurtenances shall be installed in right of ways or easements. Easement widths are based upon the upstream drainage area and the calculation methodology is included in the Town Stormwater Design Manual.
- B. Storm drainage piping sizes, catch basin locations and number, and pipe end treatment requirements shall be based upon the methodology contained in the Town Stormwater Design Manual.
- C. All storm drainage structures must meet the NCDEQ requirements for separation between water and sewer mains.

7.2 Preconstruction Activities

- A. Location of All Utilities within the Construction Area
 - i. The contractor is responsible for the location of all utilities within the construction area. The approved plans may show approximate locations of some utilities, but they are provided for information only.
- B. Construction Staking
 - i. The Contractor is responsible for all construction staking including the location, elevation, and/or grades of all improvements shown on the approved plans.
- C. Shop Drawing Review, Approval, and Submission
 - i. As required within these specifications, the Contractor is responsible for reviewing, approving, and submitting shop drawings to the Engineer for selected materials to be used on the project.
 - ii. Shop Drawing must be submitted for the following materials if they are included in the project scope:
 - Drop Inlet Frames and Grates
 - Curb Inlet Frames and Grates
 - Manhole Frames and Covers
 - Precast Concrete Flared End Sections
 - Precast Catch Basin Boxes
 - Precast Drop Inlet Boxes
 - Precast Storm Drainage Manholes
 - HDPE Pipe and Fittings
 - Curb Ramp Warning Device

D. Inspection of Delivered Materials

- i. The contractor is responsible for inspecting all materials delivered to the job site to make sure that the materials conform to the specifications and approved shop drawings and that the materials are free from defect. Any material not meeting the specifications or shop drawings or contain any defects must be removed from the job site.

7.3 Storm Drainage Pipe Installation

A. Laying the Pipe

- i. The contractor shall ensure that the storm drainage pipe is stored in such a manner as to not disrupt vehicular traffic flow and in a position to prevent stormwater, silt, or other matter from entering the pipe. The trench width, depth and shoring for storm drainage pipe installation should be in accordance with the Section 300 of the NCDOT Standard Specifications for Roads and Structures, Town Standard Details and OSHA trench slope protection requirements. All bedding materials should be installed prior to installation of the pipe.
- ii. Once a trench meeting the above referenced requirements is established, the Contractor should place the pipe beginning at the lowest point and progress to the higher point. The pipe should be carefully lowered into the trench and the pipe should not be rolled or dropped into the trench. The bell of the pipe should be placed in the upstream position. The pipe bell and spigot should be wiped clean so that the joining material may fit properly. The contractor should then install gaskets, seals, bands, or couplings in accordance with the manufacturer's recommendations.
- iii. Where significant grade changes occur or where the pipe changes direction, a manhole, drop inlet, or catch basin must be installed.
- iv. As soon as the pipe joint has been made, the joint should be wrapped with a geotextile fabric to prevent groundwater infiltration into the pipe.

B. Backfilling the Pipe

- i. After the lifting holes have been plugged and the pipe joint inspected, the pipe should be backfilled. All backfill should conform to Section 2 of these Technical Specifications and Section 300 of the NCDOT Standard Specifications for Roads and Structures for compaction and type of backfill. Keep backfill free from stones, frozen lumps, chunks of highly plastic clay or other objectionable material. All pipe laid in one day should be backfilled the same day except for the working face of the pipe.
- ii. The pipe should then be backfilled up to the spring line of the pipe to make sure that the pipe will not move. The backfill should be tamped using a mechanical tamping device.

Unless otherwise directed by the Engineer, the pipe should not be completely backfilled until the joint has been inspected by the Engineer or their designee. If lifting holes were utilized, they should be plugged with mortar prior to backfill. The lifting holes should then be wrapped with a geotextile fabric to prevent groundwater infiltration into the pipe.

- iii. The minimum amount of backfill allowed is as shown on the Town Standard Detail for the type and size of pipe installed.

C. Cutting the Pipe

- i. When a pipe needs to be cut to meet the required length, the work shall be done with approved cutting tools for the type of pipe being cut. The pipe should be cut such that the result is a smooth end and at ninety (90) degrees to the pipe axis.

D. Pipe Installation in Existing Pavement

- i. When pipelines are placed under existing pavements, a cutback of the pavement of twelve (12) inches will be required on each side of the ditch line. (Town of Leland ST-01). After the pipeline has been laid and backfilled, an eight (8) inch compacted base of ABC stone shall be placed over the total width of the pavement cut. After compaction of this base, a minimum of two (2) inches of bituminous concrete, Type S9.5B, shall then be applied in such a manner as to, when rolled, match the grade of existing pavement. Pavement repair sections on State maintained roads shall conform to NCDOT requirements.

7.4 Catch Basins, Storm Drainage Manholes, Drop Inlets, and Interference Manholes Installation

A. Base Installation

- i. The trench width and shoring for storm drainage structure installation should be in accordance with the Town Standard Details and OSHA trench slope protection requirements. The resultant excavation should be dewatered if required such that the area where the bedding will be placed is free from standing water. Bedding materials to the depth and area shown on the Town Standard Details should be placed in the excavation and compacted and graded to the proper elevation.

B. Installation of the Drainage Structure

- i. The precast drainage structure shall be constructed in accordance with the Town Standard Details and the approved shop drawings. The precast drainage structure should be backfilled with suitable fill in ten (10) inch lifts. Each lift should be compacted. The drainage structure should be placed upon the base using lifting holes or eye bolts. The top of the drainage structure should completely level upon installation.

- ii. The pipe opening in precast units should be no less than nine (9) inches from each side of the pipe. Where a manhole boot is not used, the contractor may use concrete bricks bonded with mortar to fill the void between the pipe and the walls of the drainage structure. A coating of non-shrink grout should be placed on the inside of the pipe structure and on outside of the pipe structure around the pipe to seal the void area. All lifting holes must be plugged with mortar.
 - iii. For all manholes, catch basins, and drop inlets where storm water will flow through the drainage structure, a concrete invert should be poured. The invert should be smooth and allow the free flow of the stormwater through the drainage structure.
- C. Adjustment of the Top of the Drainage Structure to Grade
- i. The contractor should order the properly sized drainage structure to minimize the amount of adjustment required to bring the drainage structure to the finished grade. Where an adjustment is required, concrete riser rings should be used to adjust the casting to grade provided the entire void between the drainage structures' flat top or manhole cone and the casting is filled to uniformly distribute the loading. On stormwater manholes, a mastic joint material shall be placed between the frame and cover and the manhole cone or grade ring.
- D. Gray Iron Castings
- i. Gray iron castings shall be used where shown on the approved plans. All castings shall conform the Town Standard Details for the type of casting and the approved shop drawing.

7.5 Pipe Removal or Abandoning Pipe by Filling with Flowable Fill

- A. All work performed under this Section shall conform to Section 340 Pipe Removal of the NCDOT Standard Specifications for Roads and Structures.
- B. Where indicated on the approved plans, the Contractor shall remove and dispose of all existing public or private roadway drainage pipe, including flared end sections, or as directed by the Town's Inspector. Salvaged pipe is the property of the Contractor unless otherwise indicated by the contract.
- C. Where indicated on the approved plans, the Contractor shall abandon all existing public or private storm drainage pipe by filling the pipe with flowable fill. Prior to placing any flowable fill, the flowable fill design mix must conform to Section 1024 of the NCDOT Standard Specifications for Roads and Structures and be approved by the Engineer. The flowable fill material should be discharged directly from the truck into the space to be filled or by other approved methods. The mix may be placed full depth or in lifts as site conditions warrant.

8 Section 8 – Pavement Markings, Street Name Signs, and Traffic Control Signs

8.1 Paving Marking Plan

Prior to installation of any pavement markings on a project, a Pavement Marking Plan must be submitted to Town for review and approval.

8.2 General for All Types of Pavement Markings

- A. All pavement markings shall conform to the requirements of Division 12 Pavement Markings, Markers, and Delineation of the NCDOT Standard Specifications for Roads and Structures, latest edition.
- B. Pavement marking materials should be installed so that it has a uniform thickness, smooth surfaced cross section throughout its entire length, width, and length not less than the dimensions shown on the approved plans and that does not exceed the dimension by more than 1/2 inch. Do not apply pavement marking materials over a longitudinal joint, manhole covers, and water valve boxes.
- C. Pavement marking lines should be installed such that they are straight or have uniform curvature and conform to the tangents, curves and transitions as specified in the plans. Finished lines should have well defined edges, are free of horizontal fluctuations, and do not exceed 1/2 inch in lateral deviation from the proposed location alignment at any point. Any greater deviation may be cause for requiring the material to be removed and replaced at no additional cost to the Town.
- D. Apply all longitudinal pavement marking lines 8 inches or less in width with one pass of the pavement marking equipment. Pavement marking lines greater than 6 inches in width and pavement marking symbols may be applied with multiple passes of the pavement marking equipment. Install all pavement marking lines, stop bars, characters and symbols that require multiple passes of the application equipment such that there are no gaps separating the application passes. Install characters and symbols so that they conform to the sizes and shapes shown in the plans.
- E. The contractor shall protect the pavement markings until they are track free and repair any markings tracked by a vehicle by acceptable methods.
- F. All pavement markings within the Town right-of-way or on roads to be dedicated to the Town must be thermoplastic.

8.3 Premarking or Temporary Pavement Markings

Premark each installation of the final pavement marking materials before application on new pavement and when required to replace existing pavement marking, except when existing markings are visible. The

premarking shall be inspected and approved by the Engineer or their designee before placing the pavement marking materials.

8.4 Thermoplastic (Alkyd/Maleic) Pavement Markings

- A. The pavement shall be dry and free of grease, oil, mud, dust, dirt, grass, loose gravel, winter surface treatments and other deleterious material, before applying pavement markings.
- B. The application equipment constructed should be constructed to assure continuous uniformity in the thickness and width of the thermoplastic pavement marking. Use application equipment that provides multiple width settings ranging from 6 inches to 12 inches and multiple thickness settings to achieve the pavement marking thickness ranging from 0.090 inch to 0.120 inch.
- C. Use a Premelting Kettle to install hot thermoplastic pavement marking material that includes an oil-jacketed or air-jacketed premelt kettle for uniform heating and melting of the thermoplastic material. Use a kettle that is equipped with an automatic thermostat control device to provide positive temperature control and continuous mixing and agitation of the thermoplastic material. Do not premelt thermoplastic material in handliner type equipment.

8.5 Heated-In-Place Thermoplastic

- A. Heated in place thermoplastic should be applied by using a propane blow torch and other material as recommended by the manufacturer. Heated-in-place thermoplastic should be installed when ambient air temperature and pavement surface temperature is forty (40) degrees Fahrenheit and rising.
- B. The heated-in-place thermoplastic on asphalt or concrete shall be installed per manufacturer's specifications. The manufacturer shall certify the installer of heated-in-place thermoplastic.
- C. The Contractor may choose to use heated-in-place thermoplastic symbols, characters, and transverse lines instead of molten thermoplastics pavement markings. The Contractor should produce a cross sectional thickness of installed heated-in-place thermoplastic markings above the surface of the pavement after installation and upon cooling in accordance with Town Standard Details and Specifications.

8.6 Painted Pavement Markings for Parking Lots and Private Streets

- A. The equipment to apply paint to pavements shall be a truck mounted pneumatic or airless spray machine with suitable arrangements of atomizing nozzles and controls to obtain the specified markings. Paint pavement markings application equipment shall be capable of placing double solid lines, single solid lines, intermittent skip lines or a combination of solid and intermittent skip lines in a single pass. This equipment shall also have an internal timing mechanism for measurement and controlled output of required line lengths.
- B. The paint applicator shall be equipped with a dispenser for the glass beads that operates automatically and simultaneously with the paint applicator through the same mechanism and that is capable of adjustment and designed to provide uniform flow over the full length and

width of the stripe. Spray guns for hand application of detail markings, symbols, and legends must be provided. A hand operated push type applicator with a glass bead dispenser may be used for radii, lane symbols, and/or parking spaces.

- C. Final pavement marking applications of paint shall be placed in two applications of 15 mils wet each. Apply the second application of paint upon sufficient drying time of the first. Each application of paint shall also include drop-on glass beads applied at a rate to immediately obtain the minimum retroreflective values.

8.7 Street Name Signs

Street name signs shall be erected on all newly constructed streets in accordance with the Town of Leland Standard Details and shall be consistent with the MUTCD standards. If the Owner desires to install either specialty street name signs or street signposts, the Owner must submit shop drawings of the proposed sign and/or signpost to the Town for review. No specialty sign may be installed without Town approval. Any specialty sign or post will be owned and maintained by the property owner or HOA.

8.8 Traffic Control Signs

All traffic control signs must be manufactured in accordance with MUTCD standards and erected in accordance with the MUCTD standards. The location and type of the traffic control signs must be shown on the approved plans after consultation with the Engineer or their designee. All traffic control signs, such as stop signs, will be erected prior to the street being open for public vehicular traffic. All traffic control signs will be installed at the Owner's expense.

8.9 Mailbox Kiosks

All mailbox kiosks must meet U. S. Postal Service and NCDOT material and location standards. Mailbox kiosk shall be located outside of the right-of-way unless approved by the Town Engineer. The mailbox kiosk must be installed such that it does not negatively impact site drainage.

