02740 – BASE COURSE AND PAVING

(Last revised 6/22/10)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.

B. Section 02200 – EARTHWORK

C. Section 02275 – TRENCHING, BACKFILLING, AND COMPACTION OF UTILITIES

D. Section 02400 – CURB & GUTTER, DRIVEWAYS AND SIDEWALKS

E. Section 02920 – SEEDING, SODDING, & GROUNDCOVER

F. Bicycle lanes and paths shall be designed and constructed in accordance with the latest version of the NCDOT *NC Bicycle Facilities Planning and Design Guidelines*, latest revision, NCDOT Office of Bicycle and Pedestrian Transportation.

1.2 SUMMARY

This section includes all equipment, labor, material, and services required for complete installation of aggregate base courses and bituminous concrete pavement structures and specialties for municipal street and greenway systems.

1.3 DEFINITIONS

A. **General**

For the purposes of this specification, the following definitions refer to roadway and street systems that come under the authority of the Town of Clayton, North Carolina as specified within this section and other sections of this manual.

1) **Aggregate Base Course**: A layer of graded aggregate materials (ABC unless otherwise specified by the Town Engineer) of a specified thickness placed between the subgrade and the paving course.

2) **Base Course**: A layer of bituminous material of a specified thickness placed between the subgrade or aggregate base course and the intermediate or surface bituminous paving course.

3) **Bikeway/Greenway**: A facility, and its appurtenances, used for the public conveyance of pedestrians and/or bicyclists that is maintained by the Town of Clayton, the North Carolina Department of Transportation, or other entity for the good of the public.

4) **Public Road System**: Roadway, streets, and their appurtenances required for the conveyance of the motoring public that are maintained by either the Town of Clayton or the North Carolina Department of Transportation.

5) **Intermediate Course**: A layer of bituminous material of a specified thickness that is placed between the subgrade or base course and the surface bituminous paving course.

6) **Subgrade**: Surface or elevation remaining after completing the excavation or top surface of a fill or backfill immediately below pavement structure, concrete or topsoil materials, as applicable.

7) **Subgrade Stabilization**: The modification of roadbed soils by admixing with stabilizing or chemical agents that will increase the load bearing capacity, firmness, and resistance to weathering or displacement.

8) **Suitable Subgrade**: A subgrade that consists of a material type and density that is approved by the Town Engineer for placement of a subsequent layer of material.

9) **Surface Course/Wearing Surface**: The top layer of a bituminous or concrete pavement structure which resists skidding, traffic abrasion, and the disintegrating effects of weather.

1.4 SUBMITTALS

A. Submit job-mix formula for each mixture to be supplied within 30 days after contract is awarded.

B. Submit product data and shop drawings for concrete manhole adjustment rings.

1.5 QUALITY ASSURANCE

A. **Geotechnical Testing Agency Qualifications**: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock-definition testing as documented according to ASTM D3740 and ASTM E548.

B. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.

C. The Contractor shall comply with North Carolina Department of Environment and Natural Resources, “Erosion and Sedimentation Control Handbook,” latest revision.

D. Materials and operations shall comply with the latest revision of the Codes and Standards listed below:

American Society for Testing and Materials

ASTM C33	Standard Specification for Concrete Aggregates
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils (for classification purposes only)
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3) (Standard Proctor)
ASTM D1556	Standard Method of Test for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (Modified Proctor)
ASTM D1883	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D2049	Standard Method of Test for Relative Density of Cohesionless Soils
ASTM D2167	Standard Method of Test for Density of Soil in Place by the Rubber-Balloon Method
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D3740	Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM D4253 Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

ASTM D4254 Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

ASTM D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

ASTM E548 Standard Guide for General Criteria Used for Evaluating Laboratory Competence

American Association of State Highway & Transportation Officials

AASHTO M145 The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

AASHTO T99 The Moisture-Density Relations of Soils using a 5.5-pound Rammer and a 12-inch drop

AASHTO T180 The Moisture Density Relations of Soils using a 10-pound Rammer and an 18-inch drop

AASHTO T191 Density of Soil In-Place by the Sand-Cone Method

AASHTO T204 Density of Soil In-Place by the Drive Cylinder Method

AASHTO T205 Density of Soil In-Place by the Rubber-Balloon Method

1.6 STANDARD ABBREVIATIONS

A. Materials and operations shall comply with the latest revision of the Codes and Standards listed below:

AASHTO American Association of State Highway Transportation Officials.

ANSI American National Standards Institute

AREA American Railway Engineers Association

ASTM American Society for Testing and Materials

FS Federal Specifications

HMA Hot Mix Asphalt

MSDS Material Safety Data Sheets

MUTCD Manual on Uniform Traffic Control Devices

NCDOT	North Carolina Department of Transportation
OSHA	Occupational Safety and Health Administration
RAP	Recycled Asphalt Pavement

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Plant operations shall be in accordance with the applicable sections of Section 610, *Asphalt Concrete Plant Mix Pavements* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision.

B. Limitation for producing and placing ashpalt mixtures shall comply with Section 610-4, *Weather, Temperature, and Seasonal Limitations For Producing and Placing Asphalt Mixutures*, of the NCDOT *Standard Specifications for Roads and Structures,* latest revision.

C. Storage shall be in accordance with Section 610-6, *Hot Mix Storage Systems* of the NCDOT *Standard Specifications for Roads and Structures*, latest revision.

D. Hauling and Spreading shall be in accordance with Section 610-7, *Hauling of Asphalt Mixture* and Section 610-8*, Spreading and Finishing* of the NCDOT *Standard Specifications for Roads and Structures*, latest revision.

E. Delivery:

1) Hauling equipment shall be loaded in a manner to minimize segregation of the mix.

2) Haul trucks must park in a designated area to minimize tracking of tack coats.

3) Once loaded, haul trucks shall proceed immediately to the job site.

1.8 COORDINATION

A. Coordinate manhole and valve box adjusting with the Town Engineer.

B. Coordinate tie-in to municipal roadways with the Town Engineer.

C. All new paved areas shall have positive drainage to eliminate ponding. Where new paved areas join existing, measures shall be taken to incorporate positive drainage to eliminate ponding.

D. Repair of pavement markings: When cuts are made through any paved surface and the cuts extend through the pavement markings, the replaced pavement shall be marked to match the existing.

PART 2 – PRODUCTS

2.1 AGGREGATE BASE COURSE

Aggregate Base Course material shall be designated as ABC in accordance with Section 520, *Aggregate Base Course*, and Table 1005-1 *Aggregate Gradation, Coarse Aggregate* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision.

2.2 ASPHALT SURFACE TREATMENT

Asphalt Surface Treatment shall be in accordance with Section 660 *Asphalt Surface Treatment* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision.

2.3 ASPHALT TACK COAT

Asphalt Tack Coat shall be in accordance with Section 605 *Asphalt Tack Coat* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision.

2.4 BITUMINOUS CONCRETE PAVEMENTS

Bituminous Concrete Pavements shall be in accordance with Section 610-3 *Composition of Mixtures (Mix Design and Job Mix Formula)* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision.

2.5 CEMENT TREATED BASE COURSE

Cement Treated Base Course shall be in accordance with Section 540, *Cement Treated Base Course* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision or as specified by the Town Engineer.

2.6 GEOTEXTILE PAVEMENT OVERLAY SYSTEM

A needle punched non-woven polypropylene Geotextile fabric saturated with uncut bituminous cement equal or exceeding Petromat® 4599 Type 1 geotextile as manufactured by Propex, Inc. The fabric is to be placed between a prepared original pavement surface (see paragraph 3.9, *Geotextile pavement overlay System*) and a bituminous concrete overlay. The fabric shall meet the following physical properties:

Physical Properties			
Property	**Test Method**	**Units**	**Value**
Grab tensile strength	ASTM D4632	Lbs	90
Grab tensile elongation	ASTM D 4632	%	50
Mullen Burst	ASTM D 3786	psi	180
Mass Per Unit Area	ASTM D5261	oz/ yd^2	3.6
Asphalt retention	ASTM D 6140	gal/yd^2	0.20
Melting Point	ASTM D276	Degrees F	320
UV Resistance	ASTM D4355	%	70 at 150 hours

2.7 LIME-TREATED SOIL

Lime-Treated Soil shall be in accordance with Section 501 *Lime-Treated Soil* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision or as specified by the Town Engineer.

2.8 PRIME COAT

Prime Coat shall be in accordance with Section 600 *Prime Coat* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision or as specified by the Town Engineer.

PART 3 – EXECUTION

3.1 GENERAL

Construction and testing shall conform to the applicable sections of Division 6 – *Asphalt Pavements* of the NCDOT *Standard Specifications for Roads and Structures,* latest revision. Other requirements for base course and pavement are also set out on the drawings and on the Standard Details shown in the Town of Clayton standard street details.

3.2 PAVEMENT, PATCHES, REPAIR AND REPLACEMENT

A. **General**: This work shall consist of replacing subbase stone, and bituminous material in the street in areas where it becomes necessary to remove the original pavement such as for sewer trenches, water main trenches, storm drainage pipe ditches, etc. Pavement repair shall be the type to match the existing street pavement as shown on the drawings or as determined by the Town Engineer**.**

B. **Cutting Pavement**

Where a utility line is proposed to be placed in an existing paved area, the edges of the pavement for the utility line shall be cut in a straight line, parallel to the pipe on each side (see **Standard Detail C01.03**) for the width of the pavement cut). Perform cutting operations prior to installation of line to avoid excessive removal of pavement. Care shall also be taken during installation of pipe to avoid damage to adjoining paved surfaces.

C. **Surface Tolerances**

The bituminous patched surface will be tested using a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not exceed ¼-inch allowing for the contours of the existing pavement. All humps or depressions exceeding the specified tolerance shall be corrected or the defective work removed and replaced with new material. Any deviation from this standard will be at the discretion of the Town Engineer who may require a 50-foot overlay if the patch is not acceptable.

3.2.1 PERMANENT PAVEMENT REPAIR

Excavation: Excavation of the existing pavement and subbase shall be made to the depth shown on the construction drawings or as directed by the Town Engineer. Before the placement of any stone, concrete, or bituminous material, a representative of the Town Engineer shall inspect the underlying subgrade. The Contractor shall be responsible for correcting any ruts or soft yielding places to the depth necessary to pass a proof roll of the subgrade before placing of the bituminous material.

A. **Bituminous Pavement Repair**

Aggregate Base Stone: The aggregate base shall be placed in accordance with **Standard Detail C01.03** and compacted to 95% of the Standard Proctor maximum dry density based on ASTM D698. A proof roll must be passed prior to the placement of any subsequent course. For subgrade compaction requirements, see *Table 2200.2A* of *02200 Earthwork*.

Bituminous Concrete Pavement: Placing of the bituminous concrete pavement shall be done in accordance with **Standard Detail C01.03**. Compact mix to 92% based on AASHTO T209.

1) **Bituminous Base Course**: Before placing any bituminous material, all sides of the existing pavement and subbase shall be thoroughly tacked at the rate of 0.3 Gal/SY.

2) **Bituminous Surface Course**: The finished surface shall abut the existing pavement with no overlap allowed. Care shall be taken to ensure a uniform grade between the existing pavement and the new surface.

B. **Concrete Pavement Repair**

Aggregate Base Stone: The aggregate base shall be placed to a depth as shown on the drawings or as directed by the Town Engineer and compacted to 95% of the Standard Proctor maximum dry density based on ASTM D698. A proof roll must be passed prior to the placement of any subsequent course.

Concrete Pavement: Placing of the concrete pavement shall be performed in accordance with drawings or as directed by the Town Engineer. Concrete shall meet Section 1000, *Portland Cement Concrete Production and Delivery* of the NCDOT *Standard Specifications for Roads and Structures*, latest revision except that the minimum compressive strength shall be 4000 psi air-entrained concrete. The Town Engineer reserves the right to require that the Contractor pull concrete test cylinders for verifying concrete strength.

3.3 AGGREGATE BASE COURSE (ABC)

A. **Weather Limitations**

Stabilized aggregate base courses shall not be constructed unless the atmospheric temperature is at a minimum of 35º F and rising. Any areas of completed base course that are damaged by freezing shall be reconditioned, reshaped, and recompacted.

B. **Subgrade Approval**

The subgrade upon which the aggregate base course is to be placed shall be prepared in accordance with the requirements 02200, *Earthwork*. Prior to any spreading operations, the subgrade shall be checked and accepted by the Town Engineer or his/her representative for adequate compaction and surface tolerances. The surface of the subgrade shall be dry and clean of all foreign substances. Any ruts or soft yielding places that may appear in the subgrade and any areas having inadequate compaction shall be corrected by loosening,

removing and adding approved material, reshaping, recompacting the affected areas to line and grade, and pass a proof roll before the base course is applied. Proof-rolls shall only be conducted in minimum one block lengths as measured from center of intersection to center of intersection, from center of intersection to end of cul-de-sac, or in lengths of no less than 750 linear feet.

C. **Installation of Aggregate Base Course**

The aggregate base course shall be mixed in an approved central mixing plant of the pugmill type and water added during mixing operations in the amount necessary to provide the optimum moisture content for compacting. After mixing, the material shall be transported to the job site and placed on the roadbed by means of an approved aggregate spreader.

The aggregate base course shall be constructed in layers not less than 3 inches or more than 6 inches of compacted thickness. When vibrating with other approved types of special compacting equipment, the compacted depth of a single layer of the aggregate base course may be increased to 8 inches upon approval. The aggregate, as spread, shall be uniform in gradation with no segregation or pockets of fine or course material. Frequent template checks shall be made to ensure that a minimum amount of patching is necessary after complete compaction is secured.

D. **Compaction Operations and Density Requirements**

After mixing and spreading, the aggregate base course shall be well rolled and machined until thoroughly compacted at optimum moisture within 2% percent of optimum. Rolling shall progress gradually from the sides to the center and shall continue until the entire area of the course has been rolled by the rear wheels. Rolling shall continue until the full depth of the material has been compacted to not less than 98 percent density of the maximum dry density when tested in accordance with ASTM D1556, Standard Method of Test for Density of Soil in Place by the Sand-Cone Method, latest revisions.

A proof roll must be passed prior to the placement of any subsequent course. See 02200, *Earthwork*, section 3.3.2, *Construction Methods*, paragraph F(2).

Aggregate base course density shall also conform to the applicable requirements of NCDOT *Standard Specifications for Roads and Structures*, Section 1006, *Aggregate Quality Control/Quality Assurance*, latest revision.

E. **Grading Tolerances of Final Surface**

After final rolling, the surface shall be inspected and any irregularities in excess of ½ inch shall be corrected. Aggregated base course shall conform to the lines, grades, and typical cross sections shown on the plans, details or as established by the Town Engineer within a tolerance of +/- ½ inch. Any irregularities in the surface shall be corrected by scarifying, remixing, reshaping, and recompacting until a smooth surface is obtained.

F. **Maintenance**

If directed by the Town Engineer, the aggregate base shall be opened to public traffic for at least 2 weeks before being surfaced. During this time, the surface

shall be protected against loss of fine material by the addition of moisture as necessary. However, traffic shall be kept off the base between preparatory final compaction and surfacing.

3.4 CEMENT TREATED STABILIZATION

Cement Treated Stabilization shall be performed in accordance with NCDOT *Standard Specifications for Roads and Structures*, Section 540, latest revision or as specified by the Town Engineer.

3.5 LIME-TREATED SOIL

Lime-Treated Soil shall be performed in accordance with NCDOT *Standard Specifications for Roads and Structures*, Section 501, latest revision or as specified by the Town Engineer.

3.6 BITUMINOUS CONCRETE PAVEMENT

3.6.1 CONDITIONING EXISTING SURFACES

A. **Protection of Manholes and Valve boxes prior to final paving:**

Where the rim and cover of a manhole or a valve box extends more than 1 inch above an unfinished road surface, a temporary layer of asphaltic concrete feathering shall be installed to provide a smooth transition from 1 inch below the edge of the rim and cover to the unfinished road surface. A 12:1 slope ratio shall be used. The exposed sides of the manhole and/or valve box shall be painted bright orange or as specified by the Town Engineer. Prior to final paving, Contractor shall remove feathering completely and apply asphalt tack coat to binder to ensure proper asphalt adhesion. See **Standard Detail C05.01**.

B. **Tacking Existing Surface:**

1) **General**: A tack coat of liquid asphalt shall be applied between the existing bituminous surface and each bituminous course placed thereafter. The tack coat shall conform to the applicable requirements of NCDOT *Standard Specifications for Roads and Bridges*, Section 605 *Asphalt tack Coat*.

Bitumen classed as cutbacks or emulsions shall be applied ahead of the paving operations, and the time interval between applying and placing the paving mixture shall be sufficient to ensure a tacky residue providing maximum adhesion of the paving mixture to the base. The mixture shall not be placed on tack coats that have been damaged by traffic or contaminated by foreign material. Traffic shall be excluded from such section.

On rich sections or those that have been repaired by the extensive use of bituminous patching mixtures, the tack coat shall be eliminated when directed by the Town Engineer.

Exception: When bituminous concrete asphalt to be placed has a total thickness of 4 inches or more, priming with liquid asphalt material will not be required on base material.

2) **Tacking**: Contact surfaces of curbing, gutters, manholes, and other structures projecting into or abutting the pavement and cold joints of bituminous concrete asphalt shall be painted with a thick uniform coating of liquid asphalt prior to placement of bituminous concrete asphalt mixture. Application of tack at joints, adjacent to curbs, gutters, or other appurtenances shall be applied with a hand wand at the rate of 0.2 gallons per square yard. At joints, the hand wand applied tack shall be 2 feet in width with 4 to 6 inches protruding beyond the joint for the first pass. Tack for the adjacent pass shall completely cover the vertical face of the mat edge, so that slight puddling of asphalt occurs at the joint, and extends a minimum of 1 foot into the lane to be paved. Milled faces that are to remain in place shall be tacked as above for the adjacent pass. Use of tack at longitudinal joint vertical faces will not be required when paving in echelon.

   Tack shall be applied in such a manner as to offer the least inconvenience to traffic and to permit a minimum of one-way traffic without pickup or tracking. Care shall be taken to prevent spattering of adjacent pavement, structures, trees, and private property. Any spattering will be cleaned up by the Contractor at no cost to the Town.

   Payment for tack shall be included in bituminous concrete asphalt prices.

3) **Tack Coating Horizontal Surfaces**: See paragraph 3.7, *Tack Coat*.

C. **Removing Depressions/Irregularities**

Where irregularities in the existing surface would result in a course more than 3 inches in thickness after compaction, the surface shall be brought to a uniform grade by placing a thin layer of bituminous concrete asphalt not exceeding the minimum thickness as recommended for that type of mix. Then the material shall be thoroughly compacted until it conforms to the surrounding surface. The mixture used shall be the same as that specified for the surface mix to be placed.

D. **Bicycle/Greenway subgrade – Herbicide Treatment:**

Herbicides shall conform to Section 1060-13, Herbicides of the NCDOT Specifications for Roads and Structures, latest revision shall be applied to the aggregate base course and/or subgrade no more than 15 minutes prior to paving. The rate of application shall be as recommended by the herbicide manufacturer. Herbicides shall not be used where they may contaminate water used for irrigation and drinking purposes.

3.6.2 PAVEMENT PROFILING - MILLING

The work included under this contract item shall consist of the removal of existing bituminous surfaces of in-place pavements on various streets within the Town of Clayton, to produce the desired profile, cross-section, and surface conditions as specified by the Town Engineer. All removed material shall become the property of the Contractor.

The Contractor shall plan and prosecute a schedule of operations so that milled roadways will be overlaid with bituminous concrete asphalt as soon as possible, and, in no instance, shall the time lapse exceed 7 days after the milling

operations, unless otherwise specified. The milled areas of the roadway shall be kept free of irregularities and obstructions that may create a hazard or annoyance to traffic in accordance with the requirements of NCDOT *Standard Specifications for Roads and Structures*, Section 607, *Milling Asphalt Pavement*, latest revision.

The Contractor shall plan and prosecute the milling operation to avoid trapping of water on the roadway. At the discretion of the Town Engineer, cutting drainage slots in roadway shoulders or inlets may be required, at no additional costs. The Contractor shall also restore the cut drainage slots afterwards at no additional cost to the Town.

A. The equipment and manpower furnished for this work shall be:

1) A cold milling machine capable of cutting at least 2 inches and 55 inches wide in flexible pavement while leaving a uniform cut and rideable surface capable of handling traffic prior to placement of a new bituminous overlay. The ground speed of the machine shall be independent of the cutting equipment. The machine shall maintain a sharp cutting edge at all times. The machine shall have a self-contained water system for control of dust and fine particles. The machine shall be capable of working in wet and dry conditions with temperatures down to 32º F.

2) The width of the machine shall be such to allow for one lane of traffic at all times. The machine shall be capable of cutting within 1 inch of manholes, valve box tops and facedown walks with a minimum radius of 5 feet.

3) If the machine is not self-loading, then a capable loader shall be furnished for placing the material onto trucks.

4) A power broom is to be used for cleaning the planed surfaces.

5) The Contractor shall furnish all hose and water.

6) Traffic control and flagman are to be provided by the Contractor.

7) All work associated with the milling operation shall be performed by the Contractor (such as asphalt removal at intersections and around utilities and clean up in yards).

B. The construction methods shall be as follows:

Where bituminous pavement extends into the existing curb and gutter, the Contractor shall be required to plane at different slopes. The first cuts shall remove the material existing above the gutter line. These cuts will be made at the appropriate gutter slope (1/2":1') for both 24 and 30 inch curb and gutter. Any curb and gutter with a different slope will be planed at the existing curb and gutter slope.

The last cuts shall remove the material to a depth of 1" below the gutter line with a street cross-section slope of 1/4":1' or to slope of existing street.

Where curb and gutter exists but the pavement is at or below the existing gutter line, the pavement will be cut to a depth of the thickness of overlay below the gutter line while adjusting street cross-section to 1/4":1' toward the centerline of the street.

Where existing straight curbing has pavement built up to expose less than 6 inches of curbing, the pavement will be planed down on grade of 1/4":1' or whatever the existing grade of the street back to the street centerline until a desired height of curbing is exposed.

Where center of pavement has correct crown but, pavement has rutting or ripples (possibly caused by vehicular braking), the pavement will be planed to the depth necessary to remove all such defects.

If milling encroaches into base, the area(s) shall be patched the same day.

C. Surface Casting Adjustments/Preparation: See paragraph *3.10B, Surface Casting Adjustments*.

3.6.3 PAVING OPERATIONS

A. **Bituminous Concrete Pavement Equipment**

Bituminous concrete pavement equipment shall be in accordance with Section 610 of the NCDOT *Standard Specifications for Roads and Structures*, latest revision.

B. **Transportation of Bituminous Mixture**

Transportation of bituminous mixture from the paving plant to the site shall be in trucks having tight, clean, and smooth beds. Each load shall be covered with canvas or other suitable material of ample size to protect it from the weather and to prevent the loss of heat. Prior to discharge from the hauling vehicle, the temperature of the mixture shall be within a tolerance of plus 15ºF to minus 25ºF of the specified job mix formula temperature. Any loads wet excessively by rain will be rejected. Hauling over freshly laid material will not be permitted.

C. **Placing and Furnishing**

Bituminous concrete asphalt shall only be placed when the weather conditions are suitable (see paragraph I, *Placement Limitations*, below).

Bituminous concrete asphalt shall not be placed until surface upon which it is to be placed has been approved by the Town Engineer. Prior to delivery of surface course material, the base course shall be completed for receiving the surface course material and shall be kept from traffic, with the exception of the mixture vehicles and those other vehicles necessary for the placement of asphalt.

For strip paved streets, the edge of the pavement shall be marked by means of a continuous line placed and maintained a sufficient distance ahead of the paving operation to provide proper control of the pavement width and horizontal alignment.

Contact surfaces of curb and gutters, manholes, etc., shall be painted with a thin uniform coating of cut-back asphalt just before the surface mixture is placed against them. Immediately adjacent to headers, flush curbing, gutters, liners, and other structures, the surface course mixture shall be spread uniformly high so that after the final compaction it will be approximately 1/8 inch above the edge of the structure.

An approved asphalt paver shall be used to distribute the bituminous mix over the widest pavement width practicable. Wherever practicable and when the capacity of sustained production and delivery is such that more than one paver can be operated, pavers shall be used in echelon to place the wearing course in adjacent lanes. Crossovers, as well as areas containing manholes or other obstacles that prohibit the practical use of mechanical spreading and finishing equipment, may be constructed using hand tools. However, care shall be taken to obtain the required thickness, jointing, compaction, and surface smoothness.

The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6 inches. However, the joint in the wearing surface shall be at the centerline of the pavement if the roadway comprises two traffic lanes or at lane lines if the roadway is more than two lanes in width. Offsetting layers will not be required when adjoining lanes are paved in echelon and the rolling of both lanes occurs within 15 minutes after laydown.

The Contractor shall have a certified Asphalt Concrete Paving Technician present during paving operations. Immediately after placement and screeding, the surface and edges of each layer shall be inspected and straightedged by the technician and necessary corrections performed prior to compaction. The finished pavement shall be uniform and smooth.

The placement of bituminous concrete shall be as continuous as possible and shall be scheduled such that the interruption occurring at the completion of each day's work will not detrimentally affect the partially completed work. Material that cannot be spread and finished in daylight shall not be dispatched from the plant unless the use of artificial lighting has been approved. When paving is performed at night, sufficient light shall be provided to properly perform and thoroughly inspect every phase of the operation. Such phases include cleaning planed surfaces, tack application, paving, compacting, and testing. Lighting shall be provided and positioned such as to not create a blinding hazard to the traveling public.

The Contractor shall distribute to each residence or business along a road to be paved, a flyer approved by the Town Engineer on Town letterhead, with notification of the work to be done and the dates it will be performed. Also to be included is a request that all vehicles be removed from the street during this time period. The flyers are to be delivered 3 to 7 days prior to the actual start date of the construction.

During paving operations, the Contractor shall be responsible for furnishing and erecting temporary "no parking" signs on each street that is to be paved to prevent residents from parking their vehicles in the way of construction. The signs shall be erected at least 24 hours prior to paving operations and on each side of the street as necessary.

D. **Layer Thickness**

Minimum Layer Thickness: Bituminous concrete SUPERPAVE pavement courses shall be placed in layers not exceeding 4.0 times the nominal maximum size aggregate in the bituminous mixture. The maximum thickness may be reduced if the mixture cannot be adequately placed in a single lift and compacted to required uniform density and smoothness. The minimum thickness for a pavement course shall be no less than 2.5 times the nominal maximum size aggregate in the bituminous mixture. These nominal maximum and minimum lift depths correlate as shown in the table below. If the proposed total depth for a prescribed mix type exceeds the maximum single layer depth shown in the table, the asphalt must be placed in **two lifts;** the first lift having a thickness of not less than the minimum single lift depth shown in the table. Asphalt cores must be taken to confirm thickness and compaction.

Mix Type	Minimum Single Lift Depth (inches)	Maximum Single Lift (inches)	Maximum Layer Depth (inches)
SF 9.5A	1	2	3
S 9.5X[a]	1.5	2	3
S 12.5X[a]	2	2	4
I 19.0X[a]	2.5	4	4
B 25.0X[a]	3[b]	5.5	No Restrictions
B 37.5C[a]	4.5	6	No Restrictions

[a] X=Level of Service
[b] For B 25.0X placed on stabilized subgrade, minimum lift thickness is 4.0 inches.
Source: NCDOT 2006 HMA/QMS Manual.

E. **Joints**

1) **General**: All joints shall present the same texture, density, and smoothness as other section of the course. The joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to ensure a continuous bond between old and new sections of the course. All contact surfaces of previously constructed pavements shall be painted with a thin, uniform coat of hot bituminous material just before the fresh mixture is placed.

Care shall be exercised when tying into curb and gutter and newly over-layed travel lanes to ensure a uniform grade and joint.

The Contractor shall construct the final riding surface to tie into the existing surface by cutting a notch 1 inch deep by 1 inch wide for all tie-ins to existing pavement, including driveways and ramps. Suitable guide lines or devices shall be used to ensure cutting of the joint on a true line. The joint shall be thoroughly cleaned and dried prior to being sealed. This work shall be done at no additional cost to the Town.

Method of temporary joints at the end of each workday shall be approved by the Town of Clayton Town Engineer.

In addition to the following, both transverse and longitudinal joints shall conform to Section 610-11, paragraphs (A) and (B), respectively of the *NCDOT Standard Specifications for Roads and Structures*, latest revision.

2) **Transverse**: The roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is to be discontinued or when delivery of the mixture is interrupted to the extent that the unrolled material may become cold. Construct a sloped wedge ahead of the end of the full depth pavement to provide for compaction and the protection of the full depth pavement. Place a paper parting strip beneath this wedge to facilitate joint construction unless waved by the Town Engineer. Before paving operations are resumed, remove the sloped wedge and cut back into the previously constructed pavement to the point of full pavement depth to expose an even vertical surface for the full thickness of the course.

3) **Longitudinal**: In all cases, the edges of cold longitudinal joints shall be cut back to expose an even, vertical surface for the full thickness of the course prior to constructing the adjacent pavement.

F. **Compaction**

Immediately after the bituminous mixture is placed and struck off and surface irregularities are corrected, the mixture shall be thoroughly and uniformly compacted by rolling.

During compaction of bituminous concrete asphalt, the roller shall not pass over the end of freshly placed material except when a construction joint is to be formed. Edges shall be finished true and uniform.

The surface shall be rolled when the mixture is in the proper condition. Rolling shall not cause undue displacement, cracking, or shoving.

The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The sequence of rolling operations and the selection of roller types shall provide the specified pavement density. However, the minimum and maximum roller weight shall be 5 tons and 10 tons, respectively.

Immediately after the hot mixture is placed, it shall be sealed with rollers. Thereafter, rolling shall be a continuous process, insofar as practicable, and all parts of the pavement shall receive uniform compaction. In the event that the rolling operation is not able to properly keep up with the placement of the mixture, the finishing machine shall be stopped and no mixture shall be laid until the rolling has been caught up.

Rolling shall begin at the sides and proceed longitudinally parallel to the center of the pavement, each trip overlapping at least ½ the roller width, gradually progressing to the crown of the pavement. When abutting a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On superelevated curves, rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel to the centerline.

Displacements occurring as a result of reversing the direction of a roller, or from other causes, shall be corrected at once by the use of rakes or lutes and addition of fresh mixture when required. Care shall be taken in rolling not to displace the line and grade of the edges of the bituminous mixture. The motion of the roller shall be at all times slow enough to avoid displacement of the hot mixture. All roller marks must be eliminated.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with a very small quantity of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Edges of bituminous pavement surfaces shall be true curves or tangents. Irregularities shall be corrected.

The surface of the compacted course shall be protected until the material has cooled sufficiently to support normal traffic without marring.

G. **Density**

Superpave mix design criteria for mixes listed in Table 610-2 of the NCDOT *Standard Specifications for Roads and Structures* shall be minimum 90.0% (based on AASHTO T209) for SF 9.5A mix and 92% for all other mixes. Density shall also meet Table 610-4 of the NCDOT *Standard Specifications for Roads and Structures*.

H. **Pavement Samples**

Bituminous pavement coring sampling and density test reports shall be submitted at completion of project in accordance with the requirements of the NCDOT *Standard Specifications for Roads and Structures* Section 609, *Quality Management System For Ashphalt Pavements*, latest revision.

Provide reports on the results of the corings in accordance with Section 609-5, *Contractor's Quality Control System* of the NCDOT Standard Specifications for Roads and Structures, latest revision.

Suitability of the samples shall be based on the limits of precision specified in Section 609-6, *Quality Assurance* of the NCDOT Standard Specifications for Roads and Structures, latest revision.

I. **Placement Limitations**

No surface course shall be laid unless the ambient air temperature is a minimum of 45º F and rising. Asphalt mixtures that have temperatures of less than 225º F, when ready to dump into the mechanical spreader, will be rejected. All compaction rolling shall be completed prior to the mat cooling down to 175º F. Finish rolling may be performed at a lower mat temperature.

Do not place asphalt material when the air temperature, measured in the shade away from the artificial heat at the location of the paving operation and the road surface temperature in the shade is less than the temperatures shown in the following table:

Asphalt Placement – Minimum Temperature Requirements[1]		
Asphalt Concrete Mix Type	**Minimum Air Temperature**	**Minimum Road Surface Temperature**
Type SF 9.5A, S 9.5B	40°F	50°F
S 9.5C, D, S 12.5C, D	50°F	50°F
I 19.0B, C, D	35°F	35°F
B 25.0B, C, B 37.5C	35°F	35°F

[1]Table 610-3 of NCDOT Standard Specifications for Roads and Structures

Other placement limitations, to include but not limited to, mixture temperatures, and cold weather paving shall be in accordance with Section 610, *Asphalt Concrete Plant Mix* of the NCDOT *Standard Specifications for Roads and Structures*, latest revision.

J. **Pavement Tolerance**

The surface will be tested by using a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not be more than 1/4 inch. Humps and depressions exceeding the specified tolerance shall be corrected, or the defective work shall be removed and replaced with new material.

3.7 TACK COAT

Procedures and equipment shall be in accordance with Section 605, *Tack Coat* of the NCDOT Standard Specifications for Roads and Structures, latest revision and Section 3.6 Bituminous Concrete Pavement of these specifications.

All castings, the gutter edge, and other surfaces which pavement rests against shall be painted with asphalt tack coat material by way of a hand brush, or other approved means, prior to the placing of the surface course. All asphaltic cement or other materials which discolor the surface of concrete structures and items which are spilled or placed on such surfaces shall be removed at the Contractor's expense. His inability to remove such foreign and disfiguring stains shall result in the complete removal of the structures so stained or disfigured, and these removed structures or surfaces shall be replaced at his expense. Particular care shall be taken to prevent tack coat from getting into and on gutter areas.

3.8 ASPHALT SURFACE TREATMENT

Section 660, *Asphalt Surface Treatment* of the NCDOT Standard Specifications for Roads and Structures, latest revision.

3.9 GEOTEXTILE PAVEMENT OVERLAY SYSTEM

A. **Asphalt Distributor**

The distributor truck shall be metered and capable of spraying tack coat at a specified uniform application rate. The applicator shall provide uniform coverage without gaps, partial overlaps, skipping, dripping or otherwise create heavy streaking. The truck shall be equipped with a hand spray nozzle to distribute tack coat in locations inaccessible by the truck.

No will be permitted. The distributor shall also be equipped with a hand spray having a single nozzle and positive shut-off valve.

B. **Fabric Laydown Equipment**

Mechanical or manual lay down equipment shall be capable of laying the geotextile smoothly. The fabric can be installed with a mechanical unit mounted on the front of a tractor or on the back of the distributor truck. Manual units can be used for small jobs. Provide stiff bristle brooms, squeegees, or pneumatic rollers to smooth fabric. Provide all tools such as scissors or blades for cutting fabric and brushes for applying asphalt sealant to Geotextile overlaps.

Do not permit traffic directly on fabric.

C. **Surface Preparation**

Washed concrete sand may be spread over an asphalt-saturated geotextile to facilitate movement of equipment during construction or to prevent tearing or delamination of the geotextile. Hot-mix broadcast in front of construction vehicle tires may also serve this purpose. If sand is applied, excess quantities shall be removed from the geotextile prior to placing the surface course.

Sand is not usually required. However, ambient temperatures are occasionally sufficiently high to cause bleed-through of the asphalt sealant resulting in undesirable geotextile adhesion to construction vehicle tires.

Neither the asphalt sealant nor the geotextile shall be placed when weather conditions, in the opinion of the Engineer, are not suitable. Air and pavement temperatures shall be sufficient to allow the asphalt sealant to hold the geotextile in place. For asphalt cements, air temperature shall be 50°F and rising. For asphalt emulsions, air temperature shall be 60°F and rising.

The surface on which the geotextile is to be placed shall be reasonably free of dirt, oil, water, vegetation, or other debris. Cracks exceeding 1/8 inch in width shall be filled with suitable crack filler (such as asphalt cement or rubberized asphalt). Repair larger cracks and potholes with a properly compacted hot mix or other similar filler as directed by the Town Engineer. Potholes shall be properly repaired as directed by the Town Engineer. Fillers shall be allowed to cure prior to geotextile placement.

Badly broken pavement is an indication of a failed subgrade and should be dug out and replaced before overlaying. If the surface is rough but stable, the Town Engineer may require milling or placement of a leveling course before installation of the Geotextile pavement overlay system. The surface should be dry prior to tack coat and fabric placement.

D. **Application of Tack**

The specified rate of asphalt sealant application must be sufficient to satisfy the asphalt retention properties of the geotextile and bond the geotextile and overlay to the old pavement.

When emulsions are used, the application rate must be increased to offset water content of the emulsion.

Application of the sealant shall be by distributor spray bar, with hand spraying kept to a minimum. Temperature of the asphalt sealant shall be sufficiently high to permit uniform spray pattern. For asphalt cements the minimum temperature shall be 300°F. To avoid damage to the geotextile, however, the distributor tank temperatures shall not exceed 320°F.

A spray pattern for asphalt emulsion is improved by heating. Temperatures in the 130°F to 160°F range are desirable. A temperature of 160°F shall not be exceeded since higher temperatures may break emulsion.

The target width of asphalt sealant application shall be the geotextile width plus 6 in. The asphalt sealant shall not be applied any farther in advance of geotextile placement than the distance the Contractor can maintain free of traffic.

Asphalt spills shall be cleaned from the road surface to avoid flushing and geotextile movement.

When asphalt emulsions are used, the emulsion shall be cured prior to placing the geotextile and final wearing surface. This means essentially no moisture remaining.

Fully saturate the fabric and provide a bond to the overlay without providing excess tack coat that could mix with the overlay of the asphalt. The optimum amount depends on the porosity of the old pavement, fabric weight, tack coat material, and other variables. Verify the applications rates with the Geotextile manufacturer and coordinate with the Town Engineer prior to application.

Required cure time varies with emulsion type, humidity, ambient temperature, and other factors. Verify the cure times with the Geotextile manufacturer and coordinate with the Town Engineer prior to application.

E. **Fabric Placement**

The geotextile shall be placed onto the asphalt sealant (calendared or smooth side up) with minimum wrinkling prior to the time the asphalt has cooled and lost tackiness. Drive the vehicle straight to avoid wrinkling. Turns should be made gradually. For sharp curves or corners, cut fabric to size and place by hand. As directed by the Town Engineer, wrinkles or folds in excess of 1-inch shall be slit and laid flat.

Blooming and/or pneumatic rolling will be required to maximize geotextile contact with the pavement surface.

Overlap of geotextile joints shall be sufficient to ensure full closure of the joint, but should not exceed 6 inches. Transverse joints shall be lapped in the direction of paving to prevent edge pickup by the paver. A second application of asphalt sealant to the geotextile overlaps will be required if in the judgement of the Town Engineer additional asphalt sealant is needed to ensure proper bonding of the double geotextile layer.

Removal and replacement of geotextile that is damaged will be the responsibility of the Contractor.

The tack coat or mix temperature should not exceed 320ºF when the fabric is placed.

F. **Hot mix overlay and protection**

The temperature of the mix shall not exceed 320°F. In the event asphalt bleeds through the geotextile causing construction problems before the overlay is placed, the affected areas shall be blotted by spreading sand. To avoid movement of, or damage to the seal-coat saturated geotextile, turning of the paver and other vehicles shall be gradual and kept to a minimum.

All areas in which paving fabric has been placed should be paved during the same day. If the fabric becomes wet, allow to dry before paving. Unless directed otherwise by the Town Engineer, a minimum compacted asphalt thickness of 1.5 inches shall be placed to provide adequate heat and pressure to bond the systems.

Trafficking the geotextile will be permitted for emergency and construction vehicles only.

Prior to placing a seal coat (or thin overlay such as an open-graded friction course), lightly sand the geotextile at a spread rate of 0.15 to 0.20 pounds per square foot, and pneumatically roll the geotextile tightly into the sealant.

3.10 PREPARATION OF PAVEMENT FOR RESURFACING

A. **Preparation of Surface**: Prior to beginning paving operations, the existing areas to be resurfaced shall be thoroughly cleaned by the Contractor to the satisfaction of the Town Engineer. This cleaning shall include sweeping of the streets with a power operated broom, cutting excess debris with a grader, washing with a water truck, and hand cleaning any debris left over after this operation is complete. Cleaning operations shall commence just prior to the resurfacing of streets. In addition, the Contractor shall expose any existing paved areas, which have been covered by soil, grass, or debris. These areas shall be thoroughly cleaned, herbicide applied, and tacked before resurfacing. Any excess material left over after this operation shall be removed or spread out to the satisfaction of the Town Engineer. No additional payment shall be made for this work.

When the surface of the existing pavement or base is irregular, it shall be brought to a uniform grade and cross section as directed by the Town Engineer. The surface on which the bituminous concrete is to be applied shall be prepared in accordance with the requirements of the applicable specifications.

When specified, prior to placement of bituminous concrete, longitudinal, and transverse joints, and cracks in cement concrete pavement shall be sealed by the application of an approved joint sealing compound.

B. **Surface Casting Adjustments/Preparation**

Any surface casting, such as water boxes, manholes, grates, cleanouts, etc., shall be set to grade prior to beginning of paving operation. All telephone manholes and gas boxes are to be adjusted by the utility companies or Contractor if approved by the Town Engineer. All such castings shall be adjusted within a tolerance of 1/8 inch below or flush with the asphalt finished elevation. Where applicable, concrete riser rings or brick shall be placed under manholes frames (see **Standard Detail C06.03**) to raise the rim to the proposed finished pavement grade. The Contractor shall be required to coat the top of any such casting with a suitable coating material to prevent adhesion of the bituminous material to the casting. A tack coat of bituminous material, conforming to the requirements of these specifications, will be applied prior to resurfacing operations.

3.11 PROTECTION OF ASPHALTIC SURFACE COURSE

Sections of newly placed and compacted asphalt surface course shall be barricaded and protected from all defects for a period of at least 8 hours until they have become properly hardened by cooling. Protect asphalt from petroleum products during and following placement of surface course.

If patching is required to make repairs, the base material in place shall be removed to a minimum depth of 4 inches, replaced with bituminous concrete base course (type B-25.0B) and surfaced with 2 inches of SF-9.5A bituminous asphalt concrete.

3.12 PAVEMENT MARKINGS

A. **General**

1) **Applicable Design Standards**: Marking layout, dimensions, colors, etc. shall be subject to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) and the applicable details of the NCDOT *Standard Roadway Drawings*, latest revision. Unless otherwise noted below, pavement marking materials and preparation shall be of a thermoplastic material, and shall comply with Section 1087, *Pavement Markings* and Section 1205, *Pavement Marking General Requirements* of the NCDOT Standard Specifications for Roads and Structures, latest revision.

   Prior to marking, all pavements are to be free of grease, oil, mud, dust, dirt, grass, loose gravel, and other deleterious material.

B. **Thermoplastic Striping**:

1) All thermoplastic striping shall be a NCDOT approved mix that minimizes the slipperiness of the marking surface.

2) Thermoplastic traffic line paint shall be a reflectorized thermoplastic pavement striping material applied to the road surface in a molten state by

mechanical means. It shall have surface application of glass beads which, upon cooling to normal pavement temperature, will produce an adherent reflectorized stripe of the specified thickness and width.

3) The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastic when heated with a torch.

4) The markings must be able to be applied in temperatures down to 32°F, without any special storage, preheating, or treatment of the material before application.

5) Thermoplastic paint shall comply with NCDOT *Standard Specifications for Roads and Structures*, Section 1087-2C, *Thermoplastic Composition*, latest revision. The material shall contain at least 30 percent by weight of graded premixed glass beads. It must contain a minimum of 10% titanium dioxide pigment (ASTM D476 Type 2) to ensure a color similar to Federal Highway White, Color No. 17886, as per Federal Standard 595.

6) The surface must have a minimum skid resistance value of 55 BPN when tested according to ASTM E303, *Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester,* latest revision.

7) The material, when applied at a temperature range of 400° F to 440° F and shall set to bear traffic in not more than 2 minutes when the air temperature is 50 °F. Minimum thickness shall be 90 mils for arrows, edge lines, diagonals, and gore lines; 120 mils for centerlines, skip lines, mini-skip lines, characters, and crosswalk lines.

8) The material must be resistant to deterioration due to exposure to sunlight, water, oil, gasoline, salt or adverse weather conditions.

9) When applied to Portland concrete surfaces, the application notes above still apply, except that a compatible surface primer/sealer shall be applied prior to the application of the Thermoplastic material to assure proper adhesion.

10) Do not apply thermoplastic pavement markings between December 15 and the following March 16.

11) Provide drainage openings at intervals of 250 feet in edge lines placed on the inside of curves and in edge lines on the low side of tangents. Provide openings that are a maximum of 12 inches and a minimum of 6 inches in length.

C. Existing Pavement Markings:

1) Prior to the installation of paint or thermoplastic pavement marking lines and symbols, the surface of existing pavement markings shall be cleaned by a method which does not materially damage the existing pavement surfaces.

2) Materials deposited on the pavement and adjacent surfaces as a result of the removal of pavement markings shall be removed as the work progresses.

3) When a blast removal method is used, care must be taken to protect adjacent surfaces and structures from flying debris.

4) Painting over or black out painting of existing pavement markings with black paint or bituminous solutions shall not be allowed.

END OF SECTION 02740

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