

# PROJECT SPECIFICATIONS MANUAL

## LINCOLN ROAD SIDEWALK

YORK COUNTY, SC

### OWNER

CITY OF YORK, SC  
10 N. ROOSEVELT ST. YORK,  
SOUTH CAROLINA 29745



### CIVIL ENGINEER

ESP ASSOCIATES, INC.  
3475 LAKEMONT BLVD.  
FORT MILL, SOUTH CAROLINA  
29708



**FEBRUARY 23, 2024**

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**END OF SECTION**

## **SECTION 103**

### **AWARD AND EXECUTION OF CONTRACTS**

#### **103.1 Consideration of Proposals**

- 1 After the proposals are opened and read, they are compared based on the summation of the extensions of the approximate quantities shown in the bid schedule multiplied by the unit bid prices. The results of such comparisons are available to the public only after the Contract has been awarded. In case of a discrepancy between unit bid prices and extensions, the unit bid price governs.
- 2 The right is reserved to reject any or all proposals, to waive technicalities, or to advertise for new bids, if in the judgment of the Director, the best interest of the Department is promoted thereby.

#### **103.2 Award of a Contract**

- 1 If awarded, the Contract will be awarded to the lowest responsible and qualified bidder whose bid complies with all the requirements prescribed. The award of the Contract will be made within 30 calendar days after the opening of bid proposals unless otherwise specified in the Special Provisions. The successful Bidder is notified by letter to the address provided in prequalification that its bid has been accepted and that it has been awarded the Contract. An award is not made until all information required by the Department has been received from the Bidder, and the Bidder's responsibility has been established.

#### **103.3 Cancellation of Award**

- 1 The Department reserves the right to rescind or cancel the award of any Contract at any time before the execution of said Contract by all parties and without any liability against the Department.

#### **103.4 Return of Proposal Guaranty**

- 1 All proposal guaranties are retained by the Department until the Contract is executed by the successful Bidder, after which all such proposal guaranties are destroyed unless the guaranty form contains a note requesting it be returned to the Bidder or the Surety.

#### **103.5 Bond Requirements**

- 1 Unless otherwise specified, provide the following bonds acceptable to the Department with the executed Contract:
  - Performance and Indemnity Bond from a surety or sureties satisfactory to the Department in the full amount (100%) of the Contract bid amount, but in no case less than \$10,000.00 for the protection of the Department, and
  - Payment Bond from a surety or sureties satisfactory to the Department in the full amount (100%) of the Contract bid amount for the

protection of all persons supplying labor and materials in the prosecution of work provided for the Contract for the use of each such person.

- 2 Provide these bonds in accordance with the requirements of South Carolina Code of Laws, Sections 57-5-1660 and 29-6-250, as amended.
- 3 Only a Performance and Indemnity Bond written on SCDOT Form 672A and a Payment Bond written on SCDOT Form 673 are acceptable to the Department. Bond forms are available through the Contracts Administration office.
- 4 Criteria that is necessary in order for a surety or sureties to be satisfactory to the Department, include, but not limited to the following:
  - A. The surety or sureties are licensed for surety authority by the Chief Insurance Commissioner of the South Carolina Department of Insurance.
  - B. The surety or sureties are assigned a rating of "A" or better by A.M. Best Company in its most recent *Best's Key Rating Guide*.

#### **103.6 Execution of the Contract**

- 1 After receiving the Contract prepared by the Department, sign and return it, together with an acceptable Payment Bond, Performance and Indemnity Bond, and acceptable Certificates of Insurance to the Contracts Administrator within 20 calendar days from the date it was mailed by the Department. No Contract will be executed by the Department without the acceptable bonds and insurance certificates. No Contract will be considered effective until it has been fully executed by all parties thereto.

#### **103.7 Failure to Execute the Contract and Provide Bonds and Insurance Certificates**

- 1 Failure of the Contractor to execute the Contract and provide acceptable bonds and insurance certificates within 20 calendar days after the Contract is mailed by the Department is just cause for the annulment of the award and forfeiture of the proposal guaranty. If the award is annulled, the proposal guaranty becomes the property of the Department, not as a penalty, but as liquidated damages.

#### **103.8 Contractor's Liability Insurance**

- 1 Purchase and maintain, in a company or companies acceptable to the Department, such insurance as protects the Contractor from claims indicated below that may arise out of or result from the Contractor's operations under the Contract, whether such operations are performed by the Contractor or by a subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable:
  - Claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts that are applicable to be performed;



- Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- Claims for damages insured by usual personal injury liability coverage that are sustained by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor or by any other person;
- Claims for damages, other than to the work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- Claims for damages because of bodily injury, death of any person, or property damage arising out of the ownership, maintenance, or use of any motor vehicle; and
- Claims involving contractual liability insurance applicable to the Contractor's obligations under the indemnity provisions of the Contract.

2 To be acceptable to the Department, the insurer must be duly qualified to transact business under the laws of this State and conform to the requirements of Section 38-1-10 of the South Carolina Code of Laws.

3 Obtain insurance with the minimum limits of liability for the types of insurance indicated in the following table or otherwise required by statute, whichever is greater:

Type of Insurance	Limits of Liability
Worker's Compensation Insurance:	
Coverage A	Statutory
Coverage B -Employer's Liability:	
Per Accident	\$100,000
Disease, Policy Limit	\$500,000
Disease, Each Employee	\$100,000
Comprehensive General Liability:	
Each Occurrence	\$1,000,000
General Aggregate	\$2,000,000
Completed Operations	\$2,000,000
Business Automobile Liability:	\$1,000,000 per occurrence
Coverage includes: All Owned, Hired and Non-Owned Automobiles	
Umbrella Liability Coverage	\$5,000,000

4 Ensure that all policies contain the Per Project endorsement and name the SCDOT as an additional insured including coverage for Completed Opera-

tions as evidenced by endorsement CG 20 37(10 01) or its equivalent. The endorsement must be submitted to the Department as part of the Certificate of Insurance. Ensure that all policies waive rights of subrogation against the SCDOT, and that the Contractor's deductibles do not exceed \$250,000 without written consent of the SCDOT.

- 5 Provide Certificates of Insurance acceptable to the Department as verification that the required insurance has been obtained. Contracts will not be executed by the Department until such certificates are furnished. Ensure that these certificates contain a provision that coverage afforded under the policies cannot be cancelled or reduced until at least 30 days prior written notice has been given to the Department and that the certificates show the deductible amounts. Make certain that the policies are endorsed to reflect this requirement.

### **103.9 Deferral and Cancellation of Contract**

- 1 If before the Department receives a bid, awards a Contract, or executes contract documents, the low bidder is indicted (directly or through its officers, directors, employees, subsidiaries, affiliates, or parent corporation) for activities that if convicted, may result in its disqualification as a bidder pursuant to Department regulations; the Department reserves the right to pursue any or all of the following actions:
  - Defer the award and execution of the Contract until the criminal charges have been resolved.
  - Cancel the award without forfeiture of the proposal guaranty.
  - Re-bid the project upon any conviction or plea of guilty or nolo contendere.

If the criminal charges have not been resolved within 90 days of the indictment, the Department reserves the right to cancel the award without forfeiture of the proposal guaranty and to re-bid the project.

- 2 A low bidder indicted (directly or through its officers, directors, employees, subsidiaries, affiliates, or parent corporation) after the letting, but before either award or execution of the Contract, is entitled to promptly withdraw its bid without forfeiture of the proposal guaranty provided that such indicted Contractor is not eligible to re-bid the project before resolution of the criminal indictment should the Department elect to reject all other initial bids and re-advertise the project.

### **103.10 Mobilization**

- 1 Mobilization consists of the preparatory operations including: moving personnel and equipment to the project site; paying bond and insurance premiums; establishing offices, buildings, and other facilities necessary for work on the project; and all other preparatory work or costs incurred before beginning work on the project.

**103.11 Measurement and Payment**

1 Mobilization is paid at the lump sum price bid, which price and payment is full compensation for organizing and moving all forces, supplies, equipment and incidentals to the project site, regardless of the number of times such moves are made, and all preconstruction costs incurred after award of the Contract. The price and payment also includes costs for demobilization.

2 Payments for mobilization are included on the first and second construction estimates. Each payment is for 1/2 of the lump sum price for Mobilization, subject to the limits shown in the following table:

Contract Amount (CA)			Max. Payment in First Estimate	Max. Payment in Second Estimate
\$0	-	\$100,000	$CA \times 0.05$	$CA \times 0.05$
\$100,000 and above			$CA \times 0.025$	$CA \times 0.025$

3 If there is a remaining amount of the lump sum price for Mobilization after payments are made according to the table above, then the remaining amount is paid after all work on the project has been completed and accepted.

4 Completion of erection of materials processing plants, if any, is not required as a condition for the release of the second payment.

5 Partial payment for this item in no way acts to preclude or limit any of the provisions of partial payments otherwise provided for by the Contract or these specifications.

6 Payment for this item includes all direct and indirect costs and expenses required to complete the work.

7 Pay items under this section include the following:

Item No.	Pay Item	Unit
1031000	Mobilization	LS

## **SECTION 107**

### **LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC**

#### **107.1 Laws to be Observed**

- <sup>1</sup> Keep fully informed of, and at all times observe and comply with, all federal, state, and local laws, ordinances, regulations, and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work or that in any way affect the conduct of the work or the execution of any documents in connection therewith. Protect and indemnify the Department and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.
- <sup>2</sup> Execute and file such documents, statements, and affidavits required under any applicable federal or state law or regulation affecting the Contract or the prosecution of the work thereunder. Permit the examination of any records made subject to such examination by any federal or state law or by regulations promulgated thereunder by any state or federal agency charged with the enforcement of such law.

#### **107.2 Permits, Licenses, and Taxes**

- <sup>1</sup> Unless otherwise specified, obtain all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incident to the due and lawful prosecution of the work.

#### **107.3 Patented Devices, Materials, and Processes**

- <sup>1</sup> If the Contractor desires to use any design, device, material, or process covered by letter of patent or copyright, provide for such use by suitable legal agreements with the patentee or owner. However, whether or not such agreement is made, together with the Surety, indemnify and save harmless the Department, any affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material, process, trademark, or copyright in connection with the work agreed to be performed under the Contract. Indemnify the Department for all costs, expenses, and damages, which it may be obligated to pay because of any such infringement at any time during the prosecution of or after the completion of the work.

#### **107.4 Restoration of Surfaces Opened by Permit**

- <sup>1</sup> Any individual, firm, or corporation wishing to make an opening in the highway must secure a permit from the Department. The right to make openings, construct or reconstruct any utility service in the highway, or grant permits for it at any time is expressly reserved by the Department. The Contractor is not entitled to any damages either for the making of openings in the highway or for any delay occasioned thereby.

- 2 Allow parties bearing such permits, and only those parties, to make openings in the highway. When ordered by the RCE or RME, make all necessary repairs due to such openings in an acceptable manner. Such necessary work is paid for as Extra Work as provided for in these specifications and is subject to the same conditions as original work performed.

#### **107.5 Federal Participation**

- 1 When the United States government is to pay all or a portion of the cost of a project, observe the federal laws authorizing such participation and rules and regulations made pursuant to such laws. When any federal laws, rules, or regulations are in conflict with provisions of a federally assisted Contract, the federal requirements prevail. These requirements take precedence and are in force over and against any such conflicting provisions. The work is under the supervision of the Department, but subject to the inspection of the appropriate federal agency. Such inspection does not make the federal government a party to the Contract and does not interfere with the rights of either party hereunder.

#### **107.6 Sanitary Health and Safety Provisions**

- 1 Provide and maintain in a neat and sanitary condition such accommodations for the use of employees as necessary to comply with the requirements and regulations of the SCDHEC or of other authorities having jurisdiction.
- 2 Attention is directed to federal, state, and local laws, rules, and regulations concerning safety and health standards. Do not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to their health or safety.
- 3 Comply with requirements pertaining to noise controls on equipment.

#### **107.7 Air Pollution Control**

- 1 Comply with the South Carolina Air Pollution Control laws, regulations, and standards as they concern the related work included in the Contract. Copies of the requirements may be obtained from the SCDHEC Bureau of Air Quality Control. Comply with county, municipal, or other regulations pertaining to air pollution.

#### **107.8 Quarantine Regulations**

- 1 Comply with the quarantine regulations of the Clemson University Division of Regulatory and Public Service Programs and the USDA for plant and insect pest control as they pertain to Witchweed, Imported Fire Ant, or any other insect pest quarantine. Keep informed as to the counties or areas within the State in which quarantine is imposed.
- 2 Soil and soil moving equipment operating in regulated areas is subject to plant and insect quarantine regulations. In general, these regulations provide for cleaning soil from equipment before it is moved from regulated areas. Complete information may be secured from the Division of Regulatory and Public Service Programs at Clemson University and the USDA. Addresses

for the USDA are as follows:

3	USDA, APHIS, PPQ Room 513 Federal Building 334 Meeting Street Charleston, SC 29403	USDA, APHIS, PPQ 9600 Two Notch Road, Suite 10 Columbia, SC 29229
	USDA, APHIS, PPQ 1030 St. Andrews Road, Suite A-1 P. O. Box 21792 Columbia, SC 29210	USDA, APHIS, PPQ 1949 Industrial Park Road, Room 153 P. O. Box 762 Conway, SC 29526
	USDA, APHIS, PPQ 2102 Airport Road Greer, SC 29651	USDA, APHIS, PPQ P. O. Box 12212 Greenville, SC 29612
	USDA, APHIS, PPQ 180 Airport Road, Suite F Mullins, SC 29574	USDA, APHIS, PPQ I-95 & Hwy. 68 P. O. Box 707 Yemassee, SC 29945

#### 107.9 Public Convenience and Safety

- 1 At all times, conduct the work in such a manner as to reasonably provide for the safety and convenience of the traveling public and of the residents along and adjacent to the highway and to offer the least practicable obstruction to the flow of traffic. This provision does not require the Contractor to provide for the safety and convenience of the traveling public for those portions of the highway or roadway that are not within the scope and the work being performed by the Contractor as defined by the Contract. Do not close any bridge or culvert or any portion of the road to traffic until permission has been granted by the RCE.
- 2 When materials and equipment are stored within the right-of-way, place them to cause the minimum obstruction to the traveling public. Conform to the requirements for storage of material equipment in **Subsection 601.2.1**.

#### 107.10 Construction of Bridges Over or Adjacent to Navigable Waters

- 1 Conduct all work over, on, or adjacent to navigable waters so that free navigation of the waterways is not interfered with and that the existing navigable depths are not impaired except as allowed by permit issued by the U.S. Coast Guard and/or the U.S. Army Corps of Engineers as applicable.
- 2 Provide and maintain such temporary navigation lights and signals as may be required by U.S. Coast Guard regulations for the protection of navigation. When, in the judgment of the RCE, the construction has reached a point where such action should be taken, promptly clear the channel or channels through the structure of all falsework, piling, or other obstructions placed

therein to the satisfaction of the U.S. Coast Guard. Complete such clearing before the acceptance of the project.

#### **107.11 Traffic Control**

- 1 The *FHWA Manual on Uniform Traffic Control Devices (MUTCD)* has been adopted as the official source for traffic control guidelines for SCDOT policies and procedures on installing and maintaining signs, markings, and signals in South Carolina. The *MUTCD* may be viewed online at the FHWA website at <http://mutcd.fhwa.dot.gov>. Execute the item Traffic Control as required by the Specifications, the Plans, and the current edition of the *MUTCD* adopted by the Department. Provide, erect, and maintain all necessary barricades, warning signs, lights, temporary signals, temporary striping, and other traffic control devices as required by the Specifications, the Plans, and the *MUTCD*. Perform this work without compensation unless bid items for such work are included in the Contract. The Contractor is not required to provide traffic control on any portion of the highway outside the scope of its work.
- 2 The Department will erect and maintain signs on detours or temporary routes that the Contractor is not required to maintain. Provide and maintain such signs at and along all detours for which the Contractor is responsible. Maintain and relocate, where necessary, all regulatory, warning, and guide signs in place of those that may be erected by the Department within the limits of the project.
- 3 The work as defined in the Contract is considered to have begun with the placing of permanent construction signs by the Contractor. The work is considered completed when the RCE authorizes the Contractor to remove the permanent construction signs and the Contractor does so. The RCE may permit the Contractor to omit permanent construction signs on low volume roads or streets where the work will be completed within the daylight hours of a single day. However, if the permanent construction signs are omitted, install temporary signs while the work is in progress.
- 4 Ensure that all barricades, signs, and traffic control devices conform to the requirements of the *MUTCD*. All signs in the *MUTCD* have been given an identification number, and a full-scale drawing of each sign is available for sign fabricators from the Director of Traffic Engineering.

#### **107.12 Measurement and Payment for Traffic Control**

- 1 The item Traffic Control is paid on a lump sum (LS) basis; and therefore, there is no specific measurement for this item. Payment is made on a percentage complete basis as specified in **Subsection 601.6**.
- 2 The payment for Traffic Control does not include payment for permanent construction signs, temporary concrete barrier, portable terminal impact attenuators, changeable message signs, pavement markings, temporary pavement markers, or any item specified as a bid item with a contract unit bid price in the Contract.

- 3 The pay item for Traffic Control is as follows:

Item No.	Pay Item	Unit
1071000	Traffic Control	LS

### 107.13 Correcting Low Shoulder Conditions

#### 107.13.1 Identifying Existing Low Shoulders Before the Commencement of Work

- 1 Before the placement of the permanent construction signs and before the work commences on a resurfacing project, together with the RCE inspect the roads within the project to identify existing low shoulder conditions. The Contractor is responsible for placing low shoulder signs at the identified locations and for correcting the existing low shoulder conditions where possible by bringing in and spreading borrow material before starting the resurfacing work. Agree with the RCE on the time allowed to perform work on correcting the existing low shoulder conditions. The RCE will provide the Contractor with a written list of the specific areas identified as requiring low shoulder signs and additional work to correct low shoulder conditions and will also specify the time allowed to complete the work. The Contractor is paid for this work at the contract unit bid price for Borrow Excavation and Permanent Construction Signs in accordance with the requirements of **Sections 203** and **605** respectively.

#### 107.13.2 Maintenance of Low Shoulder Signs During the Project

- 1 Maintain all low shoulder signs within the termini of the project until the low shoulder conditions have been corrected to the satisfaction of the RCE.

#### 107.13.3 Work Related to Existing Low Shoulders

- 1 Within 3 working days of completion of the low shoulder correction work, the RCE will inspect the prescribed work and, if necessary, direct in writing, the placement of additional low shoulder signs or borrow material before the Contractor can commence paving operations. Once this low shoulder work is complete, no further corrective action is required by the Contractor until the road surface is paved unless the Contractor is directed to do so by the RCE.

#### 107.13.4 Correction of Low Shoulders Created by Resurfacing

- 1 Upon completion of the final riding surface on each road, begin correcting low shoulder conditions within 3 days. Make reasonable efforts, weather permitting, to continue the work until the low shoulder conditions are eliminated to the satisfaction of the RCE. When necessary, correct low shoulder conditions greater than 2 inches by placing borrow material against the edge of the pavement or by such other method as directed by RCE.
- 2 When within 3 days of completing shoulder work on a roadway, notify the RCE. Within 3 working days of such notification, the RCE will inspect the prescribed work and, if necessary, will direct in writing the placement of addi-



tional borrow material.

#### **107.14 Railway/Highway Provisions**

- 1 If the Plans require that materials be hauled across the tracks of any Railway Company, arrange with the Railway Company for new crossings if required or for the use of existing crossings not within the system of public roads.
- 2 Perform all work on the railroad right-of-way at such times and in such manner as not to interfere with the movement of trains or traffic upon the track of the Railway Company. Use all care and precaution in order to avoid accidents, damage, delay, or interference with the Railway Company's trains or other property.
- 3 Reimburse the Railway Company directly under terms arranged with them for all charges by the Railway Company for the construction or use of new or existing private crossing and their subsequent removal and all charges for services of railroad personnel at such crossings. Make certain that all such payment is made to the Railway Company before the acceptance of the project.
- 4 Conduct all operations that occur on or over the right-of-way of any Railway Company fully within the rules, regulation, and requirements of the Railway Company and in accordance with any agreement made between the Department and the Railway Company, which is made a part of the Contract.

#### **107.15 Use of Explosives**

- 1 When the use of explosives is necessary for the prosecution of the work, exercise the utmost care not to endanger life or property, including the new work. The Contractor is responsible for all damage resulting from the use of explosives. Store all explosives in a secure manner in compliance with all laws, ordinances, and regulations.
- 2 Comply with all laws and ordinances, as well as with Title 29CFR, Part 1926, Safety and Health Regulations for Construction (OSHA), whichever is the most restrictive with respect to the use, handling, loading, transportation, and storage of explosives and blasting agents.
- 3 Notify each public utility company having structures in proximity to the work site of the intention to use explosives and give such notice sufficiently in advance to enable the companies to take such steps as they deem necessary to protect their property from injury. Such notice does not relieve the Contractor of responsibility for any damage resulting from blasting operations.

#### **107.16 Preservation and Restoration of Property, Trees, Monuments, etc.**

- 1 Do not enter upon private property for any purpose without first obtaining permission. The Contractor is responsible for the preservation of all public and private property, trees, crops, monuments, highway signs and markers, fences, etc. along and adjacent to the roadway. Use every precaution neces-

sary to prevent damage or injury thereto. Use suitable precaution to prevent damage to pipes, conduits, underground structures, poles, wires, cables, and other overhead structures, whether shown on the Plans or not. Protect from disturbance or damage all land monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and do not remove them until directed. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work or in consequence of the non-execution thereof on the part of the Contractor, restore, at no additional expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring as may be directed or make good such damage in an acceptable manner. If the Contractor fails to restore such property, or make good such damage or injury, the RCE may, upon 48 hours notice, proceed to repair, build, or otherwise restore such property as may be deemed necessary, and the cost thereof is deducted from any monies due, or that may become due the Contractor under the Contract. If no such monies are available, the expenses so incurred are charged against the Contractor's surety.

- 2 If it is necessary to disturb or rearrange utility service connections or other property belonging to others in order to adapt such property to the new work, cooperate with the property owners in effecting the rearrangement by giving advance notice of the necessity for such rearrangement to the owners, providing temporary supports during the rearrangement, installing utility supporting devices in concrete formwork, and permitting access by the owners' personnel.

#### **107.17 Forest Protection**

- 1 In carrying out work within or adjacent to state or national forests, comply with all the regulations of the state or federal authority having jurisdiction governing the protection of forests and the carrying out of work within forests. Observe all sanitary laws and regulations with respect to the performance of work in forest areas. Keep the areas in an orderly condition and dispose of all refuse in accordance with regulations. Obtain permits for the construction and maintenance of all construction camps, stores, warehouses, latrines, cesspools, septic tanks and other structures in accordance with the requirements of the forest supervisor. Take all reasonable precautions to prevent and suppress forest fires. Abide by such rules and instructions as the forest officers may prescribe as to the time and place for burning and for fire control generally. Do not cut roadside timber outside the roadway, nor mar the scenic values of the right-of-way for any purpose whatsoever without consent of the RCE, who must obtain permission from the proper forest authority. The responsibility of the Contractor for damages as provided for in **Subsection 107.16** applies in case of damages caused by the escape of fire.

#### **107.18 Responsibility for Claims, etc.**

- 1 Indemnify and save harmless the County, the State, the Department, its officers, agents, and employees, as well as the City, the Town or other mu-

municipality in which the work is performed and all of their officers, agents, and employees from all suits or claims of any character brought because of any injuries or damage received or sustained by any person, persons, or property, in whole or in part, because of the operations of the Contractor or any subcontractor or sub-subcontractor; or because of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials or workmanship in constructing the work; or because of any act or omission, neglect, or misconduct of the Contractor or any subcontractor or sub-subcontractor; or because of any claims or amounts recovered from any infringements of patent, trademark or copyright; or for failing to pay, when and as due, all bills and other legitimate charges, including lawful claims for labor performed or materials, equipment, and supplies furnished for use in and about the construction of the work under the Contract; or from any claims or amounts arising or recovered under the Workmen's Compensation Act, or any other law, ordinance, or decree. This indemnity obligation is intended to apply even if the County, the State, the Department, and their officers, agents, and employees are negligent and in part responsible for the injuries or damages. This indemnity obligation is not intended to apply if the County, the State, the Department, and their officers, agents and employees are solely responsible for the injuries or damages. Money due the Contractor under and by virtue of the Contract and is considered necessary by the Department may be retained for the use of the Department, or in case no money is due, the Contractor's Surety is held responsible until such suit or suits, action or actions, or claim or claims for injuries or damages as aforesaid have been settled and suitable evidence to that effect has been furnished the Department; except that money due the Contractor is not withheld when the Contractor produces satisfactory evidence that it is adequately protected by public liability and property damage insurance.

#### **107.19 Third Party Liability**

- <sup>1</sup> It is not intended by any of the requirements of any part of these specifications to make the public or any member thereof a third party beneficiary hereunder, or to authorize anyone who is not a party to a contract entered into pursuant to these specifications to maintain a suit for personal injury or property damage otherwise than as authorized and provided by law.

#### **107.20 Opening of Section of Highway to Traffic**

- <sup>1</sup> When, in the opinion of the RCE, any bridge, roadway, or portion thereof is in acceptable condition for travel, open it to traffic as directed. Such opening is not held to be in any way an acceptance of the bridge, roadway, or any part of it, or as a waiver of any of the provisions of the Contract. Pending completion and final acceptance thereof, perform any necessary repairs or renewals due to any cause other than ordinary wear and tear at no additional expense. If the construction of the project has not been completed and weather conditions require suspension of the laying of the surface courses or other work, open the incomplete portions of the work to traffic when directed by the RCE, and carry on maintenance of such incomplete sections. Make any repairs

necessary to incomplete sections without any additional compensation.

#### **107.21 Contractor's Responsibility for the Work**

- 1 Until final acceptance of the work by the RCE as evidenced in writing, the Contractor has the charge and care thereof. Take every precaution against injury or damage to any part thereof by the action of the elements or from any other cause whether arising from the execution or from the non-execution of the work. Unless otherwise provided in these specifications, rebuild, restore, and make good all injuries or damages to any portion of the work occasioned by any cause before final acceptance and bear the expense thereof.
- 2 The Contractor is responsible to the Department for the acts and omissions of its employees, subcontractors and their agents and employees, and all other persons performing work under a contract with the Contractor or any of its subcontractors.
- 3 In the case of suspension of work from any cause whatever, the Contractor is responsible for all materials and unfinished work. Properly store materials; provide suitable drainage of the roadway; continue the servicing of barricades, lights, signs, and other devices; and erect necessary temporary structures without additional compensation.

#### **107.22 Contractor's Responsibility for Utility Property and Services**

- 1 Before commencing work, arrange to protect the properties of railway, telegraph, telephone, power companies, or other utility property from damage.
- 2 Cooperate with the utility owners in the removal and rearrangement of any underground or overhead utility lines or facilities to minimize interruption to service and duplication of work by the utility owners.
- 3 If utility services are interrupted because of accidental breakage, promptly notify the proper authority and cooperate with them until service has been restored. Do not commence work around fire hydrants until provisions for continued service have been made and approved by the local fire authority.
- 4 If a permit is issued to a city, county, or other governmental unit for the installation of conduits, poles, or other appurtenances for artificial lighting of the structure, it may be necessary or desirable to revise the Plans or make structural changes as needed to accommodate such installation, and the provisions of **Subsection 104.2** apply to any changes in quantities of work.

#### **107.23 Furnishing Right-of-Way**

- 1 The Department is responsible for the securing of all rights-of-way that it deems necessary in advance of construction. Any exceptions are indicated in the Bid Proposal and Contract.

#### **107.24 Personal Liability of Public Officials**

- 1 In carrying out the provisions of these specifications or in exercising power or authority granted to them by or within the scope of the Contract, there is no liability upon the Director, RCE, or Department employees who are their au-

thorized representatives either personally or as officials of the State; it being understood that in all such matters, they act solely as agents and representatives of the State.

#### **107.25 No Waiver of Legal Rights**

- 1 Upon completion of the work, the Department will expeditiously make final inspection and notify the Contractor of acceptance. Such final acceptance, however, does not preclude or estop the Department from correcting any measurement, estimate, or certificate made before or after completion of the work; nor is the Department precluded or estopped from recovering any overpayments that may have been made; nor is the Department precluded from recovering from the Contractor or its Surety, liquidated damages because of failure to fulfill its obligations under the Contract. A waiver on the part of the Department of any breach of any part of the Contract is not held to be a waiver of any other subsequent breach. Neither the inspection, nor acceptance by the Department or representative of the Department, nor payment for or acceptance of the whole or part of the work, nor extension of time, nor possession taken by the Department, operates as a waiver of any portion of the Contract or of any power herein reserved, or of any right to damages.

#### **107.26 Environmental Protection and Water Pollution Control**

- 1 Comply with all federal, state, and local laws and regulations controlling pollution of the environment. Take the necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuel, oils, bitumens, chemicals, soil sedimentation, or other harmful materials and prevent pollution of the atmosphere from particulate and gaseous matter.
- 2 At the Preconstruction Conference or before the start of construction, submit in writing to the RCE for approval the schedule for accomplishment of temporary and permanent erosion control work as is applicable for clearing and grubbing, grading, bridges and other structures in watercourses, and paving. Do not allow the amount of surface area of erodible earth material exposed at one time by clearing and grubbing, excavation, borrow, or fill, to exceed 750,000 square feet without prior approval by the RCE. Consider the location of the project, nature of the soil, topographic features, and proximity to watercourses when setting such limitations.
- 3 Conduct operations in a manner consistent with good erosion control practices to minimize soil erosion and to the extent practicable, prevent sediment from leaving the site. Take whatever measures necessary throughout the life of the project to control erosion and to prevent the deposition of sediment into adjacent rivers, streams, wetlands, and impoundments. Carry out temporary and permanent erosion control measures that control erosion and sedimentation in conjunction with clearing and grubbing and earthwork operations.
- 4 Provide temporary erosion and sediment control measures such as berms, dikes, slope drains, sedimentation basins, and temporary seeding until permanent drainage facilities and erosion control features are completed and operative.

- 5 Unless otherwise specified in the Contract, temporary erosion control devices or measures with the exception of sedimentation basins, fiberglass roving, sediment tubes, silt fence, fabric for slope protection, terraces, sectional drains, and temporary seeding are not paid for directly, but are considered as a subsidiary obligation of the Contractor under various items of contract work.
- 6 When included in the Contract, incorporate permanent erosion control devices or measures such as culvert pipe, terraces, gutters, asphalt curb, sectional drains, permanent slope drains, riprap, and the establishment of permanent vegetation (seeding) in the construction with the least possible delay. Seed cut and fill slopes as the excavation proceeds to the extent considered by the RCE as desirable or practicable in conformance with the applicable requirements of **Section 810**.
- 7 Once work begins on a cut or fill section, grade it to the typical section with the least amount of delay and promptly install all erosion control measures.
- 8 Conform to the following practices and controls:
  - A. When the material is excavated from pits, control erosion of the pit site both during and after completion of the work such that erosion is minimized and sediment does not enter streams, wetlands, or other bodies of water. Locate and construct waste or disposal areas and haul roads in a manner that keeps sediment from entering streams.
  - B. Do not permit fording of live streams. Use temporary bridges or other structures whenever an appreciable number of stream crossings are necessary. Unless otherwise approved in writing by the RCE, do not operate mechanized equipment in live streams.
  - C. When work areas are located adjacent to live streams, perform the work in such a manner to prevent sediment from entering a flowing stream.
  - D. Clear all waterways of falsework, piling, debris, or other obstructions placed during construction operations and are not a part of the finished work as soon as practicable.
  - E. Do not discharge pollutants such as fuels, lubricants, bitumens, raw sewage, and other harmful materials into or near rivers, streams, impoundments, or natural or man-made channels leading thereto. Do not allow wash water or waste from concrete mixing operations to enter live streams.
  - F. Comply with applicable regulations of agencies and statutes relating to the prevention and abatement of pollution in the performance of the Contract.
- 9 In addition to the requirements set forth above, comply with specific project limitations and requirements included in the Contract.

#### **107.27 Hazardous and/or Toxic Waste**

- 1 If during construction operations any abnormal condition that may indicate the presence of a hazardous and/or toxic waste in the area is encountered or

exposed, immediately discontinue work and notify the RCE.

- 2 Abnormal conditions include, but are not limited to, the following:
- presence of asbestos,
  - presence of barrels,
  - discolored earth, metal, wood, etc.,
  - obnoxious or unusual odors,
  - visible fumes,
  - excessively hot earth,
  - smoke, or
  - any other condition appearing abnormal could be a possible indication of hazardous and/or toxic waste.

Treat the conditions with extraordinary caution.

- 3 Do not resume operations until so directed by the RCE.
- 4 If a building is razed, the Contractor is responsible for securing the necessary permits in accordance with the SCDHEC requirements.
- 5 Where the Contractor performs necessary work required to dispose of these materials, payment is made at the contract unit price for items applicable to such work or payment is made in accordance with **Subsection 104.5** or **109.5**. Dispose of the hazardous and/or toxic waste in accordance with the requirements and regulations of the SCDHEC. Should the disposition of waste material require special procedures by certified personnel, the Department will arrange with qualified persons to dispose of the material.

## **DIVISION 200**

### **EARTHWORK**

#### **SECTION 201**

##### **CLEARING AND GRUBBING**

###### **201.1 Description**

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for clearing and grubbing of all vegetation, debris, and obstructions within the limits of the roadway, right-of-way, ditch and channel change areas, or other easement areas, except for such objects that are designated to remain, or are to be otherwise removed in accordance with the Plans or other sections of these specifications.

###### **201.2 Materials**

- 1 None specified.

###### **201.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

###### **201.4 Construction**

###### **201.4.1 General**

- 1 Perform clearing and grubbing work before other construction work in the same general area is started. The RCE will establish right-of-way lines and construction lines and designates all trees, shrubs, plants, and other items to remain. Preserve from injury or defacement all natural terrain, vegetation, and objects designated to remain. Repair or replace, as directed by the RCE and at no cost to the Department, natural terrain, vegetation, and objects designated to remain that are damaged by the Contractor's operations or provide compensation as determined by the RCE for such damage.
- 2 Perform clearing and grubbing work by removing and disposing of all vegetation, trees, shrubs, stumps, rubbish, logs, roots, foundations, framework, utility connections not in service, fences, signs, posts, portions of structures not otherwise provided for, and other objectionable material indicated or considered necessary to satisfactorily complete the work. If trees are to remain, carefully trim trees that overhang the roadway to give a clear height of 18 feet over the roadway. In all cases, clear and grub the entire right-of-way at road intersections, traffic interchanges, and bridge sites indicated on the Plans. When the NPDES line is shown on the Plans, extend clearing and grubbing operations to that line.



- 3 On Contracts for Interstate grading projects, unless otherwise provided, clear and grub a minimum distance of 30 feet from each edge of the proposed pavement along both lanes and along the legs of interchanges. This is in addition to clearing and grubbing within the construction lines.
- 4 In areas to be cleared, remove trees that are considered merchantable timber. If required by the RCE, neatly saw trees of value that are designated for removal into merchantable lengths of not less than 5 feet and pile neatly at points within the right-of-way or in the vicinity of the project designated by the RCE. If the right-of-way agreement gives the owner the rights to the timber, the Contractor is responsible for the timber for 30 days after it is available for removal. If the owner does not claim and remove the cut timber from the project within this time, remove and dispose of the timber away from the site.
- 5 In areas to be excavated or where embankments are to be constructed, clear and grub the ground of all living or dead trees, brush, roots, weeds, leaves, and all other objectionable material. In areas where embankments are to be constructed to a height of 5 feet or less, clear and grub the area of all stumps, unless otherwise indicated on the Plans or allowed by the RCE. If stumps are allowed to remain under embankments, do not allow them to extend more than 8 inches above the ground line or low water level.
- 6 Except in areas to be excavated, backfill all stump holes and other holes from which obstructions are removed with suitable and thoroughly compacted material.
- 7 In areas designated for clearing, remove and dispose of (or salvage if required by the RCE) fences, posts, signs, structures, and other obstructions that interfere with the work and are not otherwise specified to be removed, adjusted, or relocated.

#### **201.4.2 Clearing and Grubbing within Right-of-Way**

- 1 Where clearing and grubbing within right-of-way is required, clear and grub the entire area within the right-of-way lines. Do not cut, damage, or destroy timber beyond the right-of-way lines unless the Plans or the Special Provisions provide for clearing such areas as necessary to complete the work. Do not remove or damage trees, plant specimens, or other objects considered valuable by adjacent property owners or that are aesthetically desirable and are designated by the RCE to remain.

#### **201.4.3 Clearing and Grubbing within Roadway**

- 1 Where clearing and grubbing within roadway is required, clear and grub the entire area inside of roadway construction lines. Where cut and fill slopes are shown on the Plans, extend clearing and grubbing beyond the roadway construction lines as necessary. Do not cut, damage, or destroy timber beyond the roadway construction lines unless the Plans or Special Provisions provide for clearing such areas as necessary to complete the work. Exercise care when clearing and grubbing within roadway to avoid cutting, damaging, or destroying any timber outside of the construction lines, except as directed by

the RCE.

- 2 Where clearing and grubbing within roadway is required, clearing of additional areas within the right-of-way may be directed by the RCE. Such work may include clearing and disposing of damaged limbs, trees, and other debris within the right-of-way.

#### **201.4.4 Clearing and Grubbing at Bridge Sites**

- 1 Where clearing and grubbing within the right-of-way is required at a bridge site, clear and grub the entire right-of-way at the bridge site.
- 2 Where clearing and grubbing within the roadway is indicated at a bridge site, clear by cutting all trees, stumps, etc., to within 8 inches of the ground or to low water in the full width of the right-of-way for a distance of 75 feet beyond the beginning and end of the proposed bridge. Grub the area at proposed bridge site by removing and disposing of all logs, vegetation, stumps, brush, rubbish, and other objectionable material within an area bounded by lines 5 feet beyond the outside edges of the proposed bridge and 10 feet beyond the beginning and end of the proposed bridge.
- 3 Clear, but do not grub the area to the Bridge Construction Access Line as designated on the Plans. Also, clear, but do not grub additional areas as needed for construction or safety reasons or as directed by the RCE.
- 4 Unless otherwise provided in the Contract or on the Plans, clearing and grubbing of the right-of-way is not required on bridge widening projects.

#### **201.4.5 Clearing and Grubbing of Ditches**

- 1 Where clearing and grubbing of ditches is indicated, clear and grub the entire area inside of the ditch or channel relocation construction lines or as indicated on the Plans or as directed by the RCE.

#### **201.4.6 Removal and Disposal of Clearing and Grubbing Material**

- 1 Remove all materials created by the clearing and grubbing operation from the project by burning or otherwise disposing of the removed materials as specified or directed. Perform all burning under constant care of competent guards and in accordance with applicable laws and ordinances and as provided in **Subsection 107.7**. Stumps and logs may be disposed of by depositing them off the right-of-way where they are not visible from any public road. Use only disposal sites approved by the RCE. At no cost to the Department, obtain disposal sites and secure any applicable federal, state, county, or municipal permits that are required. Certify in writing to the RCE that all permit requirements have been met before placing any material in a disposal area.
- 2 Re-cut any brush, weeds, and other designated vegetation immediately before final inspection if so instructed by the RCE.

#### **201.5 Measurement**

- 1 The quantity for the pay item Clearing and Grubbing within Roadway or Clearing and Grubbing within Right-of-Way is measured in accordance with

the pay unit specified in the Contract. If the pay unit specified is acre, the quantity is the actual surface area over which clearing or grubbing operations were performed and is measured by the acre (ACRE), complete, and accepted by the RCE. If the pay unit is lump sum (LS), no specific measurement is required or made.

- 2 The quantity for Clearing and Grubbing of Ditches is the actual area, based on field stakes, in ditches or channel changes outside the right-of-way on which the work was performed and is measured by the acre (ACRE), complete, and accepted by the RCE.
- 3 The removal of weeds, plant stalks regardless of size or density, loose rock, and small, scattered trees is not considered clearing and grubbing. No measurement or payment is made for such work.

#### **201.6 Payment**

- 1 Payment for the accepted quantity for Clearing and Grubbing within Roadway, Clearing and Grubbing within Right-of-Way, or Clearing and Grubbing Ditches, measured in accordance with **Subsection 201.5**, is determined using the contract unit bid price for the applicable item. Payment is full compensation for performing the clearing and grubbing work as specified or directed and includes proper removal and disposal of timber and debris and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 There is no payment for clearing and grubbing of pits furnished by the Contractor. The expense of clearing and grubbing the pits is considered included in the contract unit bid price for Unclassified Excavation or Borrow Excavation, etc., as applicable.
- 3 If the Contract does not include an item for clearing and grubbing work, all such work is considered incidental to the various items of work in the Contract. No separate or additional compensation is made for this work.
- 4 When obtaining rights-of-way for certain projects, the Department may acquire ownership of the timber on the property. In these instances, the Contract includes a credit for the value of the merchantable timber in the contract unit bid price for clearing and grubbing items, and the Contractor assumes the title to the timber and is responsible for removal of such timber.
- 5 Payment for each item includes all direct and indirect costs and expenses required to complete the work in an acceptable manner.

201.6

201.6

- <sup>6</sup> Pay items under this section include the following:

Item No.	Pay Item	Unit
2011000	Clearing and Grubbing within Right-of-Way	LS
2011001	Clearing and Grubbing within Right-of-Way	ACRE
2012000	Clearing and Grubbing within Roadway	LS
2012001	Clearing and Grubbing within Roadway	ACRE
2013050	Clearing and Grubbing Ditches	ACRE

## SECTION 202

### REMOVAL OF STRUCTURES AND OBSTRUCTIONS

#### 202.1 Description

- 1 This section contains specifications for the material, equipment, construction, measurement, and payment for the removal, wholly or in part, and satisfactory disposal of buildings, fences, guardrail, structures, old pavements, abandoned pipelines, underground storage tanks, and other obstructions that are not designated or permitted to remain, except for the obstructions removed and disposed of under other items in the Contract.
- 2 This subsection also contains specifications for the salvaging of all materials and backfilling of the trenches, holes, and pits.

#### 202.2 Materials

- 1 None specified.

#### 202.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### 202.4 Construction

##### 202.4.1 General

- 1 Raze and dispose of all buildings, foundations, structures, guardrail, fences, and any other obstructions that are on the right-of-way and are not designated to remain. Include structures (buildings) to be cut off at the right-of-way line and structures (buildings) and appurtenances located entirely outside the right-of-way limits when such items are indicated on the Plans as items to be demolished.
- 2 Due to the possibility of encountering asbestos, secure a permit in accordance with SCDHEC regulations anytime a structure is to be razed. Inspect the facilities identified in the Contract as a Removal and Demolition item for the presence of asbestos before the submission of the bid. If asbestos is located, the provisions of **Subsection 107.27** apply. Direct questions about the permit to the SCDHEC Bureau of Air Quality.
- 3 When structures (buildings) and obstructions are designated on the Plans to be cut off at a right-of-way line, produce a completed job of first class workmanship and remove and dispose of all debris and appurtenances, including utility connections from the portion of the structure within the right-of-way. Adequately support the portion of the structure remaining outside the right-of-way. Unless otherwise provided, re-facing is not required.

- 4 As directed by the RCE, remove, cap, or seal utility service connections such as sewers, water lines, electrical connections, gas lines, etc. left in place after the removal of the structure (buildings) and obstructions, at the right-of-way line, the edge of the existing pavement, or at the existing mains. Carefully store and protect utility materials unless the owner does not desire them. In this case, the material becomes the property of the Contractor.
- 5 When structures (buildings) and other obstructions are designated on the Plans to be cut off at the right-of-way or to be removed in their entirety, and unless otherwise provided, the structure (building) and all appurtenances and the material removed in performing this work becomes the property of the Contractor except utility materials as provided above. Take proper allowance for the value of the salvageable materials in the price bid for the item involved.
- 6 Destroy unusable perishable material. Unless otherwise permitted, dispose of non-perishable material outside the limits of view from the traveled roadway with written permission of the property owner on whose property the material is placed. Furnish copies of all agreements with property owners to the RCE. Without cost to the Department, obtain disposal sites and secure any applicable federal, state, county, or municipal permits as required. Certify in writing to the RCE that all permit requirements have been met before placing any material in a disposal area.
- 7 Remove unsuitable material from wells, cisterns, septic tanks, other tanks, basements, and cavities. Outside of construction limits, remove foundations left by structure removal to a depth of not less than 1 foot below natural ground. Within construction limits, remove foundations to a depth of not less than 2 feet below subgrade elevation. Break up basement floors to prevent them from holding water. Backfill basements or cavities left by structure removal as directed with material approved by the RCE and compact in accordance with the provisions of **Subsection 205.4.6** unless otherwise directed.
- 8 Where a structure or obstruction has been previously removed and the existing utility connections have not been terminated and capped, comply with the above provisions for utility service connections.
- 9 Comply with the requirements in the *SCDOT Construction Manual* including notifying the SCDOT Director of Communications before performing any blasting operations. Before blasting in any stream, river, or lake coordinate plans and operations with the local SCDNR District Fisheries Biologist and District Law Enforcement Captain.

#### **202.4.2 Removal and Disposal of Bridges, Culverts, and Other Drainage Structures**

- 1 Do not remove bridges, culverts, or other drainage structures in use by traffic until satisfactory arrangements have been made to accommodate traffic. Adequately shore any excavation adjacent to the structure or to its approaches to avoid damage to them or to traffic.

- 2 Before demolition of any bridge structure, coordinate with the RCE to complete SCDHEC form entitled: *Notification of Demolition and Renovation*. After the RCE and the Contractor have signed the completed form, attach a copy of the Asbestos Investigation Report and submit the completed form and report at least 10 working days before demolition begins to the following address:

Manager, Asbestos Section  
SC Department of Health and  
Environmental Control  
2600 Bull Street  
Columbia, SC 29201
- 3 Also, at least 10 working days before work begins, submit a *Demolition Plan* prepared by a Professional Engineer registered in South Carolina to the RCE for review and acceptance for structures over or adjacent to highways, navigable waters, railroads, and other public areas.
- 4 Unless otherwise directed, remove the substructures of existing structures within the stream down to the natural stream bottom. Remove those parts outside of the stream, including land structures, down 2 feet below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits of a new structure, remove them as necessary to accommodate the construction of the proposed structure.
- 5 Unless otherwise specified on the Plans and/or in the Contract, the material in the structure removed becomes the property of the Contractor. Remove this material from the work site before completion of the work, and take proper allowance for its salvage value in the price bid for the item involved. If the Plans or the Special Provisions provide for the material in the structure removed to remain the property of the Department, carefully dismantle steel or wood structures without unnecessary damage. Match-mark steel members and store all salvaged material as directed by the RCE.
- 6 Before placing any new work, complete blasting or other operations necessary for the removal of an existing structure or obstruction that may damage the new construction.
- 7 If the structural components designated for removal and disposal contain lead-based paints, comply with all applicable federal, state, and municipal requirements for lead as waste; for lead in the air, water, and soil; and for worker health and safety.
- 8 Remove and dispose of concrete or brick box culverts or arches that are designated on the Plans to be removed, but do not interfere or conflict with the placing of a new structure, to a point 2 feet below the bottom of the top slab or to a point where the sidewalls are a minimum of 3 feet below the subgrade elevation. If culverts or arches interfere or conflict with the new structures, remove them in their entirety or to the limits shown in the Plans.
- 9 Unless otherwise provided, all concrete removed becomes the property of the Contractor.

### **202.4.3 Removal and Disposal of Pipe and Tile Drains**

- 1 When noted on the Plans or when required by the RCE, remove existing pipes, pipe arches, tile drains, or other drainage devices located within the extreme limits of the project, including bridge sites. Remove pipe and tile in a careful manner and neatly store them at locations designated by the RCE unless it is to be re-laid as a part of the Contract. Any damage to pipe or tile during removal and storage because of negligence or improper handling or storing methods is the responsibility of the Contractor. Properly dispose of pipe removed and designated by the RCE as having no value.
- 2 Remove pipe or tile if any part of which conflicts with the installation of a new drainage structure. If not otherwise specified, include the cost of removal in the contract price bid for the new structure. Likewise, no direct payment will be made for the removal of pipe or tile that is to be re-laid at the same or other locations on the project.

### **202.4.4 Removal of Existing Guardrail**

#### **202.4.4.1 General**

- 1 Remove bolts securing existing guardrail and remove guardrail elements. Remove all materials, including hardware, from the roadway immediately so that it does not create an obstacle for the traveling public. Place this material behind a completed section of guardrail or store it neatly in an area at least 30 feet from the travelway unless otherwise specified. The removed guardrail components become property of either the Department or the Contractor as stated in the Contract. Backfill potholes with suitable compacted material.

#### **202.4.4.2 Guardrail that Remains the Property of the Department**

- 1 If in accordance with the Contract the existing guardrail removed remains the property of the Department, store it within the limits of the project and protect it until it is removed from the project by the Department or for a period of 30 days, whichever comes first.

#### **202.4.4.3 Guardrail that becomes the Property of the Contractor**

- 1 If in accordance with the Contract the existing guardrail removed becomes the property of the Contractor, store it safely away from the traveling public until it is removed from the project.

### **202.4.5 Removal and Disposal of Pavements, Sidewalks, and Curbs**

- 1 If so designated, remove and dispose of the following items unless such material is suitable for use in constructing embankments: existing Portland cement concrete, brick, or stone pavements with or without asphalt overlays, concrete, brick or stone sidewalks, concrete gutter or integral curb and gutter curb, asphalt concrete pavement, or asphalt curb. If suitable and approved by the RCE, this material may be used to construct embankments.
- 2 As directed by the RCE, sawcut pavement as necessary to produce a uniform line between the pavement to be retained and to be removed.



- 3 When the Plans indicate that concrete gutter is to be retained as a base and its integral curb removed, remove the curb to the top elevation of the gutter using methods approved by the RCE that prevents damage to or displacement of the retained gutter.

#### **202.4.6 Removal and Disposal of Underground Storage Tank (UST)**

- 1 When noted on the Plans or directed by the RCE, remove and dispose of all underground storage tanks and any associated contaminated soil. Conduct the work in accordance with the applicable SCDHEC regulations.
- 2 Secure the landowner's signature on the *Tank Ownership Closure Form* and submit it to the SCDHEC as required by the following regulation:  
Underground Storage Tank Control Regulations R.61-92, Part 280: promulgated pursuant to Section 44-2-50 of the 1976 South Carolina Code of Laws and enacted March 23, 1990.
- 3 Submit all paperwork involving the closure of an UST to SCDHEC within 30 days after the UST closure is complete. Visit the SCDHEC website to obtain the most current information on UST closure requirements. Provide acceptable means to assist the RCE in determining the quantity of the work items associated with all activities related to UST removal and remediation.

#### **202.5 Measurement**

- 1 Unless otherwise specified, the pay items Removal of Structures and Obstructions, Removal and Disposal Item No. *(number)*, and Removal and Disposal of Existing Bridge are paid for on a lump sum (LS) basis; and therefore, there is no specific measurement of quantities for these items.
- 2 The quantity of material used to backfill areas that is excavated as directed and approved by the RCE during the work for a removal item is measured by the cubic yard (CY) of Unclassified Excavation or Borrow Excavation as applicable in accordance with **Subsection 203.5**.
- 3 The quantity for the pay item Removal and Disposal of Existing Culvert (of the width and height specified) is measured by each (EA) reinforced concrete box culvert removed and disposed of as indicated on the Plans or directed by the RCE, regardless of the length of the culvert. If this item is not included in the Contract, the cost of the removal of concrete or brick culverts or arches is consider included in contract unit bid prices of the various other pay items in the Contract.
- 4 The removal and disposal of pipes, pipe arches, tile drains, and other drainage devices not otherwise specified is measured by the cubic yard (CY) as Unclassified Excavation in accordance with **Subsection 203.5**. No measurement is made for the removal of pipe that is replaced by new pipe or for the removal of pipe that is re-laid at any location. The cost of this removal is included in the new pipe or re-laid pipe items.
- 5 The quantity for the pay item Removal and Disposal of Existing Pavement is the actual horizontal surface area of the following material removed from

the project and is measured by the square yard (SY) of the pavement before removal, complete, and accepted:

- Existing brick pavement with or without asphalt overlay;
- Brick sidewalk;
- Cobblestone pavement with or without asphalt overlay;
- Portland cement concrete pavement with or without asphalt overlay;
- Portland cement concrete gutter;
- Portland cement concrete integral curb and gutter; or
- Portland cement stabilized base with asphalt concrete overlay.

- 6 The quantity for the pay item Removal and Disposal of Existing Asphalt Pavement is the actual horizontal surface area of asphalt concrete pavement with a total thickness of 2 inches or greater removed from the project, unless otherwise indicated, and is measured by the square yard (SY) of area before removal, complete, and accepted
- 7 Areas of asphalt pavement with a total thickness less than 2 inches or as otherwise indicated, such as aggregate bases, earth type bases, and other flexible pavement structure components are not included in the quantity for the pay item Removal and Disposal of Existing Asphalt Pavement because they are included in the quantity for the pay item Unclassified Excavation in accordance with **Subsection 203.5**.
- 8 The quantity for the pay item Removal and Disposal of Existing Curb is the length of existing stone, bituminous, or concrete curb removed from the project and is measured by the linear foot (LF) along the curb before removal, complete, and accepted.
- 9 When the Plans indicate that existing pavement or curb is to be removed, and the pay items Removal and Disposal of Existing Pavement, Removal of Existing Asphalt Pavement, or Removal and Disposal of Existing Curb are not included in the Contract, the removal and disposal of existing pavement or curb is included in quantity for the pay item Unclassified Excavation in accordance with **Subsection 203.5**.
- 10 The quantity for the pay item Removal of Existing Guardrail is the length of existing guardrail removed and is measured by the linear foot (LF) of existing guardrail removed as indicated in the Plans or directed by the RCE, complete, and accepted.
- 11 The quantity for the pay item Removal and Disposal of Tank Contents is the volume of the fluid removed from an underground storage tank and disposed of in accordance with SCDHEC regulations and is measured by the gallon (GAL), complete, and accepted.
- 12 The quantity for the pay item Removal and Disposal of Low-Level Contaminated Soil or Removal and Disposal of High-Level Contaminated Soil is the weight of the contaminated soil (as determined by SCDHEC regulations) removed from around an underground storage tank properly and disposed of in

accordance with SCDHEC regulations and is measured by the ton (TON), complete, and accepted.

#### **202.6 Payment**

- 1 Payment for the accepted quantity for each pay item, measured in accordance with **Subsection 202.5**, is determined using the contract unit bid price for the applicable item. Payment includes all direct and indirect costs and expenses necessary to complete the work.
- 2 Payment for lump sum pay item Removal of Structures and Obstructions is full compensation for removing and disposing of structures and obstructions as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 3 If there is no pay item for the removal and disposal of a structure or obstruction indicated on the Plans, no direct payment is made for work necessary to remove and dispose of the structure or obstruction, and the cost for the work is considered included in the contract unit bid price of various other pay items of the Contract.
- 4 The removal and disposal of pipe, pipe arches, tile drains, or other drainage devices not otherwise specified is paid for as Unclassified Excavation in accordance with **Section 203**.
- 5 Any backfill required under this section is paid for as Unclassified Excavation or Borrow Excavation as applicable in accordance with **Section 203**.
- 6 Payment for the accepted quantity for Removal and Disposal of Existing Pavement is full compensation for removing and disposing of the existing brick pavement (with or without asphalt overlay), brick sidewalk, cobblestone pavement, Portland cement concrete pavement (with or without asphalt overlay), Portland cement concrete gutter, Portland cement concrete integral curb and gutter, and Portland cement stabilized base with asphalt concrete overlay as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 7 Payment for the accepted quantity for Removal and Disposal of Existing Asphalt Pavement is full compensation for removing and disposing of existing asphalt pavements with thickness of 2 inches or greater as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 8 Payment for the accepted quantity for Removal and Disposal of Existing Curb is full compensation for removing and disposing of existing concrete, asphalt, or stone curb as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to

complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.

- 9 Overhaul is paid in accordance with **Section 207**, except in conjunction with the following pay items:
- Removal and Disposal of Existing Pavement,
  - Removal and Disposal of Existing Asphalt Pavement,
  - Removal & Disposal of Existing Curb, and
  - Removal & Disposal of Existing Asphalt Curb.
- 10 Payment for the lump sum item Removal and Disposal Item No. (*schedule number*) is full compensation for removing and disposing of items designated by a *Schedule Number* on the Plans and includes the salvage of materials; their custody and preservation; storage on the right-of-way or as designated; and their disposal as specified or directed; and all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 11 Payment for the accepted quantity for Removal of Existing Guardrail is full compensation for removing of existing guardrail as specified or directed and includes dismantling and removing existing guardrail, posts, blockouts, end treatments, and other components; backfilling and compacting postholes; and all materials, labor, equipment, tools, supplies, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract. Payment also includes safely storing and protecting the material until the Department removes the material or until it is removed by the Contractor, whichever is specified in the Contract or directed by the RCE.
- 12 Payment for the accepted quantity for Removal and Disposal of Tank Contents is full compensation for removing and disposing of the fluid contents in underground storage tanks (UST) in accordance with SCDHEC regulations and as specified or directed and includes safely pumping or otherwise emptying the UST; hauling the fluid in approved vehicles; properly discharging it an approved disposal site; and all materials, labor, equipment, tools, supplies, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 13 Payment for the accepted quantity for Removal and Disposal of Low-Level Contaminated Soil or Removal and Disposal of High-Level Contaminated Soil is full compensation for removing and disposing of the material classified as Low-Level or High-Level contaminated soil from around underground storage tanks in accordance with SCDHEC regulations and as specified or directed and includes safely excavating the contaminated material; protecting uncontaminated material on the site; hauling the contaminated material in approved vehicles; disposing of it at an approved site; and all materials, labor, equipment, tools, supplies, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.

- 14 The removal and disposal of the underground storage tank including all piping associated with the UST system and the dispenser island, if applicable, is paid as a Removal and Disposal pay item.
- 15 If the Contract contains the lump sum pay item Clearing & Grubbing within Right-of-Way, then in addition to the work requirements of **Section 201**, payment includes the cost of removing and disposing of items within the clearing and grubbing area in accordance with **Section 202**, except for those items setout specifically as separate pay items in the Contract or as otherwise noted.
- 16 Pay items under this section include the following:

Item No.	Pay Item	Unit
2021000	Removal of Structures and Obstructions	LS
2021200	Removal and Disposal of Tank Contents	GAL
2021205	Removal and Disposal of Low-Level Contaminated Soil	TON
2021210	Removal and Disposal of High-Level Contaminated Soil	TON
2022000	Removal & Disposal Item No. <i>(number)</i>	LS
2023000	Removal & Disposal of Existing Pavement	SY
2024100	Removal & Disposal of Existing Curb	LF
2025000	Removal & Disposal of Existing Asphalt Pavement	SY
2027801	Removal of Existing Guardrail	LF
202810X	Removal & Disposal of Existing Bridge	LS
202850X	Removal & Disposal of Existing Culvert <i>(width)</i> ft. × <i>(height)</i> ft.	EA

## SECTION 203

### ROADWAY AND DRAINAGE EXCAVATION

#### 203.1 Description

##### 203.1.1 General

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the removal, placement, compaction, and satisfactory disposal of all materials encountered within the limits of the right-of-way and borrow pits necessary for the construction of the roadway. The limits of this work may include intersecting roads, driveways, ditches, channels, parking areas, ramps, and private entrances. This work also consists of the removal and replacement of unsuitable material in the subgrade or under structures, the stripping of the roadway and material pits, and the excavation work necessary for the formation, compaction, and shaping of embankments, subgrade, shoulders, slopes, and intersections.

#### 203.2 Materials

##### 203.2.1 Classification

##### 203.2.1.1 Site Excavation

- 1 Site excavation consists of all excavation necessary to construct the roadway to the typical sections in the Plans. If excavation beyond the typical section line is required, it will be accomplished in accordance with **Subsection 109.4**. Unless otherwise provided, no separate payment is made for overhaul or for the removal and disposal of surplus material. It is the Contractor's responsibility to inspect the site and determine the quantities of material necessary to construct the roadway to the typical sections in the Plans.

##### 203.2.1.2 Unclassified Excavation

- 1 Unclassified excavation consists of roadway and drainage excavation performed under this section regardless of the materials encountered or the manner in which they are removed and includes the work described in **Subsection 203.2.1.3** through **203.2.1.8** unless otherwise provided. When the item Unclassified Excavation is included in the Contract, the bid quantity is only an estimate. It is the Contractor's responsibility to inspect the site and determine the actual amount of unclassified excavation needed to complete the project.

##### 203.2.1.3 Muck Excavation

- 1 Muck excavation consists of the removal and satisfactory disposal of unsuitable material that, in the opinion of the RCE, cannot be excavated using equipment normally utilized in the removal of Unclassified Excavation material. If the item Muck Excavation is not included in the Contract, the unsuitable material is considered Unclassified Excavation.

**203.2.1.4 Stripping**

- 1 Stripping consists of excavating and stockpiling of material from the ground surface within the roadway that, in the opinion of the RCE, is beneficial to the establishment of permanent vegetation called for later in the project. If Stripping is not a bid item in the Contract, excavation and replacement of this material is measured and paid for as Unclassified Excavation.

**203.2.1.5 Surplus Material**

- 1 Surplus material consists of the material excavated in order to complete the project and is not required or desired for use on the project. Surplus material may be designated on the Plans or referred to as "waste." Obtain disposal sites and dispose of any surplus material that cannot be accommodated by widening embankments and flattening slopes. Make certain that the disposal sites comply with all regulations governing the disposal of waste material. Secure the necessary permits if disposal sites are located in wetlands and/or floodplains of live streams and rivers. These permits include, but are not limited to, the Federal Water Pollution Control Act (Section 404), the Coastal Zone Management Act permits, and any other applicable federal, state, county, or municipal permits that may be required. Certify in writing to the RCE that all of these requirements have been met before placing any material in a disposal area. Seed disposal areas in accordance with **Section 810** or as required by permit provisions or other pertinent regulations. The contract unit bid price for the initial excavation of the material is full compensation for excavating, hauling, disposing, and seeding any surplus material.

**203.2.1.6 Watercourse and Drainage Ditch Excavation**

- 1 Watercourse and drainage ditch excavation consists of removing and disposing of material excavated from ditches or stream channels, inlets and outlets to drainage structures. If no item is specifically included in the Contract for excavation of this material, it is considered Unclassified Excavation.

**203.2.1.7 Rock Excavation**

- 1 Rock excavation consists of igneous, metamorphic, and sedimentary rock that cannot be excavated without blasting or using rippers, hoe-rams, or pavement breakers and also includes all boulders or other detached stones each having a volume of  $\frac{1}{2}$  cubic yard or more as determined by physical or visual measurement. If the item Rock Excavation is not included in the Contract, this excavation is measured and paid for as Unclassified Excavation.

**203.2.1.8 Borrow Excavation**

- 1 Borrow consists of material required for the construction of embankments or for other portions of the work where the elevation of the existing subgrade is less than the subgrade elevation required on the Plans or directed by the RCE. When sufficient borrow material is available entirely within the right-of-way, the work is covered by the item Unclassified Excavation and the material requirements of this subsection do not apply. When it is necessary to bring borrow material from outside of the right-of-way, the work is covered by the

item Borrow Excavation, and the material requirements of this subsection apply to all borrow material used in the work regardless of its origin. The requirements of this subsection are not applicable to in situ subgrade material.

- 2 Borrow Excavation includes hauling, clearing and grubbing pits, securing necessary permits, haul roads, and all other incidental related costs. Restore pits and haul roads to a condition satisfactory to property owners and in compliance with the South Carolina Mining Act.
- 3 A maximum of 25% (by weight) of recycled glass aggregate may be mixed with these materials in constructing the embankment. Use recycled glass that is free of organic and toxic materials, hypodermic needles, and hazardous materials. Ensure that the recycled glass aggregate meets SCDHEC regulations as a non-hazardous material. Do not allow the maximum particle size for recycled glass aggregate to exceed ½ inch. Ensure that the maximum lead content for the glass aggregate is not greater than 5 ppm, and the maximum silver content is less than 5 ppm. Use aggregate meeting the limits established by the EPA for the primary and secondary drinking water standards. Before any glass is incorporated into the work, obtain certified test results showing that the glass meets the requirements listed herein from the glass supplier and furnish this information to the RCE. Only test results that are less than 1 year old at the time they are furnished to the Department are acceptable. Use glass aggregate containing not more than 1% (by weight) of non-glassy material and does not contain any mirror glass.
- 4 Do not use glass aggregate in the top 18 inches of the embankment.
- 5 In order to accurately determine by cross-section the quantity of Borrow Excavation furnished, inform the RCE of the exact location and bounds of the borrow pit or the section of pit if material from the pit is being furnished to projects other than those included in this Contract. Reserve and protect the designated area(s) against use for any purpose other than furnishing the required borrow excavation for completing the project.
- 6 In the top 5 feet of the embankment, use borrow material with a loss on ignition of 1.0% or less when tested according to **SC-T-36**. For borrow material in the top 18 inches of embankment, use materials with a loss on ignition of 0.5% or less when tested according to **SC-T-36**.
- 7 Unless otherwise approved, use borrow material with a maximum dry density of not less than 100 lbs./ft.<sup>3</sup> at optimum moisture when tested in accordance with **SC-T-29** in the top 5 feet of any embankment. Do not use any soil for embankment with optimum moisture content greater than 25.0% as defined in accordance with **SC-T-29**.
- 8 Before its use, ensure that the RCE has samples of material being considered for use for embankment or subgrade tested for maximum density and optimum moisture. The maximum density and moisture content will also be checked routinely during construction. At the sole discretion of the DCE, approval may be given to use borrow material that does not meet these loss on ignition, density, and/or moisture requirements. Approval to use such materi-



als in no way relieves the Contractor from any responsibility for meeting the requirements for proof rolling, compaction, or stability.

- 9 In addition to compaction tests, proof roll each layer of embankment material whose elevation is 5 feet or less below the finished subgrade elevation. Perform proof rolling as directed by the RCE in accordance with **Section 211**.
- 10 Soils that are acceptable for use in embankment and as subgrade vary by county. The Department will test soil in accordance with **SC-T-34** and classify it in accordance with AASHTO M 145 to determine suitability when required. Acceptable borrow material for embankment and subgrade is shown below. The acceptability of the material, as outlined below, is based on the county in which the project is located, regardless of the location of the borrow pit. Perform grading operations and sequence with selective grading and cross-hauling so that the best available soils are reserved for the top portions of the embankments.
- 11 The following counties are classified as Group A:  
Abbeville, Anderson, Cherokee, Chester, Edgefield, Fairfield, Greenville, Greenwood, Lancaster, Laurens, McCormick, Newberry, Oconee, Pickens, Saluda, Spartanburg, Union, and York.
- 12 In addition to the general restrictions given above, the following restrictions apply to borrow material for work conducted in counties in Group A:
  - A. Below the top 5 feet of embankment, any soil that does not meet the description of muck may be used to form embankments as long as it is stable when compacted to the required density.
  - B. In the top 5 feet of embankment, only the following soil types are acceptable: A-1, A-2, A-3, A-4, A-5, and A-6
- 13 The following counties are classified as Group B:  
Aiken, Allendale, Bamberg, Barnwell, Beaufort, Berkeley, Calhoun, Charleston, Chesterfield, Clarendon, Colleton, Darlington, Dillon, Dorchester, Florence, Georgetown, Hampton, Horry, Jasper, Kershaw, Lee, Lexington, Marion, Marlboro, Orangeburg, Richland, Sumter, and Williamsburg.
- 14 For counties classified as Group B, only the following soil types are acceptable for use as borrow material in the top 18 inches of the embankment:  
A-1, A-2-4, A-2-5, A-3, A-4(0), and A-2-6(0).
- 15 For counties classified as Group B, only the following soil types are acceptable for use as borrow material below the top 18 inches of the embankment:  
A-1, A-2, A-3, A-4, and A-5.
- 16 For counties classified as Group B, A-6 soil may be used below the top 5 feet of the embankment. Do not use A-7 soil.

**203.2.1.9 Station Grading**

- 1 When the Contract includes the item Station Grading, include the cost of all the excavation, embankment material, and work required for the construction of the road in the contract unit bid price for this item. Station Grading includes material excavation at intersections, driveways, private entrances, or other miscellaneous excavation necessary for the roadway construction.
- 2 If borrow material is necessary to bring embankments up to a required grade, such borrow material is paid for at the contract bid price for Unclassified Excavation with Overhaul as applicable. When it is necessary to remove unsuitable material in cut sections below the finished subgrade elevation, the material excavated below the finished subgrade is considered Unclassified Excavation with Overhaul as applicable. Likewise, when it is necessary to remove unsuitable material in fill sections before the embankment is constructed, the material excavated is measured and paid for as Unclassified Excavation with Overhaul as applicable. Excavation that is removed from inlet or outfall ditches, stream channels, or from inlets and outlets of structures is measured and paid for as Unclassified Excavation.

**203.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

**203.4 Construction****203.4.1 General**

- 1 Perform all work under this section in conformance with the typical cross-sections shown on the Plans and with the lines and grades established by the RCE.
- 2 Perform all work under this section in a manner that complies with **Subsection 107.26**. Conduct all operations in a manner consistent with good erosion control practices to minimize soil erosion and to the greatest extent practicable to prevent sediment from leaving the site. During all phases of the work, take whatever measures are necessary to control erosion and to minimize the deposition of sediment into adjacent rivers, streams, wetlands, and impoundments.
- 3 The RCE may place limitations on the surface area of erodible material exposed. In order to limit the area of erodible material, the RCE may require that partially completed slopes be brought to the required slope and the seeding be performed at that time in accordance with **Section 810**.
- 4 Comply with the provisions of any required permits for the project that limit the surface area of exposed erodible material.

- 5 Unless otherwise provided, this work also includes the removal and disposal of old pavement, surfacing, curb, gutter, sidewalk, foundations, and structures necessary for the completion of the work.
- 6 Finish the excavation and embankments for the roadway, intersections, and entrances with a reasonably smooth and uniform surface. Do not disturb material outside of the limits of slopes when conducting excavation operations. Before beginning grading operations in any area, complete all necessary clearing and grubbing in that area in accordance with **Section 201**.
- 7 Notify the RCE a sufficient time before beginning excavation in order that the necessary cross-sections may be taken. Do not excavate beyond the dimensions and elevations established and do not remove any material before the staking and cross-sectioning of the site is complete.
- 8 After sufficient clearing and grubbing has been completed and the work has been cross-sectioned and staked, proceed with the excavation and placement of material at locations in a sequence approved by the RCE.
- 9 Use all suitable excavated materials to the greatest extent practicable in the formation of embankment, subgrade, shoulders, and at such other places as directed. Preserve the best materials for use in constructing the top portion of embankments to the greatest extent practicable. Where not practical or the material in the balance is unsuitable, the RCE may require the use of suitable material from other balances.
- 10 Use excavated rock in forming embankments wherever the depth of fill is sufficient to properly contain the rock. Place the rock in accordance with **Subsection 205.4.3**. No payment is made for any material that is excavated beyond the slope stakes set for construction unless such excavation is required in the formation of the embankment or is specifically ordered by the RCE. Unless otherwise directed by the RCE, dispose of surplus material or waste by widening the embankments uniformly and flattening the slopes. If additional areas are necessary to accommodate the surplus or waste material, dispose of the material in accordance with **Subsection 203.2.1**. Do not deposit excavated material above the grade of the finished road unless permitted by the RCE. Do not dispose of excavated material in a manner that causes damage to adjacent property. Do not impair the appearance or symmetry of the roadway.
- 11 When rock is encountered in the subgrade, excavate to a depth of 6 inches below subgrade for the entire width of the roadbed except where a cement modified subbase is specified. If a cement modified subbase is specified, excavate the rock to a depth of 1 foot below subgrade for the width specified on the Plans, or as directed by the RCE. Backfill the resulting excavated areas with suitable material specified by the RCE. Payment is made for both the material excavated and the material used for backfill. The excavated material is paid for as Unclassified Excavation, unless an item Rock Excavation is included, in which case, this material is paid for at the contract unit bid price for Rock Excavation. The backfill material is paid for at the contract unit bid price

of Unclassified Excavation, unless the item Borrow Excavation is included in the Contract, in which case, the backfill material may be paid for as Borrow Excavation if determined applicable by the RCE in accordance with **Subsection 203.2.1.8**.

- 12 Where unstable or other material that in the opinion of the RCE is unsuitable for foundation, subgrade, or other roadway purposes occurs within the limits of the roadway, remove and dispose of such material to the cross-section shown on the Plans or as directed by the RCE and backfill the excavation with suitable material.
- 13 Whenever it becomes necessary to obtain additional excavation to form embankments, the RCE may require that cuts be widened, cut slopes flattened, or grades in cuts lowered in lieu of obtaining material from borrow pits. The widening of cuts or flattening of cut slopes is carried to a uniform width throughout the cut to obtain a uniform and neat appearance. Obtain material from those borrow pits, cuts, backslopes, and ditches designated and previously cross-sectioned by the RCE. Trim borrow pits and leave them in a neat and suitable condition to facilitate the accurate measurement of the material excavated. Where practical, excavate them in a manner so that water does not collect or stand. After taking the final cross-sections, terrace the pits if so directed by the RCE.
- 14 Where suitable earth type base course material, selected material for shoulders, or materials suitable for stabilizing subgrade is encountered in excavation and on areas where embankment is to be placed, whether shown on the Plans or not, salvage and use this material accordingly if directed by the RCE. Materials that are stockpiled for later use in the work is measured and paid for as Unclassified Excavation in addition to payment under the appropriate item for which the material is used.
- 15 Construct watercourses as shown on the Plans or where directed and to the lines, grades, and cross-section established by the RCE. Remove all roots, stumps, rock, and other materials in the sides and bottom of watercourses to conform to the slope, grade, and shape of the required section. Where in the opinion of the RCE it is feasible, place all suitable material excavated from ditches and channels in the embankment. Where not feasible, place the material along the banks within 3 feet of the edge of the watercourse. Spread the excavation or spoil uniformly unless otherwise shown in the Plans or directed by the RCE. Construct ditches or gutters emptying from embankment cuts to avoid erosion of the embankment.
- 16 Ensure that all mail boxes, guide signs, traffic control signs, and traffic warning signs located in disturbed areas are left in a condition equal to or better than existed before excavating operations. Repair any damage caused by excavating operations at no expense to the Department.

#### **203.4.2 Excavating Rock**

- 1 If material encountered during roadway excavation appears to belong in the classification of rock excavation as set forth in **Subsection 203.2.1.7**, exca-

vate it according to this subsection. If the item Rock Excavation is not included in the Contract or unless otherwise provided, the material is measured and paid for as Unclassified Excavation.

- 2 Ensure that final breakage of rock excavation conforms with or closely approximates the slope lines shown on the Plans, unless different slope lines are established during construction. Leave the final slopes reasonably smooth and uniform with all loose and overhanging rock removed. Unless otherwise permitted, ensure that no rock projects more than 1 foot beyond the final established slopes.
- 3 Excavate rock to the required elevation for the full width of the roadway as shown on the Plans, or as directed by the RCE. When rock is excavated below the subgrade elevation, backfill to the subgrade elevation with material approved by the RCE. Properly compact and shape such material to the required elevation and cross-section.
- 4 Make certain that the final surfaces of rock excavation under the roadbed can drain sufficiently.
- 5 At any location or area to be pre-split, the RCE may require the firing of short test lines and exposure of the pre-split slope to see that the hole spacing, charge, and resulting blast give the desired results. The RCE reserves the right to require any changes in methods or procedures considered necessary to control the effectiveness of the pre-splitting operation.
- 6 Ensure that the pre-split face does not deviate more than 6 inches from the front line of the drill holes nor more than 12 inches from the back line except where, in the opinion of the RCE, the character of the rock being pre-split will unavoidably result in irregularities.

#### **203.4.3 Maintenance of Excavation**

- 1 Maintain the highway in accordance with the provisions of **Subsection 104.7.**

#### **203.5 Measurement**

- 1 When included in the Contract, the quantity for the pay item Unclassified Excavation, Rock Excavation, or Borrow Excavation is the volume of material excavated as prescribed and is measured by the cubic yard (CY). The quantity includes the material acceptably excavated and is measured in its original position and determined from cross-sections by the method of average-end-areas, complete, and accepted. The measurement includes:
  - Over-breakage or removal of slides not attributable to carelessness or negligence of the Contractor,
  - Authorized excavation of rock, unsuitable, or unstable materials below grade and the excavation necessary to replace such materials,
  - Excavation of selected materials required by the RCE to be stockpiled and reserved for later use in the project,
  - Material obtained from borrow pits, and

- Authorized excavation under bridges or box culverts exclusive of material classified as Excavation for Structures where bottom slabs have been omitted.
- 2 The volume measured for the construction of a watercourse (i.e. ditch or channel excavation) is the material removed from the end of the structure to the end of the watercourse. It does not include excavation necessary to construct the bridge foundations, but it does include excavation under structures where the RCE directs such work.
- 3 On all projects where the Plan quantity of Unclassified Excavation is computed from cross-sections included in the Plans, no field measurement is needed unless an error in the Plans or calculations is found, there are different site conditions, or a revision to the work is required. Revision to the computed Plan quantity is made in accordance with the following provisions:
- A. Where rock is removed from the subgrade as outlined in **Subsection 203.4.1**, measurements includes both the material excavated and the material used for backfill. However, payment is made only once for the backfill material.
  - B. Where rock is removed as outlined in **Subsection 203.4.2** and unless otherwise provided, the volume is computed from cross-section data taken in the field. Measurements are taken only in areas where rock removal was indicated on the Plans, where it was authorized by the RCE, or where unavoidable over-breakage occurred in accordance with the provisions of **Subsection 203.4.1**. The volume of over-breakage that, in the opinion of the RCE, was avoidable is not included.
  - C. Where the RCE directs the removal of unsuitable or unstable material, mucking, or stripping, as set forth in **Subsection 203.4.1**, the quantity is computed from cross-section data taken in the field. The quantity is computed only in areas where removal of unstable material is authorized by the RCE or indicated on the Plans. Where it is necessary to replace unstable material with borrow, the volume is computed for material removed and for the borrow material to replace it.
  - D. Where it is necessary to use borrow, the quantity of borrow material is computed from cross-section data taken in the field. Where cuts are widened, cut slopes are flattened, or grades in cuts are lowered to obtain borrow material as directed by the RCE, the quantity of borrow material is computed after first deducting the final cross-sectioned area shown on the Plans.
  - E. Where an estimated quantity is shown on the Plans for ditches or channels, the final quantity is computed from data taken in the field.
  - F. Plan quantities are used unless the final grade varies more than 0.3 foot from grade shown on the Plan. If the final grade changes are greater than 0.3 foot, or at the discretion of the RCE, revised quantities are obtained by the method outlined in item D. above.

G. Aside from any of the reasons state above, the RCE may order a re-check of the Plan quantity for Unclassified Excavation before making final payment. The results of the re-checking may result in an increase or a decrease, but regardless, the results of the recheck are used as the final quantity of Unclassified Excavation.

- 4 The quantity for the pay item Muck Excavation is the volume of the material excavated as prescribed and is measured by the cubic yard (CY), complete, and accepted. The volume is calculated using the average-end-area method. The length for the computation is the actual length of the area along the excavation, and the cross-section areas are formed by the neat lines of the typical cross-section shown on the Plans or established by the RCE. No payment is made for material excavated outside of the neat lines shown on the Plans or as established by the RCE.
- 5 The quantity for the pay item Station Grading is length of the roadway where material excavation at intersections, driveways, private entrances, or other miscellaneous excavation is necessary for the roadway construction and is measured by the station (STA) along the length of the centerline of the road (a station is 100 feet), complete, and accepted. The measurement does not include the length of exceptions to the project, such as the length of bridges, railroads, etc., or as otherwise noted on the Plans.
- 6 When the Contract includes the pay item Site Excavation, the Contractor is responsible for inspecting the site to determine the quantities of material necessary to construct the roadway to the required typical section. No field measurement is made for this item because payment is made on a lump sum (LS) basis.

#### **203.6 Payment**

- 1 Unless otherwise specified, payment for the accepted quantity of material excavated as specified herein, measured in accordance with **Subsection 203.5**, is determined using the contract unit bid price for the applicable pay item. Payment is full compensation for performing the earthwork prescribed and, if applicable, includes excavating of material; forming and compacting embankments; disposing of surplus or unsuitable material; stripping, preparing, and compacting of subgrade and shoulders; de-watering borrow pits (when necessary), terracing of borrow pits; removing and resetting of mail boxes, guide signs, etc.; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to satisfactorily complete the work in accordance with the Plans, the Specifications, and other terms of the Contract. The payment also includes hauling of the material within the free haul limit of 3000 feet. If the material is hauled beyond the free haul limit, payment for Overhaul as defined in **Section 207** applies in the case of Borrow Excavation furnished by the Department in accordance with **Subsection 203.2.1.8**.
- 2 Where the Contractor is required to furnish the borrow pits, payment for Borrow Excavation includes the cost of the borrow pit, clearing and grubbing of pits, necessary haul roads, hauling of the borrow material to the designated

location on the roadway and for all other pertinent stipulations stated above.

- 3 The accepted quantities for Muck Excavation are only paid for once. No addition payment is made for necessary re-excavation.
- 4 No payment is made for any excavated material used for purposes other than those designated, except material covered in **Subsection 104.9**.
- 5 No payment is made for excavation of rock performed for a depth greater than 6 inches below subgrade unless a Cement Modified Subbase is specified or the RCE specifically authorizes such work. No payment is made for the excavation of rock performed for a width greater than specified unless the RCE specifically authorizes such work.
- 6 Payment for the acceptable quantity for Station Grading includes excavation and embankment as specified or directed and includes all other work specified in **Subsection 203.2.1.9** required for the completion of the work, except for excavation that is specified in **Subsection 203.2.1.2** and paid for as Unclassified Excavation. No payment is made for Overhaul of material excavated on the roadway and used on the roadway.
- 7 Payment for the lump sum pay item Site Excavation includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract. No separate payment is made for any incidental costs associated with this work.
- 8 Pay items under this section include the following:

Item No.	Pay Item	Unit
2031000	Unclassified Excavation	CY
2031200	Site Excavation	LS
2032000	Rock Excavation	CY
2033000	Borrow Excavation	CY
2034000	Muck Excavation	CY
2035000	Station Grading	STA



## SECTION 208

### SUBGRADE

#### 208.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the construction and preparation of the subgrade intended to receive the pavement structure, sidewalk, curb, curb and gutter, and shoulders.

#### 208.2 Materials

- 1 None specified.

#### 208.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### 208.4 Construction

##### 208.4.1 General

- 1 Remove all soft, unstable, or unsuitable material that does not compact readily. Replace this material with satisfactory material as directed by the RCE. Remove or break off all objectionable loose rock or boulders to a depth of not less than 6 inches below the surface of the subgrade. Fill all holes, ruts, or depressions that develop in the subgrade with approved material, bring the subgrade to line and grade, and properly compact. Perform this work without any additional compensation. If the subgrade is too dry to compact properly, sprinkle with water to wet it, if deemed desirable by the RCE, to secure proper compaction.
- 2 Compact the subgrade between lines 18 inches outside the area occupied by the pavement structure, including curb and gutter and sidewalk as applicable, to not less than 95.0% of maximum density. Accomplish the compaction by using suitable construction procedures while the subgrade is at suitable moisture content. Maximum densities are determined by either **SC-T-25** (Method A or C as applicable) or **SC-T-29**.
- 3 On projects where the base and pavement are constructed under a later contract, compact the subgrade as specified above to not less than 95.0% density.
- 4 When any portion of the subgrade is constructed on an old roadbed that conforms to or approximates the elevation of the subgrade, scarify and grade the existing surface as directed by the RCE so that the subgrade has a uniform density when compacted.

### 208.4.2 Protection and Maintenance

- 1 Maintain the subgrade in a smooth and fully compacted condition, free from ruts and depressions, and adequately drained. Storing or stockpiling of materials directly on the subgrade is not permitted without the prior approval of the RCE.
- 2 Never, under any circumstances, place any base, surface course, or pavement before the subgrade is checked and approved by the RCE.
- 3 Never, under any circumstances, place any base, surface course, or pavement on frozen, muddy, or unstable subgrade.

### 208.4.3 Fine Grading

- 1 After all earthwork is substantially complete and all drains and structures completed and backfilled and the subgrade compacted to the satisfaction of the DCE, make certain that the subgrade conforms to the lines, grades and cross-sections shown on the Plans or as established by the RCE.
- 2 Ordinarily the costs necessary to complete fine grading of the subgrade are included in other items of work. Typically, these costs are included in excavation items or other items that may be subject to increases or decreases from the plan quantities as field conditions dictate. In order to alleviate this issue, an item, Fine Grading, has been established and may be included in the Contract at the discretion of the Department.
- 3 Fine Grading is defined as the work necessary to bring the in-place earth material into the final shape and compacted condition prescribed in the Contract documents. The area considered for Fine Grading is the area described in **Subsection 208.4.1**, which extends laterally 18 inches beyond the pavement structure.

### 208.5 Measurement

- 1 The quantity for the pay item Fine Grading is the surface area of the subgrade that is constructed and prepared for the intended pavement structure, sidewalk, and shoulders and is measured by the square yard (SY), complete, and accepted.
- 2 If the pay item Fine Grading is not included in the Contract, the grading work is not measured for payment directly and is considered included in contract unit bid price of the various other items of work.

### 208.6 Payment

- 1 Payment for the accepted quantity for Fine Grading, measured in accordance with **Subsection 208.5**, is determined using the contract unit bid price for the pay item. Payment is full compensation for grading and forming the subgrade as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.

208.6

208.6

2 Payment for this item includes all direct and indirect costs and expenses necessary to complete the work.

3 Pay items under this section include the following:

Item No.	Pay Item	Unit
2081001	Fine Grading	SY

## SECTION 302

### SOIL-AGGREGATE SUBBASE

#### 302.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for increasing the strength of the subgrade or subbase by the addition of crushed stone, gravel, or slag and the construction of a soil-aggregate subbase on a properly prepared foundation course (subgrade or subbase) for pavement structure in conformance with the lines, grades, dimensions, and cross-sections shown on the Plans or as directed by the RCE.

#### 302.2 Materials

##### 302.2.1 Aggregate

##### 302.2.1.1 Crushed Stone

- 1 Produce crushed stone from tough, durable parent rock, free from soft, thin, elongated, or laminated pieces, disintegrated particles, vegetable matter, or other deleterious substances. Do not use shale or shale-like aggregates unless approved by the RCE. Use crushed stone meeting the grading requirements of Aggregate No. CR-14. When subjected to the Los Angeles Abrasion Test, AASHTO T 96, the maximum allowable abrasion loss for this material is 65%. Use crushed stone obtained from sources listed on the most recent edition of *SCDOT Qualified Product List 2*.

##### 302.2.1.2 Gravel

- 1 Use gravel composed of hard durable particles of clean stone, free from an excess of thin or elongated pieces, vegetable matter, or other deleterious substances. Use gravel meeting the grading requirements of Aggregate No. CR-14. When subjected to the Los Angeles Abrasion Test, AASHTO T 96, the maximum allowable abrasion loss for this material is 65%. Use gravel obtained from sources listed on the most recent edition of *SCDOT Qualified Product List 2*.

#### 302.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### 302.4 Construction

##### 302.4.1 Placing, Mixing, and Compacting

- 1 Place the aggregate upon the approved foundation. Accomplish the spreading in such a manner that the finished subbase conforms to the lines, grades, dimensions, and the typical cross-sections shown on the Plans or as

directed by the RCE. Then, thoroughly mix the aggregate subbase material with the subbase or subgrade material to the depth specified by the RCE. During the mixing operation, add sufficient water as necessary to bring the optimum moisture of content of the mixture required for proper compaction.

- 2 Spread and shape the mixture of soil and aggregate to a uniform thickness and while at optimum moisture content, consolidate it until the aggregates are bonded and the subbase compacted to at least 95.0% of the maximum dry density as determined by **SC-T-140**. Continue operations until a uniform, dense surface, free from loose material, is produced. Take care during the shaping and rolling operations to retain the material within the limits indicated on the Plans. If during the mixing and shaping operations, the material becomes segregated, then re-mix the material until a uniform mixture is obtained.
- 3 The Department reserves the right to increase or decrease the length of road on which the aggregate is to be used from that shown on the Plans or stated in the proposal and also, to increase or decrease the quantity of materials to be used per square yard. Material used in excess of the authorized amount is not measured for payment.

#### **302.4.2 Weight Tickets**

- 1 Record in duplicate the net weight of each load of aggregate and the accumulated net weight of the loads for the day upon forms suitable to the RCE. Perform the weighing in accordance with **Subsection 109.1**. With each load of materials delivered to the worksite, present one copy of the weight ticket to the RCE or designated agent.
- 2 At any time during the delivery of material and for the purpose of checking the weighing equipment, the RCE may direct the weighing on tested and approved platform scales of any truckload of material delivered to the worksite. When so directed, comply with these directives without additional compensation.

#### **302.4.3 Maintenance**

- 1 Machine, water, roll, and perform other operations necessary to condition and preserve the aggregate subbase course until the base course is applied.

#### **302.5 Measurement**

- 1 The quantity for the pay item Soil Aggregate Subbase - Aggregate No. CR-14 is the weight of the aggregate incorporated into the subgrade or subbase to produce a subbase course as specified and measured by the ton (TON) of the material as weighed in trucks on approved platform scales and incorporated into the finished work, complete and accepted.

When aggregate meeting the requirements of **Subsection 302.2.1** is used alone, the quantity for the pay item Aggregate No. CR-14 is the weight of the aggregate placed to produce a subbase course as specified and measured by the ton (TON) of the material as weighed in trucks on approved platform

scales and incorporated into the finished work, complete and accepted.

- 2 No deduction is made for normal moisture in the aggregate.

### 302.6 Payment

- 1 Payment for the accepted quantity of Soil Aggregate Subbase - Aggregate No. CR-14, measured in accordance with Subsection 302.5, is determined using the contract unit bid price for the item. Payment is full compensation for constructing the subbase as specified or directed and includes preparing the subgrade or subbase; furnishing, handling, weighing, hauling, placing and mixing materials; watering, compacting, shaping, maintaining, and reconstruction (if necessary) of the subbase; and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 When CR-14 aggregate is used alone, payment for Aggregate No. CR-14, measured in accordance with **Subsection 302.5**, is determined using the contract unit bid price for the item. Payment is full compensation for furnishing aggregate conforming to the requirements of **Subsection 302.2.1** as specified or directed and includes handling, weighing, hauling, and placing aggregate, and all other material, labor, equipment, tools, supplies, transportation, and incidentals necessary to complete the work in accordance with the Plans, the Specifications, and other terms of the Contract.
- 3 Payment for each item includes all direct and indirect costs or expenses required to complete the work.
- 4 Pay items under this section include the following:

Item No.	Pay Item	Unit
3021000	Soil Aggregate Subbase Course - Aggregate No. CR-14	TON
3022000	Aggregate No. CR-14	TON

## SECTION 310

### ASPHALT BASE COURSE - TYPE A AND B

#### 310.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for construction of an asphalt aggregate base course composed of crushed stone, crushed slag, or gravel and an asphalt binder, mixed in an approved asphalt plant, constructed on a prepared subgrade, base course, or other surface, applied with a tack coat when specified, and in conformance with the lines, grades, dimensions, thickness, and typical cross-sections shown on the Plans or as otherwise directed by the RCE.

#### 310.2 Materials

##### 310.2.1 Asphalt Binder

- 1 Use asphalt binder meeting the requirements of **Subsection 401.2.1**. Use performance grade PG64-22 unless otherwise specified.

##### 310.2.2 Aggregates

- 1 Use aggregate material conforming to the requirements of **Subsection 401.2.2**. When Asphalt Base Course Type A is specified, use coarse aggregates consisting of crushed stone and fine aggregate consisting of screenings.

##### 310.2.3 Additives

- 1 Use hydrated lime in all base courses as an anti-stripping additive.

##### 310.2.4 Composition of Mixture

- 1 Combine the coarse and fine aggregate with asphalt binder in such proportions that the composition by weight of the aggregate is within the limits specified in the following table.

Sieve Designation	Percentage By Weight Passing, %
1½-inch	100
1-inch	85 - 100
½-inch	60 - 80
No. 4	40 - 55
No. 8	30 - 45

- 2 The percent of asphalt binder in the total mixture usually ranges from 4.0% to 5.5%. Submit the coarse and fine aggregates to the OMR to determine the exact asphalt binder content used in the asphalt base course.

**310.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.
- 2 The equipment requirements specified in **Subsection 401.3** also apply to equipment for construction of an asphalt base course.

**310.4 Construction**

- 1 The construction requirements specified in **Subsection 401.4** also apply to construction of an asphalt base course.

**310.5 Measurement**

- 1 Measurement for the quantity of Asphalt Base Course Type (*A or B*) or Liquid Asphalt Binder PG64-22 is made in accordance with methods in **Subsection 401.5**.

**310.6 Payment**

- 1 Payment for the accepted quantity of Asphalt Base Course Type (*A or B*) or Liquid Asphalt Binder PG64-22 is made in accordance with methods in **Subsection 401.6**.
- 2 Payment for each item includes all direct and indirect costs or expenses required to complete the work.
- 3 Pay items under this section include the following:

Item No.	Pay Item	Unit
3100310	Asphalt Base Course Type A	TON
3100320	Asphalt Base Course Type B	TON



**DIVISION 400**  
**ASPHALT PAVEMENTS**  
**SECTION 401**

**HOT MIXED ASPHALT (HMA) PAVEMENT**

**401.1 Description**

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for hot mixed asphalt (HMA) base courses, intermediate courses, and surface courses, regardless of gradation of mineral aggregates or the kind, type, and amount of binder or additives.
- 2 Also included in this section are the operations carried out on new and existing asphalt pavements such as milling, surface planing, and full depth HMA patching of asphalt pavement. These operations are performed to repair deteriorated pavement or segregated pavement, remove wheel ruts and other surface irregularities, and provide or restore the appropriate cross-slope to the pavement indicated in the Plans or as instructed by the RCE. Installation of milled-in rumble strips is also included in this section.

**401.2 Materials**

**401.2.1 Binder and Additives**

**401.2.1.1 General**

- 1 Use binder conforming to all of the requirements of AASHTO M 320 and meeting the performance grading within the following table unless otherwise noted in the Contract. Use binder from sources listed on the most recent edition of *SCDOT Qualified Product List 37*. When required, use polymer modified binder consisting of a neat binder modified with an elastomer polymer producing a binder complying with the requirements of a PG76-22 as specified in AASHTO M 320 with the addition of a maximum phase angle of 75 degrees when testing unaged binder in accordance with AASHTO T 320. Use neat binder meeting the requirements for PG64-22 or PG76-22 consisting of production "straight-run" materials that have not been "air-blown" or blended with acid. Use elastomer polymer consisting of a styrene-butadiene (SB), styrene-butadiene-styrene (SBS), or styrene-butadiene-rubber (SBR). Thoroughly blend the composite materials at the asphalt refinery or terminal before being loaded into the transport vehicle. Use polymer modified binder that is heat and storage stable.

Performance Graded Binder		
Type Facility	Intermediate	Surface
Interstates	PG64-22	PG76-22
Primary and Secondary Routes	PG64-22	PG64-22
Critical Areas	PG76-22	PG76-22

#### 401.2.1.2 Liquid Anti-Stripping Agent

- 1 When permitted and used, use liquid anti-stripping agents (ASA) as an asphalt anti-stripping additive in HMA mixes according to the requirements of **SC-M-402**. Use a liquid ASA that has been blended at the binder supplier's terminal at the percentage recommended by the supplier of the liquid ASA and verified during the SCDOT mix design approval process.

#### 401.2.1.3 Hydrated Lime

- 1 Use hydrated lime as an asphalt anti-stripping additive in HMA mixes according to the requirements of **SC-M-402** unless a liquid ASA is permitted and used in accordance with **Subsection 401.2.1.2**. Use hydrated lime conforming to the requirements of AASHTO M 303, Type 1 from suppliers listed on the most recent edition of *SCDOT Qualified Product List 39*.

### 401.2.2 Aggregates

#### 401.2.2.1 Mineral Aggregates

- 1 Use mineral aggregate that is composed of fine aggregate or a combination of coarse and fine aggregate. Meet the gradation requirements for coarse and fine aggregates that are specified in the tables entitled Gradation of Coarse Aggregates and Gradation of Fine Aggregates located in the Appendix of these specifications. Blend aggregates through separate bins at the cold elevator feeders and not in the stockpile. Coarse aggregate is defined as the portion of the total aggregate retained on a No. 4 sieve, and fine aggregate is the portion passing a No. 4 sieve. Before Department approval may be given for their individual use, provide fine aggregate, coarse aggregate, and any additives in combination with the specified percentage of binder meeting the requirements of the tests specified. In any mix, use aggregates with a combined effective specific gravity of 2.90 or less. Marine limestone use is restricted for surface and intermediate courses as outlined under **Sections 402 and 403**.

#### 401.2.2.2 Mineral Filler

- 1 Use mineral filler that conforms to the requirements of AASHTO M 17.

#### 401.2.2.3 Fine Aggregates

- 1 Use fine aggregate consisting of sand, stone, slag, gravel, screenings, or a combination of sand and screenings from sources listed on the most recent edition of *SCDOT Qualified Product List 1*. Use fine aggregate that is uni-

formly graded from coarse to fine, is free of lumps of clay, loam, or other foreign matter and does not have a coating of an injurious material. The RCE will sample the stockpiled materials at the plant site to ensure compliance with these requirements.

#### 401.2.2.3.1 Sand

- 1 Use sand consisting of hard, sharp, angular grains of quartz or other durable rock, free from excessive quantities of clay or other deleterious substances, and containing not more than 10.0% total material passing the No. 200 sieve with a maximum of 6.0% clay, except as indicated below. Determine the amount of material passing the No. 200 sieve using **SC-T-5**. Determine the percent of clay using **SC-T-34**. Use sand that is free of clay balls, and if it has any clay contained within it, the clay is uniformly dispersed throughout the material. Excavate, blend, and stockpile the sand so that a uniform product is provided. When sands are blended, one of the sands may contain a maximum of 12.0% minus No. 200 material; however, do not exceed 10.0% total material passing the No. 200 sieve with a maximum of 6.0% clay in the composite blend.

#### 401.2.2.3.2 Screenings

- 1 Use screenings consisting of hard, sharp, angular grains of durable materials produced from stone, slag, or gravel meeting the quality requirements of coarse aggregate under **Subsection 401.2.2.4**. When 15.0% or less screenings are used in a mix, do not use screenings containing more than 35% passing the No. 200 sieve as determined by **SC-T-5**. When more than 15.0% screenings are used in a mix, do not use screenings containing more than 15.0% passing the No. 200 sieve as determined by **SC-T-5**. Do not use screenings containing an excessive amount of flaky, micaceous, or other injurious particles. Use regular screenings having a sand equivalent value greater than 40 as determined by AASHTO T 176. When used, ensure that marine limestone screenings or fines contained in a crusher-run material produced from marine limestone material have a sand equivalent of 28 or greater as determined by AASHTO T 176.

#### 401.2.2.4 Coarse Aggregate

- 1 Use coarse aggregate from sources that appear on the most recent edition of *SCDOT Qualified Product List 2* and are shown as approved for HMA or are otherwise approved by the MRE. Use coarse aggregate consisting of clean, washed, tough, durable particles of crushed stone, gravel, or approved crushed slag free from an excess of soft or laminated pieces, disintegrated particles, and vegetable or other deleterious substances and free from aggregate coated with soil or other objectionable matter. Where slag is used, use dry slag having a weight of not less than 75 pounds per cubic foot.
- 2 Unless otherwise specified in **SC-M-402**, the following aggregate requirements apply. Use crushed stone or gravel having an abrasion loss of not more than 60.0% determined by AASHTO T 96 unless otherwise noted. Use slag that has an abrasion loss of not more than 45.0% as determined by

AASHTO T 96. Use aggregates with not more than 10% flat and elongated particles based on a 5:1 ratio following **SC-T-77**.

- 3 Before use in an HMA mixture, test stockpiled slag for expansion following ASTM D 4792 and use material with an average total volumetric expansion of less than 0.50% at the completion of the curing period. Cure stockpiles not meeting the expansion criterion for an additional 2 months minimum before re-testing.
- 4 When the stockpiled material has been aged and passes the volumetric expansion requirements, provide the AME with a certification stating that the material has been cured according to specifications and an HMA mix design for verification. The AME will assign a stockpile number to the stockpile after reviewing the required certification. Age all steel slag used for mix designs in accordance with this specification.

#### **401.2.2.5 Crusher-Run Material**

- 1 When using crusher-run material in HMA, use material produced from areas in the quarry that does not allow the possibility of intrusion of overburden, dirt, sap rock, or any other deleterious material.
- 2 The AME will review for approval the process for manufacturing the crusher-run material and the quality control program for controlling production. Utilize a manufacturing process that ensures that a consistent gradation is maintained. Verify this consistent gradation using quality control tests performed by the producer on a daily basis. Make available to the AME all test results upon request.
- 3 Use coarse aggregate in the crusher-run material that is free of clay coatings or other harmful films. Use fines in the crusher-run that meet the quality requirements specified for screenings, including the sand equivalent requirement. Crusher-run material does not require screening before entering the cold feed bin(s) provided a uniform mixture is being produced. If segregation of the finished mixture is evident, the AME may require the crusher-run material to be screened into a coarse and a fine size before entering the cold feed bin(s).

#### **401.2.2.6 Recycled Asphalt Pavement (RAP)**

##### **401.2.2.6.1 General**

- 1 Ensure that the RAP meets one of the following categories:
  - Category 1: Milled RAP - asphalt material milled from Interstate, US Highway or Primary routes.
  - Category 2: Production Returns – material generated from plant waste, i.e., start-up / shut down material or Random RAP – crushed and screened material removed from secondary routes, private paving projects and/or plant overruns / rejected loads.

**401.2.2.6.2 Stockpile Approval**

- 1 Perform extraction tests at a rate of 1 per 1000 tons of RAP, with a minimum of 3 tests per stockpile. Process the RAP in such a manner that all particles pass a 2-inch screen before entering the plant, and are free of foreign matter or other contaminations. RAP particles retained on the 2-inch screen may be re-crushed in a manner that does not result in further degradation of the aggregates. Separate stockpiles of RAP material by categories. Erect and maintain a sign satisfactory to the AME on each stockpile to identify the category. Assure that no deleterious material is allowed in any stockpile.

**401.2.2.6.3 Records**

- 1 Maintain at the plant site a record system for all RAP stockpiles. Include at a minimum the following:
  - Stockpile identification and a sketch of all stockpile areas at the plant site.
  - RAP category (project, state route, plant waste, rejected loads).
  - Origin, dates milled, and the approximate number of tons in the stockpile.
  - All extraction test results.
- 2 At the plant site, make available to the RCE and AME the RAP stockpile records. The RCE or AME may reject by visual inspection any stockpiles that are not kept clean and free of foreign materials.

**401.2.2.6.4 Composition of Recycled Mixture**

- 1 Use recycled HMA meeting all applicable requirements contained in the specifications, except as indicated herein. Submit samples of RAP and additives proposed for use in the recycled HMA to the AME at least 30 days prior to the beginning of the work. Submit a minimum of 50 pounds of representative milled/processed material along with the RAP stockpile records and the asphalt mix design approval request on forms approved by the AME.
- 2 If milled material from a project is not available, submit at least 10 cores that are between 6 and 8 inches in diameter, sliced at the proposed milling depth that is representative of the material to be milled. In addition, perform a minimum of 6 extraction tests on cored roadway samples from random locations before submitting an asphalt mix design approval request. Submit extraction test results and cores representing the material to be milled with the asphalt mix design request. Ensure that the number of roadway cores obtained is sufficient to represent the entire length of roadway to be milled taking into consideration the length of the project, changing roadway conditions, etc. Conform all HMA to the job mix formulas approved by the MRE within the tolerance range specified.
- 3 Use a final product with a maximum calculated recovered combined absolute viscosity at 140°F of 8,000 poises as determined by **SC-T-95** and AASHTO T 202.

**401.2.2.6.4****401.2.2.6.6**

- 4 Do not use softening agents, asphalt modifiers, rejuvenators, or recycling agents. Do not use RAP in any HMA mixture that requires or otherwise uses polymer-modified binder.
- 5 The AME will make random project inspections so that samples of recycled HMA can be obtained for checking the recovered absolute viscosity of the binder. For the maximum absolute viscosity at 140°F of the binder recovered from the field samples, do not exceed 14,000 poises.

**401.2.2.6.5 Non-Fractionated RAP**

- 1 In addition to the limits below, further limit RAP to 15% maximum when introduced in the hot elevator.
- 2 RAP stockpiles may contain RAP from sources indicated by the category and cannot be replenished once approved.
- 3 When used in HMA, do not exceed the maximum amounts of RAP in mixes shown in the following table.

Type Mix	Maximum % RAP	
	Category 1	Category 2
Surface Type B	10	10
Surface Types CM, C, and D	20	10
Intermediate Type B	15	10
Intermediate Type C	25	10
Asphalt Base Types A & B	30	10

**401.2.2.6.6 Fractionated RAP**

- 1 Mechanically separate RAP materials into appropriate sizes using a high frequency separation device.
- 2 Provide a QC plan approved by the AME, a fractionation device approved by the AME, and sufficient cold feed bins (one per RAP fractionation size) to handle the fine (passing No. 4 or ¼-inch sieve) and coarse material(s) generated during the fractionation process.
- 3 In addition to the limits in the table below, further limit RAP to 15% maximum when introduced in the hot elevator.
- 4 RAP stockpiles may contain RAP from sources as indicated by the category and may be replenished with RAP from sources of that same category.
- 5 When used in HMA, do not exceed the maximum amounts of RAP in mixes shown in the following table.

Type Mix	Maximum % RAP	
	Category 1	Category 2
Surface Type E Asphalt Base Types C & D	15 *	10 *
Surface Type B	15	10
Surface Types CM, C, and D	20	20
Intermediate Type B	25	10
Intermediate Type C (Binder Type 2)	25	25
Asphalt Base Types A & B	30	30

\* Fine RAP only

#### 401.2.2.7 Crushed Glass

- Crushed glass is permitted for use as an aggregate in HMA Aggregate Base Types A and B and Intermediate Type C. When used in these mixes, limit crushed glass to a maximum of 15% by weight of total aggregate. Do not exceed the limits of crushed glass in the following table.

Sieve	% Passing
3/8-inch	100.0
No. 200	8.0 max.

- When the stockpiled material is included in an HMA mix design, present a certification to the AME, along with the mix design for verification, stating that the material meets the required specifications. A stockpile number will be assigned to the stockpile after receiving the proper certification documents

#### 401.2.2.8 Shingles

##### 401.2.2.8.1 General

- Shingles are permitted in HMA Aggregate Base Types A and B, Intermediate Type C, and Surface Types C and D.
- If shingles are used, produce a uniform and reacted asphalt mixture of compatible paving grade binder, quality fine and coarse aggregates, anti-strip additive, and shredded shingles.

##### 401.2.2.8.2 Amount of Shingles in the Mixture

- Limit the amount of the shingles used in each mix in accordance of the job mix formula requirements for that mix. When used, utilize 3% to 8% shingles by the total weight of the aggregate.

#### 401.2.2.8.3 Shredded Shingles

- 1 Utilize shredded shingles that are produced primarily from the processing of shingles at a processing facility or during delivery to a landfill. Use shingles that are produced by ambient temperature grinding processes only. Optionally, use shingles of multiple types from multiple sources if the overall blend of shingles meets the gradation requirements. Ensure that the manufacturer of the roofing shingles has removed all debris such as nails, wood, metal, dirt, large stones, etc. and has rendered the materials to a particle size of less than ½ inch. Provide delivered material 99.7% (by weight) free of any debris.

#### 401.2.2.8.4 Gradation

- 1 Use shingles that meet the requirements in the following table when tested in accordance with AASHTO T 27.

Sieve Size	% Passing
1/2-inch	100.0
No. 4	70.0 – 95.0
No. 100	15.0 max.
No. 200	7.00 max.

- 2 Do not exceed ½ inch for the length of the individual shingle particles. Use shingles that are sufficiently dry to be free flowing and to prevent foaming when blended with the hot binder. Ensure that the shingles are free of all chemicals, oils, or any other hazardous materials (e.g., asbestos). Only accept shredded shingles with a certification from the shingle supplier that the material conforms to these specifications.

#### 401.2.2.8.5 Mix Design

- 1 Use the method of mix design described in **SC-T-80** for the design of HMA containing shingles. After heating the aggregates to the proper temperatures and approximately 1 hour before the addition of the binder, add the proper amount of the shingles (e.g., 8% of total weight of the aggregate or 0.080 x total weight of aggregate), mix thoroughly, and place the mix back in the oven. After approximately an additional 1-hour, add the required amount of the binder and mix. Check the temperature of the mixture to ensure that it has reached the compaction temperature before applying the compactive effort.
- 2 During the mix design verification, approval of the mixture will be based on the calculated absolute viscosity of the mixture. Use material with a recovered absolute viscosity at 140°F less than 12,000 poises as determined by **SC-T-95** and AASHTO T 202.

#### 401.2.2.8.6 Extraction

- 1 Perform the extraction process in accordance with requirements described in these specifications. Follow the testing procedures described in **SC-T-75** to



obtain the binder content of the mixture.

### 401.2.3 Composition of Mixture

#### 401.2.3.1 Submission of Materials and Job Mix Formula

- 1 Provide all asphalt mix designs for approval by the MRE. Prepare the mix designs in a laboratory approved by the AME following **SC-T-82**. Ensure that technicians designing mixes are certified as a Level 2S, HMA Mix Design Technician. Use a mix with the appropriate materials that complies with all specifications. Prepare mix designs following **SC-T-80** and AASHTO T 312.
- 2 In the job mix formula, indicate a single definite percentage of aggregate passing each required sieve and a single definite percentage of binder contained in the mixture. This percentage of binder is the percentage recovered by **SC-T-64** or **SC-T-75** and does not include any binder that may be absorbed in the aggregates. If an anti-stripping agent or other additives are required, in the job mix formula, indicate the percent of each to be incorporated in the mixture.
- 3 Submit the proposed mix design formula in writing and obtain the approval of MRE for the intended source of materials before starting any work or producing any mixture for acceptance.
- 4 The AME may make adjustments in the submitted job mix formula and if so, will provide advice as to the job mix formula to be used.

#### 401.2.3.2 Gradation Test Method

- 1 Determine the gradation of HMA indicated in **SC-M-400**.

#### 401.2.3.3 Tolerances

- 1 Conform mixtures controlled and accepted according to the standard procedure to the tolerances listed in the table below. Do not use any job mix formula, with or without the tolerances, outside of the master range provided in **SC-M-402** unless otherwise stated.

Sieve Size % Passing	Intermediate Courses	Surface Courses
3/8-inch & larger	± 7.0%	± 7.0%
No. 4	± 6.0%	± 7.0%
No. 8	± 6.0%	± 6.0%
No. 30	± 5.0%	± 5.0%
No. 100	± 4.0%	± 4.0%
No. 200	± 2.0%	± 2.0%

#### 401.2.3.4 Moisture Susceptibility

- 1 Subject all intermediate and surface courses to the indirect tensile strength (ITS) test during the mix design and during actual production of the mix.

Conduct the test in accordance with **SC-T-70**.

- 2 Use intermediate and surface courses with a minimum wet conditioned strength of 65.0 psi and a minimum tensile strength ratio (TSR) of 85.0% during mix design.
- 3 Resubmit the HMA job mix request for mixtures that do not meet the minimum wet conditioned strength or minimum TSR requirements.
- 4 Specimens may be molded in the field anytime during construction to determine the moisture susceptibility of an asphalt mix. Produce HMA having a minimum wet conditioned strength of 60.0 psi and a minimum TSR of 80.0% after plant mixing.

#### 401.2.3.5 Dust to Asphalt Ratio

- 1 Maintain the dust to asphalt ratio for all intermediate and surface courses, except for Surface Type E, in the limits of 0.60 to 1.20. The dust to asphalt ratio is defined as the percentage of material passing the No. 200 sieve divided by the percentage of binder. Determine the total amount passing the No. 200 sieve on mix designs by AASHTO T 11. Determine the amount passing the No. 200 sieve in the field by **SC-T-64**, **SC-T-76**, or **SC-T-92**.

#### 401.2.3.6 Wash Gradations

- 1 Use wash gradations on coarse and fine aggregates to determine the combined blend of aggregates in the total mixture during mix designs. Determine aggregate washed gradations by AASHTO T 11. Submit washed gradations on forms approved by the AME when requesting a job mix formula.

#### 401.2.3.7 Aggregate Selection

- 1 Use a combination of aggregates so that mix adjustments can be readily performed to correct mix design and field problems related to air voids, dust to asphalt ratio, and gradation. Use at least 3 uniformly graded aggregated types to compose an asphalt mix design: fine, intermediate, and coarse aggregates. Do not use less than 8% of any given aggregate type in any mix.

#### 401.2.3.8 Rutting Susceptibility

- 1 HMA used for Interstate and high volume routes will be subjected to the Asphalt Pavement Analyzer (APA) procedure during the mix design process and may be subjected to testing during actual production of the mixture, as deemed necessary by the AME. Perform the testing in accordance with AASHTO TP 63 in a testing laboratory approved by the AME. Fabricate and test 6 cylindrical samples with the interior temperature of the APA set at 64°C. Set the downward force at 100 pounds with the hoses pressurized to 100 psi. Compact each specimen to 4 ±1% air voids. Meet the requirements for the specimen's average rut depth as listed in **SC-M-402**.

#### 401.2.4 Mix and Pavement Samples

- 1 Samples of the HMA in use will be taken and tested as many times daily as deemed necessary by the RCE and the mixture must be maintained uniform

throughout the project within the applicable tolerances.

- 2 Furnish samples of HMA for testing from trucks at the asphalt plant site, trucks at the roadway site, or samples cut from the completed pavement structure. When areas of the pavement are so removed, replace with new HMA and refinish. No additional compensation is allowed for furnishing test samples and replacing the areas with new HMA.

#### **401.2.5 Material for Full Depth Patching**

- 1 Select the patch material from the HMA mixes approved for use in the project. Provide patch material that meets all requirements established for those mixes.

### **401.3 Equipment**

#### **401.3.1 General**

- 1 The method employed in performing the work and all equipment, plants, machinery, tools, etc., used in handling the materials and performing any part of the work is subject to the approval of the RCE before work is started. The method will be changed or improved as required when found unsatisfactory. Maintain all equipment, tools, machinery, and plants used in a satisfactory working condition. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### **401.3.2 Mixing Plants**

- 1 Use either a batch mixing plant or a drum mixing plant that is designed, equipped and operated so that the weighing, proportioning, and mixing of the materials results in a uniform and satisfactory asphalt mixture meeting the requirements of these specifications. At the plant site, provide sufficient storage space for separate stockpiles, bins, or stalls for each size of aggregate. Keep the different sizes separated until they are delivered, without segregation, by the feeder or feeders to the boot of the cold elevator or elevators in their proper proportions. Maintain the storage yard in a neat and orderly condition with separated stockpiles readily accessible for sampling. Provide separate dry storage of adequate capacity for mineral filler when used. During production of mixes for Department projects, provide full access to the control room and other areas of the plant.
- 2 Use mixing plants of sufficient capacity and that are coordinated to adequately handle the proposed construction. Unless otherwise specified, ensure that mixing plants comply with the requirements contained in **SC-M-401**.
- 3 Ensure that mixing plants for RAP conform to the requirements of **Subsection 401.3.6**.

#### **401.3.3 Hydrated Lime Systems**

- 1 Use a lime proportioning system meeting the requirements of **SC-M-401**.

- 2 Obtain approval by the AME for all lime systems, including the continuous premixing pugmill, before any mix is produced.

#### **401.3.4 Shingle Blending Equipment**

- 1 If a mechanical system is used to add the required amount of shingles to the HMA, utilize a system that is fully integrated with controls for mineral aggregate, binder, and anti-strip additive. During the pre-construction meeting, discuss and determine the system and methods of adding the shingles to the mix. The AME will inspect the system (manual or mechanical) for approval.

#### **401.3.5 Shingle Storage Area and Silos**

- 1 Provide a storage area for storing the shredded shingles that is kept free and clear of all debris such as dirt, wood, paper, stones, etc.
- 2 If the mixture is discharged from the mixer into a hot mix surge or storage silo, operate the bin so that segregation of the mixture is minimized and mixture is not stored overnight.

#### **401.3.6 Mixing Plants for Recycled Asphalt Pavement (RAP)**

##### **401.3.6.1 General**

- 1 Produce the recycled HMA in a batch plant or drum mix plant meeting all applicable requirements of the specifications and that is modified in a manner satisfactory to the AME to accomplish the hot recycling process. Ensure that the plant is capable of producing uniform mixtures meeting the requirements in **Subsection 401.2.2.6** at the temperatures specified.
- 2 Use a plant capable of meeting all applicable local, state, and federal pollution control requirements. Be familiar with all regulations and be aware that plant emissions resulting from the recycling process may be monitored.

##### **401.3.6.2 Batch Plants for RAP**

- 1 Introduce RAP into the plant at the hot elevator or in the weigh hopper.
- 2 When RAP is introduced into the weigh hopper, accurately weigh and proportion the RAP using an automatic proportioning system. Ensure that the RAP weight tolerance is  $\pm 1.5\%$  of the total batch weight. Print the RAP weight for each batch on the weight ticket along with the weight of the other batched materials.
- 3 In addition to the maximum limits in the tables provided in **Subsection 401.2.2.6**, further limit the amount of RAP to 15% maximum when RAP is introduced in the hot elevator. Continuously weigh, control, and monitor the RAP cold feed rate and virgin aggregate cold feed rate. Ensure that the weighing system is accurate to 0.5%. Provide a means for conveniently diverting RAP and virgin aggregates into trucks or other containers for checking the accuracy of the cold feed delivery systems. Calibrate the plant before starting production.

- 4 Make provisions electronically for introducing the determined moisture content of the cold feed materials (RAP and virgin aggregates) in the belt weighing system and automatically correcting wet material weights to dry material weights. Determine the moisture content of the RAP and virgin aggregates twice a day during production or when the AME deems necessary. Record the moisture test results on the daily plant report.
- 5 Equip the hot elevator RAP introduction systems so that the dry RAP and dry virgin aggregate rates, in tons per hour, are printed on a cold feed ticket at a time interval prescribed by the AME. Submit the cold feed tickets to the RCE at the end of each day's production.

#### **401.3.6.3 Drum Mixing Plants for RAP**

- 1 Continuously weigh, control, and monitor the interlocked RAP cold feed rate and virgin aggregate cold feed rate. Utilize a weighing system with an accuracy of 0.5%. Provide a means for conveniently diverting RAP and virgin aggregates into trucks or other containers for checking the accuracy of the cold feed delivery systems. Calibrate the plant before starting production.
- 2 Make provisions to electronically introduce the determined moisture content of the cold feed materials (RAP and virgin aggregates) in the belt weighing systems and automatically correct wet material weights to dry material weights. Determine the moisture content of the RAP and virgin aggregates twice a day during production or when the AME deems necessary. Record the moisture test results on the approved daily plant report.
- 3 Introduce the RAP in the plant at a location far enough down-stream from the burner away from the flame and extremely hot gases.
- 4 Equip the drum mixing plant with a printer to print the following plant information:
  - Dry virgin aggregate rate in tons per hour.
  - Dry RAP rate in tons per hour.
  - Binder in tons per hour.
  - Total virgin aggregates, RAP, and binder in tons per hour.
- 5 Print the above mentioned plant information on a ticket at a time interval prescribed by the AME. Submit the plant information tickets to the RCE at the end of each day's production.

#### **401.3.7 Hauling Equipment**

- 1 Use trucks for hauling asphalt mixture that have tight, clean, smooth metal beds and, to prevent the mixture from adhering to the bed, have been thinly coated with an asphalt release agent listed on the most recent edition of *SCDOT Qualified Product List 17*. Do not use petroleum-based products to prevent asphalt mixtures from adhering to the beds. In all cases, after spraying with solution, raise truck beds so that excess material drains before placing mixture in the truck. Place a hole at a suitable location in the truck bed for checking the temperature of the mixture. Provide and have installed on vehi-

cles a cover made of canvas or suitable material that provides an essentially weather-tight enclosure to completely cover and protect the mixture from inclement weather or where there is evidence of a crust forming. Do not use mesh tarps for covers.

#### **401.3.8 Batch and Truck Scales**

- 1 Provide truck scales at the plant site to obtain the net weight of each load of finished mixture and that meet the requirements of **SC-M-401**.

#### **401.3.9 Silos for Storage of HMA**

- 1 Ensure that silos used for storage of HMA conform to the requirements of **SC-M-401**.

#### **401.3.10 Pavers**

- 1 Unless otherwise permitted or directed by the RCE, spread the asphalt mixture by means of a mechanical self-powered paver capable of spreading and finishing the asphalt mixture without segregation to the depth and width required, true to line, grade, and crown set by the RCE. Equip the paver with hoppers and distributing screws or satisfactory devices for placing the mixture uniformly in front of the screed. When extendable screeds are used, sufficiently extend the distributing screws or augers to provide uniform distribution of the mixture for the full width of the screed. Use a screed or strike-off assembly that operates by cutting, crowding, or other practical action that is effective on the mixture at workable temperatures without tearing, shoving, or gouging and that produces a finished surface of the smoothness and texture required. Use a screed that is adjustable as to level and has an indicating level attached.
- 2 Use a paver that is capable of operating at variable speeds consistent with uniform and continuous laying of the mixture. Avoid stop and go operations of the paver.
- 3 On projects of sufficient length, in addition to the above requirements, equip the paver with a system for automatically controlling the pavement cross-slope and for automatically controlling the longitudinal profile. As the paver moves forward, ensure that the system causes the paver to automatically anticipate and make adjustments for undulations encountered on the existing surface.
- 4 Attach to the paver a 40-foot mobile stringline, a 40-foot long ski, or an approved electronic leveling device with the mobile stringline or ski reference used to establish the longitudinal profile. Use a grade-following sensor that is capable of following the taut string, wire, or other reasonable rigid grade reference produced by the leveling device. Use an automatic cross-slope device that is adjustable and is able to obtain the proper super-elevation going into curves and able to maintain the maximum super-elevation within curves once reaching the maximum super-elevation. For tying into an existing layer of material, use the existing material as the grade reference for the grade following sensor.

- 5 If desired, use manual operation for constructing irregularly shaped and minor areas. If the automatic controls fail or malfunction, the equipment may be operated manually for the remainder of the normal working day, provided specified results are obtained. If the specified surface tolerance is not obtained and maintained, suspend the paving operations until satisfactory corrections, repairs, or equipment replacements are made.

#### **401.3.11 Rollers**

##### **401.3.11.1 General**

- 1 At the job site, provide the RCE with the manufacturer's literature for the rollers being used, in order that the RCE can determine that the rollers conform to the specifications. Check the tire pressure in the pneumatic-tired rollers upon request and without additional compensation. Check the weight of any roller in use in the presence of the RCE.
- 2 Maintain roller speeds that give maximum compaction and a smooth pavement.

##### **401.3.11.2 Steel-Wheel Rollers**

- 1 Use steel wheel rollers that are between 8 and 12 tons in weight. Develop a minimum pressure of 250 pounds per inch of roller width in the compression wheel for these rollers under working conditions. Use rollers in good working condition and capable of reversing without backlash. Equip rollers with adjustable scrapers to keep the rollers clean and with efficient means of keeping the wheels wet to prevent mixes from sticking to the rollers.
- 2 Keep the surface of the rollers free of flat areas, openings, or projections that could mar the surface of the pavement.

##### **401.3.11.3 Pneumatic-Tire Rollers**

- 1 Use pneumatic-tire rollers that are self-propelled and have an effective rolling width of not less than 60 inches. Equip the rollers with pneumatic tires of equal size and diameter that are capable of exerting uniform contact pressures. Pressures varying from 60 psi to 80 psi are recommended. Adjust contact pressure by adjusting the ballast or tire inflation pressures. Place the wheels of the rollers so that one pass accomplishes complete coverage equal to the rolling width of the machine. Ensure a minimum of a ¼-inch overlap of the tracking wheels and ensure that the wheels do not wobble. Construct the roller so that the contact pressure is uniform for all wheels, and the tire pressure of the several tires does not vary more than 5 pounds per square inch. Use pneumatic-tire rollers that are constructed with enough ballast space to provide the uniform wheel loading required. Vary the total operating weight and tire pressure of the roller directed by the RCE to obtain contact pressures that results in adequate compaction.

##### **401.3.11.4 Vibratory Rollers**

- 1 Use vibratory rollers that weigh at least 8 tons and have either 1 or 2 vibrating wheels. Operate the roller at a speed, frequency, and amplitude that

yields maximum compaction and a smooth pavement.

#### **401.3.12 Field Laboratory and Equipment**

- <sup>1</sup> Provide and maintain in good condition a fully equipped field laboratory, meeting the requirements of **SC-T-81** and furnish all supplies necessary for performing the quality control inspection and testing at the asphalt plant. Furnish all the necessary electricity, fuel, and gas and furnish and maintain all necessary piping and valves. Provide full and ready access for the RCE and MRE during all production and testing. Make immediately available all records to the RCE and MRE at the asphalt plant upon request. Permit the RCE and AME to perform quality control or other tests as deemed necessary. Provide a substantial platform, constructed to the proper height, for use by the RCE and AME in obtaining HMA samples and inspecting mixtures in truck beds. All testing equipment and supplies will be inspected for approval by the AME.

#### **401.3.13 Cutting Equipment for Milled-In Rumble Strips (MIRS)**

- <sup>1</sup> Use a rotary type cutting head for MIRS. Use a head with a maximum outside diameter of 24 inches and a minimum length of 16 inches. Equip the cutting head with the cutting tips arranged in such a pattern that provide a relatively smooth cut. Ensure that the cutting head(s) is mounted on its own independent suspension from that of the power unit to allow the tool to self-align with the slope of the shoulder and/or any irregularities in the shoulder surface. Equip the cutting tool with guides to provide consistent alignment of each cut in relation to the roadway and provide uniformity and consistency throughout the project.

#### **401.3.14 Equipment for Milling Existing Asphalt Pavement**

- <sup>1</sup> Use a milling machine capable of performing the work to the specified width, depth, and cross-slope as shown in the Plans or as directed by the RCE.

#### **401.3.15 Equipment for Planing Existing Asphalt Pavement**

- <sup>1</sup> Use a planing or milling machine equipped with a cutting mandrel with carbide-tipped cutting teeth designed specifically for planing asphalt pavement to close tolerances. Make certain that the equipment accurately establishes slope elevations and profile grade controls. Ensure that a vacuum-equipped street sweeper, capable of removing all loose material from the roadway without causing dust to escape into the air, follows immediately behind the grinding machine. Provide necessary vehicles and equipment for loading and hauling away milled material and cleaning the road surface after planing.

### **401.4 Construction**

#### **401.4.1 General**

- <sup>1</sup> Construct the base, intermediate, or surface course consisting of one or more courses of binder coated mineral aggregates on the prepared surface in accordance with these specifications and the specific requirements of the type



#### 401.4.1

#### 401.4.5.2

specified. Conform the courses to the required lines, dimensions, thickness, and typical cross-section or specified rate of application.

- 2 Conform the production, spreading, compaction, etc. to the applicable requirements of the Specifications.

#### 401.4.2 Plant Production

- 1 Conform HMA production to the requirements of **SC-M-400** unless otherwise specified.
- 2 If it is believed that the HMA is not accurately represented by the field laboratory results, the RCE may contact the AME to investigate the mixture. This investigation may involve the testing of additional HMA material from the paver, delivery truck, or roadway cores.

#### 401.4.3 Paving from Multiple Plants

- 1 To avoid intermixing HMA, do not pave the same lane using mix from more than one plant during a day's production.

#### 401.4.4 Weather and Surface Temperature Restrictions

- 1 Do not apply HMA when the existing surface is wet or frozen. Place HMA in accordance with the following table.

Lift Thickness (inches)	Minimum Ambient Temperature (°F)*
1.0 or less	55.0
1.1 to 2.0	45.0
2.1 to 3.0	40.0
3.1 to 4.5	35.0
* Measure ambient air temperature in the shade with a calibrated thermometer away from artificial heat following <b>SC-T-84</b> .	

- 2 Do not place HMA surface courses, including Surface Type E, during the months of December, January, and February, except with written permission of the DOC.

#### 401.4.5 Plant Calibration

##### 401.4.5.1 General

- 1 Calibrate the asphalt plant before production so that the mix conforms to the job mix formula and field criteria. Keep stockpile aggregate gradation test results and calibration charts or graphs immediately available to the RCE at the plant upon request.

##### 401.4.5.2 Batch Plant

- 1 When a batch plant is used, calibrate the cold feed bins to the correct proportions on the job mix information sheet. Develop calibration charts or

graphs for each individual cold feed bin. Sample each hot bin and perform gradation tests on each hot bin sample. Determine the percentage of material weighed from each hot bin. Immediately correct the automatic proportioning system when it does not consistently deliver materials within the full range of batch sizes within the tolerances stated in **SC-M-401**. Ensure that the automatic proportioning system can be corrected when the binder content does not reasonably compare with the extraction test results.

#### **401.4.5.3 Drum Mixer Plants**

- 1 When a drum mixer plant is used, calibrate the cold feed bins to the correct proportions on the job mix information sheet. Develop calibration charts or graphs for each individual cold feed bin. Recalibrate binder systems when there is variance in the binder content or when the RCE deems necessary. Determine the moisture content of the aggregates before entering the drum at least two times a day or when the RCE or AME deems necessary. Keep calibration charts or graphs and aggregate moisture content test results immediately available to the RCE and AME in the field laboratory upon request.

#### **401.4.5.4 Contractors Monitoring Operations**

- 1 Monitor the gradation and quality of materials that are delivered to the asphalt plant. When one or more aggregate gradations do not reasonably conform to the gradation on the job mix information sheet, resubmit another job mix design request.

#### **401.4.5.5 Failing Samples**

- 1 Adjust plant production and address samples that are out of tolerance as indicated in **SC-M-400**.

#### **401.4.6 Use of HMA Stored in Silos and Surge Bins**

- 1 Ensure that storage of HMA in silos is conducted following the requirements stated in **SC-M-401**.
- 2 The RCE is not obligated to purchase any HMA stored in a silo or surge bin that does not comply with the job mix formula and/or mixture field criteria. HMA that the RCE determines is segregated or contains too much binder due to migration will be rejected.

#### **401.4.7 Preparation of Binder**

- 1 Heat the binder to a temperature range recommended by the binder supplier in tanks designed to provide uniform heating of the entire content and to provide a continuous supply of the binder to the mixer at a uniform temperature. Do not heat the unmodified binder to more than 325°F or greater than the temperature recommended by the binder supplier at any time before or after shipment to the plant site.

#### **401.4.8 Preparation of Aggregate**

- 1 At the plant, dry and heat the aggregate for the mixture. Heat the aggregate to a temperature between 250°F and 325°F or within the temperature

range recommended by the binder supplier.

#### **401.4.9 Preparation of Mixture**

- 1 Heat and prepare the ingredients in a manner that produces a mixture that, when discharged, is at a temperature recommended by the binder supplier, except for HMA Base Type C and D, which requires a temperature to provide complete coating of all particles (typically 240°F to 275°F).
- 2 Whenever possible, devote the full production of the plant to the project in order that the work is performed as continuously as practical. Do not intermix different job mixes in a silo.

#### **401.4.10 Mixing: Batch, Drum, and Continuous Mix Plants**

- 1 In order to give the correct individual proportions, follow the HMA job mix formula at all asphalt plants. Dry the aggregates to a consistent mixing temperature before introducing the binder into the HMA. Mix the correct proportions of aggregate, mineral filler, lime, and binder to produce a homogenous asphalt mix in which all particles are thoroughly coated. Use asphalt plants meeting **SC-M-401**, with lime systems checked initially by the AME before producing HMA for Department projects. Use a plant that is able to produce a consistent asphalt mix, without problems with segregation, mix temperature, and varying binder content to meet requirements of the Specifications.

#### **401.4.11 Blending of Hydrated Lime**

- 1 Uniformly blend hydrated lime with the damp aggregate at a rate of 1% by weight of dry aggregate. Use damp aggregate containing a minimum of 3% moisture. Use a water spray delivery system if aggregate moisture is less than 3% or when the RCE deems it necessary to prevent lime from becoming airborne. Adjust the production rate so that there is not any retained moisture in the finished mix.
- 2 Perform aggregate moisture tests at least two times a day or when deemed necessary by the RCE. Obtain the aggregate moisture samples at a location between the water spray delivery system and the lime feed system. Keep a record of the test results in an easily accessible location at the asphalt plant for review by the RCE and MRE.
- 3 Determine the percentage of hydrated lime being introduced into the HMA in accordance with **SC-T-71** or **SC-T-78**. Check the percentage of hydrated lime at least two times a day or when the RCE deems necessary. Additionally, when **SC-T-78** is used, verify the weighing system accuracy at least one time per week or as often as the RCE deems necessary.
- 4 Maintain a daily record of aggregate moisture tests and lime percentage determinations on a form approved by the AME. Maintain the amount of hydrated lime by dry aggregate weight in the range of 0.90% to 1.10%. Upon request, make all records immediately available to Department personnel at the asphalt plant.

**401.4.12 Milling Existing Asphalt Pavement**

- 1 Mill the existing asphalt pavement to the specified width, depth, and cross-slope at locations shown on the Plans or as directed by the RCE. Monitor the milled surface to ensure smoothness and to reduce excess scarification marks or other damage as determined by the RCE. Establish the longitudinal profile of the milled surface by using a skid sensor on the side of the cut. Dispose of the milled material. Thoroughly clean the milled surface of all loose particles.
- 2 Tie milled surfaces to existing drives and intersections. Conduct additional milling in these areas as necessary.

**401.4.13 Planing Existing Asphalt Surfaces**

- 1 Conduct planing operations in a manner that produces a uniform finished surface of the required texture, grade, and cross-slope. Conduct planing operations in a continuous manner to ensure uniformity. It is not acceptable to conduct frequent halting of the planing operations to load and unload trucks.
- 2 Substantially plane and texture all of the surface area indicated. Extra planing to eliminate small depressed areas is not required if the cumulative total of these un-textured areas does not exceed 5% of the total treated area. It is critical that the planed surface does not allow water to accumulate at the edges of the pavement. Extend planing operations into the paved shoulders or other adjacent pavement a sufficient distance to prevent the construction of a "lip" or other area that retains water on the roadway surface.
- 3 Before commencing work, construct a test section of at least 500 feet in length. The purpose of the test section is to determine the appropriate forward speed for the planing equipment and to demonstrate that the equipment is providing a surface texture, cross-slope, and lane/shoulder configuration satisfactory to the RCE and consistent with this specification.
- 4 Create a "corduroy" texture consisting of a transverse pattern with grooves spaced no greater than 0.2 inches center to center and running generally parallel to the pavement centerline. Ensure that the maximum depth from high to low points on the planed surface is  $\frac{1}{8}$  inch.
- 5 After completion of the planing process, test the ground pavement surface transversely and longitudinally with a 10-foot straightedge. Conduct the straightedge testing at no additional cost to the Department. Conduct testing parallel and normal to the pavement centerline. The RCE will determine the minimum frequency of testing and may require additional testing. Perform additional planing at no additional expense to the Department on all areas with high or low spots in excess of  $\frac{1}{8}$  inch or in areas where the RCE determines that the appropriate cross slope and grades are not met.
- 6 Before allowing traffic on the planed pavement, clean the pavement of dust and debris using appropriate equipment. Use a vacuum sweeper if instructed to do so by the RCE.

**401.4.14 Removal of Existing Asphalt Pavement before Patching**

- 1 Remove the deteriorated pavement to the width and length as determined by the RCE, with the face of the cut being straight and vertical. Construct patches with a minimum patch size of 6 feet X 6 feet with at least 25 feet between patches. Remove the pavement to the depth indicated in the Plans. If unstable material is encountered at this point, remove additional material as directed by the RCE. Backfill the volume of material removed below the patch with material meeting the requirements of **Section 305**, Graded Aggregate Base and thoroughly compact in layers not exceeding 4 inches with vibratory compactors. Thoroughly tack the sides of the existing asphalt pavement before placing the asphalt patch material in the hole. Place the patch material in layers not exceeding 3 inches. Thoroughly compact each layer with a vibratory compactor and pneumatic roller. Conduct the work so that patches are opened and filled the same day, with the roadway being opened to traffic by late that same day. Ensure that the finished patch is smooth riding. Do not apply asphalt mixture when the existing surface is wet or frozen.

**401.4.15 Conditioning of Subgrade**

- 1 Before placing any HMA base course mixture, prepare the subgrade in accordance with the requirements specified in **Section 208**.

**401.4.16 Surface Preparation and Leveling**

- 1 Prepare base courses as specified in the applicable sections of Division 300.
- 2 Thoroughly sweep the base course, old pavement, or existing surface so that it is clean and free from dust and foreign material. Maintain it until the HMA is placed.
- 3 Bring irregularities in the surface of the existing pavement or old base (including widened shoulders where settled) to uniform contour by leveling with HMA. Place the leveling HMA in a separate operation from the specified depth of surface course. Thoroughly compact the leveling HMA until it conforms to the surrounding surface. Where necessary, perform the leveling with a motor grader or paver.

**401.4.17 Transportation and Delivery of Mixes**

- 1 Transport the HMA from the plant to the point of use in vehicles meeting the requirements of **Subsection 401.3.7**. Do not permit any load of HMA to leave the plant so late in the day that it cannot be spread, finished, and compacted during daylight of that same day unless an approved artificial lighting system is provided.
- 2 Deliver the HMA to the spreader at a temperature within 20°F of the temperature set at the plant.

**401.4.18 Application of Prime or Tack Coat**

- 1 Where the Plans call for HMA to be placed directly on a sand clay base course, coquina shell base, or graded aggregate base course and the priming of which is not otherwise provided, apply a prime coat meeting the requirements of **Section 303, 304, 305, or 306** as applicable. A prime coat is not required when HMA is placed directly on the subgrade.
- 2 Before laying any HMA on existing pavements or on unsealed asphalt surface treatment course, uniformly apply a tack coat by use of the distributor spray bars at the rate of 0.05 to 0.15 gallons per square yard as measured by **SC-T-86**. Ensure that all nozzles on the distributor are fully open and operational and are turned at the same angle to the spray bar, which is approximately 30 degrees. In addition, place the spray bar at the proper height above the pavement and apply the proper pressure to provide a uniform double or triple lap of the liquid asphalt material. Place lesser amounts on new pavements and greater amounts on older pavements to ensure a bond between the surface being paved and the overlying course. In areas where it is impractical to use distributor spray bars, such as crossovers, small areas, etc., it is permissible to apply the material by the use of the handheld nozzle. In both cases, apply the actual rate of application as directed by the RCE. Provide a tack coat consisting of binder or emulsified asphalt from a supplier listed on the most recent edition of *SCDOT Qualified Product List 37 or 38*. The acceptable grades of emulsified asphalt are RS-1, MS-1, MS-2, HFMS-1, HFMS-2, SS-1, CRS-1, CRS-2, CMS-2, and CSS-1. Emulsified asphalt, with the exception of grades RS-1 and CRS-1, may be diluted with up to 50% with water provided the dilution is performed at the manufacturing plant by the manufacturer using acceptable procedures. Do not dilute any of the emulsions at the point of use.
- 3 In all cases, regardless of the type tack material used, ensure that the existing pavement or unsealed asphalt surface treatment course is dry and thoroughly cleaned before applying the tack material.
- 4 When HMA sand base course is constructed in layers, clean and scarify the compacted layer as directed by the RCE before placing the next successive layer. When considered necessary by the RCE, apply a tack coat between layers as stipulated above.
- 5 Coat contact surfaces of headers, curbs, gutters, edges of existing pavement, manholes, catch basins, etc. with a thin uniform coating of asphalt tack coat material just before the HMA is placed against them.
- 6 Apply the tack coat as outlined above in a sufficient length of time in advance of the laying of the HMA to permit drying but not so far in advance or over such an area to cause it to lose its adhesiveness.
- 7 No additional compensation is provided for furnishing and applying the tack coats as specified in this subsection.

**401.4.19 Spreading and Finishing**

- 1 Upon arrival at the point of use, dump the HMA into the mechanical spreader and immediately spread and strike off true to the line, grade, and cross-section stipulated and to such appropriate loose depth for each successive course that when the work is completed, the specified thickness or weight per square yard is achieved. Determine HMA placement rates using **SC-T-85**. Deliver and spread all HMA while in a thoroughly workable condition and free from lumps. Handle material in such a manner to reduce segregation. Dump the HMA in the center of the hoppers and take care to avoid overloading and spilling material on the base.
- 2 If during construction it is found that the spreading and finishing equipment leaves tracks or indented areas in the new course that are not satisfactorily corrected by the scheduled operations, or which produce other permanent blemishes, discontinue the use of such equipment and provide other satisfactory spreading and finishing equipment.
- 3 Provide competent personnel who are capable of performing the work for the correction of all pavement irregularities. Correct irregularities in HMA courses while the mixture is still hot. Give special attention to the straight edging of construction joints immediately following the final rolling. Provide a qualified employee to perform the straight edging.
- 4 Immediately after a course is placed and before roller compaction is started, check the surface and adjust any inequalities. Remove all fat spots and irregular areas and replace them with satisfactory material. Correct irregularities in alignment and grade along the outside edge by the addition or removal of HMA before the edge is rolled.
- 5 Unless otherwise directed by the RCE, do not allow the compacted thickness of any single constructed course to exceed the following thicknesses:
  - 4½ inches for HMA Aggregate Base Course,
  - 3 inches for HMA Sand Base Course,
  - 3 inches for HMA Intermediate Course, or
  - 2 inches for HMA Surface Course.
- 6 Place each layer to such thickness as instructed by the RCE. Overlap the joints in the layers a minimum of 6 inches where practical.
- 7 When multiple lifts are being placed in a single day, ensure that the interior mat temperature of the previous lift is less than 175°F when measured at the mid-point of the depth of mat with a calibrated thermometer following **SC-T-84**.
- 8 If desired, in ditch paving, narrow widening, deep or irregular sections, intersections, turnouts, driveways, or at other locations where it is impractical to spread and finish the HMA by standard methods, use approved spreading equipment or acceptable hand methods. When it is considered necessary to improve the profile and cross-section of an existing pavement before placing the additional normal layer of HMA, the RCE may require that the material be

spread with a blade grader or other type of construction equipment that will give the desired results. Do not dump the loads faster than the material can be properly handled. Perform the raking carefully and skillfully to avoid segregation and so that after the first pass of the roller over the raked HMA, minimal back-patching is required.

- 9 Provide approved means for keeping all small tools clean and free from accumulations of asphalt material.
- 10 Locate the finished surface of surface courses placed adjacent to curbs, gutter, manholes, etc., approximately ¼ inch above the edges of these structures.

#### **401.4.20 Compaction (Standard)**

- 1 Ensure that compaction is obtained following the requirements stated in **SC-M-400**.
- 2 Ensure that the intermediate rolling is completed before the mat temperature drops below 175°F.
- 3 To prevent adhesion of HMA to the steel-wheel roller, keep the wheels moistened, without using excess water. Do not use oil.
- 4 In areas such as ditches or along forms, curbs, headers, and walls not accessible for the operation of rollers as specified herein, perform compaction with hand or mechanical tampers, hand-drawn steel wheel rollers, or self-propelled tandem steel wheel rollers as directed by the RCE.
- 5 Ensure that the surface of the HMA after compaction is smooth and true to the established crown and grade. Remove any mixture that becomes loose and broken, mixed with dirt, or in any way defective and replace it with fresh HMA. Immediately compact the fresh HMA to conform to the surrounding area.

#### **401.4.21 Compaction Monitoring**

- 1 Monitor the compaction process and make adjustments in equipment or roller patterns so that the finished HMA pavement meets the specified in-place density requirement. Conduct in-place density tests at least every 500 feet per paving lane width by conducting density-gauge tests at randomly selected locations approved by the RCE and at least 1 foot from any unsupported edge. Determine randomly selected locations by **SC-T-101**.
- 2 Do not start production in a lot until the roadway cores from the previous day's production have been obtained unless permission is given by the RCE. Obtain all density tests and cores required for compaction determination using equipment and procedures approved by the RCE.

#### **401.4.22 Weak Base or Poor Surface Conditions**

- 1 If in the judgment of the RCE a weak base or poor surface condition results in a density lower than the minimum specified, the RCE may establish a "maximum practical density" lower than that specified.



**401.4.23 Joints**

- 1 Roll longitudinal joints directly behind the paver. Position the paver so that in spreading, the material overlaps the edge of the lane previously placed by 1 to 2 inches. Leave the loose material high enough to allow for compaction to the depth of the previously rolled lane. Push back the overlapped material by means of lutes or other suitable tools to the edge of the "cold" joint. Perform this work in a manner that provides a uniform joint when rolled.
- 2 Carefully construct and thoroughly compact transverse joints to provide a smooth riding surface. Straightedge or stringline joints to ensure true alignments.
- 3 Construct longitudinal and transverse joints in a careful manner and present the same texture, density, and smoothness as other sections of the course.
- 4 Make joints between old and new pavements, or between successive strips, in a manner that ensures proper bond between the old and new surface for the full depth of the course. Thoroughly coat the joints, transverse and longitudinal, with an approved asphalt tack coat material before placing adjacent material. If necessary, form joints by cutting back on the course. Include the cost of cutting back and coating joints in the contract unit price for the HMA.
- 5 On projects containing multiple courses, arrange the width of the lanes so that the longitudinal joints of each successive course are offset from the joints of the previous course at least 6 inches where practicable. Construct the width of each lane in the top layer the same as the width of the design travel lanes, unless directed otherwise by the RCE.

**401.4.24 Milled-in Rumble Strips (MIRS)**

- 1 If MIRS are called for in the Plans, place them in the mainline paved shoulder only. Do not place MIRS on ramp shoulders.
- 2 Construct MIRS with finished dimensions of 7 inches ( $\pm \frac{1}{2}$  inch) wide in the direction of travel and a minimum of 16 inches long measured perpendicular to the direction of travel. Construct the depressions with a concave circular shape with a minimum  $\frac{1}{2}$ -inch depth at center. Place the MIRS perpendicular to the roadway on 12-inch centers. Begin the MIRS on the shoulder, 10 inches from the right edge of the travelway.
- 3 Do not construct MIRS on the median paved shoulder unless specified in the Plans. If the median shoulder is specified, construct the milled area 4 inches from the left edge of the travelway on the shoulder.
- 4 If desired, use removed pavement material suitable for recycling on the project or for other operations at no additional expense to the Department.
- 5 At the end of each working day, remove all equipment to a location where it does not present a hazard to traffic. Clean the pavement by sweeping or flushing; and reopen the work area to traffic each day.

**401.4.25 Requirements for Recycled Asphalt Pavement (RAP)**

- 1 Conform the production, spreading, compaction, etc. of the RAP to the applicable requirements of the **Subsection 401.3.6**.

**401.4.26 Protection of Surface**

- 1 Protect the newly constructed surface from traffic until the mixture has hardened sufficiently to prevent distortion. Keep the surface clean and free from foreign material when the shoulders are being constructed.

**401.4.27 Finished Surface Requirements****401.4.27.1 General**

- 1 After compaction, ensure that the finished surface of the intermediate or surface course is smooth, of uniform texture, and true to the specified crown and grade.

**401.4.27.2 Variability**

- 1 When checked with a 10-foot straightedge applied parallel to the centerline of the pavement, ensure that the finished surface of the intermediate course does not vary more than  $\frac{1}{4}$  inch and the finished surface course does not vary more than  $\frac{1}{8}$  inch as measured from the bottom of the straightedge to the top of the finished surface. Correct intermediate or surface courses not meeting these finished surface requirements by repairing or if necessary, by removing and replacing subject to the approval of the RCE.

**401.4.27.3 Ride Quality**

- 1 In addition to meeting any specified requirements for surface tolerances, ensure that the intermediate and surface courses meet the satisfactory riding qualities for the HMA placed as determined by the RCE.

**401.4.28 Segregation Identification and Correction**

- 1 Segregation is defined as areas of non-uniform distribution of coarse and fine aggregate particles in a compacted HMA pavement.
- 2 Conduct necessary production, storage, loading, placing, and handling procedures to prevent segregation. Prevent placement of a segregated HMA mat by making plant modifications or providing auxiliary equipment.
- 4 Correct segregated areas in HMA courses at no additional expense to the Department. Meet all compaction and rideability requirements on roads with corrected segregated areas.
- 5 Correct segregated HMA courses that are not considered riding courses by removing and replacing segregated areas for the full depth of the course and extend at least 10 feet on either side of the segregated areas for the full width of the paving lane.
- 6 Correct all segregated HMA riding courses and segregated courses placed immediately below open graded friction courses by removing and replacing these segregated areas for the full depth of the riding course and extend at

least 300 feet on either side of the segregated areas.

- 7 Overlay the entire roadway with an open grade friction course when more than 25% of the final roadway surface area is corrected due to segregation. Place the open graded friction course at no additional expense to the Department.
- 8 Meet all compaction and rideability requirements on roads with corrected segregated areas.

#### **401.4.29 Rideability**

- 1 Ensure that pavement rideability meets the requirements of **SC-M-403**.

#### **401.4.30 Plant Tickets**

- 1 Record in triplicate on forms approved by the RCE the net weight of each load of HMA, the accumulated net weight of the loads for the day, and if loaded from a silo, the silo identification number.
- 2 When each load of HMA is delivered to the work, present the original copy of the plant ticket for the load to the RCE. Maintain the stub copy until the completion of the work. Deliver copies to the RCE at the end of the project.
- 3 Note any changes in the amounts designated on all copies of the tickets necessitated by the rejection of material and the reason stated for rejection.
- 4 At any time during the delivery of material and for the purpose of checking the weighing equipment at the plant, the RCE may request that any truckload of HMA delivered to the work be weighed on tested and approved platform scales at no additional expense to the Department.

#### **401.5 Measurement**

- 1 The quantity for HMA Intermediate Course and HMA Surface Course is the weight of the material placed determined by using approved scales with no deduction made for the weight of asphalt materials, hydrated lime, liquid anti-striping agent, or any other admixtures and is measured by the ton (TON) of material, complete in place, and accepted,
- 2 The quantity for HMA base course is measured by the unit specified in the Contract. When measurement is specified by the ton (TON), measurement is in accordance with the requirements of this subsection. When measurement is specified by the square yard (SY), measurement is in accordance with the requirements of **Section 309** or **310** for Asphalt Base Course.
- 3 The quantity for Liquid Binder (of the performance grade specified) in the HMA is measured by the ton (TON) of liquid asphalt binder contained in the work and accepted. The amount of binder in the HMA is determined by **SC-T-63**, **SC-T-64**, or **SC-T-75** or, at the option of the RCE, from the amounts printed on the load tickets using an approved ticket printer. In order to check scale accuracy when using a ticket printer for measurement of binder, perform periodic extraction tests (not for pay purposes) on HMA other than those that contain marine limestone or slag.

- 4 Weight of binder that may be absorbed by the aggregate is not included in the quantity of binder.
- 5 When the binder content is not being measured by ticket printout, the quantity of binder in the HMA is the percentage of binder determined at the field laboratory unless otherwise directed by the RCE.
- 6 HMA wasted or lost due to negligence, HMA or binder applied in excess of the rate specified or directed in writing, or HMA applied beyond the limits of the work is deducted from pay quantity.
- 7 The quantity for Milling Existing Asphalt Pavement is surface area of asphalt pavement milled to the specified depth measured and is measured by the square yard (SY), complete in-place, and accepted. The measurement is made on the surface of the road or area designated for milling. No additional measurement is made for variable milling needed to tie in to existing drives and intersections unless specifically directed by the RCE.
- 8 The quantity for Surface Plane Asphalt Pavement is the surface area of the road planed to the specified texture and is measured by the square yard (SY), complete, and accepted. Surface planing conducted outside of the area designated for planing is disregarded in the quantity, except where necessary to provide acceptable cross-slope and lane/shoulder transition as directed by the RCE.
- 9 The quantity for Full Depth Asphalt Pavement Patching is surface area of full depth asphalt pavement patched to a uniform depth and is measured by the square yard (SY), complete, and accepted. Base course material used in the patching work is measured by the ton (TON) of Graded Aggregate Base in accordance with **Subsection 305.5**.
- 10 The quantity for Milled-In Rumble Strip is the sum of the length of the segments of rumble strips milled into the asphalt pavement as indicated on the Plans or as directed by the RCE and is measured by the mile (MI), complete, and accepted. The length of a segment is measured along the inside edge of the shoulder from the center of the first rumble strip in a segment to the center of the last rumble strip in that segment. Where MIRS are provided on more than one shoulder, the segments on each shoulder are measured separately and then, added together.

#### **401.6 Payment**

- 1 Adjustments in the contract unit bid prices for HMA courses are determined in accordance with **SC-M-400**. The unit bid prices of HMA courses may be adjusted due to fluctuations in the Monthly Asphalt Price Index or the Monthly Fuel Price Index only if specified as applicable in the Special Provisions.
- 2 Payment for the accepted quantity for HMA Intermediate Course or HMA Surface Course (of the type specified), measured in accordance with **Subsection 401.5**, is determined using the contract (or adjusted) unit price for the applicable pay item. For specific requirements and listing of pay items for the HMA Intermediate Courses and HMA Surface Courses, refer to

**Sections 402 and 403**, respectively.

- <sup>3</sup> Payment for the accepted quantity for Asphalt Base Course (of the type specified), measured in accordance with **Subsection 401.5**, is determined using the contract (or adjusted) unit price for the applicable pay item. For specific requirements and listing of pay items for the asphalt base courses, refer to **Sections 309 and 310**.
- <sup>4</sup> The above mentioned contract (or adjusted) unit prices and payments for all HMA courses are full compensation for constructing the HMA base course, intermediate course, or surface course as specified or directed and includes furnishing, mixing, hauling, placing, and compacting the HMA course; furnishing and applying a tack coat; determining the compaction of the course; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- <sup>5</sup> Unless otherwise specified in the Contract, hydrated lime and any other admixtures are not paid for separately. Include all costs for furnishing and incorporating the hydrated lime and any other admixtures into the HMA in the contract (or adjusted) unit price of the HMA course.
- <sup>6</sup> Payment the accepted quantity for Liquid Asphalt Binder (of the performance grade specified), measured in accordance with **Subsection 401.5**, is determined using the contract (or adjusted) unit price for the applicable pay item. Payment is full compensation for providing the required liquid asphalt binder as specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- <sup>7</sup> Payment for the accepted quantity for full depth Full Depth Asphalt Pavement Patching (of the specified uniform depth), measured in accordance with **Subsection 401.5**, is determined using the contract (or adjusted) unit price for the applicable pay item. Payment is full compensation for patching deteriorated asphalt pavement as specified or directed and includes cleaning, removing, and disposing of debris from the patching work, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- <sup>8</sup> Base course material used in the full depth asphalt pavement patching work is paid for as Graded Aggregate base in accordance with **Subsection 305.6**.
- <sup>9</sup> Payment for the accepted quantity for Milling Existing Asphalt Pavement (for the depth specified), measured in accordance with **Subsection 401.5**, is determined using the contract unit price for the applicable pay item. Payment is full compensation for milling the existing asphalt pavement as specified or directed and includes cleaning, removing, and disposing of debris from the milling work, and all other materials, labor, equipment, tools, supplies, trans-

portation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

- 10 Payment for the accepted quantity for Surface Plane Asphalt Pavement, measured in accordance with **Subsection 401.5**, is determined using the contract unit bid price for the applicable pay item. Payment is full compensation for surfacing planing asphalt pavement as specified or directed and includes straightedge testing of planed surface; cleaning, removing, and disposing debris from planing work; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 11 Payment for the accepted quantity for Milled-In Rumble Strip measured in accordance with **Subsection 401.5**, is determined using the contract unit price for the applicable pay item. Payment is full compensation for milling the rumble strips into asphalt pavement as specified or directed and includes cleaning, removing, and disposing of debris from the work, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 12 Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.
- 13 Pay items under this section includes the following:

Item No.	Pay Item	Unit
4011004	Liquid Asphalt Binder PG64-22	TON
4011008	Liquid Asphalt Binder PG76-22	TON
4011010	Liquid Asphalt Binder PG82-22	TON
4012030	Full Depth Asphalt Pavement Patching 3" Uniform	SY
4012040	Full Depth Asphalt Pavement Patching 4" Uniform	SY
4012060	Full Depth Asphalt Pavement Patching 6" Uniform	SY
4012080	Full Depth Asphalt Pavement Patching 8" Uniform	SY
4012100	Full Depth Asphalt Pavement Patching 10" Uniform	SY
4012120	Full Depth Asphalt Pavement Patching 12" Uniform	SY
4013001	Surface Plane Asphalt Pavement	SY
4013XXX	Milling Existing Asphalt Pavement (X)"	SY
4013990	Milling Existing Asphalt Pavement (Variable)	SY
4019000	Milled-In Rumble Strip	MI

## SECTION 402

### HMA INTERMEDIATE COURSE

#### 402.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for hot mixed asphalt (HMA) intermediate courses composed of mineral aggregate and binder, mixed in an approved asphalt plant, constructed on a prepared surface, and in conformance with the lines, grades, dimensions, thickness, and typical cross-section shown on the Plans or as otherwise specified.

#### 402.2 Materials

##### 402.2.1 General

- 1 Provide and use materials that meet the applicable requirements of **Subsection 401.2** and **SC-M-402**.

##### 402.2.2 Composition of Mixture

- 1 Combine the mineral aggregates and binder in such proportions so that the composition by weight of the finished HMA is within the composition limits shown in **Subsection 401.2.3** and **SC-M-402**.

#### 402.3 Equipment

- 1 Provide equipment meeting the requirements of **Subsection 401.3**.

#### 402.4 Construction

- 1 Construction HMA intermediate courses in accordance with the requirements specified in **Subsection 401.4**.

#### 402.5 Measurement

- 1 Measurement of the quantity for HMA Intermediate Course Type (A, B, or C) is performed in accordance with **Subsection 401.5**.

#### 402.6 Payment

- 1 Payment for the accepted quantity for HMA Intermediate Course Type (A, B, or C) is determined in accordance with **Subsection 401.6**.
- 2 Payment for each item includes all direct and indirect costs and expenses required to complete the work.

402.6

402.6

3 Pay items under this section include the following:

Item No.	Pay Item	Unit
4020310	HMA Intermediate Course Type A	TON
4020320	HMA Intermediate Course Type B	TON
4020330	HMA Intermediate Course Type C	TON



## SECTION 403

### HMA SURFACE COURSE

#### 403.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for HMA surface courses composed of mineral aggregate and binder, mixed in an approved plant, constructed on a prepared surface, and in conformance with the lines, grades, dimensions, thickness, and typical cross-section shown on the Plans or as otherwise specified.

#### 403.2 Materials

##### 403.2.1 General

- 1 Use materials that meet the applicable requirements of **Subsection 401.2** and **SC-M-402**.

##### 403.2.2 Composition of Mixture

- 1 Combine the mineral aggregates and binder in such proportions that the composition by weight of the finished HMA is within the limits set forth in **SC-M-402**.
- 2 A job mix formula is not required for the HMA Surface Course Type E; however, maintain a binder content within an allowable variation  $\pm 0.4\%$  of the content approved by the MRE.
- 3 If included in the Contract, use HMA Surface Course Type C or D for Ditch Paving.

#### 403.3 Equipment

- 1 Provide equipment meeting the requirements of **Subsection 401.3**.

#### 403.4 Construction

- 1 Construct HMA surface courses in accordance with the requirements specified in **Subsection 401.4**.

#### 403.5 Measurement

- 1 Measurement of the quantity for HMA Intermediate Course Type (A, B, CM, C, D, or E) is determined in accordance with **Subsection 401.5** with the following addition:
  - When the item of HMA Surface Course for Ditch Paving is included in the Contract, the binder in the ditch paving mixture is not measured for separate payment.

#### 403.6 Payment

- 1 Payment for the accepted quantity for HMA Intermediate Course Type (A, B, CM, C, D, or E) is determined in accordance with **Subsection 401.6** with the following addition:

- When the item HMA Surface Course for Ditch Paving is included in the Contract, the cost of the binder material in the ditch paving mixture is considered included in the contract unit price for the work and is not paid for separately.
- 2 Payment for each item includes all direct and indirect costs and expenses required to complete the work.
- 3 Pay items under this section include the following:

Item No.	Pay Item	Unit
4030310	HMA Surface Course Type A	TON
4030320	HMA Surface Course Type B	TON
4030330	HMA Surface Course Type CM	TON
4030340	HMA Surface Course Type C	TON
4030350	HMA Surface Course Type D	TON
4030360	HMA Surface Course Type E	TON
4037000	HMA Surface Course for Ditch Paving	TON

## SECTION 627

### THERMOPLASTIC PAVEMENT MARKINGS

#### 627.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for furnishing and applying permanent thermoplastic pavement markings within the limits of the project to delineate the travel lanes and channelize traffic.
- 2 This work includes protection of pavement markings during installation, determination of no passing zones for two-lane facilities in accordance with the *MUTCD*, and providing the Department data used in establishing no passing zones on two-lane facilities.

#### 627.2 Materials

##### 627.2.1 General

- 1 Provide thermoplastic pavement marking material that is a reflectorized mixture of a thermoplastic binder and spherical glass beads upon which additional glass beads are applied by dropping immediately following application. Coat Portland concrete pavement surfaces, including bridge decks, with a primer-sealer material before application of the thermoplastic binder material. Coat other surfaces as well if recommended by the thermoplastic manufacturer.

##### 627.2.2 Thermoplastic Binder Compound

###### 627.2.2.1 General

- 1 Ensure that the thermoplastic binder compound meets all requirements of AASHTO M 249 as modified herein.
- 2 The material may be shipped in the granulated form or the block form. Use alkyd based thermoplastic pavement markings. Apply alkyd/maleic thermoplastic pavement markings by extrusion methods only. Extrusion may be accomplished using either conventional extrusion equipment or ribbon gun extrusion devices.
- 3 Ensure that the alkyd/maleic binder consists of a mixture of synthetic resins containing high boiling point plasticizers and at least one synthetic resin that is solid at room temperature. Use a binder with at least one-half of its composition consisting of 100% maleic-modified glycerol of resin and not less than 15% by weight of the entire material formulation. Make certain that the binder does not contain petroleum hydrocarbon resins. Ensure that resins/rosins used are maleic-modified glycerol esters.
- 4 Ensure that the thermoplastic material dissolves immediately in diacetone alcohol. Slow dissolution is evidence of the presence of hydrocarbon binder components, which are not allowed.

**627.2.2.2 Yellow Thermoplastic**

- 1 Use a yellow thermoplastic that is lead-free (L/F). Ensure that it does not contain more than 3ppm of lead by weight in a cured state and not more than 100ppm of total Heavy Metals as defined by Resource Conservation and Recovery Act (RCRA) including lead and hexavalent chromium when tested in accordance with Environmental Protection Agency (EPA) Methods 3050 and 6010. Ensure that the yellow thermoplastic contains proper amounts of pigment to produce a material that is weather-fast, heat stable, and meets the Yellow Color, Reflectance, Color Stability (Accelerated Weathering), and Retroreflectivity requirements specified herein. Make certain that the lead-free yellow thermoplastic material appears yellow during both daytime and night-time conditions when applied with drop-on beads. Ensure that the thermoplastic does not contain any hazardous materials at levels that would cause the thermoplastic to be classified as a hazardous waste as defined by RCRA Subarticle C rules and Table 1 of 40 CFR 261.24 Toxicity Characteristic.
- 2 Ensure that the yellow color of unbeaded material matches Federal Standard Designation No. 595b, color No. 33538 and is within the following chromaticity limits (color box) defined by plotting the following four (x, y) pairs on a C.I.E. 1931 Chromaticity diagram:
 

(x1, y1)	(.5300, .4560)
(x2, y2)	(.5100, .4850)
(x3, y3)	(.4550, .4440)
(x4, y4)	(.4720, .4000)

Reflectance (Y) between 45 and 55  
 Measurement conditions = 2 degrees observer/illuminant D65  
 Instrument: BYK – Gardner “Color-Guide” Spectrophotometer

**627.2.2.3 Accelerated Color Stability**

- 1 Ensure that the accelerated weathering of white and yellow (L/F) thermoplastic meets the requirements of ASTM G 155, Table X3.1, Cycle I for 1500 hours total exposure time. Prepare sample by dipping a sheet aluminum panel into the molten thermoplastic and removing it to obtain a 1.5 to 3.0 mm coating thickness of thermoplastic on the panel. Place the panel in the weathering apparatus for 1500 hrs.
- 2 After accelerated weathering, measure the Yellow Color or Yellowness Index of the unbeaded material as stated in AASHTO M 249, Section 4.3.1 or 4.3.7. Material must meet the color stability requirements below after this exposure:
  - White – ASTM E 313 – Yellowness Index, max. 20
  - Yellow – Measured chromaticity coordinates falls within a “color box” defined by the following four (x, y) pairs on a C.I.E. 1931 Chromaticity diagram:

(x1, y1) (.5300, .4560)  
 (x2, y2) (.5100, .4850)  
 (x3, y3) (.4350, .4290)  
 (x4, y4) (.4490, .3770)

#### 627.2.2.4 Color Stability of In-Service White and Yellow Thermoplastic

- 1 The daytime color of the applied white and yellow thermoplastic pavement marking material (with drop-on beads) must meet the color requirements shown in **Subsection 627.2.2.3** (Accelerated Color Stability). The color may be measured within 60 days of application using a portable BYK-Gardner "Color-Guide" Spectrophotometer (see **Subsections 627.2.2.2** and **627.2.2.3**) and must remain within the "color-box" as noted in **Subsection 627.2.2.3**.

#### 627.2.2.5 Hardness and Indentation Resistance

- 1 Measure the hardness according to ASTM D 2240, except condition the sample for 2 hours in a 115°F water bath, before measuring the hardness. Condition the Durometer at 115°F in a forced air oven. Remove the sample from the water bath and quickly place the Durometer on the sample while starting a stopwatch. Record the hardness after 15 seconds. Ensure that the total weight of the Durometer is 2000 grams. Make certain the hardness is a minimum of 40 and a maximum of 70.

#### 627.2.2.6 Flash Point

- 1 Ensure that the flash point of the thermoplastic pavement marking is a minimum of 475°F (245°C) when tested in accordance with ASTM D 92.

#### 627.2.3 Glass Beads

- 1 Ensure that Type 1, Type 3, and Type 4 glass beads meet the requirements of AASHTO M 247 with the following exceptions:

Glass beads are a minimum of 80% true spheres when tested according to ASTM D 1155 and meet the following gradation requirements when tested in accordance with ASTM D 1214:

Sieve Size	Percent by Mass Passing Designated Sieve (ASTM D 1214)		
	Grading Designation		
	Type 1 (AASHTO)	Type 3 (FP 96)	Type 4 (FP 96)
No. 8	---	---	---
No. 10	---	---	100
No. 12	---	100	95 - 100
No. 14	---	95 - 100	80 - 95

(table continued on the next page)

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Sieve Size	Percent by Mass Passing Designated Sieve (ASTM D 1214)		
	Grading Designation		
	Type 1 (AASHTO)	Type 3 (FP 96)	Type 4 (FP 96)
No. 16	100	80 - 95	10 - 40
No. 18	---	10 - 40	0 - 5
No. 20	95 - 100	0 - 5	0 - 2
No. 25	---	0 - 2	---
No. 30	75 - 95	---	---
No. 40	---	---	---
No. 50	15 - 35	---	---
No. 80	---	---	---
No. 100	0 - 5	---	---

- 2 Ensure that the intermixed glass beads meet the requirements for Type I with the following exception:

The intermixed glass beads are incorporated into the thermoplastic binder at a minimum of 35% and a maximum of 40% by mass weight.

#### 627.2.4 Primer-Sealer

- 1 Use a two-part epoxy primer-sealer recommended by the manufacturer of the thermoplastic pavement marking material on Portland cement pavement surfaces and bridge surfaces that have not been overlaid with asphalt. Use the primer-sealer on any type of pavement before the placing of any pavement symbols. Use the primer-sealer on asphalt concrete pavement surfaces if recommended by the manufacturer of the thermoplastic pavement marking material. Ensure that the primer-sealer forms a continuous film that will mechanically adhere to the pavement and neither discolor nor cause any noticeable change in the pavement outside of the finished pavement markings. Apply the primer-sealer in accordance with the manufacturer's recommendations.

#### 627.2.5 Quality Assurance Provisions And Certification

- 1 Obtain actual laboratory test results from the manufacturer of the thermoplastic binder indicating compliance with all requirements of AASHTO M 249 for each batch or lot of material furnished, along with a final certification that the material furnished meets the requirements of the Department's specifications. Also, obtain from the manufacturer of the drop-on glass beads a certification stating that the material furnished meets all the requirements of the

Contract specifications. Furnish copies of the above-described affidavits to the RCE.

### **627.3 Equipment**

#### **627.3.1 Application Equipment**

- 1 Use equipment that enables the installation of thermoplastic pavement markings by methods in accordance with AASHTO M 249 with the addition of the following requirements.
- 2 Applicators may be either a truck-mounted liner or a portable unit. A truck-mounted unit is defined as a self-propelled vehicle with six or more wheels and an enclosed cab for housing a driver. Make certain that the operator has controls that allow override of pre-set automatic cycles in order to extend a line or to begin a new cycle at any selected point.
- 3 Prepare material with an insulated batching machine recommended or furnished by the manufacturer and consists of a special kettle for melting and heating the composition. Ensure that heating of kettles and melters is done by controlled heat transfer systems that are oil jacketed or indirect flame air jacketed. Do not use direct flame heating equipment. Make certain that all kettles and melters are equipped with an automatic thermostatic control device and proper thermometers to control the temperature of the material at the manufacturer's recommended application temperature range. Ensure that all mixing and conveying parts up to the final dispensing nozzle/shaping die maintain the material at the appropriate temperature. Ensure that the applicator and kettle are equipped and arranged to satisfy the requirements of all state and local requirements.
- 4 Ensure that the batching machine provides continuous mixing and agitation of the material. Make certain that all parts of the equipment that come in contact with the material are easily accessed and exposed for cleaning and maintenance and are designed to prevent accumulation and clogging.
- 5 Apply thermoplastic pavement markings by extrusion methods. Extrusion may be accomplished either with a conventional extrusion equipment, wherein one side of the shaping die is the pavement surface and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material, or with ribbon gun extrusion devices. Make certain that the applicators have a means for cleanly cutting off square ends.
- 6 Ensure that the applicators are capable of producing the various widths of traffic markings required in the *MUTCD* and/or on the Plans. Make certain that the applicators are mobile and maneuverable so that it can follow straight lines and make normal curves in a true arc. Use a truck-mounted liner with a method of automatically applying "skip" or solid longitudinal lines, including right and left edge lines, or any combination of single or double line configurations (color and pattern) as illustrated in the *MUTCD*. Adjust application equipment to prevent nozzle/shaping die overruns without the use of pans,

aprons, or other devices.

- 7 Apply glass beads to the surface of the completed marking with an automatic bead dispenser attached to the applicator so that the beads are dispensed almost instantly following application of the marking material.

#### **627.3.2 Equipment on Site**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

### **627.4 Construction**

#### **627.4.1 Use and Coordination of Traffic Control**

- 1 It is the Contractor's responsibility to use and coordinate the proper traffic control indicated in the Specification, on the Plans and the *SCDOT Standard Drawings*, in the *MUTCD*, or as directed by the RCE to allow for the safe removal of existing pavement markings if required, surface preparation, and installation of new pavement markings.

#### **627.4.2 Surface Preparation**

- 1 Ensure that the pavement is dry and free of glaze, oil, dirt, grease, or other foreign contaminants. Where directed by the RCE, remove any existing markings that conflict with the *Pavement Marking Plans* by an approved method before the application of thermoplastic material. Use approved removal methods, which are shot blast, sand blast, or grinding.
- 2 In cases where the existing symbol markings (i.e. arrows, ONLY, etc.) differ from or are in conflict with the Plans, the *MUTCD*, or the *SCDOT Standard Drawings* the RCE will determine which governs. For symbol marking relocation or replacement, remove 95% of the conflicting markings by buffing, water blasting, sand blasting, or otherwise ensuring that the pavement surface is in proper condition for adequate bonding of the new thermoplastic markings. Include the cost of removal in the bid prices for placement of the new symbol markings.
- 3 On Portland cement concrete surfaces including bridge decks, remove at least 95% of any existing markings by an approved method to provide for adequate bonding of the thermoplastic material. Make the width of the removal 2 inches wider than the line to be applied. Apply a primer sealer, recommended by the thermoplastic manufacturer, to the prepared surface before the application of the thermoplastic material.
- 4 When removing existing markings from the pavement surface, provide a positive means to control dust and accumulation of debris resulting from the removal operation. Capture the removed material utilizing a separate vacuum equipped vehicle or other approved system, to prevent its dispersal, and to properly dispose of this material. Do not allow visible marking material debris



to remain on the pavement shoulders. Ensure that the clean-up operations include removal and disposal of the excess or waste materials away from the project site.

- 5 Ensure that the removal or dust and debris collection operations do not damage the existing pavement surfaces (concrete or asphalt) or damage the pavement joint materials. Repair any significant damage occurring from the removal operations to the satisfaction of the RCE and at no expense to the Department.
- 6 Immediately before application of the new marking material, clean all surfaces to be marked with a jet of compressed air. At the time of marking application, ensure that the pavement surface is free of dust, dirt, oil, grease, and any remaining loose or flaking existing marking material.

#### **627.4.3 Application of Primer-Sealer**

- 1 Where required, spray the primer-sealer on the pavement surface where the lines are to be applied. Follow the recommendations of the manufacturer of the primer sealer and/or thermoplastic material for the application thickness and curing time before application of the thermoplastic material.

#### **627.4.4 Application of the Thermoplastic Pavement Marking Material**

- 1 Except when directed or approved by the RCE, place all longitudinal markings with a truck-mounted applicator in conformance with the requirements of **Subsection 627.3**. Such an exception may occur where the length of a particular marking is too short or the curvature too great to permit efficient use of the truck-mounted liner. Transverse markings may be applied with a portable unit.
- 2 Ensure that the markings are straight or uniform in curvature and conform uniformly to tangents, curves, and transitions. Make certain that symbols are of the dimensions shown in the *SCDOT Standard Drawings*. Ensure that markings are of the dimensions and are placed as shown on the *Pavement Marking Plans* or as directed by the RCE. Provide sufficient control points to serve as guides for the application of markings at no additional expense to the Department.
- 3 Ensure that the finished line pavement markings are free from waviness and lateral deviation does not exceed 2 inches in 15 feet. Any greater deviation is sufficient cause for removal and correction of such markings at no additional expense to the Department. Remove and correct symbol pavement markings not meeting the dimensional requirements shown in the *SCDOT Standard Drawings*. Protect the pavement markings until dry by placing guarding or warning devices as necessary. If a vehicle crosses the wet marking, remove the pavement marking and any tracking lines made by the moving vehicle and apply new markings at no additional expense to the Department.
- 4 Place pavement markings only when the pavement is dry as determined by visual inspection or other approved method and the pavement temperature is

a 55°F or greater and the air temperature is 50°F or greater. No work is allowed when any moisture is visible on the pavement surface or pavement is wet. Provide each work crew with a hand-held infrared non-contact thermometer with a temperature range of 0°F to 1000°F to verify the minimum surface temperature and a pocket thermometer capable of accurately measuring air temperature. Measure air temperature away from heat generating equipment.

- 5 Do not apply thermoplastic pavement markings between December 15 and March 15, inclusive. Additionally, the RCE may disallow application on any days when the weather is cold and/or rainy and there is some question as to whether the surface temperature will be above 55°F for a period adequate to obtain quality pavement markings. Application may also be disallowed on any day when, in the opinion of the RCE, moisture conditions are not satisfactory for obtaining quality pavement markings.
- 6 Ensure that new asphalt concrete surfaces are in place a minimum of 7 days before application of thermoplastic pavement markings. Remove the curing compound on new Portland cement concrete surfaces before application of pavement markings.
- 7 Have on hand an adequate number of personnel experienced in the handling and application of this type of material to ensure that the work is done properly. Run the marking machine only in the direction of normal traffic flow during marking operations.
- 8 Perform work only during daylight hours unless specified otherwise. Ensure that all markings are sufficiently dry before sunset to permit crossing by traffic. Remove all protective devices before sunset to allow free movement of traffic at night.
- 9 Apply the thermoplastic pavement marking material at a temperature between 390°F and 420°F that provides the best adhesion to the pavement as recommended by the manufacturer. Heat the material uniformly throughout, and ensure that it has a uniform disbursement of binder, pigment, and glass beads when applied to the surface of the pavement.
- 10 Apply extruded lines 12 inches or less in width with a die that equals the width of the line. Extruded lines greater than 12 inches may be applied with two dies whose combined width is equal to the width of the line.

#### **627.4.5 Rate of Application of Thermoplastic Material**

- 1 Apply the thermoplastic material at the specified widths and at the rate of new dry material thickness as specified as follows.
  - 90 mils for edge lines and median lines including:
    - 4-inch solid white lines,
    - 4-inch solid yellow lines,
    - 4-inch broken yellow lines,
    - 6-inch solid white lines, and

- 6-inch solid yellow lines.
- 90 mils for lane lines including:
  - 4-inch broken white lines and
  - 6 inch broken white lines.
- 90 mils for center lines on two-lane roads including:
  - 4-inch broken yellow lines and
  - 4-inch solid yellow lines.
- 125 mils for all symbols, words, or other lines not listed above.

#### **627.4.6 Application of Glass Beads**

##### **627.4.6.1 General**

- 1 Mechanically apply drop-on glass beads to the surface of the pavement marking material immediately after the material is applied to the pavement surface while the pavement marking material is still molten. Ensure that the beads are held by, and mechanically embedded in, the surface of the material. Make certain that the beads are uniformly distributed over the entire surface of the marking utilizing the single-drop or double-drop method specified below.
- 2 Uniformly apply drop-on glass beads to the surface of the molten thermoplastic material using either Single-Drop or Double-Drop method as required. Make certain that beads are embedded at 60% of their diameter and at a rate of 8 to 10 lbs per 100 square feet. Ensure that Type I glass spheres used for Single-Drop applications have a dual coating for adhesion promotion and moisture resistance.

##### **627.4.6.1 Double Drop Method**

- 1 Use the double-drop method of applying glass beads for all Interstate highways and for other roadways when specified or required by the plans.
- 2 Use small glass beads meeting the gradation for Type 1 required in **Subsection 627.2.3**.
- 3 Use large glass beads meeting the gradation for Type 3 or 4 required in **Subsection 627.2.3** and are a minimum of 80% true spheres.
- 4 Apply large beads uniformly to the surface of the thermoplastic material so that they are embedded at 60% of their diameter at a rate of 8 to 10 lbs. per 100 square feet of material. Immediately follow the application of the large beads with application of the smaller spheres at a rate of 8 to 10 lbs. per 100 square feet of material.
- 5 Ensure that the beads are properly embedded and adhered to the thermoplastic line; if not, cease all marking operations until corrections are made.
- 6 Make certain that the marking is uniformly retroreflectorized upon cooling.

**627.4.7 Reflectance Requirements**

- 1 Ensure that the markings have the minimum retroreflectance values shown in the following table at the time of installation as obtained with a LTL 2000 Retroreflectometer. Make certain these values are maintained for a minimum of 30 days from the time the markings are placed. Make certain that each marking is uniformly retroreflectorized upon cooling.

Retroreflectivity (mcd/lux/m <sup>2</sup> )		
	White	Yellow
Single-Drop	375	250
Double-Drop	450	350

**627.4.8 Inspection and Departmental Sampling**

- 1 In addition to initial acceptance, thermoplastic material may be required to be sampled, tested, and approved by the OMR or their designated representative before shipment.
- 2 At the discretion of the Department, additional sampling and testing at the job site may be performed. Submit to the RCE a certification from the manufacturer for each shipment, certifying through actual laboratory test results that the thermoplastic meets the requirements of AASHTO M 249 as amended herein for each type of thermoplastic material. No thermoplastic material may be used or be paid for until the thermoplastic certification is received and accepted by the RCE. The Department reserves the right to sample and test any thermoplastic material supplied for any SCDOT project at any time.
- 3 A lot consists of a batch or consecutive batches of thermoplastic manufactured on the same day using the same formulation. A lot must be more than 2000 lbs and less than 44,000 lbs of thermoplastic material. A batch is that amount of thermoplastic that was manufactured and packaged in a single operation. Make certain thermoplastic material from the same lot is palletized, stretch-wrapped, labeled with the manufacturer's lot and batch numbers (on each pallet) and batch number (on each bag) and stored in a common area to facilitate random sampling of the entire lot by the Department's Inspector.
- 4 Ensure that the following information is included on the manufacturer's certification:
  - State Specification No.,
  - Manufacturer's Product No.,
  - Color (White or Lead-Free Yellow),
  - Weight of the sample,
  - Identification numbers of batches comprising the lot and lot number,
  - Date of Manufacture,

- Form (block or granular),
  - Binder Type – Alkyd,
  - Sampling Method (splitting, thieving, quartering, random bag, etc.), and
  - SC File No. or Contract No.
- 5 Submit to the OMR or their designee a manufacturer's test report showing actual laboratory test results on each lot of thermoplastic material. Include the following information in the manufacturer's test report:
- Binder Content,
  - Pigment Content,
  - Glass Bead Content,
  - Daylight Luminous Reflectance,
  - 4 Hour Daylight Luminous Reflectance after 4 hrs at 425°F,
  - Yellow Color – Chromaticity Coordinates (for yellow only),
  - Yellowness Index (for white only),
  - Ring and Ball Softening Point,
  - Hardness,
  - Flowability,
  - Extended Flowability, and
  - Flash Point.
- 6 The Department reserves the right to retest any batch/lot of thermoplastic material after delivery. Results from such retesting will prevail over all other tests and failure will be the basis of rejection. Remove material not meeting the specification from the project and replaced at no expense to the Department, including all costs for handling, retesting and shipping.

#### **627.4.9 Testing**

- 1 Perform tests according to the specified test methods. Qualitative and quantitative analysis may also be performed by other methods of analysis at the option of the Department. Ensure that the manufacturer maintains a laboratory sufficiently staffed and equipped to maintain the quality of the product called for in these specifications.
- 2 The Department may require the manufacturer to fully disclose details of the systems and processes in its QA/QC Program.

#### **627.4.10 Inspection and Acceptance of Work**

- 1 All thermoplastic pavement markings will be inspected for proper line thickness and width, adhesion, and cycle length. The markings will also be observed in both daytime and nighttime conditions to determine whether all requirements of the Contract have been met. Remove and replace markings that fail to have a satisfactory appearance during either daytime or nighttime conditions at no additional expense to the Department.

- 2 The final acceptance of the thermoplastic pavement markings will be delayed for a period of 90 days after the last date of marking on the project to permit observation of performance. The Contractor is responsible for the maintenance and performance of pavement markings during the 90-day observation period. The markings are guaranteed under the payment and performance bond. Traffic must be operating on the facility during the entire 180-day observation period unless otherwise directed.
- 3 Replace markings or markers that, in the opinion of the RCE, have not performed satisfactorily during this 90-day period due to defective materials and/or workmanship.
- 4 Ensure that the pavement marking material provided shows no signs of failure due to blistering, excessive cracking, chipping, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, or gasoline drippings, spilling, poor adhesion to the pavement materials, loss of retroreflectivity, and normal wear.
- 5 Ensure that the thermoplastic marking maintains minimum retroreflectance values shown in the following table throughout the observation period. These measurements will be taken within 30 days before the end of the observation period. The retroreflectance values will be taken using a LTL 2000 Retroreflectorometer.

180-Day Retroreflectivity (mcd/lux/m <sup>2</sup> )		
	White	Yellow
Single-Drop	325	200
Double-Drop	400	300

#### 627.5 Measurement

- 1 The quantities for thermoplastic pavement markings for lines are measured by the linear foot (LF) along the center of the pavement marking lines for each type of line, width, color, and dry thickness of pavement marking line in-place, complete and accepted. Measurement is made of the pavement marking only and excludes the spaces between broken lines.
- 2 The quantities for thermoplastic pavement marking symbols (arrows, words, and railroad crossing symbols) are measured by each (EA) arrow (straight, right, left or combination), word or words, and railroad crossing symbol in-place, complete and accepted. A railroad-crossing symbol consists of "X RR".
- 3 Traffic control utilized during the performance of thermoplastic pavement marking work is not measured under items covered by this section, but is included in the item Traffic Control in accordance with **Subsections 107.12** and **601.5**.

- 4 Unless included in other pay items in the Contract, the work required to remove existing pavement markings is considered incidental work for the thermoplastic pavement marking items and is not measured separately.
- 5 Unless included in other pay items in the Contract, the work required to determine the no passing zones for two-lane facilities and to provide the Department with the data used in establishing the zones is considered incidental to the work under this section and is not measured for payment.

#### 627.6 Payment

- 1 Payment for the accepted quantity for each type of thermoplastic pavement markings measured in accordance with **Subsection 627.5** is determined with the contract unit bid price for the applicable item. Payment is full compensation for applying thermoplastic pavement markings as specified or directed and includes preparing the pavement surface; removing unacceptable pavement markings; and all other materials, labor, equipment, supplies, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Removal of existing pavement markings is considered incidental to the other items of work and no separate payment is made for this work unless separate pay items are included in the Contract.
- 3 Unless otherwise included in the Contract, traffic control for application and/or removal of pavement markings is included in the pay item Traffic Control in accordance with **Subsections 107.12** and **601.6**.
- 4 Determination of the no passing zones for two-lane facilities and providing the Department with the data is considered incidental to the other various items of work, and no separate payment is made for this work.
- 5 Payment for each item includes all direct and indirect costs and expenses required to complete the work.
- 6 Pay items under this section include the following:

Item No.	Pay Item	Unit
6271005	4" White Broken Lines (Gaps Excluded) Thermoplastic - 90 mil.	LF
6271007	6" White Broken Lines (Gaps Excluded) Thermoplastic- 90 mil.	LF
6271010	4" White Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271012	6" White Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271015	8" White Solid Lines Thermoplastic - 125 Mil.	LF

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Item No.	Pay Item	Unit
6271020	12" White Solid Lines (Stop Lines) - Thermoplastic -125 mil.	LF
6271023	12" X 18" White Triangular Yield Bar (Gaps Excluded) Thermoplastic – 125 mil.	LF
6271025	24" White Solid Lines (Stop/Diagonal Lines) – Thermoplastic - 125 mil.	LF
6271030	White Single Arrows (Left, Straight, Right) - Thermoplastic - 125 mil.	EA
6271035	White Word Message "Only" - Thermoplastic - 125 mil.	EA
6271036	White Word Message "Stop Ahead" - Thermoplastic - 125 mil.	EA
6271037	White Word Message "School" - Thermoplastic - 125 mil.	EA
6271040	White Combination Arrows (Straight & Right or Straight & Left) Thermoplastic – 125 mil.	EA
6271043	White Lane Drop Arrow (Left or Right) Thermoplastic – 125 mil.	EA
6271045	Railroad Crossing Symbols - Thermoplastic - 125 mil.	EA
6271050	Handicap Symbol - Thermoplastic - 125 mil.	EA
6271064	4" Yellow Broken Lines (Gaps Excluded) Thermoplastic - 90 mil.	LF
6271066	6" Yellow Broken Lines (Gaps Excluded) Thermoplastic - 90 mil.	LF
6271074	4" Yellow Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271076	6" Yellow Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271078	8" Yellow Solid Lines (Pavement Edge Lines) Thermoplastic - 90 mil.	LF
6271080	24" Yellow Solid Lines - Thermoplastic - 125 mil.	LF



## DIVISION 700

### STRUCTURES

#### SECTION 701

##### PORTLAND CEMENT AND PORTLAND CEMENT CONCRETE

###### 701.1 Description

- 1 This section contains specifications for the materials, construction, measurement, and payment for furnishing, storing, and handling of the materials; and the proportioning, mixing, and delivery of Portland cement concrete for structures.

###### 701.1.1 Classes of Concrete

- 1 Classes of concrete typically used by the Department are listed in the Structural Concrete Table in **Subsection 701.2.12.2**. The numerical portion of the Class is the minimum 28-day mix design strength based on ASTM C 39.

###### 701.2 Materials

###### 701.2.1 Portland Cement

###### 701.2.1.1 General

- 1 Use Portland cement conforming to the requirements of the following specifications for the type required or permitted and obtained from a source listed on the most recent edition of *SCDOT Qualified Product List 6* with the additional requirements stated hereafter.
- 2 Use Portland cement concrete for structures composed of Portland cement, fine aggregate, coarse aggregate, water, air-entraining admixture, and other permitted or required admixtures. Fly ash, water granulated blast-furnace slag, and silica fume may be added or used as a replacement for a portion of the Portland cement and is considered as cement in the water-cementitious material ratio unless otherwise designated. Ensure that the materials conform to the requirements hereinafter specified. Prepare and deliver the mixture in accordance with these specifications.
- 3 Comply with compressive strength requirements and meet the requirements for low-alkali cement (0.6 maximum).
- 4 Except for cement in RC pipe and prestressed or precast products, use cement complying with the maximum limits of fineness of grind in AASHTO M 85 controlled as follows:
  - A. Ensure that the cement in the mill test reports furnished by the manufacturer complies with the maximum fineness (air permeability test) values stated in AASHTO M 85.

- B. Take job control samples at random at the project site and submit them to the OMR for testing. Make certain that the maximum fineness limit (air permeability test) is in conformance with the requirements of AASHTO M 85 with allowance for variations in sampling, presence of moisture in the sample, age of the cement production, and multi-laboratory coefficient of variation.
- 5 Type I (SM) slag-modified Portland cement may be used instead of Type I and Type II cement. If used, furnish Type I (SM) cement conforming to the requirements of AASHTO M 240 and obtain from the sources listed on the most recent edition of *SCDOT Qualified Product List 18*. Provide an intimate and uniform blend of Portland cement and granulated blast-furnace slag. In any case, make certain that the slag constituent is less than 25% of the total weight of the slag-modified Portland cement.
- 6 Furnish certified mill test reports to the RCE as outlined in the most recent edition of *SCDOT Qualified Product Policy 6*.
- 7 Do not store incompatible brands of cement or different types of cement in the same cement storage bin or silo and do not use them together in any continuous pour.
- 8 Have the weighing and handling procedures of bulk cement approved by the OMR before its use. Protect cement shipments at all times. Inspect, sample, and test questionable cement before its use. Do not use cement that is lumpy, caked, or from open or otherwise damaged bags.
- 9 Measure cement by weight or by the bag as packed by the manufacturer. Unless another weight is indicated on the bag, use 94 pounds as the weight of one bag of cement.
- 10 Whenever it is determined by subsequent laboratory testing of mill or job control samples that a cement shipment does not comply with these specifications, discontinue use of the cement from that cement mill until testing reveals that the problem has been corrected. The Contractor is responsible for replacing or otherwise making satisfactory the concrete in which any defective cement is used.

#### **701.2.2 Fly Ash**

- 1 Use fly ash (Type C or Type F) conforming to the requirements of AASHTO M 295, except for the supplementary optional physical requirements. Use fly ash from sources listed on the most recent edition of *SCDOT Qualified Product List 3*.

#### **701.2.3 Water Granulated Blast-Furnace Slag**

- 1 If slag is used, use water granulated blast-furnace slag Class 100 or higher conforming to the requirements of ASTM C 989.

**701.2.4 Silica Fume**

- 1 Use silica fume meeting the general requirements of ASTM C 1240. Make certain that the raw silica fume meets the chemical requirements of Table 1 and Table 2 and the physical requirements of Table 3 in ASTM C 1240. Furnish the manufacturer's certification stating the results of tests made on samples of silica fume during production and that the applicable requirements of ASTM C 1240 have been met. Provide certification for each lot of each shipment to the RCE and to the OMR.
- 2 Silica fume may be added to the mix in either a dry (densified) form or a wet (slurry) form. The dry form is usually supplied in 50-pound bags. When a dry form is used, adjust the mix design to use whole bags of silica fume, i.e. do not use partial bag(s). Whole bags of silica fume in excess of the normal 50-pound bag and whole bags as small as 40 pounds are permitted only if approved by the RCE. Make certain that the guidelines of OSHA regulations for worker protection are followed.
- 3 When a wet (slurry) form is used, compute the water contained in the slurry and count it as part of the total water in the mix. Ensure that this data is in accordance with the manufacturer's certified quality test report for the lots of silica fume being used in the mix.

**701.2.5 Air Entrained Concrete**

- 1 Unless otherwise specified, use a design mix for air-entrained concrete based on 4.5% ( $\pm 1.5\%$ ) entrained air, except for prestressed concrete. If the concrete is pumped, then the entrained air will be acceptable at 5.5% ( $\pm 1.5\%$ ) measured at the truck.
- 2 Do not use air entrainment exceeding the maximum limits specified in the paragraph above. Air entrainment for Class 10000 concrete is left to the judgment of the Contractor and approval of the OMR.
- 3 Use air entrained concrete in all bridge columns, bent or pier caps, decks, sidewalks, parapets, barrier walls, and other structural elements on the bridge deck regardless of the class of concrete used.
- 4 When air-entrainment is used, vary the proportions of water, fine aggregate, and coarse aggregate from those specified herein to maintain the specified strength of the concrete. Use approved admixture specified in **Subsection 701.2.5.1** to obtain the required air entrainment.

**701.2.5.1 Air-Entraining Admixtures**

- 1 When air entrainment is required, use air-entraining admixtures complying with AASHTO M 154. Submit an affidavit to the RCE and the OMR to show that the admixture conforms to the requirements of AASHTO M 154. Use admixtures from sources appearing on the most recent edition of *SCDOT Qualified Product List 5*.

**701.2.6 Accelerating, Retarding, and Water-Reducing Admixtures**

- 1 If the use of a chemical admixture to facilitate concrete placement in adverse conditions is desired, the use of an admixture complying with AASHTO M 194 must be approved by the RCE before its use. The RCE may direct the use of an admixture due to adverse placement conditions.
- 2 When a retarding admixture is desired and approved, use a Type G high range water reducing-retarding admixture or a Type D water reducer-retarder combined with a Type F high range water reducer as provided in **Subsections 701.4.7 and 701.4.8**. Do not use a Type B retarding admixture. Furnish the RCE with an affidavit showing that the admixtures conform to the requirements of AASHTO M 194. Use admixtures from sources appearing on the most recent edition of *SCDOT Qualified Product List 5*.

**701.2.7 Corrosion Inhibitor**

- 1 When a corrosion inhibitor is required in a concrete mix, add the corrosion inhibitor to the concrete while batching. Use the corrosion inhibitors that appear on the most recent edition of *SCDOT Qualified Product List 53*. Adhere to the manufacturer's written recommendations regarding the use of the admixture including storage, transportation, and method of mixing. Add the corrosion inhibitor to the mix by a dispenser meeting the requirements of **Subsection 701.4.3.4**.
- 2 Furnish the RCE a copy of the manufacturer's certified test report showing the composition of the corrosion inhibitor and the percent of solids.

**701.2.8 Calcium Chloride**

- 1 If calcium chloride is approved by the RCE for use in non-reinforced concrete during cold weather work, do not exceed a rate of 2% by weight of cementitious material. Use calcium chloride complying with the requirements of AASHTO M 144 for Type S or Type L. In any case, do not use calcium chloride in reinforced concrete structures.

**701.2.9 Fine Aggregate for Portland Cement Concrete****701.2.9.1 General**

- 1 Submit the fine aggregate in the concrete mix designs for approval by the OMR. Use natural sand, manufactured sand, or a combination of natural and manufactured sand meeting the requirements of **Subsections 701.2.9.2 through 701.2.9.8** below. Do not use marine limestone aggregate in reinforced concrete.

**701.2.9.2 Natural Sand**

- 1 Use natural sand, FA-10, composed of clean, hard, durable, and uncoated grains that is free of lumps or flaky particles, organic matter, loam, or other deleterious substances.

**701.2.9.3 Manufactured Sand**

- 1 Use manufactured sand, FA-10M, made from stone meeting all the quality requirements for coarse aggregates.

**701.2.9.4 Mixtures of Sand**

- 1 When a blend of sands is approved, store and batch the two materials separately unless otherwise approved in writing by the OMR.

**701.2.9.5 Organic Impurities**

- 1 Make certain that fine aggregate is free of injurious amounts of organic impurities. Do not use fine aggregates, which when subjected to the colorimetric test, AASHTO T 21 for organic impurities, produces a color darker than 3, unless the following criteria is met:
  - Fine aggregate with the color darker than 3 may be used if the relative strength at 7 and 28 days is not less than 95% when tested in accordance with AASHTO T 71 as revised herein.
- 2 Comply with Section 4.2 of AASHTO T 71 revised as follows:
  - Mix one batch of mortar with the aggregate treated in sodium hydroxide and one batch with untreated aggregate on the same day. Mold six 2-inch cubes from each batch. Test three of the cubes from each batch at 7 days and 28 days.

**701.2.9.6 Soundness**

- 1 Use fine aggregate that has a weighted loss not exceeding 10% by weight when subjected to five alternations of the sodium sulfate soundness test conducted according to AASHTO T 104.

**701.2.9.7 Approved Sources**

- 1 Use sand from sources that appear on the most recent edition of *SCDOT Qualified Product List 1*.

**701.2.9.8 Gradation of Fine Aggregate**

- 1 Use fine aggregate for all classes of Portland cement concrete and concrete pavement conforming to the following gradations of FA-10 or FA-10M as indicated in Gradation of Fine Aggregate table in the Appendix of these specifications.

**701.2.10 Coarse Aggregate****701.2.10.1 General**

- 1 Use coarse aggregate that is clean, tough, durable crushed gravel or crushed stone. Make certain that it is free from soft, thin, elongated, or laminated pieces and sufficiently washed during production to produce a clean aggregate free from lumps or coatings of clay, disintegrated particles, vegetation, or deleterious substances. Adherent coatings are considered injurious. Do not use coarse aggregate with a Los Angeles Abrasion Loss exceeding 60% as determined by AASHTO T 96. Use coarse aggregate that has a

weighted loss not exceeding 15% when subjected to five alternations of the sodium sulfate soundness test conducted according to AASHTO T 104. Use coarse aggregate for Portland cement concrete conforming to the requirements in **Subsections 701.2.10.2 through 701.2.10.4.**

- 2 Use aggregate from marine limestone quarries only in applications of non-reinforced concrete. Use marine limestone coarse aggregate that has a weighted loss not exceeding 25% when subjected to five alternations of the sodium sulfate soundness test conducted according to AASHTO T 104. When marine limestone aggregate is used, use a sprinkler system to produce a saturated aggregate during concrete batching.

#### **701.2.10.2 Slag**

- 1 Use crushed slag or other inert materials having similar characteristics and approved in writing by the OMR, consisting of clean, tough, durable pieces of approved slag or other inert materials, is reasonably uniform in density and quality, and is reasonably free of thin or elongated pieces. Ensure that the slag or other inert material is air-cooled and has a weight of not less than 75 pounds per cubic foot. Do not use crushed slag with a Los Angeles Abrasion Loss exceeding 40% as determined by AASHTO T 96. Do not use slag containing free lime in deleterious quantities as determined by laboratory tests and containing more than 15% by weight of glassy pieces.

#### **701.2.10.3 Approved Sources**

- 1 Use coarse aggregate from sources listed on the most recent edition of *SCDOT Qualified Product List 2* and approved for use with Portland cement concrete.

#### **701.2.10.4 Gradation of Coarse Aggregate**

- 1 Use Aggregate No. 56, No. 57, or No. 67 as coarse aggregate for Portland cement concrete. Aggregate No. 78 may be used in thin sections and prestressed panels when approved in writing by the OMR. Use only Aggregate No. 67 in prestressed concrete. Do not use blends of aggregate other than Aggregate No. 67, except when approved in writing by the OMR. Use gradation requirements for Aggregate No. 56, No. 57, No. 67, and No. 789 as indicated in the table entitled Gradation of Coarse Aggregates, in the Appendix of these specifications.

#### **701.2.11 Water**

##### **701.2.11.1 General**

- 1 Make certain that water used in mixing, fogging, or curing of Portland cement concrete is free of salt, oil, acid, alkali, organic matter, sewage, or other substances injurious to the finished product. The RCE in consultation with the SME will be the sole judge in determining whether the water used in mixing, fogging, or curing of Portland cement concrete is reasonably free of salt, oil, acid, alkali, organic matter, sewage, or other substances injurious to the finished product. If at any time, the water is found to be unacceptable by the RCE, discontinue its

use and provide approved water at no additional cost to the Department.

- 2 Conduct tests using the services of a laboratory that has an equipment calibration and verification system, technician training, and an evaluation process in conformance with AASHTO R 18 or, for Chemical Testing, has otherwise been approved by the SCDHEC for the tests being conducted. Supply AASHTO R 18 documentation to the SME for review and acceptance before using a non-SCDHEC approved laboratory. Keep all laboratory test results on file at the concrete plant, and ensure that all reports are readily available to the RCE and the SME. Conduct testing at no additional cost to the Department.

#### **701.2.11.2 Water from a Public Water Supply**

- 1 Water from a public water supply may be accepted and approved without being tested.

#### **701.2.11.3 Water from Sources Other than a Public Water Supply**

- 1 Do not use water from sources other than a public water supply until tested and approved by the RCE. Do not use wash water in structural concrete or other applications using reinforcing steel.
- 2 For water sources of questionable water quality, except for wash water recycling sources, make a comparison of the water with distilled or other satisfactory water by means of the standard cement test for soundness, time of setting, and 1:3 mortar strength with standard sand conforming to ASTM C 778 using the same cement with each water. Reject the water being tested if there is any indication of unsoundness, change in time of setting of  $\pm 30$  minutes, or a reduction of more than 10% in strength from 7 day test results obtained with mixtures containing satisfactory water.
- 3 When required by the SME, determine the acidity or alkalinity of the water in accordance with AASHTO T 26. In the event an approved water source reservoir is relatively shallow, enclose the intake pipe and elevate it to exclude silt, mud, grass, or other foreign matter.
- 4 Water from washout operations or is a blend of concrete wash water and other acceptable water sources is certified by the concrete producer as complying with the requirements of AASHTO M 157, Table 2 (Level 3 – conventionally reinforced concrete in a moist environment, but not exposed to chloride) and either AASHTO M 157, Table 1 (using mortar) or the table below entitled Acceptance Criteria for Questionable Water Supplies (Using Concrete), may be used as mix water. Wash water from mixer washout may be used only with RCE approval. When wash water is permitted, provide satisfactory proof or data that no detrimental effects if potentially reactive aggregates are used. Discontinue use of wash water if undesirable reaction with admixtures or aggregates occurs. Test the wash water or blended water weekly for 4 weeks for compliance with the chemical and physical requirements indicated above. Conduct subsequent tests on the water every month with records of test results provided upon request by the RCE or the OMR.

**701.2.11.3****701.2.12.1**

- 5 In addition, do not allow the specific gravity of the mixing water sampled from the discharge line to exceed 1.03 at any time concrete is being produced for the Department. Check the specific gravity by acceptable means and document the value before commencing the batching operation for use in work for the Department.
- 6 Use the following table to determine acceptance of water.

<b>Acceptance Criteria for Questionable Water Supplies (Using Concrete)</b>		
<b>Criteria</b>	<b>Limits</b>	<b>Test Method <sup>(1)</sup></b>
Compressive Strength, min. percent Control at 7 days	90	AASHTO T 22 (ASTM C 39)
Time of Set, Deviation from Control	From 1:00 hr. earlier to 1:30 hr later	AASHTO T 197 (ASTM C 403)
<sup>(1)</sup> Base comparison on fixed proportions and the same volume of test water compared to control mix using public water or distilled water.		

**701.2.12 Concrete Mix Design****701.2.12.1 General**

- 1 Design the concrete mix and determine the proportions of cementitious material, fine aggregate, coarse aggregate, water, air-entraining admixture, and water-reducing or water-reducing set retarding admixture (when used) that produces a workable concrete mix. Meet the criteria for the typical classes of concrete shown in the Structural Concrete Table in **Subsection 701.2.12.2**. Consider the amount of air-entrainment that is incidentally afforded by the use of water-reducing or water-reducing/retarding admixtures. Determine the proportions of ingredients in accordance with requirements for the particular type of work and with consideration of the specific gravities of the materials to provide the desired workability and consistency.
- 2 At its own expense, the Contractor may retain an independent testing laboratory accredited by the AASHTO Accreditation Program to design the mix for the class of concrete specified, or use a mix design previously reviewed and used by the Department.
- 3 Submit all design mixes to the OMR for review using standard forms approved by the SME. After successful review by the OMR, provide a copy of all concrete designs to the RCE.
- 4 For the water-cementitious material ratio, use the ratio of water to cementitious materials by weight.
- 5 Design the concrete mix using Department approved ingredients intended for use in the project and make all trial batches using such materials. Test trial mixes for complete conformance with the Specifications by the approved laboratory engaged by the Contractor.



**701.2.12.1****701.2.12.2**

6 Base mix designs on the air entrainment specifications in **Subsection 701.2.5.**

7 Base the total water content of the mix on the weight of cement, fly ash, and silica fume multiplied by the water-cementitious ratio. Do not include the absorbed water in the aggregate as mix water.

8 Base mix designs on specific gravities and saturated surface dry moisture contents of aggregate obtained from a source on the most recent edition of *SCDOT Qualified Product List 2*.

9 Base the sand to stone ratio on volume. Vary the ratio to obtain good workability.

10 No separate payment is made for the cost of the laboratory engaged by the Contractor, the materials furnished and used for trial batches, the preparation and testing of trial batches either by the Contractor or its laboratory, or furnishing the OMR with the mix data, the results of the cylinder tests, and yield to be tested. These costs are considered incidental to the work of the applicable item. Include the cost in the unit prices for the applicable pay items in the Contract.

11 After successful review of a design mix by OMR, do not change the mix proportions for concrete of that class unless modifications are necessary and are approved in advance.

**701.2.12.2 Structural Concrete Table**

1 Unless otherwise noted or directed, make certain that the properties of the various classes of concrete incorporated into the work conform to the following Structural Concrete Table. Compressive strength is based on ASTM C 39.

<b>Structural Concrete Table</b>					
<b>Aggregate Type</b>	<b>Minimum Cement Content (lbs./CY)</b>	<b>Other Cementitious Material (lbs./CY)</b>	<b>Min. 28 Day Mix Design (psi)</b>	<b>Percent Fine to Coarse Aggregate Ratio</b>	<b>Max. Water to Cementitious Material Ratio</b>
<b>Class 2500 (Non Structural)</b>					
Crushed stone	494	--	2500	36:64	0.54
Gravel	494	--	2500	35:65	0.52
Marine Limestone	494	--	2500	40:60	0.56

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<b>Structural Concrete Table</b>					
<b>Aggregate Type</b>	<b>Minimum Cement Content (lbs./CY)</b>	<b>Other Cementitious Material (lbs./CY)</b>	<b>Min. 28 Day Mix Design (psi)</b>	<b>Percent Fine to Coarse Aggregate Ratio</b>	<b>Max. Water to Cementitious Material Ratio</b>
<b>Class 3000</b>					
Crushed stone	588	--	3000	35:65	0.46
Gravel	588	--	3000	34:66	0.44
Marine Limestone	588	--	3000	39:61	0.47
<b>Class 4000</b>					
Crushed stone	611	--	4000	35:65	0.40
Gravel	611	--	4000	34:66	0.40
<b>Class 4000S</b>					
Crushed stone	682	--	4000	38:62	0.45
Gravel	682	--	4000	38:62	0.45
<b>Class 4000DS</b> (See Notes 2 & 4)					
Crushed stone	625	--	4000	40:60	0.44
Gravel	625	--	4000	39:61	0.43
<b>Class 4000P</b> (See Note 5)					
Crushed stone	682	--	4000	34:66	0.43
Gravel	682	--	4000	33:67	0.38
<b>Class 5000</b>					
Crushed stone	705	--	5000	35:65	0.46
Gravel	705	--	5000	34:66	0.42

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<b>Structural Concrete Table</b>					
<b>Aggregate Type</b>	<b>Minimum Cement Content (lbs./CY)</b>	<b>Other Cementitious Material (lbs./CY)</b>	<b>Min. 28 Day Mix Design (psi)</b>	<b>Percent Fine to Coarse Aggregate Ratio</b>	<b>Max. Water to Cementitious Material Ratio</b>
<b>Class 6000</b>					
Crushed stone	750	--	6000	34:66	0.44
Gravel	750	--	6000	33:67	0.39
<b>Class 6500</b> (See Notes 1 & 3)					
Crushed stone	500	CF35, FA140	4000	37:63	0.37
Gravel	500	CF35, FA140	4000	38:62	0.37
<b>Class 7000</b>					
Crushed stone	800	---	7000	35:65	0.37
Gravel	800	---	7000	34:66	0.37
<b>Class 8000</b>					
Crushed Stone	840	---	8000	34:66	0.30
Gravel	840	---	8000	34:66	0.30
<b>Class 10000</b>					
Crushed stone, or Gravel	800	Silica Fume: 74 & Fly Ash, Type F: 100	10000	34:66	0.25

**701.2.12.3 Structural Concrete Table Notes****1 Note 1:**

Provide a mix design that yields a 56-day minimum laboratory strength of 6500 psi. Acceptance of in-place concrete is based on a minimum strength of 4000 psi compression strength at a maximum of 28 days or 6500 psi at 56 days.

2 **Note 2:**

Use Type G or Type D admixture.

3 **Note 3:**

Use the following proportions for Class 6500 concrete mix per cubic yard:

Cement (min.).....	500 lbs.
Fly Ash.....	140 lbs.
Silica Fume.....	35 lbs.
Corrosion Inhibitor.....	(see <b>Subsection 701.2.7</b> )
Entrained Air (Range).....	4.5 (± 1.5)%
Water-Cementitious Material Ratio (max.)...	0.37
High Range Water Reducer.....	Required
Aggregates.....	Variable

4 If a Type A or Type D admixture is used, demonstrate that the admixture is compatible, does not adversely extend normal setting time, and does not cause excessive bleeding.

5 The slump of the concrete at time of placement in the forms may be increased by the use of a High Range Water Reducer, either Type F or Type G in accordance with the requirements of **Subsection 701.2.6**.

6 If silica fume slurry is used, add it at a point that produces an acceptable mix.

7 Add a High Range Water Reducer at the job site. Limit additional mixing to the minimum specified in accordance with **Subsection 701.4.7**, but it may be increased in order to obtain the necessary air entrainment.

8 Concrete Temperature: Do not allow the temperature of Class 6500 concrete to exceed the maximum permitted in **Subsection 701.4.4.3**.

9 Mix Design Review: Submit to the OMR a proposed sequence of mixing and a proposed concrete mix design based on trial mixes by the concrete supplier. Perform the laboratory mix design with the observation and assistance from the OMR. There is no separate payment for this mix design.

10 Class 6500 Trial Mix: Before placing Class 6500 concrete in the deck, place one or more small batches of Class 6500 concrete in a part of the structure as directed by the RCE. Test air content, slump, unit weight, temperature, cylinder for 28-day compressive strength, and time of set. Repeat the trial batch procedure until all desired mix properties are achieved.

11 No payment is made for the trial batches. The Class 6500 concrete used in trial batches may be substituted for another class of concrete elsewhere in the project if it meets proper strength requirements, and in which case, it is paid for at the contract unit price of the concrete for which it is being substituted.

- 12      Mixing Sequence: Develop a proposed mixing sequence for review that ensures breakup and distribution of the dry densified silica fume. (Generally, the addition of part of the water, aggregates, and silica fume at mixing speed adequately disperses the silica fume. The remaining ingredients may then be added in a sequence to produce a desirable mix.)
- 13      Include both silica fume and fly ash as part of the cementitious material.
- 14      **Note 4:**  
             Use Class 4000DS concrete for drilled shaft construction.
- 15      Design the mix for drilled shaft concrete and determine the proportions of cement, fine aggregate, coarse aggregate, water, and water reducing/retarding admixture that produces a workable concrete mix meeting the following criteria:
- Minimum cement per cubic yard.....625 lbs.
  - Slump.....7-9 inches
  - Max. water/cementitious ratio.....(see Table)
  - 28-day minimum compressive strength.....4000 psi
  - Air entraining admixture.....not required
  - Nominal coarse aggregate size..... ¾ inch
  - No. 67 aggregate gradation.....as required
- 16      Design concrete mix using approved ingredients intended for use on the project. Test trial mix for complete conformance with the Specifications.
- 17      Submit the proposed mix with test results showing full compliance with the Specifications to the OMR for review.
- 18      A Type G High-Range Water Reducing/Retarding admixture or a Type D Water Reducer-Retarder combined with a Type F High-Range Water Reducer may be used.
- 19      **Note 5:**  
             Minimum Class 4000P concrete is preferred in non-prestressed precast items.

#### **701.2.12.4 Non-conforming Concrete**

##### **701.2.12.4.1 Price Reduction**

- 1      If the 28-day compressive strength or tensile strength of the concrete test cylinders falls below the expected design strengths, but is at least 90% of the design strength, a price reduction is applied on the quantity of concrete represented by the non-conforming cylinders determined from the following table. (This subsection does not apply to prestressed concrete, which due to complex design criteria is handled on a case-by-case basis.)

Cylinder Test Results:	Price Reduction per cubic yard (Percent) X (Contract Unit Price)	
Percentage of Minimum Strength	With Contract Unit Price	Without Contract Unit Price*
98.0 - 100.0	0%	0%
95.0 - 97.9	5%	25%
90.0 - 94.9	10%	50%
<p>* If there is no contract unit price for concrete, use (percent reduction) x (supplier's invoice unit cost).</p> <p>The BCE may approve use of concrete test method <b>SC-T-49</b> to determine the accepted strength if the concrete test cylinders have been considered non-conforming.</p> <p>The total amount of the price reduction will not be less than \$500.00.</p>		

- 2 If any cylinder test result is below 90%, take cores in the presence of the BCE or RCE from the concrete in the structure that is represented by the non-conforming test cylinders in order to evaluate the strength of the concrete in place. Ensure that test cores are taken, conditioned, and tested in accordance with the requirements of **Subsection 701.2.12.4.2.2**.

#### **701.2.12.4.2 Procedure for Testing Non-conforming Concrete**

##### **701.2.12.4.2.1 Limits of Questionable Concrete**

- 1 The limit of questionable concrete is determined by using concrete test method **SC-T-49**. Acceptance is solely based on the compressive strength of the cores removed from the in-place concrete, unless authorized otherwise by the BCE.

##### **701.2.12.4.2.2 Obtaining Cores**

- 1 Have the OMR or an independent firm, accredited by AASHTO, remove the cores from the structure in the presence of representatives of all affected parties. The BCE will determine the location(s) of the test cores that best represent the concrete in question. Take three cores (3 to 4 inches in diameter), sized to match the testing equipment used, from each area of concrete that produced a test cylinder with test strength less than 90% of the required strength. Take care to avoid damaging reinforcing steel. Properly label cores before shipment. Obtain and test cores at no expense to the Department.

##### **701.2.12.4.2.3 Conditioning and Testing Cores**

- 1 Deliver cores to the OMR or an independent testing laboratory accredited by AASHTO.
- 2 Have cores tested in accordance with AASHTO T 24. Provide a written report on the laboratory test results to all affected parties.

**701.2.12.4.2.4 Acceptance of Concrete**

- 1 Acceptance of the concrete from which the cores are taken is based on the core test results. If access to the concrete is not practical for obtaining cores or the taking of cores would result in irreversible damage to the structure, the BCE may approve concrete test method **SC-T-49** to determine the strength of the concrete.
- 2 If the **SC-T-49** test results or the core test results are below 90%, but are equal to or greater than 85% of the design strength, obtain a design analysis based on the reduced strength from the Designer-of-Record. Based on the design analysis, the BCE will determine if the concrete can remain in place. If the concrete test results are less than 85% of the design strength, remove the concrete unless authorized otherwise in writing by the BCE.
- 3 If non-conforming concrete is allowed to remain in-place, a price reduction on the quantity of concrete in question is determined by the following table.

<b>Price Reduction for Non-conforming Concrete Left In-Place</b>		
<b>Core Test Results: *</b>	<b>Price Reduction per cubic yard (Percent) X (Contract Unit Price)</b>	
<b>Percent of Minimum Strength</b>	<b>With Contract Unit Price</b>	<b>Without Contract Unit Price**</b>
98.0 - 100.0	0%	0%
95.0 - 97.9	5%	25%
90.0 - 94.9	10%	50%
85.0 - 89.9	15%***	80%
<p>* Or <b>SC-T-49</b> if approved by the BCE.</p> <p>** If there is no contract unit price for concrete, use (percentage) x (supplier's invoice unit cost).</p> <p>*** Use 15% of contract unit price or 80% of supplier's invoice unit cost, whichever is greater.</p> <p>The total amount of the Price Reduction will not be less than \$500.00.</p>		

**701.2.12.5 Changes in Mix Design**

- 1 When changes are made in the mix design, furnish the new proportioning values for batching purposes to the OMR for review.

**701.3 Equipment****701.3.1 Equipment, Inspection, and Approval**

- 1 Have all equipment specified herein inspected and approved before use. Schedule such inspections at least annually and at other times considered necessary by the RCE.

**701.3.2 Weighing Equipment**

- 1 At all batch plants, provide equipment with a positive means of weighing ingredients in each batch of concrete.
- 2 Weigh individual cementitious material to not less than 99% of the required weights.
- 3 Ensure that the weight of individual aggregates is within  $\pm 2\%$  of the required weight and the total weight of aggregate is within  $\pm 2\%$  of the total required weight. Use beam, springless-dial, or load cell scales for weighing aggregates and cement. Make certain that scales are accurate to within 0.5% when used for cement and to within 1.0% when used for aggregate under operating conditions throughout the range of use. When beam scales are used, provide a device such as a "tell-tale" dial for indicating when the load in the weighing hopper is approaching the required weight. Use poises designed to lock in any position to prevent accidental change of position.
- 4 Provide dust tight enclosure for dial scales. Ensure that the chart is made from a durable material and has good readability.
- 5 Periodically have scales used in batching Portland cement concrete checked for accuracy by the Division of Weights and Measures of the State Department of Agriculture or by other qualified scale service agents. Post on the scales or in the batching room a statement certifying as to their accuracy with the date of inspection. Do not allow the interval between inspections to exceed 12 months.
- 6 Ensure that the cement weighing hopper is properly sealed and vented to preclude dusting during weighing operations.

**701.3.3 Central Mixing Plant**

- 1 Thoroughly mix concrete in a batch mixer of an approved size and type that ensures a uniform distribution of the materials throughout the batch. Use plants that are listed on the most recent edition of *SCDOT Qualified Product List 28*.
- 2 Ensure that there is adequate water storage. Make certain that the mixer is equipped with a device to accurately weigh or measure and automatic control the quantity of water used in each batch. Ensure that the device used is accurate, and so calibrated that under all operating conditions, it is accurate to within 1% of the quantity of water required for the batch. Furnish the Department's inspector with facilities for checking the water measuring equipment whenever deemed necessary by the RCE. Clearly mark scales or other means used to measure water to accurately show the quantity of water used. Ensure that there is no loss of water from the time it is measured until it is deposited in the mixer drum. Make certain that the water supply is automatically shutoff while the water is being discharged into the mixer. Use a mixer with an acceptable timing device capable of being locked and that does not permit the batch to be discharged until the specified mixing time has elapsed.



**701.3.3****701.3.4**

- 3 Maintain mixers in good working condition. Repair mixers when necessary to ensure that the concrete is of uniform quality. Examine mixers for change in condition due to accumulation of hard concrete or mortar and for wear of the blades. Replace the pick-up and throw-over blades when any part or section is worn 1 inch or more below the original height of the manufacturer's design. If requested by the OMR, provide a copy of the manufacturer's design, showing dimensions and arrangements of blades.
- 4 Use mixers equipped with a separate dispenser for each type of admixture. The dispensers may operate either automatically or manually, but regardless of which type is used, make certain that they are capable of measuring and placing exactly and consistently the desired amount of admixtures in each batch.

**701.3.4 Truck Mixers**

- 1 Make certain that all truck mixers are pre-approved by the SCDOT or NRMCA and display a valid approved inspection sticker.
- 2 Ensure that the manufacturer's rating plate is attached on all truck mixers and the mixing speed and agitating speed are clearly visible and legible on the plate. If the speeds are not legible or if truck mixer does not have a rating plate, provide the OMR a written document from the truck mixer manufacturer stating the mixing and agitating speeds.
- 3 Use truck mixers capable of combining the ingredients of the concrete within the specified number of mixing revolutions into a thoroughly mixed and uniform mass and discharging the concrete with a degree of uniformity satisfactory to the RCE.
- 4 Do not exceed the manufacturer's rating for the volume of mixed concrete permitted in the drum of truck mixer indicated on the capacity plate. Ensure that the National Ready Mixed Concrete Association (NRMCA) plate is accessible, clear, and legible at all times. Ensure agitators are capable of producing concrete with a degree of uniformity to the satisfaction of the RCE.
- 5 If the equipment does not have an attached rating plate with maximum capacities. The approved capacity as a mixer and as an agitator will be assumed from the following table.

Maximum Gross Volume of Drum (cubic feet)	Maximum Capacity (cubic yards)	
	As Mixer	As Agitator
261	6.0	7.75
306	7.0	9.25
329	7.5	9.75
352	8.0	10.50

(table continued on the next page)

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Maximum Gross Volume of Drum (cubic feet)	Maximum Capacity (cubic yards)	
	As Mixer	As Agitator
376	8.5	11.25
399	9.0	12.00
423	9.5	12.75
446	10.0	13.25
493	11.0	14.75
540	12.0	16.00
587	13.0	17.50
634	14.0	19.00
681	15.0	20.25

- 6 If the volumes are determined using the table above, provide with each truck the proper documentation to be used instead of the manufacturer's rating plate showing the maximum mixing and agitating capacity.
- 7 Use truck mixers equipped with a water system and measuring device. Make certain that the device permits ready access and can accurately determine the quantity of water used. Use a water-measuring device that can accurately measure water in the tank to within 1.0% when the truck mixer is stationary and essentially level.
- 8 Ensure that truck mixers and agitators of the revolving drum type are equipped with a hatch in the periphery of the drum shell that will permit access to the inside of the drum for inspection, cleaning, and repair of the drum and blades.
- 9 Use truck mixers that have an electrically or mechanically actuated revolution counter that can be reset to zero. Make certain that this counter is mounted in a position such that it can be read from the ground.
- 10 Maintain truck mixers in good working condition. Repair when necessary to ensure that the concrete is of uniform quality. Replace blades when any part or section is worn 1 inch or more below the original design. If requested by the OMR, provide a copy of the manufacturer's design, showing dimensions and arrangements of blades.

#### **701.4 Construction**

##### **701.4.1 Care and Storage of Concrete Aggregates**

- 1 Handle and store concrete aggregates in a manner that prevents intermixing, segregation, and contamination by foreign materials. Handle and stock-

pile each aggregate component from a different source or grading separately. Clear vegetation and other extraneous matter from stockpile sites, so that they have natural ground bottoms, and ensure that they are generally smooth, firm, and well drained. Do not use the bottom 1-foot of any stockpile with a natural ground bottom except under direct supervision of the RCE. If excessive segregation is likely because of the stockpiling of an aggregate, construct the stockpile in layers not to exceed 3 feet in depth.

#### **701.4.2 Storage of Cement**

- 1 Store bulk cement in weatherproof bins or silos that protect the cement from dampness and provide for the free flow of the cement. If the OMR authorizes the use of bagged cement, store it in weatherproof buildings or temporary store it in the open on a raised platform with ample waterproof flooring and covering.
- 2 At a batching plant with two or more silos in which different types of cement or cementitious materials are stored, place a sign at each fill inlet indicating the type of cement stored therein. Make the sign from a durable material with raised, indented, or cut letters a minimum of 2 inches high and ¼ inch thick or deep. Ensure that the sign clearly identifies the material that is in the silo.
- 3 If concrete is to be proportioned at the work site and is only for the Department's use, keep accurate records of the deliveries of cement and of its use in the work. Provide copies of these records to the RCE and OMR in such form as they may require.

#### **701.4.3 Measuring Materials**

##### **701.4.3.1 Portland Cement**

- 1 Measure Portland cement and other cementitious materials by weight unless otherwise specified. Weigh the cementitious materials on scales meeting the requirements of **Subsection 701.3.2** and are not used to weigh other materials. If bagged cement is authorized, measure it in bags packed by the manufacturer. From time to time, weigh full bags as a check on the net weight. Prepare batches that do not require fractional bags of cement unless all the cement for each batch is weighed.

##### **701.4.3.2 Water**

- 1 Measure water by volume or by weight through an approved measuring system. Use a measuring system with a metering or weighing device capable of incorporating into the batch the predetermined quantity of water with an accuracy of 1.0% of the quantity of water required for the batch. Assume water to weigh 8.33 pounds per gallon.

##### **701.4.3.3 Fine and Coarse Aggregate**

- 1 Measure fine and coarse aggregates separately by weight on scales meeting the requirements of **Subsection 701.3.2**. In measuring aggregates, make allowance for water in the aggregates. For determinations of the moisture content of aggregates, use automatic sensing devices if available; otherwise,

take representative samples and investigate individually or combined in a composite sample.

#### **701.4.3.4 Admixtures**

- 1 Dispense admixtures into the batch as a solution of uniform concentration and in the amounts recommended by the manufacturer. Use properly equipped sight-tube dispensers with a graduation strip or strips that are labeled in terms of ounces or ounces per hundred pounds of cement. Identify graduated strips as to the rate at which the admixture is being measured for the particular diameter of the tube being used.
- 2 Calibrate meter and timing dispensers by obtaining a metered sample and checking the accuracy of the system. Have the equipment checked and approved during the annual inspection and at other times when deemed necessary or as directed by the RCE.
- 3 Maintain the accuracy of all systems to within  $\pm 3\%$ . Discharge the admixture into the stream of water entering the mixer drum or into the pre-measured or pre-weighed water for each batch. Take precautions to prevent the dilution of the admixture in storage by rain and condensation. For actual control, measure the air content with air meters only. Add additional admixtures at any time to achieve the proper amount of entrained air.
- 4 When adding Types A, C, D, or E admixtures, ensure that the dispensing equipment and procedure adds the admixture after the dispensing of the air entraining agent is complete and some mixing of the concrete has occurred. When adding Types F or G admixture, do not add the admixture agent until after all of the materials are in the mixer and have been mixed for 1 minute if in a truck mixer, for 15 seconds if in a central-mix mixer, or at approximately the midpoint of the primary mixing portion of the auger mixing chamber on a mobile concrete mixer unit.

### **701.4.4 Concrete Batching and Mixing**

#### **701.4.4.1 General**

- 1 When concrete is furnished by a transit or central-mix plant, use the batching equipment that is sufficient to weigh out a load of the required size in not more than 15 minutes.
- 2 Make certain that an SCDOT-certified concrete field technician is present at the plant when concrete is being produced for SCDOT work. The SCDOT-certified concrete field technician may be an employee of the Contractor, the concrete supplier, or an independent testing laboratory. While concrete is being produced for SCDOT work, ensure that the SCDOT-certified concrete field technician's sole, full-time responsibility is to maintain quality control records and conduct physical testing of concrete and its constituent materials. Have the SCDOT-certified concrete field technician complete and sign a SCDOT *Form 700.04*. Except for Class 2500 concrete and prestressed, precast concrete, the Department will not accept concrete unless a completed SCDOT *Form 700.04*, signed and certified by the SCDOT-certified field tech-

nician, accompanies the delivery of the concrete.

- 3 Provide sufficient advance notification to the RCE as to the name of the plant supplying the concrete in order to permit time to make the necessary arrangements for inspection of equipment at the plant.

#### **701.4.4.2 Batching and Mixing in Cold Weather**

- 1 Before starting work on the project, submit a written *Cold Weather Batching and Mixing Plan* developed in conjunction with the concrete supplier and to be used when the atmospheric temperature is below 35°F (determined by the RCE).
- 2 At a minimum, include in the plan the methods and equipment employed to meet the following requirements and restrictions:
  - Do not batch concrete with aggregates that contain frozen particles.
  - Do not heat mixing water to a temperature exceeding 170°F at discharge into the mixer.
  - Heat aggregates by either steam or dry heat.
  - Use heating apparatus to heat the aggregates uniformly and avoid hot spots.
  - Make certain that the temperature of the batched concrete is at least 50°F when placed in the forms.

The RCE may add other requirements to the plan if deemed necessary.

- 3 Batch concrete only after the plan has been accepted, and the RCE has specifically authorized the batching.

#### **701.4.4.3 Batching and Mixing in Hot Weather**

- 1 Before starting work on the project, submit a written *Hot Weather Batching and Mixing Plan* developed in conjunction with the concrete supplier to prevent the concrete mix temperature from exceeding 90°F measured before placement in the forms, unless specified otherwise. For Class 2500 concrete, do not allow the temperature of the concrete to exceed 95°F. For mass concrete pours, do not allow the mix temperature to exceed 80°F as measured at discharge into the forms. This requirement does not apply to concrete used in precast/prestressed members.
- 2 The plan may include the following methods and equipment to meet the mix temperature requirements:
  - Use Type II cement.
  - Sprinkle coarse aggregate with water to cool by evaporation.
  - Use chilled mixing water or shaved ice to replace part of the mixing water.
- 3 Ensure that the plan conforms to the applicable requirements of ACI 305R, *Hot Weather Concreting*.

**701.4.4.4 Central Plant Mixing**

- 1 Thoroughly mix concrete in a central mixer of an approved plant. Ensure that the period of mixing after all materials including water are in the drum exceeds 1½ minutes. During the mixing period, operate the drum at speeds specified by the mixer manufacturer and shown on the nameplate on the machine.
- 2 Mix concrete only in quantities required for immediate use. Transport the mixed concrete to the work site in a truck mixer operating at agitating speed.

**701.4.4.5 Truck Mixing**

- 1 After all materials, including water, have been placed in a truck mixer, rotate drum for not less than 70 revolutions at the mixing speed designated by the truck mixer manufacturer and shown on the rating plate. Mix concrete at the batching plant or at the job site. After mixing or while in transit between the plant and the work site, rotate the drum at agitating speed of 2 to 6 rpm or at the speed designated for agitation by the manufacturer.

**701.4.4.6 Wash Water Stabilizers**

- 1 Ready mix concrete producers may use mixer drum wash water stabilizer agents in truck and central mix drums. Use products that appear on the most recent edition of *SCDOT Qualified Product List 32*. Make certain that the stabilizing agents are used in accordance with the most recent edition of *SCDOT Qualified Product Policy 32*.
- 2 The RCE or the OMR may disallow the use of mixer drum wash water stabilizers if the Department's policy is not strictly adhered to or technical problems are encountered because of using a stabilizer.

**701.4.4.7 Mobile Concrete Mixing Plants**

- 1 Use a truck mounted mobile Portland cement concrete plant designed for automatic volume proportioning of the concrete materials and for mixing the concrete for immediate use at the work site for incidental construction and only when authorized by the OMR. If authorized, ensure that the plant provides a satisfactory rate of production and is capable of combining the concrete ingredients into a thoroughly mixed and uniform mass and of discharging the concrete without segregation.

**701.4.5 Consistency**

- 1 Provide compatible pozzolans and/or admixtures as necessary to obtain the appropriate workability and consistency at no additional cost to the Department. Provide the RCE and the OMR with written documentation from the concrete supplier stating that all products in the concrete mix are compatible.

**701.4.6 Slump**

- 1 Except for Class 2500 concrete and unless otherwise specified, provide concrete that has a maximum slump of 4 inches when measured in accordance with ASTM C 143. In any case, do not exceed the water to cementi-

tious material ratio for the appropriate class of concrete shown in the Structural Concrete Table in **Subsection 701.2.12.2**.

- 2 For pumped concrete, the slump is measured at the truck.
- 3 In the event additional water is required to obtain the specified slump at the work site, the RCE may approve adding water from an acceptable water supply at the rate of 1 gallon per cubic yard per inch of desired slump, but not to exceed the maximum water to cementitious material ratio shown in the table in **Subsection 701.2.12.2**. When additional water is added, make certain that the truck mixer drum turns a minimum of 25 revolutions at mixing speed before discharge of the concrete.
- 4 For Class 2500 concrete with an initial slump between 4 to 6 inches, additional cement may be added at the work site at the rate of 20 pounds of cement per cubic yard of concrete per inch of slump over 4 inches to attempt to bring the slump down to the maximum of 4 inches. Batches of Class 2500 concrete with slumps greater than 4 inches after the allowable addition of cement will not be accepted for Department use, unless otherwise permitted by these specifications or the Special Provisions.

#### **701.4.7 Water Reducers**

- 1 A water reducer may be used to increase the slump of concrete. A Mid-Range Water Reducer (MRWR) may be used to increase the slump to a maximum of 6 inches. A High-Range Water Reducer (HRWR) may be used to increase the slump to a maximum of 9 inches. In any case, do not allow the slump to exceed the maximum slump for the following items:
  - Maximum 6" slump for concrete in bridge decks.
  - Maximum 9" slump for seal concrete and in drilled shaft concrete.
  - Maximum 9" slump for prestressed concrete.
- 2 Use MRWR or HRWR admixtures listed on the most recent edition of *SCDOT Qualified Product List 5*. Provide to the RCE for prior approval the admixture manufacturer's product data sheet that clearly states the product is intended for use as a MRWR or a HRWR. Use MRWR and HRWR admixtures strictly in accordance with the manufacturer's recommendations and the limitations specified in this subsection.
- 3 Type F or Type G admixtures may be added to concrete to increase workability and/or to reduce the water to cementitious material ratio. Type F is a HRWR, and Type G is a High Range Water Reducer-Retarder. If these admixtures are used, add them at the work site just before discharge, and mix concrete for a minimum of 30 seconds per cubic yard of concrete in the mixer after each addition of an admixture. Measure the slump of the concrete before the addition of the high-range admixture, and make certain not to exceed the maximum slump limits indicated above. Discontinue or avoid the use of admixtures when there is any indication of excessive flow, bleeding, or segregation. The admixture may be added a second or third time to re-establish mixture flow if the maximum time for placing the concrete after the mix water

is added has not expired.

#### 701.4.8 Water Reducer-Retarders

- 1 A water reducer-retarder admixture may be added to concrete mixes to reduce the water content and shrinkage in the concrete, improve its workability, retard the initial set of the concrete, and/or reduce the rate of internal heat development in concrete pours without sacrificing quality or strength.
- 2 Use a water reducer-retarder, Type D or Type G complying with **Subsection 701.2.6** in concrete deposited underwater, and also in concrete that is not likely to reach its final position in the forms before initial set takes place. Ensure that proportioning and dispensing of the admixture is in accordance with **Subsection 701.2.6**.

#### 701.4.9 Fly Ash and Water-Granulated Blast-Furnace Slag

- 1 The addition of fly ash or water granulated blast-furnace slag is allowed in the concrete mix if the following requirements are met when using these materials:
  - A. Fly ash or water-granulated blast-furnace slag may replace allowable percentages of Type I, Type II, or Type III Portland cement. Do not use fly ash or slag replacement for mixes using Type I (SM) or any other blended cement.
  - B. Remove forms in accordance with **Subsection 702.4.5**.
  - C. When fly ash is used to replace the Portland cement, replace at a ratio of not less than 1.2:1 by weight, and do not replace more than 20% of the cement originally called for in the mixture.
  - D. When water-granulated blast-furnace slag is used to replace Portland cement, replace at a ratio of 1:1 by weight, and do not replace more than 50% of the cement originally called for in the mixture.
  - E. Submit a mix design to the OMR for review a minimum of 7 calendar days in advance of batching. Indicate in the submittal the amount of cement to be removed, the material that will replace it, and compressive strength results of the mix.
  - F. After batching begins and as concrete is delivered to the work site, make certain that the concrete contains the specified entrained air content at the time it is discharged from the transit mixer. Do not use concrete with non-conforming air content.
  - G. To ensure accurate batching, provide separate storage bins, conveying devices, weighing equipment, and weighing procedures for each material (fly ash or slag) used.
  - H. Provide fly ash from sources that appear on the most recent edition of *SCDOT Qualified Product List 3*. Furnish certified mill test reports and shipping tickets from the supplier for each shipment.
  - I. Provide slag from sources that appear on the most recent edition of *SCDOT Qualified Product List 6*.



**701.5 Measurement**

- 1 The quantity for the pay item Concrete for Structures - Class (as specified) is the volume of specified concrete within the neat lines of the structure as shown on the Plans or as revised by the RCE (excluding precast/prestressed members, bridge barrier parapet, bridge barrier parapet transitions, and drilled shaft concrete) and is measured by the cubic yard (CY) of concrete, complete, and accepted. Deductions are made for the volume of embedded items, except for reinforcing steel; however, no deduction is made for edge chamfers of  $\frac{3}{4}$  inch or smaller.
- 2 Measurement for the quantity of concrete in bridge slabs is computed from the neat line dimensions shown on the Plans with no allowance for form deflection. No additional payment is made for extra concrete required by the use of permanent steel bridge deck forms or for the SIP forms themselves.
- 3 The costs for concrete used in precast/prestressed members, bridge barrier parapet, bridge barrier parapet transitions, and drilled shafts, including the cost of designing the mix, testing, engaging the testing laboratory, and furnishing materials for testing is included in the contract unit bid price for the applicable pay item.

**701.6 Payment**

- 1 Payment for the accepted quantity of Concrete for Structures - Class (as specified), measured in conformance with **Subsection 701.5**, is determined using the contract unit bid price for each pay item. Payment is full compensation for furnishing and placing the Class of concrete as specified or directed and includes costs of the mix design, sampling, and testing; furnishing, storing, batching, mixing, and transporting concrete materials; admixtures; falsework and forms (including SIP forms); surface finishing and curing; quality control personnel and equipment; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Concrete is paid for at 100% of the contract unit bid price upon completion of the Initial Surface Finish.
- 3 Unless otherwise specified, payment for concrete includes the cost of pipe drains, French drains, weep holes, expansion joints, expansion joint materials, flashing, pipes, conduits, anchors, and other similar material. Payment for concrete also includes the cost of removing and disposing of portions of existing structures designated on the Plans to be widened or reconstructed and the costs of drilling for dowels or expansion bolts.
- 4 Payment for the item Concrete for Structures includes all direct and indirect costs and expenses required to complete the work.

**701.6****701.6**

5 Pay items under this section include the following:

Item No.	Pay Item	Unit
7011100	Concrete for Structures – Class 3000 (Roadway)	CY
7011105	Concrete for Structures – Class 3000 (Retaining Wall)	CY
7011200	Concrete for Structures – Class 3000 (Bridge)	CY
7011300	Concrete for Structures – Class 2500	CY
7011400	Concrete for Structures – Class 4000	CY
7011400	Concrete for Structures – Class 4000	CY
7011401	Concrete for Structures – Class 4000 (Retaining Wall)	CY
7011402	Concrete for Structures – Class 4000 (Culvert)	CY
7011403	Concrete for Structures – Class 4000 (Roadway)	CY
7011500	Concrete for Structures – Class 4000S	CY
7011501	Concrete for Structures – Class 4000P	CY
7011510	Concrete for Structures – Class 4000DS For Drilled Shafts	CY
7011600	Concrete for Structures – Class 5000	CY
7011630	Concrete for Structures – Class 6500	CY
7011640	Concrete for Structures – Class 7000	CY

## SECTION 705

### BRIDGE RAILING

#### 705.1 Description

- 1 This section contains specifications for materials, equipment, construction, measurement, and payment for the furnishing and erection of bridge railing of cast-in-place concrete, precast concrete, aluminum, steel, or other specified materials, or a combination of these materials on bridges, walls, or incidental structures as shown on the Plans.
- 2 Unless otherwise stated, bridge railing includes that portion of the structure erected on and above the bridge deck, curb, or sidewalk, or above the top of retaining walls for the protection of traffic and pedestrians.
- 3 Construct bridge railing in accordance with the details shown on the Plans and include the necessary devices for anchoring or attaching the railing to the main structure.

#### 705.2 Materials

##### 705.2.1 Concrete Railing Wall and Barrier Parapet

- 1 Unless otherwise specified, use Class 4000 concrete or greater. Use concrete and procedures conforming to the requirements of **Sections 701 and 702**. Provide reinforcing steel conforming to the requirements of **Section 703**.
- 2 If lightweight concrete bridge barrier parapet is required, produce the concrete from lightweight coarse aggregate sources approved by the OMR. Ensure that the concrete obtains a 28-day design compressive strength equal to or greater than Class 4000 and weighs  $3100 \pm 50$  pounds per cubic yard.

##### 705.2.2 Precast Bridge Barrier Parapet

- 1 Use Class 5000 concrete, or greater, for precast bridge parapet. Use concrete and procedures conforming to the requirements of **Sections 701 and 702**. Provide reinforcing steel conforming to the requirements of **Section 703**. Cast sections to the dimensions shown on the Plans. Galvanize all installation hardware consisting of bolts, nuts, washers, inserts, and rods in accordance with ASTM A 123 or ASTM A 153 as applicable.

#### 705.2.3 Galvanized Steel Railing and Steel Handrail

##### 705.2.3.1 Post and Rail

- 1 Fabricate steel post assembly to the same general appearances as the railing shown in the Plans. Prepare and submit Shop Plans in accordance with the requirements of **Subsection 105.2** and show complete details of all parts of the post and rail. Unless otherwise shown on the Plans, ensure all steel rail and post components conform to the requirements of ASTM A 709, Grade 36. Ensure rail caps conform to the requirements of ASTM A 245, Grade C. Provide required hardware including bolts, nuts, screws, etc., con-

forming to the requirements of **Subsection 705.2.5.**

#### **705.2.3.2 Galvanizing**

- 1 Hot-dip galvanize steel posts and railing in accordance with the current ASTM A 123 or ASTM A 153 as applicable.

#### **705.2.3.3 Cut Ends of Galvanized Steel Railing**

- 1 After grinding smooth, give cut ends of galvanized steel railing two coats of a zinc rich paint meeting the requirements of Federal Specification TT-P-641 or an equal material approved by the OMR.

#### **705.2.4 Aluminum Railing**

##### **705.2.4.1 Extruded Aluminum**

- 1 Provide aluminum alloy extruded rails, posts, bases, expansion bars, etc. conforming to the requirements of ASTM B 221, Alloy 6061, Condition T6.

##### **705.2.4.2 Cast Aluminum**

- 1 Ensure cast aluminum railing post and other items for permanent mold castings conform to the requirements of ASTM B 108, Alloy G70B, Condition T61, except that the elongation in 2 inches is not less than 8%.

#### **705.2.5 Stainless Steel Bolts, Nuts, Set Screws, and Washers**

- 1 Fabricate and erect galvanized steel or aluminum rail with stainless steel bolts and set screws meeting the requirements of ASTM F 593, and stainless steel nuts meeting the requirements of ASTM F 594.

#### **705.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### **705.4 Construction**

##### **705.4.1 General**

- 1 Provide the type railing specified and construct in accordance with the details shown on the Plans and in conformance with the requirements herein. Construct railing to the alignment, grade, and camber designated on the Plans. Ensure that shop fabricated railing is of such uniformity as to ensure good joints and continuous lines after erection on the structure. Any appreciable amount of cutting, bending, or adjusting required during erection to produce a reasonable fit is cause for rejection of the railing. Unless otherwise provided, do not place railing on a span until after the falsework for the span has been removed. During erection of the railing, ensure proper functioning of expansion joints.

- 2 Unless otherwise shown on the Plans or approved in writing by the BCE, erect railing posts vertically with tops of posts parallel to the roadway grade shown on the Plans.

#### **705.4.2 Fabrication and Erection of Metal Railing**

- 1 Ensure the fabrication and erection of steel railing is in conformance with the pertinent provisions of **Section 709**, and to the requirements of this specification. Fabricate aluminum railings in accordance with the current AASHTO *LRFD Bridge Design Specifications*. Splice rail members generally near railing posts and do so only as shown on the Plans. Prepare and submit Working Drawings for metal railing in accordance with **Subsection 105.2** and **Section 725** of these specifications.
- 2 Carefully handle and store all components of metal railing to avoid scratching, marring, denting, or otherwise damaging the railing. Separate aluminum members from concrete or steel by methods called for on the Plans; or if not shown on the Plans, provide the separation by means of a 1/16-inch thick elastomeric sheet, Durometer 60, that meets the requirements of AASHTO M 251.
- 3 Weld all steel railing in accordance with the requirements of the current ANSI/AASHTO/AWS D1.5, *Bridge Welding Code*. Weld all aluminum railing in conformance to the requirements of Section 10 of the current AWS D1.2, *Structural Welding Code - Aluminum*.

#### **705.4.3 Concrete Bridge Railing Wall and Barrier Parapet**

- 1 Construct the concrete railing wall and barrier parapet in conformance to the requirements of **Section 702**. Exercise extreme care in the construction of railing forms to ensure that true grade and alignment of railing or barrier members is obtained. Do not place concrete in forms until the forms have been inspected by the RCE. Remove and replace any portion of the concrete railing wall or barrier parapet that is not constructed to true grade and alignment and cannot be satisfactorily corrected in the opinion of the RCE. Removal and replacement is at the Contractor's expense.
- 2 At the option of the Contractor, the concrete bridge rail, curb base, or barrier parapets may be slip formed. Submit the method of slip forming the concrete to the RCE for approval. A 1½-inch extension of the concrete slab is provided on the Plans to enable the Contractor to slip form the concrete bridge rail, curb base or barrier parapets. No additional reinforcing steel is required, and the payment for the concrete in the slab is for the quantity shown on the Plans.

##### **705.4.3.1 Concrete Bridge Rail Surface Finish**

- 1 Provide either a rubbed finish or a final surface finish as specified in **Subsection 702.4.11** and as indicated on the Plans and/or in Special Provisions.

### 705.5 Measurement

- 1 The quantity for the pay item Concrete Bridge Parapet or Concrete Bridge Railing is the length of cast-in-place bridge parapet or bridge railing above the top of the deck, curb, or sidewalk, excluding all reinforcing steel and is measured by the linear foot (LF) along the continuous parapet or railing in-place from end to end, complete, and accepted. The bridge railing items include all posts and spaces between posts. The reinforcing steel is measured for payment in accordance with **Subsection 703.5**.
- 2 The quantity for the pay item Precast Bridge Barrier Parapet is the length of precast bridge barrier parapet above the top of the deck, curb, or sidewalk, including the reinforcing steel and is measured by the linear foot (LF) in-place, complete, and accepted.
- 3 The quantity for the pay item Steel Bridge Railing, Steel Handrail, or Metal Bicycle Handrail is the length of metal handrail above the top of the deck, parapet wall, or sidewalk and is measured by the linear foot (LF) in-place, from end to end, complete, and accepted.

### 705.6 Payment

- 1 Payment for the accepted quantity of Concrete Bridge Parapet, Concrete Bridge Railing, or Precast Bridge Parapet, measured in accordance with **Subsection 705.5**, is determined using the contract unit bid price for the applicable item. Payment is full compensation for constructing bridge parapets or railings as specified or directed and includes preparing Shop Plans; forming and placing concrete; furnishing and installing expansion joint material, metal castings, pipe, hardware, anchor bolts, and reinforcing steel (except in cast-in-place concrete); and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Reinforcing steel in cast-in-place concrete parapets and railings is paid for under the provisions of **Subsection 703.6**.
- 3 Payment for the accepted quantity of Steel Bridge Railing, Steel Handrail, or Metal Bicycle Handrail, measured in accordance with **Subsection 705.5**, is determined using the contract unit bid price for the applicable item. Payment is full compensation for constructing metal railings or handrails as specified or directed and includes preparing Shop Plans; fabricating and installing railing supports, base pads, hardware, and anchor bolts; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 4 Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.

**705.6****705.6**

5 Pay items under this section include the following:

Item No.	Pay Item	Unit
7051000	Concrete Bridge Barrier Parapet	LF
7051005	Precast Concrete Barrier Parapet	LF
7051010	Concrete Bridge Barrier Parapet (Lightweight)	LF
7051100	Concrete Bridge Median Barrier	LF
7053000	Steel Bridge Railing	LF
7054000	Concrete Bridge Railing Wall (3'6" Height)	LF
7054001	Concrete Bridge Railing Wall with Indentations	LF
7054009	Concrete Bridge Railing Wall (2'10" Height)	LF
7054010	Concrete Bridge Railing Wall (2'6" Height)	LF
7054012	Concrete Bridge Railing Wall (2' Height)	LF
7054014	Concrete Bridge Railing Wall (1.5' Height)	LF
7054030	Concrete Bridge Railing Wall with Formliner Finish	LF
7055010	Steel Handrail	LF
7055100	Metal Bicycle Handrail	LF

**SECTION 714****PERMANENT PIPE CULVERTS****714.1 General**

- <sup>1</sup> Ensure that all types and sizes of permanent and temporary pipe culverts to conform to the requirements of the Special Provisions and the latest edition of applicable SCDOT Supplemental Specifications, OMR Standard Method of Tests, and the Supplemental Technical Specification **SC-M-714** in effect at the time the bid proposal for the project was advertised.



## PERMANENT PIPE CULVERTS

### SCDOT Designation SC-M-714

#### Reinforced Concrete (RCP), Corrugated Aluminum Alloy (CAAP), Spiral Ribbed Aluminum (SRAP) & High Density Polyethylene Pipe (HDPE) Pipe Culverts

##### 714.1 Description

This specification establishes requirements for the materials, construction, measurement, and payment for furnishing reinforced concrete pipe culverts (RCP) corrugated aluminum alloy pipes and pipe arches (CAAP), spiral ribbed aluminum pipe (SRAP), and high density polyethylene pipe culvert (HDPE) of the size, shape, type, and dimensions indicated on the plans and installing them to provide drainage structures at places designated on the plans or by the RCE in accordance with these specifications and true to the lines and grades shown on the plans or otherwise given by the RCE. This work includes the furnishing and installing of necessary tee, wye, elbow, and bend joints, and making connections to existing and/or new structures, including drilling and chipping as is necessary to complete the work.

##### 714.1.1 Pipe Culvert Type Selection

Flexible pipe culverts are prohibited from use on all Interstate and SCDOT Evacuation Routes. Use only rigid pipe culverts for all Interstate and SCDOT Evacuation Routes statewide. SCDOT Evacuation Routes are available on the Department's website at [www.scdot.org](http://www.scdot.org). See table below:

Permanent Pipe Culvert Material Selection Criteria For Drainage Pipe				
Pipe Material Type	Pipe Type	Non-Interstate Routes	Interstate Routes	SCDOT Evacuation Routes
Reinforced Concrete (RCP)	Rigid	Yes	Yes	Yes
Spiral Ribbed Aluminum (SRAP)	Flexible	Yes	No	No
Corrugated Aluminum Alloy (CAAP)	Flexible	Yes	No	No
High Density Polyethylene (HDPE)	Flexible	Yes	No	No

##### 714.2 Materials

Use only materials specified herein for the several items that constitute the finished pipe culverts.

#### 714.2.1 RCP Materials

Use only RCP from a qualified manufacturer as indicated on SCDOT Qualified Product List 69. Use only joint sealant specified on SCDOT Qualified Product List 69 with the pipe supplied.

On occasion, the OMR may accept RCP that is not stamped, provided certified tests results are submitted for review for each class and size of RCP to include but is not limited to the results from the three edge bearing test for hairline crack (0.01 inch) and the ultimate strength of RCP. All testing will be in accordance to the latest applicable SCDOT and AASHTO specifications.

Use circular RCP conforming to the applicable requirements of AASHTO M 170 for the specified diameters, shapes, types, and strength classes except for the modifications stated herein and on SCDOT Standard Drawings. Provide the RCE with certification that pipe meets the requirements of AASHTO M 170. When a strength class is not specified in the plans, refer to standard drawing 714-205-01 for allowable fill heights, or provide structural calculations signed by a Professional Engineer that is licensed in South Carolina following the appropriate criteria outlined in SCDOT Preconstruction Design Memorandum-05. Furnish pipe in manufactured lengths from 4 to 12 feet.

Ensure circular pipe meet or exceed the reinforcement requirements of AASHTO M 170. Install standard AASHTO M 170 reinforced pipe within minimum and maximum fill heights shown on SCDOT Standard Drawings.

Ensure that Portland cement conforms to the requirements of SCDOT Standard Specifications Section 701.

The manufacturer may use fly ash and water-granulated blast-furnace slag in accordance with the following requirements:

1. Fly ash meets AASHTO M 295 for Type F or C with a maximum  $\text{Na}_2\text{O}$  of 1.5%. Water-granulated blast-furnace slag meets the requirements of AASHTO M 302, Grade 100 or better.
2. Cement may be replaced by fly ash or water-granulated blast-furnace slag in accordance with AASHTO M 170.
3. Fly ash is allowed only from sources listed on the latest edition of SCDOT Qualified Product List 3. Slag is allowed only from sources listed on the latest edition of SCDOT Qualified Product List 6. Certified mill test reports are furnished with each shipment to verify compliance requirements.
4. The manufacturer provides a qualified OMR mix design in advance of batching. The submittal indicates the amount of cement removed and the material replacing it.

5. Storage bins, conveying devices and weighing equipment and procedures to ensure accurate batching provided for each material (fly ash or slag) used.

Use only circular reinforcement as listed in AASHTO M 170 for standard pipe. Make certain that steel reinforcement conforms to the requirements of AASHTO M 336 for wire reinforcement as applicable. Use only steel that conforms to the parameters used in the pipe structural calculations supplied for SCDOT Standard Drawings. For custom pipe requiring deformed billet steel, use circular reinforcement that conforms to AASHTO M 31, Type W (ASTM A 706 Grade 60). Ensure that steel conforming to AASHTO M 31, Type W comes from a source listed on SCDOT Qualified Product List 60.

Ensure that Rubber Gasket Joint Material meets the requirements of ASTM C 443. Ensure that Preformed Flexible Joint Sealant meets the requirements of ASTM C 990. Use only gasket sources that appear on SCDOT Qualified Product List 69 with the supplied pipe. Obtain qualification by furnishing the OMR a certified affidavit with test results made in a recognized laboratory confirming that the material meets ASTM C 990 for preformed flexible joint sealant and ASTM C 443 for rubber gaskets, along with complete instructions for installation of the material.

Make certain water meets the requirements of SCDOT Standard Specifications Section 701.

When lift holes or lugs are required in pipe, follow OSHA guidelines for handling pipe, and manufacturer guidelines for plugging lift holes after installation.

For custom pipe, when noncircular (elliptical, shear stirrups, etc.) reinforcement is used,

1. Stabilize reinforcement by satisfactory means to ensure that it does not shift or rotate during the manufacturing process
2. Provide a stencil on the inside and outside shell indicating "CUSTOM PIPE NON CIRCULAR REINFORCEMENT TOP OF PIPE" and a mark "X" indicating exact top of pipe.
3. Provide structural calculations signed by a Professional Engineer that is licensed in South Carolina following the appropriate criteria outlined in SCDOT Preconstruction Design Memorandum-05 for custom pipe with non-circular reinforcement.
4. Provide to RCE and follow manufacturer guidelines for proper handling and installation instructions. Use installation procedure and materials that meet or exceed the limitations of this specification.

### 714.2.2 CAAP and SRAP Materials

Use only materials specified herein for the several items that constitute the finished pipe culvert. Use pipe supplied with joint sealant material and manufactured at a facility listed on Qualified Product List 68.

Provide corrugated aluminum alloy pipe, pipe-arch, and spiral ribbed aluminum pipe conforming to AASHTO M 196. Provide the RCE certification that the pipe meets the requirements of AASHTO M 196. Ensure that the thickness of the pipe is in accordance with the plans.

Use aluminum alloy sheets or coils that have been marked and conform to AASHTO M 197. Use permanent sheet markings which identify the name or trademark of sheet manufacturer; alloy and temper; specified thickness or gage; date of manufacture by a six-digit number indicating in order the year, month, and day of the month; and designation number AASHTO M 197.

Use a permanent sheet marking method to mark pipe with pipe fabrication information. Mark fabricated pipe with name or trademark of pipe fabricator, date of fabrication of pipe by a six-digit number indicating in order the year, month, and day of the month, designation number AASHTO M 196. Align identifying markings with the direction of corrugation and spaced in accordance with ASTM B 666.

Mark fittings with the manufacturer's identification symbol and specification designation AASHTO M 196.

### 714.2.3 HDPE Materials

Provide corrugated high density polyethylene pipe culvert conforming to the requirements of AASHTO M 294, Type S, as required. Use pipe supplied with joint sealant material and manufactured at a facility listed on Qualified Product List 30.

For AASHTO M 294, Type S pipe, provide pipe with an outer corrugated high density pipe wall and a smooth inner liner. Use only AASHTO M 294, Type S pipe in permanent applications.

Use only materials from sources complying with the SCDOT Qualified Product Policy 30 and appearing on the SCDOT Qualified Product List 30. Pipe facilities listed on Qualified Product List 30 are considered to be in compliance with M 294 and will be listed as Compliant-V for facilities qualified to supply pipe produced with only virgin materials or Compliant-VR for facilities qualified to supply pipe containing recycled materials as well as pipe containing only virgin materials.

Ensure that the shipped pipe is plainly marked with the manufacturer's name, trademark, nominal size, specification designation AASHTO M 294V or M 294R, plant designation

code, and the date of manufacture or an appropriate code. Ensure that the shipped fittings are plainly marked with the manufacturer's identification symbol and specification designation AASHTO M 294.

#### 714.2.4 Special Materials and Connections

If special designed pipe is required (beyond the fill height limits of the SCDOT Standard Drawings), have the manufacturer submit a design to the OMR that meets or exceeds the loading criteria specified on SCDOT Preconstruction Design Memorandum-05 for the design cover height for the project and the pipe material chosen.

Use tees, wyes, elbows, bends, reducers, and increasers with strength matching or exceeding the strength of the strongest pipe being connected and with the same joint profile of the connecting pipe. Use tees, wyes, elbows, bends, reducers, and increasers with joint profiles that match connected pipe.

When geotextile for drainage filtration is required, follow SCDOT Standard Specifications Section 804 and SCDOT Standard Drawings.

#### 714.2.5 Referenced Documents

SCDOT Standard Specifications for Highway Construction

SCDOT Supplemental Specification for Dissimilar Pipe Couplers

SCDOT Test Procedure:

- SC-T-29

SCDOT Qualified Product Lists:

- Qualified Product List 1
- Qualified Product List 2
- Qualified Product List 3
- Qualified Product List 30
- Qualified Product List 60
- Qualified Product List 68
- Qualified Product List 69

SCDOT Memorandums:

- SCDOT Instructional Bulletin 2009-4
- SCDOT Preconstruction Design Memorandum-05

AASHTO Standard Specifications for Transportation Materials & Methods of Sampling and Testing:

- AASHTO M 31
- AASHTO T 96
- AASHTO T 99
- AASHTO T 104

- AASHTO M 145
- AASHTO M 170
- AASHTO M 196
- AASHTO M 197
- AASHTO M 198
- AASHTO M 207
- AASHTO M 294
- AASHTO M 295
- AASHTO M 302
- AASHTO M 315
- AASHTO M 336

ASTM Standard Specifications:

- ASTM A 307
- ASTM A 706
- ASTM B 666
- ASTM C 443
- ASTM C 990
- ASTM C 1479
- ASTM D 1149
- ASTM D 2321
- ASTM D 1056
- ASTM D 3212
- ASTM F 477

Websites:

[www.scdot.org](http://www.scdot.org)  
[www.osha.gov](http://www.osha.gov)  
[www.scosha.llronline.com](http://www.scosha.llronline.com)  
[www.concretepipe.org](http://www.concretepipe.org)  
[www.precast.org](http://www.precast.org)  
[www.plasticpipe.org](http://www.plasticpipe.org)  
[www.ntpep.org](http://www.ntpep.org)

### 714.3 Construction Requirements

#### 714.3.1 Handling and Storage

Inspect pipe before it is installed. Check pipe for proper markings and for signs of damage due to fabrication or shipment. Pipe may be rejected due to improper marking, incorrect pipe class, gage, corrugation type, size, or strength. Pipe may also be rejected due to damage which may include, but is not limited to fractures or cracks passing through the wall or extending the entire length of the pipe, spalling, chips, breaks, honey-combing, cuts, gouges, de-laminations, bulges, flat areas, bubbles, dents, tears, breaks, gaps, missing or malformed corrugations, or deformations that would adversely affect the

strength or function of the pipe. Damage to the end of the pipe including open seams (particularly at rerolled ends) or end damage to bell or spigot, or ends that are not normal to the walls or centerline of the pipe that prevent satisfactory joint installation may also be cause for rejection. Defective or damaged joint sealant or gaskets may require replacement, but are not cause for rejection of pipe that meets the above requirements.

Handle and store pipe such that no damage occurs to the pipe. Unload the pipe at a site that is relatively flat and level, free of debris, and away from construction traffic. Stack belled RCP pipes using blocking to avoid excess loading on the bells.

For RCP pipe marked “NON CIRCULAR REINFORCEMENT TOP OF PIPE” follow manufacturer requirements for proper handling of pipe.

#### 714.3.2 Trench for Pipe

Excavate trenches to the required grade and to a width sufficient to allow for proper jointing of the pipe and for thorough compaction of the structural backfill material under and around the pipe. Excavate the trench to a minimum width for the selected pipe type or specific site conditions as required below:

1. CAAP, SRAP, HDPE Trench Widths =  $1.5 \times \text{Pipe OD} + 12''$  or the width required to safely fit compaction equipment and personnel between the pipe and the trench walls, whichever is greater.
2. RCP Trench Width =  $\text{Pipe OD} + 24''$  or  $1.33 \times \text{OD}$  or the width required to safely fit compaction equipment and personnel between the pipe and the trench walls, whichever is greater.
3.  $3 \times \text{Pipe OD}$  (only in sections where the foundation, lower side, or trench wall improvements are required in the plans or by the RCE).

Where pipe culverts will be placed in new embankments, first construct the embankments to a height of approximately  $1/2$  the diameter of the pipe above the top of the designated pipe or to such height as directed by the RCE. Construct the embankment for a distance of not less than 5 times the diameter of the pipe on each side of the pipe location, after which excavate the trench in the embankment as described in this section above.

When excavating for pipe culverts, if rock, hard pan, or other unyielding foundation material is encountered, excavate the hard unyielding material below the elevation of the bottom of the pipe to accommodate the required bedding thickness.

Follow OSHA’s excavation regulations found in Subpart P of 29 CFR 1926 for safety requirements of trench excavations and protection systems. The Contractor shall employ an onsite Competent Person (as defined by SC OSHA as follows: one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization

to take prompt corrective measures to eliminate them. In order to be a competent person for the purpose of this standard one must have had specific training in, and be knowledgeable about, soils analysis, the use of protective systems, and the requirements of this standard) during all trenching operations. Provide the RCE with the name and contact information of the responsible Competent Person for each installation. If trench widths or wall slopes are changed due to safety requirements, backfill the trench with structural or embankment backfill equal to the level described in the Standard Drawings for Pipe Culverts.

If trench boxes (shields, etc.) are required, follow 29 CFR 1926.652, trench box manufacturer, and industry standards for trench installations not exceeding 20 feet deep. When trench boxes are required for trenches exceeding 20 feet deep, the Contractor shall submit to the RCE designs, plans and supporting calculations for protective systems and shoring equipment sealed by a Professional Engineer that is licensed in South Carolina unless provided in the plans. When trench boxes are moved, the previously placed pipe and structural backfill shall not be disturbed. Move trench box in increments during the installation process to permit placement and compaction of structural backfill material for the full width of the trench while continuing to follow Subpart P of 29 CFR 1926 OSHA Standards. Voids that are created by movement of the trench box shall be filled and compacted with structural backfill incrementally with the movement of the trench box, as described in Subsection 714.3.7. If necessary to prevent movement, restrain the pipe using methods that do not damage the pipe.

If temporary shoring (sheet pile, timber shoring, mechanically stabilized earth, etc.) is required, the Contractor shall submit to the RCE designs, plans and supporting calculations for protective systems and shoring equipment sealed by a Professional Engineer that is licensed in South Carolina unless provided in the plans. If temporary shoring is to be removed, if structural design allows, it shall be pulled out in vertical increments during the installation process to permit placement and compaction of fill material for the full width of the trench while continuing to follow Subpart P of 29 CFR 1926 OSHA Standards. If temporary shoring is to be left in place, provide the RCE with location and description of all buried systems for inclusion in as-built plans.

Provide for temporary diversion of water or pumping as may be necessary in order to permit dry installation of the culvert. Keep trenches free from water until pipes are joined and properly backfilled.

#### 714.3.3 Improved Foundation for Pipe

Unless noted otherwise in the plans or by the RCE, support pipe using foundation material that meets the minimum requirements of the roadway embankment.

Use the soil boring Standard Penetration Test SPT “N” values and recommendations of SCDOT Standard Drawings to determine if additional work is required to prepare an improved foundation. Reference SCDOT standard drawings for improved foundation requirements. Excavate deep enough to install nonwoven geotextile for drainage



filtration and pipe foundation material as indicated on SCDOT Standard Drawings. If Type B4 biaxial geogrid is used with the foundation material and geotextile for drainage filtration, the additional foundation undercut may be reduced as indicated on SCDOT Standard Drawings. When pipe foundation material is indicated, use the same material that is used for the bedding and pipe structural backfill. Compact the pipe foundation material in accordance with methods used for pipe structural backfill. Provide trench suitable to accommodate site conditions and obstructions.

If site conditions are encountered that were not indicated in the plans, contact the design engineer of record for instructions on foundation preparation.

#### 714.3.4 Bed for Pipe

For bedding material, use either:

1. Well graded A-1 (AASHTO M 145) soils
2. Screenings meeting A-1 (AASHTO M 145)
3. Macadam or Marine Limestone Graded aggregate base from Qualified Product List 2
4. Materials meeting AASHTO soil classifications A-2-4
5. Uniformly graded, coarse grained A-3 (AASHTO M 145) soils
6. Uniformly graded angular stone as large as #5 stone (Class 2 wrapped, vibrated)

The same material must be used for bedding and structural backfill unless CLSM is used for structural backfill.

The materials marked as (wrapped) require geotextile wrap to control migration of fines into open voids. Other materials should be wrapped if there is a significant grain or particle size difference between the in-situ or embankment material and the bedding and structural backfill material as determined by the RCE. When wrapping is used, provide a geotextile that prevents the transmission of the smallest soil particles present in both the in-situ soil and the soil used for bedding and structural backfill. Wrap the entire bedding and backfill envelope and provide a minimum overlap of 2 feet at all geotextile splices. For shallow installations, provide a cover of 6 inches of soil between geotextile and hot mix asphalt.

A sample of the pipe bedding material will be taken at the beginning of pipe laying operations to verify the classification of materials used for bedding and pipe structural backfill. After the initial sample is taken, the sampling frequency will be for each 1,000 foot production lot or until the source or classification of the bedding/backfill material changes. These are minimum requirements that may be increased at the RCE's discretion.

Ensure that trenches are free of water when placing bedding.

Support the pipe by placing uncompacted bedding material above the stable foundation material. Use the larger of 6 inches or 10.0% of the nominal pipe outside diameter for the bedding thickness. Prepare bedding material at pipe bells and projected hubs (if present) to prevent excess loading and to provide uniform support in these areas.

Compact bedding material that is outside of the middle third pipe diameter in order to ensure proper support of the pipe. Ensure that bedding material outside the middle third of pipe is compacted to a minimum of 95.0% of the maximum dry density when measured in accordance to SC-T-29 (use AASHTO T-99 for determination of maximum dry density for A-1 Screenings or Aggregate Base Course materials). Ensure that compaction of bedding material does not cause the pipe to move.

Vibrate angular stone in place using a minimum of 2 passes with a vibratory plate tamp in lifts not to exceed 12 inches, unless additional passes are required to consolidate the stone as directed by the RCE.

Do not use controlled low strength material (CLSM), flowable fills or concrete for pipe bedding.

#### 714.3.5 Laying Pipe

Begin pipe laying at the downstream end of the culvert with the bell or groove ends and outside laps upstream.

Make certain each section of pipe has a full firm bearing throughout its length, true to line and grade given. Make certain that all supports are uniform (without point loading from irregular backfill) and joints and bells have been properly accommodated. Remove pipe that settles before final acceptance or which is not in alignment and re-lay without extra compensation.

When custom RCP pipe with noncircular reinforcement is used, install the pipe in such a position that the manufacturer's marks designating the top of the pipe is not more than 5 degrees from the vertical plane through the longitudinal axis of the pipe or manufacturers guidelines, whichever is most vertical.

Prior to being lowered into the trench, closely examine corrugated metal pipe sections and fit so that they will form a true line of pipe when in place. Do not use sections that do not fit together properly.

Place distorted circular metal pipes with the major axis vertical. If rods, struts, or other means are used to maintain pipe distortion, do not remove them before the completion of the embankment unless otherwise permitted by the RCE.

Before laying the pipe or during the pipe laying operations, construct adequate outfall ditches and inlets free of obstructions in order that proper drainage is provided.

When pipes are connected to drainage structures, install or cut pipe flush with inside face of drainage structure. When pipes are connected to end treatments such as slabs or headwalls, install or cut pipe flush with exposed face of end treatment. When pipe culverts are installed connecting to pipe of different material or of connection details, use a standard drainage structure or designed interface as directed by the RCE. Where pipe culverts are constructed in conjunction with existing structures, make connections to the satisfaction of the RCE.

#### 714.3.6 Joints

Use a combination of pipe and joint material that meets performance requirements of the laboratory 10 psi pressure test. Provide a combination of pipe and joint material meeting a 13 psi pressure test when specified in the plans or when working in the following coastal counties: Berkeley, Beaufort, Charleston, Colleton, Dorchester, Georgetown, Horry, and Jasper.

##### 714.3.6.1 Reinforced Concrete Pipe (RCP) Joints

For RCP, use a joint material supplied with the pipe and made by a manufacturer listed on SCDOT Qualified Product List 69 that corresponds with the type of joint specified in the plans or provided by the pipe manufacturer. Order pipe and appropriate joint material from pipe manufacturer. Install pipe using joints specified in the plans, contract documents, or pay items.

##### 1. AASHTO M 198 Preformed Flexible Joint Sealant

Use a combination of pipe and joint material that meets performance requirements of AASHTO M 198 (ASTM C 990), including the laboratory 10 psi pressure test. Carefully clean all dirt and foreign substances from the jointing surface of the groove end already laid and tongue end of the pipe being added. Allow jointing surfaces to dry completely before application of the joint material. If required by site conditions or manufacturer recommendations, apply an adhesive primer specified by the flexible sealant manufacturer. During cold weather, warm flexible sealant as directed by the manufacturer before application. Apply material in a single strip as specified by pipe manufacturer (typically from within 1 inch of the tongue end to approximately the middle of the tongue on pipe) for up to 48 inch diameter pipe. For pipe larger than 48 inch diameter, place half of the sealant on the top side of the tongue end and the other half on the bottom side of the groove end of the two pipes being joined. Provide between 1" and 3" overlap of the installed joint sealant by laying the edges of the sealant side by side. Do not twist ends of sealant around each other or stack one end on top of the other. Leave protective paper on outside of flexible sealant to protect during pipe alignment. Apply enough flexible sealant to fill the annular joint space. Align the tongue and groove or bell and spigot ends of the pipes before joining.

(closing) the joint. Remove any remaining protective paper from outside surface of flexible sealant. Make sure that the flexible sealant is in contact with the entry taper around the entire circumference of the pipe. Confirm that the pipe is aligned properly. Seat the pipe completely before installing next pipe section.

## 2. AASHTO M 315 Rubber Gasket Joint Material

When specified in the plans, contract documents, pay items or coastal counties, use a combination of pipe and joint material that meets performance requirements of AASHTO M 315 (ASTM C 443), including the laboratory 13 psi pressure test. Carefully clean all dirt and foreign substances from the jointing surface of the groove end already laid and tongue end of the pipe being added. Follow pipe manufacturer's recommendations for lubrication of joint and/or gasket. Fit the gasket on the tongue recess. Equalize the rubber gasket, when required by manufacturer, by running a smooth round object (such as a screwdriver shaft) between the gasket and the pipe. Complete this equalization procedure at least 3 times around the entire length of each gasket (see detail on standard drawing for reinforced concrete pipe). Ensure proper seating of the gasket before proceeding with installation. Align the tongue and groove ends of the pipes before homing (closing) the joint. Make sure that the gasket is in contact with the entry taper around the entire circumference and that the pipe is aligned properly. Seat pipe completely before installing next pipe section.

### 714.3.6.2 Corrugated Aluminum and Spiral Ribbed Aluminum Pipe (CAAP&SRAP) Joints

For CAAP & SRAP, order pipe and appropriate joint material from pipe manufacturer.

For CAAP and SRAP, rerolled pipe ends with annular corrugations are allowed. Use fully corrugated aluminum coupling bands with either welded angle brackets or bar bolt and strap connections that conform to the requirements of AASHTO M 196 article 9 unless specified otherwise in the plans. Provide coupling bands and connections that match the configuration used during the joint testing and indicated on Qualified Product List 68. Use minimum 1/2 inch diameter galvanized ASTM A 307 bolts and nuts to connect all size coupling bands and follow minimum quantity requirements shown on SCDOT Standard Drawings. Use closed cell expanded rubber strip or sleeve gaskets conforming to ASTM D 1056.

Manufacturer must certify that the pipe, coupling band, and gasket combination meets the laboratory 10 psi pressure test. Each manufacturer may also elect to test their pipe joints to 13 psi for use in locations where 13 psi joints are specified or required, such as coastal counties. Both 10 psi and 13 psi tests are to be conducted in straight alignment with the pipe deflected 5%. Make certain that the strip or sleeve gaskets are at least as wide as the coupling band (12 inches minimum) and approximately 3/8 inch thick minimum. Rubber O-ring gaskets are not allowed since they are not visible from the inside of the pipe after installation.

Carefully clean pipe ends to remove all debris that could hinder proper sealing of the pipes and gasket. Liberally lubricate the gasket and outside pipe surfaces in contact with the gasket using a lubricant specified by the gasket manufacturer. Lubricate the inside surfaces of the coupling band, check for proper position, and adjust if required to match corrugations. If necessary, fold gasket over itself to allow placement of joining pipe, then unfold over newly placed pipe. Snap the gasket several times to allow for final seating. Confirm that the separation between pipe ends is less than one corrugation of the coupling band and that no foreign matter is present between the gasket and the pipe/coupling band surfaces. Pull coupling band ends together using a long bolt if needed to start the band lap. Make sure that coupling band corrugations align with the pipe's corrugations. When helical corrugations are used, if necessary, rotate coupling band to align with previously installed pipe or rotate newly installed pipe to align with coupling band. Insert final bolts and tighten to snug tight conditions (approximately 25-30 ft-lb of torque) or manufacturer recommendations. Tap the band with a rubber mallet during tightening to ensure uniform seating of the gasket. Ensure that band corrugations are fully seated into corrugations of both pipes before proceeding to next pipe connection.

#### 714.3.6.3 High Density Polyethylene Pipe (HDPE) Joints

For HDPE, order pipe and appropriate joint material from pipe manufacturer.

##### 1. Standard Joint

Use a bell and spigot type connection with an elastomeric rubber seal meeting ASTM F477 and meeting the requirements specified in the plan and by the pipe manufacturer. Pipes may be shipped with gaskets installed on pipe. Certify that the pipe and gasket system meet or exceed the laboratory 10 psi internal pressure test of ASTM D 3212. Each manufacturer may also elect to test their pipe joints to 13 psi for use in locations where 13 psi joints are specified or required like coastal counties. Both 10 psi and 13 psi tests are to be conducted in straight alignment with the pipe deflected 5%. Provide, to the RCE, manufacturer's certification that gaskets are manufactured in accordance with the requirements of ASTM F 477 and do not have any visible cracking when tested according to ASTM D 1149. Store bell and spigot type pipe in alternating rows to prevent bell flattening. Cover gaskets with a protective wrap during storage to prevent damage to the gasket. Inspect pipe to ensure that pipe joint components are clean and free from damage or defect before installation. Mark or verify that the pipe ends are marked to indicate the insertion stop position. If pipe bell is manufactured separately from pipe, ensure it is securely installed before proceeding with installation. Lubricate inside and leading edge of bell with a lubricant, specified by the pipe manufacturer, which does not cause damage or deterioration to the gasket material. Push the pipe spigot into the bell until the end of the bell meets the homing mark while the pipe maintains line and grade. Follow manufacturer recommendations on construction devices to use to prevent damage to the pipe. Do not use excessive force that may result in over-assembled joints or dislodged gaskets. If pipe is not fully installed to the marked insertion point, disassemble joints, clean and reinstall joint as

described above. Ensure that pipe installed has proper line and grade before installing next pipe section.

## 2. Field Fabricated Joint

Use field fabricated joints only outside of roadbed and driveways. Splice two field cut pieces of HDPE pipe, using a split coupler band with an elastomeric rubber seal meeting ASTM F 477.

Wrap entire joint with a geotextile for drainage filtration to prevent the migration of soils into the pipe or to meet a silt tight designation per AASHTO M 294. Geotextile fabric shall extend 12 inches either side of the joint and overlap at least 18 inches.

No additional payment will be made for the use and installation of split coupler bands.

### 714.3.6.4 Dissimilar Pipe Joint/Coupler

Follow the guidelines in the SCDOT Supplemental Specification for Dissimilar Pipe Couplers when joining two different types of pipe.

### 714.3.7 Pipe Structural Backfill

Advise the RCE of the time Pipe Structural Backfill operations are expected to begin. If not properly advised, the RCE may require the excavation and reinstallation of the structural backfill material.

For structural backfill, use the same material as the pipe bedding (Subsection 714.3.4) unless controlled low strength material is used as described below. When a geotextile wrap is required, cover the entire bedding and structural backfill envelope as described in subsection 714.3.3.

Controlled low strength material (CLSM) and controlled density fill are flowable fills that may be used for structural backfill in the haunch area and above. Select a flowable fill mix design that can be excavated. Do not use CLSM when placing perforated pipe. When using CLSM ensure that the pipe is not displaced and does not float while using methods that do not damage the pipe.

Ensure that trenches are free of water when placing and compacting structural backfill.

Thoroughly compact the structural backfill material in layers not exceeding 6 inches of compacted material. The first lift must be sufficiently below the spring line such that the material can be worked into the haunch zone of the pipe. Perform compaction by the use of mechanical tampers with the assistance of hand tamps when necessary. Thoroughly compact the structural backfill under the haunches of the pipe and ensure that the backfill soil is in continuous uniform contact with the side and joints of the pipe. Exercise

sufficient care to prevent damaging or misaligning the pipe with the compaction equipment.

Install and compact structural backfill on both sides of pipe before adding the next lift of backfill material. Evenly distribute structural backfill on both sides of the pipe for its full length. Ensure that Pipe Structural Backfill process does not cause joint separation or displacement of the installed pipe.

Ensure that the compaction of structural backfill is a minimum of 95.0% of the maximum dry density when measured in accordance with SC-T-29 (use AASHTO T-99 for determination of maximum dry density for A-1 Screenings or Aggregate Base Course materials).

The RCE will establish a compaction pattern for the contractor to follow during pipe backfill operations. The pattern will be in effect for production lots of 500 feet of pipe, until the source or classification of backfill material changes, site weather conditions change such as rain, or the compactive efforts being applied change. The compaction pattern will be established by allowing the contractor to apply a 6 inch lift in a 50 foot section until the material has been compacted to 95.0% of the maximum dry density for the structural backfill when measured in accordance with SC-T-29 (use AASHTO T-99 for determination of maximum dry density for A-1 Screenings or Aggregate Base Course materials). The number of passes and the watering efforts applied to the material will be recorded and this pattern will be considered the compaction pattern.

For pipe smaller than 36 inches in diameter, the RCE will run a minimum of one verification compaction test at the springline of the pipe for each run of pipe between drainage structures or pipe ends. For pipe 36 inches in diameter and larger, a minimum of one test for each 18 inches of the pipe embedment zone height (including one at the pipe springline) for each run of pipe between drainage structures or pipe ends will be performed. This is a minimum frequency and should be increased at the RCE's discretion.

For all tests, insert the nuclear gauge probe to its full depth or within 2 to 3 inches of the bottom of the layer being tested, whichever is less. In the event of a non-conforming compaction measurement, the RCE will check the compaction of the previous lift by removing enough material to perform the verification test. If the second test passes, the contractor will continue the compaction efforts of the current layer until the verification test passes. In the event of 2 failing compaction tests within a single run of pipe (between drainage structures or pipe ends), remove the pipe structural backfill, clean trench and set a new compaction pattern at the RCE's discretion.

For driveway pipes and runs of pipe up to 16 feet in length, the frequency of compaction testing will be at the discretion of the RCE.

Vibrate angular stone backfills in place using methods that properly lock the angular stone in place around the pipe and do not damage the pipe. Typically 2 passes with a vibratory

plate tamp for each 12 inch lift will provide adequate compaction unless additional passes are required to consolidate the stone as directed by the RCE.

Complete structural backfill installation up to the elevation shown on the corresponding SCDOT Standard Drawings.

#### 714.3.8 Cover Height

Ensure that the minimum and maximum cover is in accordance with the height of cover tables in the SCDOT Standard Drawings.

#### 714.3.9 Construction Loads

Fill height requirements may dictate that more fill is required during construction than for final design. In all cases, install backfill to the minimum construction fill height specified in the SCDOT Standard Drawings before driving heavy equipment over pipe. Maintain this minimum cover until heavy equipment usage is discontinued so that damage does not occur to the pipe. Install and remove backfill required due to the construction loading on the pipe at no expense to SCDOT. Repair all damage or displacement at no expense to SCDOT.

#### 714.3.10 Structures and End Treatments

Unless shown otherwise in the plans, use a minimum end treatment of a straight pipe end with Class B or C riprap and geotextile for erosion control.

When specified in the plans, use end treatments such as pipe beveled end, concrete slab, straight headwall for pipe, pipe end structure, or pipe wingwall and apron system in accordance with SCDOT Standard Drawings or plan structure details.

#### 714.3.11 Installation Inspection

##### 1. Construction Inspection:

Visually inspect 100% of pipe for fractures, cracks, spalling, chips, and breaks during all phases of the installation process. Inspect joints, including tongues and grooves. Chipped pipe ends that prevent the full bond between joint sealant/gasket and both pipes may only be installed in drainage structures at the ends of pipe runs where they will be grouted over. Inspect installed joints for missing, damaged, or improperly installed joint sealant or gasket. Verify line and grade in accordance with the frequencies detailed in the Construction Manual. All inspections must be performed by a SCDOT certified Earthwork, Drainage and Base Technician.

When improper installation or damage is noted during the construction installation inspection of the pipe, repairs must be made to the satisfaction of the RCE. Additional



inspections may be performed until confidence is restored that the installation has been performed in accordance with these specifications.

## 2. Post Construction Inspection:

The RCE will collect survey data for 100% of installed pipe. Survey data will be collected electronically to establish a pipe inventory. Survey data will include county, route information, mile point, latitude and longitude for inlet end of pipe. Survey data collected will also include at a minimum pipe diameter, pipe material, fill height, and shape and description of drainage structures and end treatments. This inventory data will be submitted to the Director of Maintenance office upon acceptance of the project.

Post Installation Inspection for acceptance purposes shall be performed by the Department or its Consultant at the discretion of the RCE. The timing, frequency, location, and the method of post construction inspection will be determined by the RCE. 100% of pipe installed on the project may be inspected. The Department or its Consultant will provide any necessary Traffic Control to support the inspection operation. The Contractor shall cooperate fully with the post installation inspection and in no way interfere with the post installation inspection.

Inspections of completed pipe installations will be performed after the embankment is in place and all non-asphalt bases and/or subgrades have been completed for at least 30 days. In cases where the Contractor's accepted schedule indicates that paving operations will be conducted in less than 30 days, an early inspection may be performed for acceptance. The Contractor will be provided with a copy of the post installation inspection report if deficiencies are discovered.

When improper installation or damage is noted in any prior inspection (visual, compaction, installation, etc.) of the pipe, repair the pipe installation to the satisfaction of the RCE. The RCE may perform additional inspections until confidence is restored that the remaining pipe has been installed in accordance with these specifications and is performing satisfactorily.

- A. For concrete pipe, when signs of distress, such as differential movement, efflorescence, spalling, rust stains or cracks wider than 0.01 inch are present in the pipe, the Contractor shall prepare a remedial action plan for submittal to the RCE. This remedial action plan must address: structural integrity, environmental conditions, design service life of the pipe, and recommended remediation. The RCE must approve both the remediation report and proposed repair procedure. At a minimum, seal cracks having widths equal to or greater than 0.01 inch in accordance with manufacturer's instructions. Replace pipes having cracks greater than 0.1 inch that are determined by the RCE to be beyond satisfactory structural repair. Repair or replace pipes having displacement across the crack. Repair or replace pipes exhibiting spalls or delamination. The RCE may perform additional inspections until confidence is restored that the remaining pipe has been installed in accordance with these specifications and is performing satisfactorily.

- B. For aluminum pipe, when pipe distress such as cracking, wall damage (dents, bulges, creases, cracks and tears) and deflection or poorly shaped cross-section are present in the pipe, or when installed pipe deflections exceed 5.0% of the inside diameter, the Contractor shall prepare a remedial action plan for submittal to the RCE. This remedial action plan must address: structural integrity, environmental conditions, design service life of the pipe, and recommended remediation. The RCE must approve both the remediation report and proposed repair procedure. Replace the pipe at locations where the measured deflection exceeds 7.5% of the nominal inside diameter of the pipe. Replace, repair or remediate locations as recommended in the inspection report or by the RCE. The RCE may perform additional inspections until confidence is restored that the remaining pipe has been installed in accordance with these specifications and is performing satisfactorily.
- C. For HDPE pipe, when installed pipe deflections exceed 5.0% of the inside diameter, the Contractor shall prepare a remedial action plan for submittal to the RCE. This remedial action plan must address: structural integrity, environmental conditions, design service life of the pipe, and recommended remediation. The RCE must approve both the remediation report and proposed repair procedure. Replace the pipe at locations where the measured deflection exceeds 7.5% of the nominal inside diameter of the pipe. Repair or remediate locations as recommended in the inspection report or by the RCE. Replace locations where directed by the RCE. The RCE may perform additional inspections until confidence is restored that the remaining pipe has been installed in accordance with these specifications and is performing satisfactorily.

#### 714.3.12 Installing Pipe Culvert under Existing Pavement

On projects where the original approach pavement structure is being retained, lay the pipe culvert as herein specified. Repair the portion of the pavement structure removed due to the excavation of the trench using the same type of materials used in the original construction. The RCE may accept the use of other materials as deemed appropriate. Perform the work to the satisfaction of the RCE. Include the cost of the materials and the labor involved in the unit bid price for the pipe culvert.

#### 714.3.13 Placing Pipe under Railroads and Other Transportation Facilities

When the plans include the installation of pipe under railroads or other transportation facilities not under the jurisdiction of the Department, unless otherwise provided, install the pipe using such methods, materials, and procedures required by the owner. There is no extra compensation for this change in methods, materials, and procedures.

#### 714.3.14 Cleaning Out Pipe

Thoroughly clean out the entire length of newly installed pipe culverts. No additional payment will be made for the cleaning out of newly installed pipe culverts. Pipes must be clean and accessible for inspection and acceptance.

#### 714.3.15 Trench Backfill for Expedited Construction

At the RCE's discretion or where otherwise noted, controlled low strength material (CLSM) may be used as structural backfill and to complete trench backfill for pipe installations in order to expedite the re-opening of the roadway to traffic. The decision should be based on traffic volume, safety, and public inconvenience.

CLSM, also known as flowable fill, can be placed to a height not to exceed the subgrade elevation. The remaining pavement structure must be installed according to the pavement design. CLSM shall be installed in accordance with manufacturer's recommendations to prevent pipe displacement and uplift during CLSM placement.

When CLSM is specified in the plans or special provisions for completion of the trench backfill, CLSM in the pipe embedment zone will be included in the cost of the pipe, and CLSM above the pipe embedment zone will be paid for at the contract unit price for Controlled Low Strength Material.

When CLSM is not specified in the plans or special provisions, but is specified by the RCE during construction, all CLSM used in the trench will be paid for at the contract unit price for Controlled Low Strength Material.

#### 714.3.16 Cleaning Out of Existing Pipe (All Existing Pipe)

Maintain retained pipe culverts that are clean in the same condition as they existed before beginning work. When specified in the plans, thoroughly clean out the entire length of existing pipe culverts. Remove all debris and sediment that affects the hydraulic performance of the entire pipe, including all debris within two pipe diameters of each end of the pipe.

#### 714.3.17 Removing of Existing Pipe (All Existing Pipe)

Remove existing pipe in accordance with the provisions of SCDOT Standard Specifications Section 202. Backfill and compact fill material to the same grade and slope of the area before the pipe was removed.

#### 714.3.18 Abandoning Pipe (All Existing Pipe)

At locations on the plans where existing pipe culvert is to be abandoned, plug the existing pipe using brick and mortar or use the Taylor Made Plastics, Inc. "Pipe Plug" or equal. Fill the entire abandoned pipe with CLSM that meets the strength requirements of the embankment and can be excavated. Place CLSM using a method that produces the smallest air pockets or voids within the abandoned pipe, such as pumping from a single location until the both ends of the pipe are full.

#### 714.4 Measurement

The quantity for the items pipe culvert, of the size, kind, class, thickness or type specified, or Smooth or Corrugated Wall Pipe Culvert of the size specified is measured in linear feet of the net length of pipe culvert complete in place and accepted.

Pipe quantities will be the linear measurement from end to end of the pipe through tees, wyes, elbows, bends, reducers, increasers, elbows, and beveled ends, excluding all drainage structures. The length is obtained by adding the centerline length of each run of pipe between Drainage Structures and to the completed end of pipe at End Treatments. Do not include the length of end treatment beyond the pipe in the measurement of the pipe.

If the plans require bevels at the pipe ends, include the length of the beveled end section in the measured length of pipe.

The quantity for the items beveling of smooth wall pipe culvert, beveling of corrugated wall pipe culvert, pipe culvert tees, wyes, elbows, bends, reducers, and increasers of the size and kind specified is measured by each item.

Measure the quantity for riprap placed around pipe end or end treatment in tons based on the quantity required to complete installation in accordance with the SCDOT Standard Drawing for the pipe end treatment used.

Measure the quantity for geotextile for erosion control under riprap and geotextile for separation in square yards based on the quantity required to complete installation in accordance with the SCDOT Standard Drawing for the pipe end treatment used.

The quantity for the items pipe culvert flared end section, straight headwalls, concrete slabs, pipe end structures, wingwall and apron system, and drainage structures is measured by each unit, complete in place and accepted.

The quantity of pipe additional foundation work is measured in linear feet along the centerline of the pipe as shown in the SCDOT Standard Drawings. Dispose of any unstable material in the manner outlined in SCDOT Standard Specifications Section 203.

For installations in cut sections, embankment material overfill above the pipe embedment zone will be measured as the volume between the standard trench walls from the top of the pipe embedment zone to the top of the subgrade as shown on the SCDOT Standard Drawings.

No measurement will be made for the removal of existing pipe culverts that will be replaced by new culverts. No measurement will be made for pipe inspection.

The quantity for the cleaning of existing pipe culverts is measured in linear feet for the entire length of the pipe to be cleaned.

The quantity for the excavation necessary for the removal of existing pipe culverts that are not to be replaced by new culverts is measured in cubic yards as set forth in SCDOT Standard Specifications Section 202.

Measurement for pipe abandoning will be paid for as CLSM in accordance with SCDOT Standard Specifications Section 210.

#### 714.5 Payment

Pipe culvert and end treatments, measured as provided in Subsection 714.4, are paid for at the contract unit price for the respective items, which price and payment is compensation for furnishing all material, labor, equipment, tools including hauling and placing all pipe sections and materials, excavation of the entire standard trench, bedding, and pipe structural backfill as described in the measurement section (both structural and embankment backfill in this region), removal of existing pipe to be replaced, constructing pipe joints, removal of old end treatments, cleaning out pipe, disposal of surplus materials, all visual inspection, and all incidentals necessary to complete the work.

The Contractor may choose to dispose of the material excavated from the pipe trench on the project site if the RCE determines that the material is suitable, or the Contractor may dispose of the material off the site of the project in accordance with the disposal requirements for surplus material as set forth in SCDOT Standard Specifications Section 203. The Contractor is not entitled to any additional payment for the disposal of the material excavated from the pipe trench regardless of which method of disposal is utilized.

When the in-situ soil material is used as structural backfill, no additional payment will be made for the structural backfill (shown on SCDOT Standard Drawings within the pipe embedment zone) and payment for this material is included in the Unclassified Excavation pay item. The in-situ soil material must meet the requirements of this specification before it can be used as structural backfill.

When select structural backfill is required, no additional measurement will be made for the structural backfill material (shown on SCDOT Standard Drawings within the pipe embedment zone) and payment for this material will be include in the cost of the pipe.

Beveling of the pipe ends will be included in the unit cost of beveling of pipe culvert as specified in the plans.

Payment for riprap geotextile for erosion control under riprap, and geotextile for separation as measured in Subsection 714.4 includes all direct and indirect costs and expenses necessary to complete the work.

The quantities for the items pipe culvert tees, wyes, elbows, bends, reducers, and increasers measured as provided in Subsection 714.4, are paid for as each.

The quantity of pipe additional foundation work, measured as provided for in Subsection 714.4, is paid for at the contract unit price, which price and payment is compensation for furnishing all material (foundation, extra bedding, extra structural backfill, extra geotextile, etc.), labor (additional trench excavation, compaction, etc.), equipment, tools, hauling, and disposal (of poor material) to complete construction of the pipe foundation, and wider trench as specified in the SCDOT Standard Drawings, the plans, or by the RCE.

Embankment material overfill in cut sections as described in the measurement section will be paid for as borrow.

All work associated with the excavation, removal and disposal of existing pipe culverts that will be replaced by a new structure will be paid for in the pay item of the new structure.

The excavation for the removal of existing pipe is paid for at the contract unit price for Unclassified Excavation as specified in SCDOT Standard Specifications Section 202, which price and payment is full compensation for all work and costs of removal, transporting, and storing or disposing of existing pipe that is not to be replaced by a new structure and re-installation and compaction of fill material to restore embankment to original grade.

Cleaning of existing pipe is paid for at the contract unit price for Cleaning Existing Pipe, which price and payment is full compensation for all work and costs of cleaning, debris removal, transporting, disposing of all obstructions within the pipe that is to be cleaned.

Payment for pipe abandoning will be in accordance with SCDOT Standard Specifications Section 210, which price and payment is full compensation for all work and costs of materials, labor, and construction costs to abandon the pipe. No additional pay items will be made for this work regardless of the method chosen.

Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.

Pay items under this Supplemental Technical Specification include the following:

Item No.	Pay Item	Unit
714XXXX	<i>(size) Smooth Wall Pipe Culvert</i>	LF
714XXXX	<i>(size) Corrugated Wall Pipe Culvert</i>	LF
714XXXX	<i>(size) RC Pipe Culvert (RCP) - (class)</i>	LF
714XXXX	<i>(size) RC Pipe Culvert (RCP) - (class) AASHTO M315</i>	LF
714XXXX	<i>(size) Corr. Alum. Alloy Pipe Culvert (CAAP) - (gage)</i>	LF
714XXXX	<i>(size) Spiral Rib. Alum. Pipe Culvert (SRAP) - (gage)</i>	LF

714XXXX	<i>(size)</i> Corr. Polyethylene Pipe Culvert (HDPE) – Type S	LF
714XXXX	<i>(size) (kind)</i> Pipe Culvert Flared End Section <i>(class or thickness)</i>	EA
714XXXX	<i>(size) (kind)</i> Pipe Culvert Tee	EA
714XXXX	<i>(size) (kind)</i> Pipe Culvert Wye	EA
714XXXX	<i>(size) (kind)</i> Pipe Culvert <i>(degree)</i> Bend	EA
714XXXX	<i>(size) (kind)</i> Increaser <i>(size)</i> to <i>(size)</i> Diameter	EA
7149999	Cleaning Existing Pipe	LF
20345XX	Pipe Additional Foundation Work	LF

## SECTION 719

### CATCH BASINS, DROP INLETS, MANHOLES, JUNCTION BOXES, AND SPRING BOXES

#### 719.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the construction or adjustment to grade of catch basins, drop inlets, manholes, junction boxes, and spring boxes at the location shown on the Plans or as directed by the RCE, in accordance with these specifications, and in conformity with the lines and grades shown on the Plans or established by the RCE.

#### 719.2 Materials

##### 719.2.1 Cast-In-Place Concrete

- 1 Unless otherwise specified on the Plans or in the Special Provisions, provide Class 4000 for cast-in-place concrete conforming to the requirements of applicable subsections of **Section 701**

##### 719.2.2 Clay or Shale Brick

- 1 Provide clay or shale brick conforming to the requirements of **Subsection 718.2.1**.

##### 719.2.3 Concrete Brick

- 1 Provide concrete brick and similar solid units conforming to the requirements of **Subsection 718.2.2**.

##### 719.2.4 Mortar Materials

- 1 Provide mortar materials conforming to the requirements of **Subsection 718.2.5**.

##### 719.2.5 Castings

- 1 Provide iron castings for frames, grates, covers, etc., conforming to the requirements of AASHTO M 105, Class 35B, and the alternate load test conforming to the requirements of AASHTO M 306.
- 2 Produce castings in closed molds and boldly filleted at angles. Ensure that the arises are sharp and perfect and make certain that they are true to pattern in form and dimensions, free from pouring defects, sponginess, cracks, blow holes, and other defects affecting their strength and value for the service intended. Ensure that the castings are clean and neatly finished. Make certain gratings and covers fit firmly into their respective frames.
- 3 Steel grates and frame may be used instead of cast iron as long as the loading and hydraulic requirements are met and they conform to the following:
  - A. Hot dip zinc coat steel grates and frame in accordance with AASHTO M 111.



## 719.2.5

## 719.2.9.1

- B. Dimension steel grates and frame to be interchangeable with each piece of the cast iron grate and frame shown on the Plans.
  - C. Provide steel grates and frames of sufficient strength to meet or exceed the loading requirements of *Federal Specification RR-F-621* (latest edition).
- 4     Ensure that the manufacturer has a testing program to verify that the castings comply with the strength requirements of AASHTO M 105. Make certain test bars are Type B and are made and tested in accordance with the requirements of AASHTO M 105.

### 719.2.6 Reinforcing Steel

- 1     Furnish reinforcing steel conforming to the requirements of ASTM A 706, Grade 60, and meeting the applicable requirements of **Section 703**.

### 719.2.7 Structural Steel

- 1     Provide structural steel conforming to the requirements of AASHTO M 270, Grade 36.

### 719.2.8 Steel Tubular Sections

- 1     Provide steel tubular sections conforming to the requirements of ASTM A 53, Schedule 80.

### 719.2.9 Precast Reinforced Concrete Drainage Structures

#### 719.2.9.1 General

- 1     Subject to the approval of the RCE, precast reinforced concrete drainage structures may be substituted for constructed-in-place structures shown on the Plans. If precast structures are specified on the project, or if permission is given to substitute precast alternates, ensure that they conform to the details shown on the Plans and the applicable provisions of this specification. Design precast concrete drainage structures for HS-25 loading. Use Class 4000P Portland cement concrete conforming to the applicable requirements of **Section 701**. Use reinforcing steel that conforms to ASTM A 706, Grade 60, and is from a source listed on the most recent edition of *SCDOT Qualified Product List 60*. Use wire mesh that conforms to the requirements of AASHTO M 55 and AASHTO M 221.
- 2     Supply components of precast concrete drainage structures from a single source precast manufacturer. Have the manufacturer inform the OMR of the planned concrete placement and curing schedule in advance of the start of any fabrication work to afford time for the testing of materials, the inspection of equipment, and the review of the procedures for casting the units. Allow the OMR inspector free access to the fabrication plant at all times for the purpose of inspecting materials, plant facilities, and fabrication and curing procedures.

**719.2.9.2 Precast Drainage Base**

- 1 Have drainage bases manufactured to the sizes shown on the Plans and in accordance with the applicable requirements of AASHTO M 199. Ensure that drainage bases are manufactured with all required openings to accept all prescribed inlet and outlet pipes.

**719.2.9.3 Precast Concrete Transition Section**

- 1 A precast concrete transition section may be used to transition from a larger diameter riser to a smaller diameter riser. Use transition sections that are either a cone shape or a flat slab as specified on the Plans. Ensure that they are manufactured in accordance with the requirements of AASHTO M 199.

**719.2.9.4 Precast Concrete Risers**

- 1 Have risers manufactured to the diameters and lengths shown on the Plans and in accordance with the requirements of AASHTO M 199. Place risers plum and backfill in a manner that preserves their alignment.

**719.2.9.5 Flat Slab Adapter**

- 1 Use flat slab adapters to change round precast concrete risers to rectangular openings to facilitate construction of the prescribed catch basins or drop inlets to grade. Use the flat slab adapters as foundations for the necessary courses of brick. Flat slab adapters are not required for manholes. Use a flat slab top with an eccentric 24-inch diameter hole on top of the manhole riser when the casting is placed directly thereon, and as shown on the Plans. Do not allow the distance from the top of the adapter to the top of the cover or casting to be more than 6 feet.

**719.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

**719.4 Construction****719.4.1 Excavation**

- 1 Excavate to the required depth and compact the material on which the masonry is constructed to a firm even surface.

**719.4.2 Brick Masonry**

- 1 Construct brick masonry in accordance with the applicable requirements of **Section 718**.

**719.4.3 Reinforced Concrete**

- 1 Construct reinforced concrete in accordance with applicable requirements of **Sections 701, 702, and 703**. Provide and place reinforcing steel, if re-

quired, in position as shown on the Plans and hold securely in place.

#### **719.4.4 Placing Pipe**

- 1 Incorporate inlet and outlet pipes into the structure at the elevation, direction, and grade required. Neatly and substantially hold these pipe connections in the masonry. Place the ends of the pipe flush with the inner faces of the walls unless the RCE directs otherwise. Place grout up to the lowest flow elevation in the structure to maintain continuous flow. For grout, use Type M mortar material in accordance with applicable requirements of **Section 718**.

#### **719.4.5 Placing Castings**

- 1 Set the castings in a full mortar bed composed of 1 part Portland cement to 2 parts of fine aggregate, meeting the requirements of **Subsection 718.2.5** and **718.4.1**.

#### **719.4.6 Precast Concrete Drainage Structures**

- 1 Fabricate and install precast concrete drainage structures in accordance with these specifications and applicable AASHTO specifications. Have the manufacturer of precast components provide recommendations for all field connections of precast sections and piping.
- 2 Provide the proper bedding for precast concrete drainage structures to ensure proper installation and elimination of point bearing. Provide bedding of sand, gravel, or crushed stone. Include cost of bedding in the cost of the respective drainage items.
- 3 Seal joints with a butyl rubber joint sealant meeting the requirements of **Section 714** and AASHTO M 198, Type B. Apply the sealant in accordance with the manufacturer's recommendations. Supply a copy of the recommendations to the RCE.

#### **719.4.7 Grade Adjustment of Existing Structure**

- 1 When grade adjustment of existing structure is required, remove the frames, covers, and gratings and reconstruct the walls as required. Perform the work using salvaged materials when practicable. Furnish new materials as necessary to complete the adjustment.
- 2 Adjust the existing structures to the required grade and elevation by carefully removing the grating, removing or adding masonry below or above the existing masonry, and replacing the casting on a full mortar bed to the new elevation.
- 3 Where the pavement consists of an asphaltic mix or mixes and unless otherwise permitted or directed, adjust the casting to grade after the last base or binder course has been laid and before placing the surface course. Where the pavement, base, or subgrade is removed from around the structure to make the adjustment, fill the area with concrete before placing the surface course.

**719.4.8 Backfilling**

- 1 Backfill the excavated areas not occupied by the structure with suitable material placed and thoroughly compacted in layers not more than 8 inches.

**719.5 Measurement**

- 1 The quantity for new or adjusted cast-in-place, brick, or block masonry drainage structure is measured by each (EA) unit complete in place and accepted, and includes all frames, covers, gratings, and fittings necessary to complete the unit.
- 2 When the depth of a catch basin, drop inlet, manhole, junction box, or spring box is greater than 6 feet, the quantity for the pay item Extra Depth of Box is the depth of excavation for the drainage structure in excess of 6 feet and is measured by the linear foot (LF), complete, and accepted. The depth of the drainage structure is measured from the top of manhole cover, concrete masonry, hood, or grate and, in the case of drop inlets, from the top of the bottom slab.
- 3 The quantity for precast drainage structure components is measured by the linear foot (LF) or each (EA) unit in place, complete and accepted and includes all frames, covers, gratings, and fittings necessary to complete the unit. Extra Depth of Box is not measured for precast drainage structures. The lay length of a precast transition section is not included in the measurement for the precast concrete drainage structure to which it is connected.
- 4 The excavation required for the installation of drainage structures includes the removal of all obstructions and the removal and replacement of unstable materials as necessary for a proper foundation, but such excavation is not measured nor paid for as a separate item. The cost of excavation is included in the contract unit bid price for the associated drainage structure.

**719.6 Payment**

- 1 Payment for the accepted quantity for a new or adjusted drainage structures, measured in accordance with **Subsection 719.5**, is determined using the contract unit bid price for such items as Catch Basin, Drop Inlet, Manhole, Junction Box, Spring Box, or Adjust Catch Basin, Drop Inlet, Manhole, Junction Box, Utility Box of the size and type specified, or the respective precast concrete drainage structures, Precast Concrete Riser, PC Drainage Base, PC Transition Section (Flat Slab) PC Transition Section (Cone) of the size specified. Payment is full compensation for constructing drainage structures as specified or directed and includes furnishing and placing precast and cast-in-place drainage structure; furnishing and placing reinforcing steel, bricks, blocks, and mortar for masonry structures; providing inlet and outlet openings and joint sealant; excavating (6 foot maximum depth); providing and placing bedding material and backfilling; disposing of surplus material; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract

- 2 Payment for drainage structures is made in accordance with the following schedule:

Drainage Structure Pay Schedule			
Structure	Brickwork Complete	Throat/Pad Complete	Lid/Grate Complete
Type 1	90%	---	10%
Type 9	90%	---	10%
Type 9 Manhole	90%	---	10%
Type 12	80%	10%	10%
Manhole	90%	---	10%
Type 14 and 14 MG	80%	10%	10%
Type 15	90%	---	10%
Drop Inlet	90%	---	10%
Spring Box	90%	---	10%
Type 16	70%	10%	20%
Type 17	70%	10%	20%
Type 18	70%	10%	20%

- 3 Payment for the accepted quantity of Extra Depth of Box, measured in accordance with **Subsection 719.5**, is determined using the contract unit bid price for the pay item. Payment is full compensation for excavating for drainage structures beyond the 6 feet included in the structure pay item as specified or directed and includes backfilling and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract. Extra Depth of Box is not applicable to pre-cast drainage structures.
- 4 Making connection with an existing culvert or drain including joint sealant, drainage openings, excavation, bedding material, backfilling, disposal of surplus material, replacing pavement, reinforcing steel, bricks, mortar and other miscellaneous items needed to complete the work is not paid for separately, and the cost thereof is included in the contract unit bid price for the pay item that requires the work.
- 5 Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.

719.6

719.6

6 Pay items under this section include the following:

Item No.	Pay Item	Unit
7191XXX	Catch Basin (type)	EA
71920XX	Drop Inlet ( <u>size</u> )	EA
7192105	Manhole	EA
71922XX	( <u>size</u> ) Junction Box	EA
7192300	Spring Box	EA
71930XX	Precast Concrete Riser - ( <u>size</u> )" Diameter	LF
71931XX	PC Drainage Base - ( <u>size</u> )" Diameter	EA
71931XX	PC Transition Section (Flat Slab) - ( <u>size</u> )" to ( <u>size</u> )"	EA
719317X	PC Transition Section (Cone) - ( <u>size</u> )" to ( <u>size</u> )"	EA
7196000	Extra Depth of Box	LF
7197110	Adjust Catch Basin	EA
7197120	Adjust Manhole	EA
7197130	Adjust Drop Inlet	EA
7197140	Adjust Utility Box	EA
7197150	Adjust Junction Box	EA

## SECTION 720

### CONCRETE CURB, GUTTER, CURB AND GUTTER, SIDEWALK, DRIVEWAY, AND MEDIAN

#### 720.1 Description

- 1 This section contains specifications for the materials, construction, equipment, measurement, and payment for the construction of Portland cement concrete curb, Portland cement concrete gutter, Portland cement concrete curb and gutter, Portland cement concrete sidewalk, Portland cement concrete driveway, and Portland cement concrete median in one course on a prepared subgrade in accordance with these specifications, conforming to the dimensions, typical cross-section, and notes shown on the Plans, and to the lines and grades shown on the Plans or established by the RCE.
- 2 This work includes the placing of reinforcing steel in the concrete when indicated on the Plans.

#### 720.2 Materials

##### 720.2.1 Portland Cement Concrete

- 1 Provide Class 2500 Portland cement concrete conforming to the applicable requirements of **Section 701**.

##### 720.2.2 Expansion Joint Material

- 1 Provide expansion joint materials meeting the requirements of **Subsection 702.2.2.1**.

##### 720.2.3 Reinforcing Steel

- 1 Provide reinforcing steel conforming to the requirements of ASTM A 706, Grade 60, and meeting the applicable requirements of **Section 703**.

#### 720.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### 720.4 Construction

##### 720.4.1 Subgrade

- 1 Thoroughly compact the subgrade and finish to a smooth, firmly compacted surface, which is moist at the time the concrete is placed. In areas where it is impractical to use standard type rollers, accomplish compaction by vibratory hand compactors. Remove and replace concrete that settles and/or cracks after placement as directed by the RCE without additional compensation.

**720.4.2 Forms**

- 1 Use wood or metal forms of a depth equal to the thickness of the concrete course. Make certain they are free from warp and are of sufficient strength when staked, to hold the alignment during the concrete placing and finishing operations. Before concrete is placed against them, clean and oil the forms. Use flexible or curved forms on curves as necessary in order to prevent a chord effect in the alignment of the finished work.

**720.4.3 Existing Sidewalks and Driveways**

- 1 Where a portion of an existing sidewalk or driveway is reconstructed, cut the existing section to a minimum depth of 2 inches with a suitable saw at the location designated by the RCE and remove the entire section to be reconstructed. Join the new sidewalk or driveway with the old work at this line.

**720.4.4 Mixing and Placing Concrete**

- 1 Batch and mix the concrete in accordance with the applicable requirements of **Section 701**.
- 2 Unless otherwise indicated on the Plans, construct concrete curbs, concrete gutters, and concrete curb and gutters in uniform 10-foot sections, except where shorter sections are necessary for closures; but ensure that no section is less than 4 feet in length. Separate the sections by sheet steel templates or dividing plates set normal to the face and top of the curb. Carefully set the plates during the placing of the concrete and keep in place until the concrete has set sufficiently to hold its shape. Remove the plates while the forms are still in place.
- 3 Deposit concrete in the forms so that the forms do not displace out of grade or alignment. During the placing operations, spade or vibrate the concrete throughout the entire mass and especially against the forms and joints. Tamp, float, trowel, broom, edge, and finish the surface of the concrete to the typical section, lines, and grades as soon as practicable after the placing of the concrete. Leave the forms in place until the concrete has set sufficiently and their removal does not injure the concrete.

**720.4.5 Extruded or Slip-Formed Curb or Curb and Gutter Construction**

- 1 Unless otherwise specified and except on structures, concrete curb may be placed by an extrusion machine acceptable to the RCE. An accepted slip-form machine may be used to construct concrete curb or curb and gutter if satisfactory results are obtained. When, in the opinion of the RCE, satisfactory results are not being obtained, discontinue the extrusion or slip-form work and use the stationary form type of construction with no adjustment in compensation. Remove and replace unsatisfactory work without any additional compensation.
- 2 Construct expansion and weakened joints at the same locations as required when form construction is being used. Make weakened joints, spaced at 10 foot intervals, by cutting the plastic concrete with a trowel or by other



acceptable methods. Ensure that the manner of construction of joints meets the approval of the RCE and has a workmanlike finish after edging.

#### **720.4.6 Joints**

##### **720.4.6.1 Expansion Joints**

- 1 Ensure that preformed expansion joints are  $\frac{3}{4}$  inch thick and extend the full-depth of the concrete. Construct joints at the locations indicated on the Plans and at the following locations:
  - Wherever a sidewalk is constructed between an adjoining substantial structure on one side and curbing on the other side, form an expansion joint adjacent to the curbing.
  - Place an expansion joint between the sidewalk and the radius curbing at street intersections.
  - Where concrete sidewalks or medians are constructed adjacent to existing or new concrete pavement or structures, place a transverse expansion joints in the sidewalk or median opposite such joints in the concrete pavement or structure.
  - Where existing structures such as light standards, poles, fire hydrants, etc., are within the limits of the sidewalk or median area, surround them with an expansion joint.
  - Place transverse expansion joints at intervals of not more than 100 feet in all concrete shapes.

##### **720.4.6.2 Contraction Joints**

- 1 Divide the concrete slabs in sidewalks between expansion joints into blocks 10 feet in length, by scoring transversely after floating operations are completed. Where the sidewalk slabs are more than 10 feet in width, score them longitudinally in the center. Extend transverse and longitudinal scoring for a depth of 1 inch and not less than  $\frac{1}{4}$  inch or more than  $\frac{1}{2}$  inch in width. Edge and finish joints smooth and true to line.
- 2 In concrete medians, locate transverse contraction joints, formed as described above, at intervals of not more than 25 feet and extend not less than a quarter of the median depth.

#### **720.4.7 Final Finish**

##### **720.4.7.1 Curbs and Curb and Gutters**

- 1 As soon as the concrete has set sufficiently, remove the forms from the exposed surfaces. Float and trowel the concrete on the curb face and top as necessary to provide a smooth uniform finish. Leave joint templates in place a minimal length of time to prevent bonding or distortion at the joint.
- 2 After the surface of the gutter has been properly shaped and prepared and the water sheen has disappeared, produce the final finish by brooming. Apply brooming transverse to the line of traffic. Ensure that joints are in a vertical plane perpendicular to the curb face. Make certain that joints are clean and

corners well rounded. Edge corners and conform to the typical cross-section. Eliminate all tool marks in final finish.

#### **720.4.7.2 Sidewalks, Gutters, Medians, and Driveways**

- 1 Apply the final finish for sidewalks, gutters, medians, and driveways by brooming as specified in **Subsection 720.4.7.1**, unless otherwise directed. As soon as the forms are removed from concrete median, rub down the sides to a smooth and uniform finish. Remove mortar or aggregate particles that spill onto the pavement.

#### **720.4.7.3 Repair of Defects**

- 1 As soon as the forms are removed from all concrete shapes, fill honey-combed places and other minor defects with a mortar composed of one part Portland cement and two parts sand. Plastering is not allowed. Replace sections with visible cracks at no expense to the Department.

#### **720.4.8 Protection and Curing**

- 1 Protect the concrete as specified in **Subsection 702.4.6** and cure with liquid membrane-forming compounds meeting the requirements of **Subsection 702.2.2.11**. Ensure that methods and rates of application of curing compounds are in accordance with **Subsection 702.4.4.2**.

#### **720.4.9 Backfilling**

- 1 After the concrete has set sufficiently and the forms have been removed, backfill the spaces on both sides to the required elevation with suitable material that is firmly compacted and neatly graded. Backfill concrete gutter so that the earth materials are a minimum of 1 inch above the concrete. Maintain an earth roll on each side as necessary to prevent undermining of curb and gutter.

#### **720.5 Measurement**

- 1 The quantity for the pay item Concrete Curb, Concrete Gutter, or Concrete Curb and Gutter (of the type and size specified) is the length of the cast-in-place curb and/or gutter and is measured by the linear foot (LF), complete, and accepted. Concrete Curb and Gutter is measured along the roadway face of the curb at the gutter line. Concrete Curb and Concrete Gutter are both measured along the roadway at the finished grade elevation.
- 2 The quantity for the pay items Concrete Sidewalk, Concrete Driveway, and Concrete Median is the finished surface area of the top of the cast-in-place sidewalk, driveway, or median and is measured by the square yard (SY), complete, and accepted. Deductions for drainage structures such as catch basins, drop inlets, etc., are in accordance with the Plans, the Specifications, and *SCDOT Standard Drawings*.
- 3 Excavation, when applicable and approved, is measured for in accordance with **Subsection 203.5**

**720.6 Payment**

- 1 Payment for the accepted quantity, measured in accordance with **Subsection 720.5**, is determined using the contract unit bid price for the applicable pay item. Payment is full compensation for constructing curb and/or gutter as specified or directed and includes fine grading; compacting the subgrade; formwork; concrete, reinforcing steel; joint templates; joint materials; curing concrete; backfilling; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 2 Excavation, when applicable and approved, is paid for in accordance with **Subsection 203.6**.
- 3 Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.
- 4 Pay items under this section include the following:

Item No.	Pay Item	Unit
7201000	Concrete Curb (9" X 15")	LF
7201010	Concrete Bridge Curb (6")	LF
7201100	Concrete Transition Curb	LF
72020X0	Concrete Gutter Type <u>(X)</u>	LF
7203110	Concrete Curb and Gutter (1'-6")	LF
7203210	Concrete Curb and Gutter (2'-0")	LF
7203240	Concrete Curb and Gutter (2'-6")	LF
7203310	Concrete Curb and Gutter (3'-0")	LF
7204100	Concrete Sidewalk (4" Uniform)	SY
7205000	Concrete Driveway (6" Uniform)	SY
7205100	Concrete Driveway (8" Uniform)	SY
7206000	Concrete Median	SY

## SECTION 722

### PRECAST CONCRETE BOX CULVERTS

#### 722.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for production, transportation, and storage of precast concrete box culverts of the size and dimensions indicated on the Plans, installed in conformity with the Plans, the *SCDOT Standard Drawings*, the Special Provisions, and these specifications, and true to the line and grades established by the RCE. This section includes specifications for the proper fabrication at the precast plant, finishing, marking, joining, and other incidental items of work. See *SCDOT Standard Drawing 722-1* for details and additional installation requirements.

#### 722.2 Materials

##### 722.2.1 Precast Concrete Sections

- 1 Ensure that precast concrete box culvert sections conform to the requirements of either AASHTO M 259 for depths of cover 2 feet and greater or AASHTO M 273 for depths of cover less than 2 feet with the exception of modifications as stated herein. Conform precast concrete box culverts to the requirements of ASTM C 1433 or ASTM C 1577 for manufacturing procedures, tolerance, and designs meeting or exceeding ASTM C 1433, Table 2 or ASTM C 1577, Table 1.
- 2 Manufacture the sections in accordance with the appropriate AASHTO or ASTM designation based on the size (span (W) and rise (H) dimensions), loading (minimum earth dead load and Interstate Live Load to be used in all applications unless otherwise indicated), and earth cover as specified on the Plans and in the Special Provisions. Box sections that exceed the minimum specified requirements may be substituted for the Plan designated box sections at no extra cost to the Department and with prior written approval of the OMR. Ensure that box culvert is obtained from a source listed on the most recent edition of *SCDOT Qualified Product List 14*.

##### 722.2.2 Site Cast Concrete

- 1 Except for the aggregate gradation, provide concrete for the precast sections meeting the applicable requirements of **Sections 701 and 714**. Ensure that concrete for components cast at the site (wingwalls, headwalls, aprons, cut-off walls, etc.) meet the applicable requirements of **Section 701** for Class 4000P concrete (minimum).

##### 722.2.3 Reinforcing Steel

- 1 Provide reinforcing steel conforming to the requirements of ASTM A 706, Grade 60, AASHTO M 259, AASHTO M 32, AASHTO M 55, AASHTO M 221, or AASHTO M 225 as applicable. Ensure that ASTM A 706 steel is obtained from a source listed on the most recent edition of *SCDOT Qualified Product*

List 60.

#### **722.2.4 Joint Material**

- 1 Use a joint seal material that is a preformed flexible joint sealant conforming to the requirements of AASHTO M 198 and is manufactured by a supplier listed on the most recent edition of *SCDOT Qualified Product List 13*.

#### **722.2.5 Liquid Membrane-Forming Compounds**

- 1 Use liquid curing compounds conforming to the requirements of **Subsection 702.2.2.11**.

#### **722.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

#### **722.4 Construction**

##### **722.4.1 Fabrication**

##### **722.4.1.1 General**

- 1 The precast concrete box sections may be precast by either the dry cast (machine) or wet cast method. Use steel forms for both, and ensure that forms are mortar-tight and of sufficient strength to prevent bulging and the misalignment of adjacent boxes when placed in the field. Ensure that the forms permit removal without damage to the concrete.
- 2 Do not allow offsets at form joints to exceed  $\frac{1}{8}$  inch. Make certain forms are clean and have a light coating of a bond-breaking material applied before concrete placement.
- 3 Provide a maximum of four lifting holes, 2 inches in diameter or 2 inches square or lifting lugs, as required, in each section to properly complete fabrication and installation. Form the holes in-place, cut them into the fresh concrete, or core them into the hardened concrete.
- 4 Provide precast sections with a minimum length of 4 feet. Use positive methods acceptable to the OMR to support reinforcing steel and prevent displacement during the casting operation. Weld reinforcing steel only as shown on the Plans.
- 5 Cast precast boxes by a process that provides for uniform placement of the concrete in the forms and compaction by mechanical devices that ensures dense, well-compacted concrete. Mix concrete in a central batch plant or other approved batching facilities.
- 6 Construct all formed openings between the precast sections and adjacent structures (including pipes, inlet structures, manholes, connecting culverts, etc.) to accommodate a soil tight seal. Provide additional reinforcement

around all formed openings as shown in the *SCDOT Standard Drawings* for culvert openings or as directed by the RCE.

- 7 Install 3-inch diameter weep holes at intervals of approximately 8.0 feet at an elevation of about 1.0 foot above the normal water surface in accordance with **Subsection 702.4.19.2**.

#### **722.4.1.2 Finishing and Marking**

- 1 Finish and mark precast sections in accordance with the applicable requirements of AASHTO M 259, AASHTO M 273, ASTM C 1433, or ASTM C 1577 with the addition of the SCDOT project number.

#### **722.4.1.3 Fabrication Tolerances**

- 1 Make certain that the precast sections do not exceed the geometric tolerances allowed in the applicable sections of AASHTO M 259, AASHTO M 273, ASTM C 1433, or ASTM C 1577.
- 2 Cast the slab thickness and the tongue and groove joint configuration to provide a continuous line of box sections with interior offsets at the joints less than 1% of the dimensions of the rise and span. Fabricate end sections with exposed end flat in lieu of tongue or groove joint. Fabricate end sections with holes for resin anchors or inserts for mechanical anchors to connect headwall, wingwalls, and apron unless these connections are specifically omitted by directions in the Plans.
- 3 To ensure the proper fit of contiguous sections, check the squareness tolerance of the boxes by measuring the distance between opposite interior corners at the ends of the sections. Make certain the diagonal measurements do not vary by more than ½ inch.
- 4 Deviations from the above tolerance are acceptable if the sections can be fitted at the plant and it is determined that an acceptable joint can be made. A joint is considered acceptable if the sections can be fitted together on a flat surface in the position in which they will be installed and the joint opening at any point does not exceed ¾ inch.
- 5 Match-mark sections pre-fitted at the precast plant.
- 6 Repair small damaged or honeycombed areas that are purely cosmetic. Excessive damage, honeycomb, or cracking is subject to structural review. Make repairs to the satisfaction of the OMR. Ensure that such repairs are sound, properly finished, and cured in accordance with **Subsection 722.4.1.5**. When fine cracks or hair-checks on the surface indicate poor curing practices, discontinue further production of precast boxes until corrections are made and proper curing is provided.
- 7 Store precast boxes on level blocking in a manner acceptable to the OMR. Do not place load upon sections until design strength is reached and curing completed. Ship boxes when the design strength has been met and the boxes have been inspected and stamped by the Department's inspector.

**722.4.1.4 Samples and Tests**

- 1 Provide concrete compressive strength test cylinders in accordance with the requirements of AASHTO M 259, AASHTO M 273, ASTM C 1433, or ASTM C 1577, except that when a wet cast method is used, provide a minimum of 4 test cylinders for each day's production of each size and design of box. Strength tests for each production lot are based on the average strength of 2 cylinders that are tested any time after the curing period. When design strength is attained on the initial test, further tests on that lot are not required.
- 2 Should the initial test fail to meet the design strength, perform a subsequent test at 28 days unless additional cylinders were made for intermediate breaks. Check low cylinder strengths by compression strength of cores. Obtain cores for testing and repair the core holes at no cost to the Department.

**722.4.1.5 Curing**

- 1 Cure precast concrete box culverts made in a precast plant in accordance with the requirements of AASHTO M 259, AASHTO M 273, ASTM C 1433, or ASTM C 1577.
- 2 Protect the boxes from freezing during the curing period.
- 3 Cure test cylinders at the same time and in the same manner as the boxes.
- 4 Cure concrete placed at the job site during construction in accordance with **Subsection 702.4.4.2.**

**722.4.2 Bedding**

- 1 Ensure that excavation for foundations of precast concrete box culverts conform to the requirements of **Section 204** and the details shown on the Plans. Exercise special care in leveling the foundation area to ensure uniform support throughout the entire width and length of the structure. Make certain bedding material is minimum fine aggregate, and no larger than coarse aggregate (No. 57 stone) in conformance with the requirements in **Section 701**. Erect shoring, bracing, or other devices necessary to achieve safe working conditions without additional compensation. Ensure that culvert bedding is protected from scour during the installation of culvert sections.
- 2 When a firm foundation is not encountered at the required grade, remove all such unstable material and backfill the resulting excavation with suitable material (no larger than Aggregate No. 57) in accordance with **Section 203**, the Plans, or the contract documents. For culverts on shallow rock, cast-in-place construction is recommended. If placing precast culvert sections on rock is required, provide a minimum of 3 inches of bedding material between the rock surface and the bottom of the bottom slab.

**722.4.3 Laying Sections**

- 1 Place sections beginning at the outlet end of the conduit with the groove end being laid up grade (and the flat end toward the outlet) unless otherwise approved by the RCE. Install successive tongue ends into each adjoining

groove. Provide positive means to pull or push each section firmly into the previously placed section so that the joints are tightly meshed. Install final section with flat end toward inlet. Repair and fill lift holes with mortar or concrete and cure as directed after the sections have been installed. Install French Drain in accordance with the requirements of **Subsection 702.4.19.2**. Completely wrap French drain with geotextile for drainage filtration to prevent migration of site soils into aggregate.

#### 722.4.4 Joints

- 1 Make joints between the precast box sections using preformed flexible joint sealant in accordance with AASHTO M 198. Do not use mortar. Install joint sealant in conformance with the details on *SCDOT Standard Drawing 722-1*, and in accordance with the manufacturer's recommendation and as specified herein.
- 2 Clean and dry all surfaces of the joint to remove all debris and contaminants. Lubricate joint surfaces with a lubricant that does not cause damage to or deteriorate joint sealant material. Use continuous sealant of the minimum size to produce a soil-tight joint in the annular space of the joint. The joint sealant size may be varied by the RCE to provide enough sealant material to properly fill the annular space or to prevent waste of the sealant material. When the culvert is in place, ensure that the joint sealant is visible on the inside or the outside of the joint. Give special attention placing the joint sealant on the tongue to prevent excess seal from squeezing out of the culvert joints. If excess seal is observed squeezing out on the inside and outside, check the placement of the joint sealant or reduce the joint sealant size if required to prevent waste of seal material.
- 3 Ensure that the culvert trench is free of standing water and mud when a section is placed. Press culvert sections together to form a durable soil tight and structurally sound joint. Install the joint sealant material without stretching it.

#### 722.4.5 Backfilling

- 1 Conform backfilling materials and construction methods to the requirements on the Plans and **Subsection 205.4.2**.
- 2 When multiple barrel structures are specified, place the barrels a minimum of 3.5 inches apart. Place the material between culvert barrels in accordance with the Plans and the *SCDOT Standard Drawings*. When not specified in the Plans, use flowable fill or continuous concrete for gap material. Provide a minimum 6-inch cast-in-place concrete plug along the length of the barrels at the exposed ends of the barrel to prevent erosion of the gap material.

#### 722.4.6 Connections

- 1 Make connections with other structures including headwalls, wingwalls, aprons, inlets, structures, or manholes in accordance with the Plans.



- 2 Construct wingwalls, cut-off walls, headwalls, parapet walls, and aprons using cast-in-place reinforced concrete consisting of Class 4000 (minimum) Portland cement concrete conforming to the applicable requirements of **Sections 701** and **702** unless directed by the RCE. Use reinforcing steel conforming to the requirements of ASTM A 706, Grade 60 and applicable requirements of **Section 703**.
- 3 Place a minimum of ½ inch grout layer between culvert top slab and bottom of drainage structure. Do not install risers directly on top slab of culvert unless directed by the RCE.
- 4 Ensure that all inlet structures and pipe openings are soil tight. Consult the Design Engineer and the box culvert manufacturer before field cutting any opening in the culvert.
- 5 Install resin anchors in accordance with the Plans and *SCDOT Standard Drawings for Road Construction*.

#### **722.5 Measurement**

- 1 The quantity of the precast concrete box culvert is the length of the box culvert and is measured by the linear foot (LF) in-place, complete, and accepted. The length is obtained by measuring the centerline length of each barrel between the end treatments.
- 2 Structure excavation is measured in accordance with **Subsection 204.5** and includes unstable material removed as specified in **Subsection 203.4**.
- 3 The quantity of cast-in-place Class 4000 concrete used in wingwalls, cut-off walls, parapet walls, and aprons is measured for payment by the cubic yard (CY) of Concrete for Structure Class 4000 (Culvert) in accordance with **Subsection 701.5**.
- 4 Reinforcing steel used in the cast-in-place portion of the culvert is measured for payment by the pound (LB) of Reinforcing Steel for Structures (Roadway) in accordance with **Subsection 703.5**. Reinforcing steel in the precast portion of the culvert, including resin anchors, is not measured for payment, but is included in the contract unit bid price of the precast culvert.

#### **722.6 Payment**

- 1 Payment for the accepted quantities of PC Box Culverts (of the size, type, and fill height specified), measured in accordance with **Subsection 722.5**, is determined using the contract unit price for the applicable pay item. Payment is full compensation for constructing precast concrete box culverts as specified or directed and includes bedding; fabricating, transporting, and laying culvert sections; furnishing and installing joint material; connections to headwalls and other drainage structures; French drains and weepholes; backfilling; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

- 2 Structure excavation is paid for as Structure Excavation for Culverts in accordance with **Subsection 204.6**.
- 3 The quantity of cast-in-place Class 4000 concrete is paid for in accordance with **Subsection 701.6**.
- 4 The quantity of reinforcing steel other than that in precast box sections is paid for as Reinforcing Steel for Structures in accordance with **Subsection 703.6**.
- 5 Payment includes all direct and indirect costs and expenses necessary to complete the work.
- 6 Pay items under this section include the following:

Item No.	Pay Item	Unit
722XXXX	<i>(size)</i> P C Box Culvert <i>(type)</i> Fill Height $\leq$ <i>(fill height)*</i>	LF

## SECTION 804

### RIPRAP AND SLOPE PROTECTION

#### 804.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the construction of the protective layer of broken stone or concrete (grouted or ungrouted), bagged sand and cement, polyvinyl chloride (PVC) coated wire enclosed rock gabions, precast concrete units, or concrete slope protection in conformity with the Plans and the Specifications or as directed by the RCE.

#### 804.2 Materials

##### 804.2.1 Stone for Riprap

- 1 Provide hard quarry stone or fieldstone that does not disintegrate on exposure to water or weathering. Ensure that stone has a sodium sulfate content less than or equal to 15% as tested in accordance with AASHTO T 104. Use stone that is suitable in all respects for the purpose intended and obtained from a source listed on the most recent edition of *SCDOT Qualified Product List 2*.
- 2 Provide well graded stone with test samples falling between the gradation limits for riprap shown in the following table.

Stone Size Range (feet)	Stone Weight Range (pounds)	Percent Smaller Than
1.4 D <sub>50</sub> to 1.6 D <sub>50</sub>	3.0 W <sub>50</sub> to 5.0 W <sub>50</sub>	100
1.14 D <sub>50</sub> to 1.33 D <sub>50</sub>	2.0 W <sub>50</sub> to 2.75 W <sub>50</sub>	85
0.95 D <sub>50</sub> to 1.09 D <sub>50</sub>	1.0 W <sub>50</sub> to 1.5 W <sub>50</sub>	50
0.38 D <sub>50</sub> to 0.57 D <sub>50</sub>	0.1 W <sub>50</sub> to 0.2 W <sub>50</sub>	15

- 3 Provide riprap conforming to the gradation classes in the following table.

Riprap Class	Rock Size (Feet)	Rock Size(2) (Lbs.)	Percent of Riprap Smaller Than
A	0.75	37	100
	0.50	11	50
	0.20	0.7	15

(table continued on the next page)

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Riprap Class	Rock Size (Feet)	Rock Size(2) (Lbs.)	Percent of Riprap Smaller Than
B(1)	1.33	200	100
	1.0	75	85
	0.75	37	50
	0.42	5	10
C(1)	1.80	500	100
	1.30	200	50
	0.40	5	10
D(1)	2.25	1000	100
	1.80	500	50
	0.95	75	10
E(1)	2.85	2000	100
	2.25	1000	50
	1.80	500	5
F(1)	3.60	4000	100
	2.85	2000	50
	2.25	1000	5
(1) Based on AASHTO Gradations			
(2) Specific Gravity > 2.6			

**804.2.2 Stone for Foundation Riprap**

- 1 Provide stone pieces for the protection of foundations, piers, abutments, and walls ranging in weight from a minimum of 25 pounds to a maximum of 250 pounds. Ensure that at least 60% of the stone pieces weigh more than 150 pounds.

**804.2.3 Concrete for Riprap**

- 1 With written approval from the RCE, broken concrete may be used in lieu of stone for hand placed riprap. If approved, use acceptable concrete broken into proper size pieces, having no exposed reinforcing steel, and meeting the requirements as specified in these specifications.

**804.2.4 Bagged Sand-Cement Riprap****804.2.4.1 Bags**

**804.2.4.1****804.2.7.2**

- 1 Provide bags with a capacity of 1 to 2 cubic feet and made of burlap or other approved material. The RCE will approve bag sizes before use.

**804.2.4.2 Sand**

- 1 Provide sand conforming to the requirements of **Subsection 701.2.9**.

**804.2.4.3 Portland Cement**

- 1 Provide Portland cement conforming to the requirements set forth in **Subsection 701.2.1**.

**804.2.5 Grouted Riprap**

- 1 Provide riprap conforming to the requirements of Class B Riprap specified in **Subsection 804.2.1**.
- 2 Use grout consisting of one part Portland cement conforming to the requirements of **Subsection 804.2.4.3** and three parts sand conforming to the requirements set forth in **Subsection 804.2**. Adjust water content of the grout to permit gravity flow into the voids with limited spading and brooming.

**804.2.6 Precast Concrete Riprap**

- 1 Provide precast concrete riprap consisting of unreinforced Portland cement concrete units of the thickness specified and conforming to the details shown on the Plans. Use concrete for precast riprap that conforms to the requirement for Class 2500 concrete specified in **Section 701**.

**804.2.7 Polyvinyl Chloride (PVC) Coated Wire-Enclosed Gabions****804.2.7.1 General**

- 1 Provide gabions consisting of baskets fabricated from PVC coated galvanized wire mesh, filled with stone, connected together, and anchored to the slope or channel bottom. Ensure that the materials in the finished gabion meet the requirements of **Subsections 804.2.7.2 through 804.2.7.5**.

**804.2.7.2 Polyvinyl Chloride (PVC) Coated Wire**

- 1 Ensure that the wire mesh in the gabions has the physical properties shown in the following table.

<b>Physical Property</b>	<b>Gabion Wire</b>
Wire Diameter (gauge)	12 gauge (0.105 inch)
Tensile Strength of Wire	60,000 psi
Mesh openings	3 inches X 3 inches
Galvanizing	In accordance with ASTM A 641, Class 3
PVC Coating	gray color, 0.015 inch thick min.
Lacing Wire diameter (gauge)	13.5 gauge (0.087 inch)

Spiral Binder diameter (gauge)	12 gauge (0.105 inch)
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- 2 Ensure that the longitudinal and transverse members of the wire mesh are securely connected at each intersection and substantially form square or rectangular openings. Ensure that the PVC coating of the wire mesh is accomplished after fabrication of the mesh.
- 3 Ensure that the PVC coating is resistant to the destructive effects of immersion in acidic, salt, or polluted water, exposure to ultraviolet light, and abrasion and retain these resistant characteristics after a period of not less than 3000 hours under tests in accordance with ASTM G 23.

#### 804.2.7.3 Rock

- 1 Provide rock, to fill the PVC coated wire units, that meets the requirements of **Subsection 804.2.1**. Ensure that the rock is well graded and that the smallest dimension of 70% of rock, by weight, exceeds the wire mesh openings. Ensure that the maximum rock size, measured normal to the slope, does not exceed the thickness of the gabion.

#### 804.2.7.4 Lacing Wire, Spiral Binder Wire, and Stiffeners

- 1 Provide lacing wire and spiral binder wire, which are used to assemble, interconnect, and close the gabion units, have the same PVC coating as the wire mesh. Provide stiffeners for support by providing diagonal braces having the same PVC coating as on the wire mesh.

#### 804.2.7.5 Geotextile Fabric

- 1 Provide geotextile fabric in conformance with **Subsection 804.2.11**.

#### 804.2.8 Polyvinyl Chloride Coated Wire-Enclosed Rock Mattresses

- 1 Provide PVC coated wire-enclosed rock mattresses conforming to the requirements of **Subsection 804.2.7**.

#### 804.2.9 Cast-in-Place Concrete Slope Protection

- 1 Provide cast-in-place concrete for slope protection conforming to the requirements for Class 2500 concrete specified in the applicable subsections of **Section 701**.

#### 804.2.10 Fiber Reinforced Concrete Slope Protection

- 1 Provide fiber reinforced concrete for slope protection conforming to the requirements of ASTM C 94, ASTM C 1116, ASTM C 1018, and ASTM E 119 and having the following characteristics:
  - Chemical. Use fiber reinforcement that is virgin polypropylene and is inert to alkali and chemical attack. Do not use fiberglass or polyester-based fibers.
  - Physical. Use the fillibrated twisted-bundle form for reinforcement. Do not use monofilament or untwisted fibers.
  - Length. Base the minimum fibrous length on the top-size coarse ag-

gregate – Multi-Design Gradation.

#### 804.2.11 Geotextile Fabric for Erosion Control Under Riprap

- 1 Provide an engineered fabric capable of reducing soil erosion. Use fabrics appearing on the most recent edition of *SCDOT Qualified Product List 44*. Submit the manufacturer's literature concerning the proposed product and proof of satisfactory performance to the RCE before use.
- 2 Provide geotextiles for erosion control under riprap applications that conform to the physical requirements in the following tables.

Strength Property Requirements (All Fabrics)		
Property	Class 1 Fabric Protected*	Class 2 Fabric Unprotected
Grab Strength ASTM D 4632	90 lbs.	200 lbs.
Seam Strength** ASTM D 4632	80 lbs.	180 lbs.
Puncture Strength ASTM D 4833	40 lbs.	80 lbs.
Burst Strength ASTM D 3786	140 psi	250 psi
Trapezoid Tear Strength ASTM D 4533	40 lbs.	80 lbs.
Elongation at Failure ASTM D 4632	15% minimum	15% minimum
Ultraviolet Degradation at 500 Hours ASTM D 4355	50% Strength Retained	50% Strength Retained
<p>* Fabric is protected when cushioned from rock placement by a sufficient layer of sand or gravel at least 6 inches thick or by zero height of placement. All other conditions are unprotected.</p> <p>** Values apply to both field and manufactured seams. Sew seams upwards for inspection.</p>		

Piping Resistance (Soil Retention) & Permittivity Requirements		
Type	AOS (ASTM D 4751)	Permittivity (ASTM D 4491)
Type A	≥ No. 30 Std Sieve	≥ 0.7 per sec
Type B	≥ No. 40 Std Sieve	≥ 0.2 per sec

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<b>Piping Resistance (Soil Retention) &amp; Permittivity Requirements</b>		
<b>Type</b>	<b>AOS (ASTM D 4751)</b>	<b>Permittivity (ASTM D 4491)</b>
Type C	≥ No. 60 Std Sieve	≥ 0.1 per sec
Type D	AOS and fabric permittivity requirements are based on site specific design and are indicated in the Special Provisions.	

- 3 Unless otherwise specified, use Type A fabric for soils with less than 15% particles, by weight, passing the No. 200 sieve.
- 4 Unless otherwise specified, use Type B fabric for soils with 15% to 50% particles, by weight, passing the No. 200 sieve.
- 5 Unless otherwise specified, use Type C fabric for soils with more than 50% particles, by weight, passing the No. 200 sieve.
- 6 Unless otherwise specified, use Type D fabric for Critical/Severe Applications.

#### **804.2.12 Granular Filter**

- 1 When specified on the Plans, provide granular filter instead of geotextile filter fabric under riprap. Place a layer or layers of well-graded crushed stone or gravel meeting the gradations specified on the Plans. Ensure that the gradation of each layer is in the following relationship with the gradation of the underlying material, either soil or filter material:

$$\frac{D_{15} \text{ (coarser layer)}}{D_{85} \text{ (finer layer)}} \leq 5 \leq \frac{D_{15} \text{ (coarser layer)}}{D_{15} \text{ (finer layer)}} \leq 40$$

Where:

- $D_{15}$  is the diameter of the particle size that 15% of the material is smaller than.
- $D_{85}$  is the diameter of the particle size that 85% of the material is smaller than.
- No more than 5% of the filter material should pass the No. 200 sieve.

#### **804.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.



## **804.4 Construction**

### **804.4.1 General**

- 1 Shape and grade the slope or area on which riprap is placed to the lines, grades, thickness, or typical sections shown on the Plans or as directed by the RCE. Install either a fabric or a granular filter as specified on the Plans. If indicated by the Plans or directed by the RCE, place a layer of sand over the fabric to prevent puncture by large size riprap.
- 2 Place riprap to the thickness equal to the maximum stone diameter or the thickness specified in the Plans, whichever is greater. Place riprap either mechanically or by hand in a manner such that the larger stones are well distributed, and the entire mass of stone conforms to the specified gradation. Place riprap with the percentage of voids is as small as practical. Place riprap to its full thickness in one operation and in a manner that avoids displacing the underlying material. Hand place or re-arrange individual stones by mechanical equipment to the extent necessary to secure the results specified.
- 3 Unless the Plans specify a different toe treatment, dig a 2-foot deep trench along the toe of the fill at the bridge end fills and place the riprap from the bottom of the trench to the specified height shown on the Plans.

### **804.4.2 Riprap (Stone)**

- 1 Place the stone by dumping such that the smaller stone is uniformly distributed throughout the mass. Place stone to the required thickness on approved slopes at locations designated on the Plans or at other locations designated by the RCE.

### **804.4.3 Sand-Cement Riprap**

- 1 Prepare the slope as specified in **Subsection 804.4.1**. Fill the bags with sand and cement with sufficient water to moisten the mix in the ratio of 5 parts sand to 1 part cement. After filling, securely tie the bags closed. Start placing bags at the bottom and progress upward with the tied ends of the bags turned inward. Offset the joint between bags in successive rows and manipulate the bags until their surfaces are in full contact to the extent feasible.
- 2 Place terminal cutoff walls at each end of the bagged sand-cement riprap treatment. Place cutoff walls, 3 feet wide by 3 feet deep, approximately every 30 feet along the length of the treatment or as directed by the RCE.
- 3 Whenever placement of sand-cement bags is delayed sufficiently to affect the bond between succeeding courses, excavate a small trench, one-half a sack in depth, after the last row in place and fill the trench with concrete before laying the next layer. At the start of each day's work or when a delay of over 2 hours occurs during the placing of successive layers of sacks, moisten and dust the previously placed sacks with cement to develop a bond.

**804.4.4 Grouted Riprap**

- 1 Prepare the slope and place the riprap as specified in **Subsection 804.4.1**. After the riprap has been placed and approved, fill all voids between the stones with mortar to a depth of not less than 4 inches below the surface of the stone. Leave the face or surface of the stones reasonably free of grout. Do not plaster the riprap. Ensure that the spaces between the stones are reasonably free of sand or other material and wet during the placing of the grout.
- 2 Ensure that the edges on the ends of the grouted riprap intersect solid rock, formed into smooth transitions, or trenched well back into the bank to prevent undermining. Ensure that the bottom of the grouted riprap is founded on solid rock or extended below the depth of possible scour. Provide weep holes through the grout blanket to relieve any hydrostatic pressure behind the blanket.

**804.4.5 Precast Concrete Riprap**

- 1 Prepare the slope as specified in **Subsection 804.4.1**. Begin placing precast concrete pieces in a 2-foot deep trench below the toe of the slope and progress upward. Place each piece by hand perpendicular to and firmly embedded against the slope, and ensure that the vertical and horizontal joint between individual pieces does not exceed  $\frac{3}{8}$  inch unless otherwise permitted. Use half pieces, odd shaped pieces, or Class 2500 concrete to fill the voids at the end of the sections placed or in curved shaped sections.
- 2 Conform the top course as nearly as practicable to the prescribed berm or shoulder elevation. Obtain any adjustment necessary to achieve this elevation by constructing a wedge course, when required, that consists of Class 2500 concrete. Use toe walls, when required, that consist of Class 2500 concrete. Joint and texture concrete as directed to blend with the precast blocks.

**804.4.6 Geotextile Fabric for Slope Protection**

- 1 Place geotextile fabric for slope protection in accordance with the Plans or the *SCDOT Standard Drawings* or as directed by the RCE. Place the fabric on a slope that conforms to the Plans and in a relatively smooth condition free from obstructions, debris, or sharp objects that could puncture the fabric. Do not operate construction equipment directly on the fabric.
- 2 Place fabric with the long dimension parallel to the toe of the slope and lay smooth and free of tension, stress, folds, wrinkles, or creases. If more than one strip is necessary, overlap the strips a minimum of 18 inches. Place transverse laps with the upstream strip overlapping the downstream strip. Place horizontal laps with the lower strip overlapping the upper strip. Laps may be eliminated if the joint is sewn using an approved method.
- 3 Install approved fastener pins through both strips of overlapped fabric at no less than 5-foot intervals along a line through the midpoint of the overlap and at any other locations as necessary to prevent any slippage of the fabric.

- 4 When placing material on the fabric, limit the height of the drop in order to prevent damage to the fabric. Demonstrate to the satisfaction of the RCE that the placement technique prevents damage to the fabric. Begin placement of the material at the toe of the slope and proceed upward.
- 5 Repair or replace any fabric damaged during installation or during placement of filter materials, slope protection, or other materials. Remove and replace extensively damaged fabric as directed by the RCE. Repair individual isolated cuts, tears, or punctures by placing a patch of geotextile fabric over the damaged areas. Extend patch at least 18 inches beyond the damage in all directions or fasten the entire perimeter of the patch by a sewing method approved by the RCE.
- 6 Cover the fabric with the specified material before damage or deterioration from ultraviolet light occurs. Remove and replace fabric not covered within 30 calendar days after placement. If damage or deterioration is evident before 30 days after placement, as determined by the RCE, remove and replace the fabric.

#### **804.4.7 PVC Coated Wire-Enclosed Gabions**

- 1 Excavate the channel before the installation of gabions as shown in the Plans or as directed by the RCE. Ensure that the resulting subgrade is smooth, firm, and free from protruding objects or voids that would affect the proper placement of the PVC coated wire mesh units or damage the geotextile fabric.
- 2 Use geotextile fabric meeting the requirements of **Subsection 804.2.11** (Class 2) for all gabions. Place on a prepared subgrade and overlap adjacent strips a minimum of 2 feet. Exercise care in placing and anchoring the empty PVC coated wire mesh units to ensure proper alignment and avoid damage to the geotextile fabric. If the geotextile is damaged, replace or repair it as directed by the RCE.
- 3 Begin placing the units at the vertical abutment wall and proceed upstream or downstream. Place the empty units on the geotextile fabric. Bind the vertical ends together with lacing or spiral binder wires sufficiently to allow stretching of the units to remove any kinks. Use any stretching methods that do not damage the fabric or the units. Use stakes, pins, or other approved methods to secure the units once they are placed in proper alignment. Interconnect adjacent units at intervals not to exceed 6 inches with lacing or spiral binder wire.
- 4 Fill the empty units carefully with rock placed by hand or machine to maintain alignment of the units. Place the rock uniformly in the units with a minimum of voids between the rocks. Avoid bulging of the side or top mesh. Limit the dropping of the rock to a height that avoids damage to the PVC coating or a maximum of 36 inches, whichever is less. Once filled, close the lid of the units and secure with lacing or spiral binder wire. When space limitations along the channel bottom or slope prevents the use of a complete unit, cut the unit to fit as approved by the RCE.

- 5 Backfill any excavation voids existing along the edges of the completed gabions in a manner acceptable to the RCE.

#### **804.4.8 PVC Coated Wire-Enclosed Rock Mattresses**

- 1 Use construction methods specified for gabions in **Subsection 804.4.7**.

#### **804.4.9 Concrete Slope Protection**

- 1 Provide cast-in-place concrete slope protection consisting of Class 2500 concrete meeting the requirements of **Subsection 804.2.9**, or fiber-reinforced Class 2500 concrete meeting the requirements of **Subsection 804.2.10** as indicated in the contract documents. Construct in accordance with the Plans at the locations indicated or where directed by the RCE. Ensure that the slope on which slope protection is placed conforms to requirements shown on the Plans unless otherwise directed by the RCE.
- 2 When specified, provide reinforcement meeting the requirements of **Section 703**, and place in accordance with the Plans and the *SCDOT Standard Drawings*. Finish surface of the slope uniformly with floats and textured by dragging with wet burlap. After finishing, cure the slope protection in accordance with the requirements of **Subsection 501.4.11**.

#### **804.5 Measurement**

- 1 The quantity for the pay item Riprap (of the type specified) is indicated in the Contract as either the weight of riprap placed, measured by the ton (TON), or the volume of riprap in-place, measured by cubic yard (CY) as applicable, complete, and accepted.
- 2 The quantity for the pay item Sand-Cement Riprap is the volume of riprap in-place and is measured by the cubic yard (CY), complete, and accepted.
- 3 The quantity for the pay item Grouted Riprap or Precast Concrete Riprap (including the area occupied by the wedge course) is surface area the riprap in-place and is measured by the square yard (SY) parallel to the slope, complete, and accepted.
- 4 The quantity of PVC Coated Wire-Enclosed Rock Gabion or PVC Coated Wire-Enclosed Rock Mattress is the volume of gabions or rock mattresses in-place and is measured by the cubic yard (CY), complete, and accepted.
- 5 The quantity of Slope Protection 4" Concrete or Geotextile Fabric for Slope Protection is the surface area covered by the slope protection materials or slope protection in-place, measured by the square yard (SY) parallel to the slope, complete, and accepted.

#### **804.6 Payment**

- 1 Payment for the accepted quantity for each pay item, measured in accordance with **Subsection 804.5**, is determined using the contract unit bid price for the applicable pay item, and the payment include all direct and indirect costs and expenses necessary to complete the work.

- 2 Payment for Riprap (of the class required), Sand-Cement Riprap, or Pre-cast Concrete Riprap is full compensation for furnish and placing riprap protection as specified or directed and includes preparing slopes, excavating the footing trench; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract, except for the geotextile fabric under the riprap, which is paid for as a separate item.
- 3 Payment for Grouted Riprap is full compensation for furnishing, mixing, and placing the grout only as specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract. The establishment of the riprap itself is paid as separate items.
- 4 Payment for Slope Protection - 4" Concrete is full compensation for constructing concrete slope protection as specified or directed and includes preparing of slopes; furnishing and placing the concrete; and all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract. .
- 5 When fiber reinforcement is required in the concrete slope protection, payment of Slope Protection 4" Concrete (Fiber Reinforced) is full compensation for constructing the fiber reinforced concrete slope protection as specified or directed and includes preparing slopes; furnishing and placing concrete; providing and mixing fiber reinforcement; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract
- 6 Payment for Geotextile for Erosion Control Under Riprap (of the type and class required) is full compensation for furnishing and placing geotextile under riprap as specified or directed and includes providing sand or granular filter layer and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 7 Payment for PVC Coated Wire-Enclosed Rock (Gabion) or PVC Coated Wire-Enclosed Rock (Mattress) is full compensation for constructing rock gabions or mattresses as specified or directed and includes excavating; furnishing and placing geotextile fabric, PVC coated baskets, and rock; tying baskets together; anchoring, staking, fastening, and bracing the baskets; backfilling or disposing of excess material; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

8 Pay items under this section include the following:

Item No.	Pay Item	Unit
8041010	Riprap (Class A)	TON
8041015	Riprap (Class A)	CY
8041020	Riprap (Class B)	TON
8041025	Riprap (Class B)	CY
8041030	Riprap (Class C)	TON
8041035	Riprap (Class C)	CY
8041040	Riprap (Class D)	TON
8041045	Riprap (Class D)	CY
8041050	Riprap (Class E)	TON
8041055	Riprap (Class E)	CY
8041060	Riprap (Class F)	TON
8041065	Riprap (Class F)	CY
8041100	Hand Placed Riprap	TON
8041200	Hand Placed Riprap	CY
8042100	Foundation Riprap	TON
8042200	Foundation Riprap	CY
8043100	Dumped Riprap	TON
8043200	Dumped Riprap	CY
8043350	Sand Cement Riprap	CY
8043370	Grouted Riprap	SY
8043390	Precast Concrete Riprap	SY
8044050	PVC Coated-Wire Enclosed Rock (Mattress)	CY
8044100	PVC Coated-Wire Enclosed Rock (Gabion)	CY
8047040	Slope Protection - 4" Concrete	SY
8047041	Slope Protection 4" Concrete (Fiber Reinforced)	SY
80481XX	Geotextile for Erosion Control Under Riprap (Class 1) Type <i>(A, B, C, or D)</i>	SY
80482XX	Geotextile for Erosion Control Under Riprap (Class 2) Type <i>(A, B, C, or D)</i>	SY

## SECTION 808

### RELOCATION OF STRUCTURES AND OTHER ITEMS (MOVING ITEMS)

#### 808.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the removal and relocation of structures, buildings, and other scheduled moving items in conformity with the Plans and the Specifications or as directed by the RCE.
- 2 Scheduled moving items include relocating buildings or structures with incidental improvements or appurtenances, such as walkways, driveways, animal enclosures, fences, steps, pipe lines, septic tanks, pumps, grease pits or lifts, signs, plants, shrubs, etc. that are not an integral part of the relocated item, and may not necessarily be shown on the Plans, but the moving of which is necessary because of the relocation of a building or structure. Each moving item is identified by a unique schedule number.
- 3 It is the Contractor's responsibility to investigate each moving item and determine the actual work involved in the moving and relocation of each item before bidding. The size and description of buildings or structures, distance to be moved, and placement elevation shown on the Plans are only approximate. The RCE may require the Contractor to move any building or structure an additional distance of 50 feet; raise or lower from the final elevation shown on the Plans a distance of 18 inches; or turn a building or structure through an angle of 15 degrees more or less than called for on the Plans without additional compensation.
- 4 Moving items shown on the Plans as parts of power transmission or other public utility lines are approximate as to distance to be moved, materials to be furnished, and appurtenances. Perform this work in accordance with the owner's standard practice and to its satisfaction. It is the Contractor's responsibility to contact the owner of such moving items and determine the amount of work required before bidding.
- 5 The relocation of a building or structure, any part of which is used as a service station, includes the removal, relocation, and installation of all pumps, tanks, pipes, signs, grease pits or lifts, and other accessories appurtenant to the service station in accordance with SCDHEC regulations.

#### 808.2 Materials

- 1 The RCE will determine the suitability of materials salvaged from the existing structure for use in the relocated structure.
- 2 Use new material for brick or concrete block to reconstruct exterior walls, pillars, and chimneys that are unable to be moved with the structure. Use masonry mortar that meets the requirements specified in **Subsection 718.2.5**.

- 3 Construct concrete driveways and walkways to replace existing drives and walks in accordance with the applicable requirements of **Section 720**. Construct driveways at a uniform thickness of 6 inches and walkways or sidewalks at a uniform thickness of 4 inches.
- 4 Use new materials for all well casings, water pipes, and steps unless the material salvaged from the old structure is acceptable to the owner and RCE.
- 5 Use new material for septic tanks and sewer pipes.
- 6 Ensure that new materials conform to the applicable contract specifications.

### **808.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

### **808.4 Construction**

- 1 Prepare structures for removal and then move and place them in their new locations as shown on the Plans or as designated by the RCE. Set structures plumb and level. Leave the entire structure including appurtenances in the same or better condition in all respects than it was before moving.
- 2 Do not make any change or alteration in the work specified unless approved in advance by the RCE.
- 3 Do not place the bottom of the wooden sill of a structure less than 12 inches above ground.
- 4 Because steps, outside stairways, porches, sheds, and other appurtenances forming an integral part of the building are considered as part of the building, move and relocate them accordingly. Disconnect and remove cellars, cellar steps, drains, walls, concrete or masonry porches and floors, concrete, brick, and masonry foundations and supports, septic tanks, fireplaces, chimneys, and other appurtenances attached or connected to the building but are not movable as an integral part of the building. Unless otherwise specified, construct such new appurtenances of the same size, type, and character as existed before the building was moved. Replace all driveways and walkways to conform to the new location of the building. Relocate all shrubbery and miscellaneous items appertaining to the structure to maintain the same symmetry existing before relocation unless otherwise specified.
- 5 Where work involves new materials or the reuse of salvaged materials in the relocation and reconstruction of buildings or structures or in the construction of new buildings or structures, paint all such work to the satisfaction of the RCE.
- 6 Whenever sanitary sewers, water, gas, electric, or telephone service lines are connected to the building being relocated, move and reconnect such ser-



vice lines without unnecessary inconvenience to the occupants of the building. Plug or otherwise satisfactorily disconnect utilities not reconnected in a manner preventing infiltration of foreign matter. The Contractor is responsible for arranging for the removal of all utility connections where the connections interfere with the construction of the road. Include all work and costs incidental to removing and relocating these utilities in the contract unit or lump sum price for moving the building to which they are attached. Ensure that all connections and installations are in accordance with all codes, ordinances, or regulations governing such work. The Contractor is responsible for notices to public utility companies and fees charged by the utilities concerning the moving operation.

- 7 Conduct moving operation to allow businesses to render service to their customers without undue interruption. After work is started on any building, maintain a sufficient force to ensure satisfactory progress. Weather permitting; do not discontinue work on any building without consent of the RCE.
- 8 Remove and dispose of materials in existing foundations, drives, walks, concrete or masonry floors, chimneys, etc. not used in the reconstruction of appurtenances to structures being moved as directed by the RCE.
- 9 Relocate the content of structures along with the structure to its new site. In the event that it is not practicable to move the structure with the contents therein, remove, protect, and replace the contents. Take the necessary precautions to prevent damage to or loss of the contents.
- 10 Carry all foundations for pillars, underpinning, or chimneys a minimum of 12 inches below ground and/or to a solid bearing. Construct footings 6 inches wider than pillars or underpinnings and 12 inches wider than chimneys proper.
- 11 Install septic tanks, tile drainage fields, and privy meeting the requirements of SCDHEC.
- 12 Ensure that new wells and pumps furnish an adequate supply of potable water and, in all cases, ensure that they furnish at least the amount of water as the pump or well being replaced. Ensure that new pumps and wells are in service before the old units are made ineffective.
- 13 Whenever the Plans specify buildings, structures, etc. to be dismantled or salvaged, dismantle them with sufficient care to preserve the salvage value of the materials therein. Store all salvage materials at locations shown on the Plans or designated by the RCE. Dispose of all discarded material, rubbish, or debris as directed by the RCE.
- 14 Perform all transplanting work required in the removal and relocation of buildings and structures indicated on the Plans in accordance with the requirements of **Section 811**.

#### **808.5 Measurement**

- 1 Unless otherwise specified, moving items are paid on a lump sum (LS) basis; and therefore, there is no specific measurement of quantities for these

items. For acceptance for payment, the completed moving item must be accepted by the property owner and the RCE.

#### **808.6 Payment**

- 1 Payment for a moving item accepted in accordance with **Subsection 808.5** is determined using the contract lump sum bid price for the applicable scheduled moving item, and the payment includes all direct and indirect costs and expenses necessary to complete the work.
- 2 Payment for Moving Item No. (*schedule number*) is full compensation for moving the specified item as specified or directed and includes the necessary clearing, grubbing, and grading of the relocation site, except as otherwise provided for on the Plans and all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 3 Payment for a moving item involving transplanting of trees, shrubbery, etc. is full compensation for excavating and preparing planting pits; moving, setting, and watering the transplanted items; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to satisfactorily complete the work.
- 4 No payment is made for a moving item until the Contractor secures a statement from the property owner or owners certifying that the work has been performed to the property owner's satisfaction and that the Department and Contractor are released from all responsibility and liability in connection with the work. In extreme cases when, in the opinion of the RCE, this requirement is being abused by the property owner the Department, at its option, may waive the procurement of the owner's release.
- 5 Pay item under this section include the following:

Item No.	Pay Item	Unit
8081000	Moving Item No. ( <i>Schedule No.</i> )	LS

## SECTION 810

### SEEDING

#### 810.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the seeding, interseeding, fertilizing, applying nitrogen and lime when specified, and mulching in conformity with the Plans and the Specifications or as directed by the RCE.
- 2 Interseeding consists of the planting of centipede grass seed within the existing turf.

#### 810.2 Materials

##### 810.2.1 General

- 1 At the time of delivery, furnish invoices for materials received in order to determine the application rate of materials.

##### 810.2.2 Seed

- 1 Ensure that seed conforms to state laws and the requirements and regulations of the South Carolina Department of Agriculture (SCDA).
- 2 Provide individually packaged or bagged and tagged varieties of seed that show the name of seed, net weight, origin, percentages of germination and purity, lot number, and other information required by the SCDA.
- 3 The Department reserves the right to test and reject or approve any or all seed before application of the seed.
- 4 For mixtures of different types of seed called for in the seeding schedule, weigh and mix in the proper proportions at the site of the work in the presence of the RCE.

##### 810.2.3 Seeding Schedules

- 1 Unless otherwise provided, select the type of seeding from the tables shown below for the upper state and the lower state regions as applicable to the project.
- 2 The total seed rate in pounds per acre is the sum total shown for all the varieties of seed opposite the schedule number in the seeding schedules included herein.

##### 810.2.3.1 Permanent Vegetation Seeding Schedules

- 1 The upper state region consists of all counties west of the counties of Aiken, Lexington, Richland, Kershaw, and Chesterfield. The lower state region consists of the above-cited counties and all counties east.

- <sup>2</sup> Adhere to the following two seeding schedules.

Seeding Schedule for Permanent Vegetation Upper State				
Schedule No.	Common Name of Seed	Pounds/acre <sup>1</sup>		Planting Dates
		Rural	Urban	
1	Common Bermuda (hulled) <sup>3</sup>	23	23	March 15 to August 14
	Sericea Lespedeza (scarified) <sup>2</sup>	50	50	
	Kentucky 31 Fescue	50	60	
	Weeping Lovegrass <sup>2</sup>	10	10	
2	Kentucky 31 Fescue	50	80	August 15 to March 14
	Sericea Lespedeza (unhulled, unscarified) <sup>2</sup>	80	80	
	Common Bermuda (unhulled) <sup>3</sup>	30	30	
	Weeping Lovegrass <sup>2</sup>	10	10	
	Reseeding Crimson Clover <sup>4</sup>	20	0	
	Annual Rye Grass <sup>5</sup>	5	15	
	Rye Grain	20	0	

Notes:

<sup>1</sup> Includes rural areas adjacent to well-developed lawns.

<sup>2</sup> Not required on shoulders, medians, etc. and on slopes under 5 feet in height.

<sup>3</sup> Do not use Giant Bermuda seed including NK-37.

<sup>4</sup> Inoculate Reseeding Crimson Clover in accordance with **Subsection 810.2.4**. Do not plant clover in medians or in rural areas adjacent to well-developed lawns.

<sup>5</sup> The use of Italian Rye Grass is prohibited on all projects.

Seeding Schedule for Permanent Vegetation Lower State				
Schedule No.	Common Name of Seed	Pounds/acre <sup>1</sup>		Planting Dates
3 <sup>5</sup>	Common Bermuda (hulled) <sup>3</sup>	30	30	March 1 to August 14
	Weeping Lovegrass <sup>2</sup>	10	10	
	Sericea Lespedeza (scarified) <sup>2</sup>	50	50	
4 <sup>5</sup>	Common Bermuda (unhulled) <sup>3</sup>	40	40	August 15 to February 28
	Weeping Lovegrass <sup>2</sup>	10	10	
	Sericea Lespedeza (unhulled, unscarified) <sup>2</sup>	80	80	
	Reseeding Crimson Clover <sup>4</sup>	20	0	
	Annual Rye Grass <sup>7</sup>	5	15	
	Rye Grain	20	0	
5 <sup>6</sup>	Centipede	10	10	March 1 to April 15
Notes: <sup>1</sup> Includes rural areas adjacent to well-developed lawns. <sup>2</sup> Not required on shoulders, medians, etc. and on slopes under 5 feet in height. <sup>3</sup> Do not use Giant Bermuda seed including NK-37. <sup>4</sup> Inoculate Reseeding Crimson Clover in accordance with <b>Subsection 810.2.4</b> . Do not plant clover in medians or in rural areas adjacent to well-developed lawns. <sup>5</sup> Pensacola Bahia is allowed only as shown in Seeding Schedules 3 and 4 at the rate of 50 pounds per acre only when seeding pit areas that are governed by the South Carolina Mining Act. Otherwise, do not include Bahia seed in the mix. <sup>6</sup> Apply one-half of lime rates and one-half of maintenance fertilizer rates. Fertilize centipede at the application rate of 20 pounds per acre of 16-4-8 or 15-0-15 fertilizers in May and repeat in August. <sup>7</sup> The use of Italian Rye Grass is prohibited on all projects.				

- <sup>3</sup> The Contractor may include quantities of rye grain and millet in Schedule Nos. 1 and 3 to establish quick ground cover for erosion control purposes.

**810.2.3.2 Interseeding Schedule**

- <sup>1</sup> Adhere to the following schedule for interseeding.

Interseeding Schedule			
Schedule No.	Common Name of Seed	Pounds per acre	Planting Dates
1	Centipede	10	October 15 to July 15

**810.2.3.3 Temporary Vegetation Seeding Schedule**

- <sup>1</sup> Adhere to the following seeding schedules for temporary vegetation.

Seeding Schedules For Temporary Vegetation Upper and Lower State			
Schedule No.	Common Name of Seed	Pounds per acre	Planting Dates
1	Brown Top Millet	50	April 1 to August 15
2	Rye Grain	55	August 16 to March 31
	Annual Ryegrass <sup>1</sup>	15	
<sup>1</sup> The use of Italian Rye Grass is prohibited on all projects.			

- <sup>2</sup> Add oat grain at the rate of 10 pounds per acre to schedules if the seeding date is between March 1 and April 16.

**810.2.4 Inoculants**

- <sup>1</sup> Provide an inoculant for treating reseeding crimson clover seed of a pure culture of nitrogen-fixing bacteria selected for a maximum vitality and ability to transform nitrogen from the air into soluble nitrates and deposit them into the soil. Ensure that inoculants consist of purebred cultures and are not more than one year old. All cultures are subject to the approval of the RCE.

**810.2.5 Commercial Fertilizer**

- <sup>1</sup> Provide commercial fertilizers that comply with state fertilizer laws.
- <sup>2</sup> When a fertilizer is required for any grass, use a mixed fertilizer with a designation such as 10-10-10, where the first number represents the minimum percent of nitrogen required, the second number represents the minimum percent of available phosphoric acid required, and the third number represents the minimum percent of water soluble potash required in the fertilizer.
- <sup>3</sup> For centipede grass, use only 15-0-15 or 16-4-8 fertilizer.

### 810.2.6 Lime

- 1 Ensure that lime is agricultural grade, standard ground limestone conforming to the current *Rules, Regulations, and Standards of the Fertilizer Board of Control*. These rules, regulations, and standards are promulgated and issued by the Fertilizer Board of Control at Clemson University in accordance with Section 16 of the South Carolina Liming Materials Act. Ensure that each bag has affixed in a conspicuous manner a tag or label, or in the case of bulk sales, a delivery slip showing the brand or trade name, calcium carbonate equivalent, percent by weight passing prescribed U.S. Standard sieves, and other pertinent information to identify lime as agricultural grade, standard ground limestone.
- 2 The Contractor may substitute liquid lime for ground lime if it meets all requirements for agricultural grade lime specified herein, except percent by weight passing U.S. Standard Sieves, which is waived for liquid lime.

### 810.2.7 Tackifiers as Mulch Binders

#### 810.2.7.1 Emulsified Asphalt

- 1 If emulsified asphalt is used as a tackifier, ensure that it meets the requirements of **Subsection 407.2.4**. Ensure that emulsified asphalt is diluted at the manufacturing plant with water, if necessary, to provide a homogenous and satisfactory material for spraying.

#### 810.2.7.2 Chemical Tacking Agents

- 1 If a chemical tacking agent is used, ensure that it consists of a polymer synthetic resin, polypectate, liquid latex, or other material that gives similar adhesive properties as asphalt emulsion when sprayed on straw and cellulose fiber mulches. Chemical tacking agents require approval by the RCE.

### 810.2.8 Straw Mulch

- 1 Use straw mulch material consisting of straw or hay. Use straw that consists of stalks of wheat, rye, barley, oats, or other approved straw. Use hay that consists of Timothy, Peavine, Alfalfa, Coastal Bermuda, or other grasses from sources approved by the RCE. Ensure that these materials are reasonably dry and reasonably free from mature seed-bearing stalks, roots, or bulblets of Johnson Grass, Nutgrass, Sandburg, Wild Garlic, Wild Onion, Wild Mustard, Crotolaria, Pigweed, Witchweed, and Cocklebur. Comply with all state and federal domestic plant quarantine regulations.

### 810.2.9 Wood Fiber Hydroseeding Mulch

- 1 Use wood fiber hydroseeding mulch made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. Ensure that it remains in uniform suspension in water under agitation and blends with grass seed and fertilizer to form homogeneous slurry. Make certain that the fibers intertwine physically to form a strong moisture-holding mat on the ground surface and allow rainfall to percolate the underlying soil. Use a fiber material that is heat processed

and contains no germination or growth-inhibiting factors. Use a fiber material dyed (non-toxic) an appropriate color to facilitate the uniform application of material.

- 2 Use suppliers that certify that their product has been laboratory and field tested and meets all of the foregoing requirements based upon such testing.
- 3 Ensure that the weight specifications from suppliers and for all applications of this material refer only to the absolute air-dry weight of the fiber material. Absolute air-dry weight is based on the normal weight standard of the Technical Association of the Pulp and Paper Industry for wood fiber hydroseeding mulch and is considered equivalent to 10% moisture. Ensure that the manufacturer marks each package of the wood fiber hydroseeding mulch to show the air-dry weight content.

#### **810.2.10 Cellulose Fiber Hydroseeding Mulch**

- 1 Use cellulose fiber hydroseeding mulch consisting of recycled magazine stock products shredded into small pieces for application by hydraulic seeding equipment. Ensure that it mixes readily and uniformly under agitation with water and blends with grass seed and fertilizer to form homogeneous slurry. When applied to the ground surface, ensure that the material forms a strong moisture-holding mat, allows rainfall to percolate to the underlying soil, and remains in place until the grass root system is established. Ensure that the material contains no growth inhibiting characteristic or organisms. Obtain mulch from suppliers that certify that their product meets these requirements.

#### **810.2.11 Wood/Cellulose Fiber Mix Hydroseeding Mulch**

- 1 If approved by the RCE, use wood/cellulose fiber mix hydroseeding mulch that consists of a combination of **Subsections 810.2.9** and **810.2.10** at a ratio recommended by the manufacturer.

### **810.3 Equipment**

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

## **810.4 Construction**

### **810.4.1 Partial and Temporary Seeding**

- 1 Coordinate seeding with the construction of cut and fill slopes. Limit the area of erodible material by bringing partially completed slopes to the required slope and perform seeding operations at that time as directed by the RCE. Temporarily seed slopes to coincide with the embankment work.

### **810.4.2 Erosion Control Measures**

- 1 In addition to the erosion control measures specified herein and in the Plans and the Special Provisions, the Contractor is advised that all land dis-



turbing activities (clearing and grubbing, excavation, borrow and fill) are subject to the requirements set forth in the following permits and regulations:

- South Carolina Code of Regulations 63-380, Standard Plan for Erosion, Sediment, and Stormwater Runoff Control. The regulation may be viewed at the following Internet web address:

<http://www.scstatehouse.net/coderegs/c063.htm>

- Erosion and Sediment Reduction Act of 1983 (Title 48, Chapter 18 of the South Carolina Code of Laws of 1983, as amended). Section 70 of this code authorized the South Carolina Department of Health and Environmental Control (SCDHEC) to administer this regulation with respect to lands under the jurisdiction of the South Carolina Department of Transportation. The code may be viewed at the following Internet web address:

<http://www.scstatehouse.net/code/t48c018.htm>

- National Pollutant Discharge Elimination System (NPDES) General Permit Number SCR100000, effective September 1, 2006: The Environmental Protection Agency, in accordance with the Federal Clean Water Act, has granted to the South Carolina Department of Health and Environmental Control (SCDHEC) the authority to administer the Federal NPDES permit program in the State of South Carolina. The permit may be viewed at the following Internet web address:

<http://www.scdhec.net/environment/water/docs/finalcgp.pdf>

- 2 In accordance with the NPDES General Permit, sign a Co-Permittee Agreement and Contractor Certification statement (shown in Part 3.2D of the General Permit) and require all subcontractors performing land-disturbing activities to sign a Co-Permittee Agreement and Contractor Certification statement as part of their subcontract. These certifications are incorporated into the proposal form for the Contract. By signing either form, the Contractor acknowledges that upon award and execution of the Contract, he/she accepts/understands the terms and conditions of the *Storm Water Pollution Prevention Plan (SWPPP)* as required by the NPDES General Permit and may be legally accountable to SCDHEC for compliance with the terms and conditions of the *SWPPP*. In addition, the Contractor certifies that the NPDES certification statement and/or co-permittee status is made part of all its subcontracts.
- 3 Prepare and submit a *Contractor's Erosion Control Plan (CECP)* to the RCE before the pre-construction conference. Ensure that the plan meets the requirements of the NPDES General Permit. The plan will be reviewed and approved by the Department before commencing any land disturbing activities. Upon approval of the *CECP*, the RCE will complete and forward a *Notice of Intent (NOI)* to SCDHEC. If SCDHEC does not send a letter within 10 business days of receipt of the *NOI*, authorizing coverage, denying coverage, or advising that a review of the *CECP* will take place, coverage will be auto-

matically granted.

- 4 At the pre-construction conference, with all contactors and subcontractors performing land-disturbing activities present, the CECP will be explained and discussed so that each contractor and subcontractor is made aware of their responsibilities in the *CECP*.
- 5 Once approved, fully implement the *CECP*. Coordinate the prompt installation of erosion control devices with construction activities to maintain compliance with the above regulations and NPDES General Permit.
- 6 Conduct an Erosion and Sediment Control Inspection by an appointed Certified Erosion Prevention and Sediment Control Inspector (CEPSCI) from the Contractor and the Department at least every 7-calendar days. Both parties will acknowledge participation in the inspection by signing the inspection report and include their inspector's CEPSCI number on the report. Correct deficiencies noted during these inspections within the assigned priority period. If deficiencies are not corrected within this timeframe, the RCE will stop all work (except erosion and sediment control measures) until the deficiencies are corrected.
- 7 Give special attention to critical areas within the project limits (i.e., running streams, water bodies, wetlands, etc.). In these areas, the RCE may direct the Contractor to undertake immediate corrective action, but in no case allow these deficiencies to remain unresolved more than 7 days or 48 hours in accordance with their assigned priority after being identified during the Erosion and Sediment Control Inspection.
- 8 Closely follow the grading operations with the seeding operations. Shape and prepare the slopes for seeding as the grading progresses. Unless the RCE grants prior written approval, limit the amount of surface area exposed by land disturbing activities to 750,000 square feet. Commence seeding operations within 7 days following completion of construction activities within an area.
- 9 Initiate stabilization measures within 7 days for an area where construction activities will be temporarily or permanently ceased for 21 days or longer.
- 10 Coordinate the installation of all other permanent erosion control items with the grading and seeding operations. These items include, but are not limited to, asphalt gutter and riprap. Construct gutter work before or promptly after the seeding is performed. Place riprap at the ends of pipe immediately after the pipe is laid and promptly install riprap ditch checks after ditch work has been performed.
- 11 Failure to adequately comply with the provisions as detailed above or any other required erosion control measures will result in stoppage of all contract operations (except erosion and sediment control measures) until corrective action has been taken. Additional sanctions may be invoked by the SCDHEC in accordance with their authority.

- 12 Keep the following documents at the RCE's office from the start of construction until the site is finally stabilized:
  - Copy of the *CECP*,
  - Copies of all the co-permittee agreements and Contractor certification statements,
  - Copy of the permit,
  - Letter from DHEC authorizing permit coverage, and
  - A marked-up set of site plans.
- 13 When uniform perennial vegetation achieves a cover density of 70%, submit a *Notice of Termination (NOT)* to SCDHEC to terminate coverage. Include a signed statement with the *NOT* certifying that all work on the site has been completed in accordance with the *SWPPP* and the NPDES General Permit for all sites one acre or greater.
- 14 Fines assessed on the Department by SCDHEC as the result of the Contractor's non-compliance or violation of said permit provisions will be paid by the Department and will subsequently be deducted from any monies due or that may become due to the Contractor. In case no monies are due or available, the fines incurred will be charged against the Contractor's Surety.

#### **810.4.3 Stand of Grass**

- 1 Before acceptance of the seeding performed for the establishment of permanent vegetation, produce a uniform perennial vegetative cover with a density of 70% of the seeded area. Ensure that the root system is developed sufficiently to survive dry periods and winter weather and is capable of re-establishment in the spring.
- 2 Before acceptance of the seeding performed for the establishment of temporary vegetation, produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or the establishment of permanent vegetation commences.

#### **810.4.4 Seeding Dates and Rates of Application**

- 1 Perform seeding during the periods and at the rates specified in the seeding schedules in **Subsection 810.2.3**. The Contractor may perform seeding work throughout the year using the schedule prescribed for the given period. Do not conduct seeding work when the ground is frozen or excessively wet. Produce a satisfactory stand of grass meeting the requirements of **Subsection 810.4.3** regardless of the period of the year in which the work is performed.
- 2 Perform interseeding during the periods and at the rates specified in the interseeding schedule. Conduct the interseeding with a no-till drill calibrated to deliver the specified rate of seed per acre.

**810.4.5 Preparation of Ground Before Seeding**

- 1 Ensure that the areas seeded are uniform and conform to the finished grade and cross-section shown on the Plans or as otherwise directed by the RCE. Perform minor shaping and evening of uneven and rough areas outside the graded section as directed by the RCE in order to provide for more effective erosion control and ease of subsequent mowing operations.
- 2 Loosen the seedbed (including cut slopes) to a minimum depth of 3 inches before agricultural lime, fertilizer, or seed is applied. Clear the areas to be seeded of stones larger than 2½ inches in any dimension, roots, and other debris.
- 3 Temporarily seed slopes to coincide with the embankment work in 10-foot increments. When 10 feet of fill is in place, seed the slope. Track the slopes vertically to help hold the seed in place.

**810.4.6 Applying Organic Topsoil**

- 1 At areas to be grassed where the existing seedbed has little or no topsoil, topsoil may be furnished and placed on the seedbed to ensure a good stand of grass.

**810.4.7 Applying Lime and Fertilizer**

- 1 When called for in the Contract, spread lime and/or fertilizer uniformly over the designated areas and thoroughly mix with the soil to a depth of approximately 2 inches. Apply fertilizer at the rate of 1000 pounds per acre unless otherwise directed. Apply lime at the rate of 2000 pounds per acre, unless otherwise specified in the Special Provisions, or as authorized by the RCE. Unless otherwise provided, do not apply lime for temporary seeding. Adequately scarify steep slopes, which are inaccessible to power equipment and are subject to slides. Fertilizer may be applied as a mixture of fertilizer and seed by approved mechanical spreaders or by hydraulic methods. When fertilizer is applied in a combination seed and fertilizer drill, no further incorporation is necessary. Apply the fertilizer and seed together when the hydraulic method of seeding is used. Remove all stones larger than 2½ inches in any dimension, larger clods, roots, or other debris brought to the surface.
- 2 A fertilizer of a different analysis than that specified on the Plans may be substituted if approved by the RCE. If a different fertilizer is approved, apply the fertilizer at such a rate per acre to give at least the amount of nitrogen, phosphoric acid and potash as would have been accomplished had the originally specified fertilizer been used and applied at the specified rate. If the substitute fertilizer meets the minimum analysis of at least one or more of the three basic ingredients, do not consider the excess in calculating the required quantity of the substituted fertilizer. Payment is made for the number of tons of fertilizer which would have been required if the originally specified fertilizer had been used at the specified rate.
- 3 For Interseeding, apply fertilizer at the rate of 500 pounds per acre. Use 15-0-15 or 16-4-8 fertilizer.

#### **810.4.8 Permanent Vegetation**

- 1 Produce a satisfactory stand of perennial vegetation with a root system that is developed sufficiently to survive dry periods and winter weather, and is capable of re-establishment in the spring. The perennial vegetative cover must have a minimum coverage density of 70% for the seeded areas. Using the seed specified in **Subsection 810.2.3**, determine the rate of application necessary to produce the required stand of grass and follow the application procedures as specified herein.

#### **810.4.9 Temporary Vegetation**

- 1 Obtain a satisfactory stand of vegetation that is capable of erosion control. Using the seed specified in **Subsection 810.2.3**, determine the rate of application necessary to produce the required results. Ensure that the temporary vegetation provides minimum density coverage of 70% of the seeded area.

#### **810.4.10 Temporary Seeding**

- 1 Sow seed within 24 hours following the application of fertilizer and preparation of seedbed as specified in **Subsection 810.4.5**. Sow seed at the required rate by hand or by methods as outlined in **Subsection 810.4.11**. Compact or cover the seeded areas as specified in **Subsection 810.4.11**. On small areas inaccessible to machinery, the Contractor may cover the seed by hand rakes or other methods satisfactory to the RCE. Apply fertilizer at the rate of 500 pounds per acre or as directed by the RCE. Lime is not required in temporary seeding unless otherwise specified. No tackifiers or mulches are required for temporary seeding.
- 2 The Contractor may use temporary seeding in isolated problem areas or, where it is not feasible or practicable to bring an area to final slope, grade and finish so that the permanent seeding can be performed without subsequent serious disturbance by additional grading.

#### **810.4.11 Seeding (Unmulched)**

##### **810.4.11.1 General**

- 1 Ensure seeding without mulch (unmulched) conforms to Method A or B as prescribed below, except do not use Method A in urban areas or in areas adjacent to sidewalk, guardrail, curb, curb and gutter, or concrete median.

##### **810.4.11.2 Method A: Seeding with Emulsified Asphalt Tackifier**

- 1 Sow seed within 24 hours following the application of fertilizer and lime and preparation of the seedbed as specified in **Subsections 810.4.5** and **810.4.7**. Uniformly sow seed at the rate specified by the use of approved mechanical seed drills, rotary hand seeders, hydraulic equipment, or any other type of equipment that produces a uniform application of the seed.
- 2 Except on steep slopes where mechanical equipment cannot operate satisfactorily, compact all seeded areas by means of a cultipacker or light roller. Compaction is not necessary if seeds are planted by mechanical seed drills that perform a compaction procedure. On slopes that are inaccessible to

compaction equipment, cover the seed by dragging spiked-chains, by light harrowing, or by other methods satisfactory to the RCE.

- 3 Within 24 hours following compaction of the seeded areas, uniformly apply emulsified asphalt, diluted at the manufacturing plant with an equal amount of water, over the seeded areas at a rate of 0.15 to 0.32 gallon of the dilution per square yard. The RCE will determine the exact rate of application.
- 4 Before spraying emulsified asphalt, cover parts of bridges, culverts, guard-rail, signs, sidewalk, curb and gutter, catch basins, pipe ends, and other structures as necessary to prevent discoloration.

#### **810.4.11.3 Method B: Seeding with Wood Fiber Mulch Tackifier, Cellulose Fiber Mulch Tackifier, or Wood/Cellulose Fiber Mix Tackifier**

- 1 Apply lime and prepare the ground as shown on the Plans or as directed by the RCE in accordance with **Subsections 810.4.5** and **810.4.7**. Choose one of the following tackifiers: wood fiber tackifier, cellulose fiber tackifier, or wood/cellulose fiber mix tackifier and apply with a mixture of water, seed, and fertilizer at the rate of 1500 pounds per acre. Use hydraulic equipment for the application of slurry of water, fertilizer, seed, fiber, and tackifier. Use equipment with a built-in agitation system and an operating capacity sufficient to agitate, suspend, and homogeneously mix the slurry. Ensure that the slurry distribution lines are large enough to prevent clogs. Equip the discharge line with a set of hydraulic spray nozzles to provide even distribution of the slurry on the various areas seeded. Use a slurry tank with a minimum capacity of 1000 gallons.
- 2 Combine all of the seed, fertilizer, tackifier, and water into the slurry tank for distribution of all ingredients in one operation by the hydraulic seeding method specified herein. Combine the materials in a manner recommended by the manufacturer. Regulate the slurry mixture so that the amounts and rates of application result in a uniform application of all materials at rates not less than the amounts specified. Using the color of the slurry as a guide, spray the prepared seedbed with a uniform visible coat. Apply the slurry in a sweeping motion in an arched stream falling like rain and allow the slurry to build upon itself until an even coat is achieved.

### **810.4.12 Seeding (Mulched)**

#### **810.4.12.1 General**

- 1 Ensure that seeding with mulch conforms to Method A, B, or C as prescribed below, except do not use Method A in urban areas or in areas adjacent to sidewalk, guardrail, curb, curb and gutter, or concrete median.

#### **810.4.12.2 Method A: Seeding with Straw or Hay Mulch**

- 1 Sow seed as specified in Method A of **Subsection 810.4.11**. Within 24 hours following covering of the seed, uniformly apply straw or hay mulch material at the rate of 2 tons per acre. Spread mulch by hand, by appropriate mechanical spreaders, or by blowers. Use mulch that allows sunlight to penetrate and air to circulate but also partially shades the ground and conserves

soil moisture. Use emulsified asphalt meeting the requirements of **Subsection 810.2.7.1**, or other approved tacking agent, to hold the newly laid mulch in place.

- 2 Ensure that the emulsified asphalt is diluted at the manufacturing plant with an equal amount of water. Uniformly apply the material as a film over the mulch at approximately 0.20 gallon of dilution per square yard. Make certain that the film is sufficient to bond together the mulch particles without giving a heavy coating of the asphalt material. Ensure that the film prevents wind erosion. Other tacking agents may be used and applied at the manufacturer's recommended rate. Replace displaced mulch.

#### **810.4.12.3 Method B: Seeding with Straw and Hydroseeding Mulch**

- 1 Apply seed as in Method A in **Subsection 810.4.11**, then cover with straw tacked with the manufacturer's recommended rate of wood, cellulose, or a wood/cellulose mix hydroseeding mulch; or straw tacked with manufacturer's recommended rate of a combination of tacking agent and any of the aforementioned hydroseeding mulches.

#### **810.4.12.4 Method C: Hydroseeding**

- 1 Hydroseed using 1500 pounds per acre of wood, cellulose, or a wood/cellulose mix hydroseeding mulch with the manufacturer's recommended rate of an approved tacking agent.

#### **810.4.13 Application of Nitrogen**

- 1 As soon as the plants show satisfactory growth, apply nitrogen evenly at the rate of 48 pounds per acre on the areas designated by the RCE. Unless otherwise permitted, apply the nitrogen in a solid form rather than in a liquid state. Do not apply nitrogen to stands of *sericea lespedeza*. Unless otherwise provided, do not apply nitrogen to temporary vegetation.

#### **810.4.14 Mowing**

- 1 Mow areas seeded or sodded under the Contract, or other areas as necessary, to maintain the project in a satisfactory manner. Perform mowing where directed by the RCE. Commence mowing within three business days following verbal notification by the RCE. Failure to comply with the above may be grounds for stopping work on the project or withholding payment of the next pay estimate.
- 2 Use mowing equipment equipped with safety devices designed to prevent injury or property damage caused by flying debris propelled from under the mowing equipment. Keep all mowing equipment in good operating condition and maintain to provide a clean, sharp cut of vegetation at all times. If the RCE determines the equipment is defective to the point that the quality of work or safety is affected, immediately repair or replace the equipment.
- 3 Ensure that mowing results in a vegetation height of 4 to 6 inches, unless otherwise directed by the RCE. Mow as closely as possible to all fixed objects, exercising care not to damage trees, plants, shrubs, signs, delineators,

or other appurtenances that are a part of the facility. Hand trim around such objects if required and to the satisfaction of the RCE.

- 4 Immediately remove and properly dispose of any debris thrown on the roadway by the mowing operation. Mowed grass is not normally removed unless it becomes a hazard as determined by the RCE.
- 5 Do not perform mowing when, in the opinion of the RCE, soil and weather conditions are such that rutting or other damage to the project may occur. The three-business day period noted above will be extended until the soil and weather conditions become suitable for mowing on the project.

#### **810.4.15 Maintenance**

- 1 Perform all maintenance necessary to keep seeded areas in a satisfactory condition until the work is finally accepted. This includes mowing, repairing washes, and additional applications of seed, fertilizer, and mulch to areas where a satisfactory stand of grass has not been achieved.

#### **810.5 Measurement**

- 1 The quantity for Permanent Vegetation, Temporary Vegetation, Temporary Seeding, Seeding (Unmulched), or Seeding (Mulched) is the ground surface area with acceptable vegetation or stand of grass and is measured by the one-thousand square yard (MSY) unit, complete, and accepted.
- 2 The quantity of Interseeding is the ground surface area acceptably interseeded and is measured by the one-thousand square yard (MSY) unit, complete, and accepted.
- 3 The quantity of Fertilizer or Lime is the weight of fertilizer or lime applied, and is measured by the ton (TON), complete, and accepted. The quantity of Nitrogen is the actual weight of nitrogen applied and is measured by the pound (LB), complete, and accepted. Weights are determined by approved scales or by guaranteed weight of sacks shown on the manufacturer's tag. Furnish invoices of the above materials received on the project to the RCE.
- 4 The quantity of Mowing is the area of ground surface area mowed at the direction of the RCE and is measured by the one-thousand square yard (MSY) unit, complete, and accepted. Separate measurements will be made and added to the quantity for payment each time the area is mowed.
- 5 The quantity of Organic Topsoil is the volume of organic topsoil placed on site and is measured by the cubic yard (CY), complete, and accepted.

#### **810.6 Payment**

- 1 Payment for the accepted quantity for each pay item, measured in accordance with **Subsection 810.5**, is determined using the contract unit bid price for the applicable pay item, and the payment includes all direct and indirect costs and expenses necessary to complete the work.
- 2 Payment for Permanent Vegetation or Temporary Vegetation is full compensation for furnishing and placing vegetative materials (including fertilizer,



lime, and nitrogen when called for) as specified or directed and includes all other materials, labor, equipment, tools, supplies transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

- 3 Payment for Temporary Seeding, Seeding (Unmulched), or Seeding (Mulched) is full compensation for furnishing and placing all seeding materials (excluding fertilizer, lime, nitrogen, and selected material for shoulders and slopes) as specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract. Payment will not exceed 90% of the contract unit bid price for these items until a satisfactory stand of grass meeting the requirements of **Subsection 810.4.3** is established.
- 4 Payment for Interseeding is full compensation for interseeding an area as specified or directed and includes furnishing and placing seeds; aerating the existing turf; providing and applying herbicide and nonionic surfactant (if required with herbicide); and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 5 Payment for Fertilizer, Lime, or Nitrogen is full compensation for furnishing and applying fertilizer, lime, or nitrogen as specified or directed and includes all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 6 Payment for Mowing is full compensation for mowing vegetation to an acceptable height in areas as specified or directed and includes all other materials, labor, equipment tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract. No adjustment in unit price will be made in case of overruns or underruns of this item.
- 7 Payment Organic Topsoil is full compensation for furnishing and placing organic topsoil as specified or directed and includes all other materials, labor, equipment, tools, supplies and transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 8 Payment for each item includes all direct and indirect costs and expenses necessary to complete the work.
- 9 Pay items for this section include the following:

Item No.	Pay Item	Unit
8100001	Permanent Vegetation	MSY

(table continued on the next page)

(table continued from the previous page)

Item No.	Pay Item	Unit
8101000	Seeding (Mulched)	MSY
8102100	Seeding (Unmulched)	MSY
8102700	Interseeding	MSY
8103000	Temporary Seeding	MSY
8103100	Temporary Vegetation	MSY
8104100	Fertilizer (10-10-10)	TON
8104200	Fertilizer (8-8-8)	TON
8104300	Fertilizer (16-4-8)	TON
8104400	Fertilizer (15-0-15)	TON
8104410	Fertilizer (15-15-15)	TON
8105000	Lime	TON
8106000	Nitrogen	LB
8109900	Mowing	MSY
8101100	Organic Topsoil	CY

## SECTION 815

### EROSION CONTROL

#### 815.1 Description

- 1 This section contains specifications for the materials, equipment, construction, measurement, and payment for the placement of temporary erosion control measures to prevent erosion and water pollution through the use of best management practices including the use of berms, silt basins, silt ditches, sediment dams, fiber roving, rolled erosion control products, silt fences, floating turbidity barriers, brush barriers, sediment tubes, inlet filters, bonded fiber matrix, flexible growth matrix, temporary flexible pipe slope drains, temporary seeding, and stabilized construction entrances in conformity with the Plans the Specifications, *SCDOT Standard Drawings*, or as directed by the RCE.

#### 815.1.1 Erosion Control Device Applications

##### 815.1.1.1 Rolled Erosion Control Products (RECP)

##### 815.1.1.1.1 Temporary Erosion Control Blankets

- 1 Erosion control blanket will be designated on the Plans or by the RCE. The following criteria will be followed to select the type of blanket utilized:
  - Install Type A temporary erosion control blankets on slopes 2H:1V or flatter only. For slopes greater than 2H:1V, use turf reinforcement matting (TRM).
  - Install Type B temporary erosion control blankets on channels or concentrated flow areas with a maximum calculated design shear stress less than or equal to 1.75 lbs/ft<sup>2</sup>. For channels and concentrated flow areas with design shear stresses greater than 1.75 lbs/ft<sup>2</sup>, use TRM.
  - Install Type C temporary erosion control blankets on areas where the establishment of temporary erosion control is critical and seeding needs additional reinforcement. Use temporary blankets for anionic polyacrylamide applications on slopes 2H:1V or flatter.

##### 815.1.1.1.2 Turf Reinforcement Matting (TRM)

- 1 Turf reinforcement matting will be designated on the Plans or by the RCE. The following criteria will be followed to select the type of TRM utilized:
  - Install a Type 1 TRM on slopes 2H:1V or flatter or in channels where the calculated design shear stress is 4.0 lbs/ft<sup>2</sup> or less and the design flow velocity reaches a value up to 10-ft/sec.
  - Install a Type 2 TRM on slopes 1.5H:1V or flatter or in channels where the calculated design shear stress is 6.0 lbs/ft<sup>2</sup> or less and a design flow velocity reaches a value up to 15-ft/sec.
  - Install a Type 3 TRM on slopes 1H:1V or flatter or in channels where the calculated design shear stress is 8.0 lbs/ft<sup>2</sup> or less and the de-

sign flow velocity reaches a value up to 20-ft/sec.

- Install a Type 4 TRM on slopes 1H:1V or greater or in channels where the calculated design shear stress is up to 12 lbs/ft<sup>2</sup> and the design flow velocity reaches a value up to 25-ft/sec, and when field conditions exist with high loading and/or high survivability requirements.

#### **815.1.1.2 Sediment Tubes**

- 1 Sediment tubes are temporary erosion control devices installed along contours, in drainage conveyance swales, and around drainage inlets to reduce the effects of soil erosion and to retain sediment. Locations for installation will be designated on the Plans or by the RCE.

#### **815.1.1.3 Inlet Structure Filters**

- 1 Inlet structure filters are temporary erosion control devices installed around pipe inlet structures to trap sediment and keep silt, sediment, and construction debris from entering pipe systems through open inlet structures. Additionally, inlet structure filters are used to prevent the silting-in of inlets, storm drainage systems, and receiving channels. Locations for installation will be designated on the Plans or by the RCE.
- 2 The criteria for the use of Inlet Structure Filter Types A, B, D, E, and F are identified in **Subsections 815.1.1.3.1 through 815.1.1.3.5.**

##### **815.1.1.3.1 Type A Low Flow Inlet Filters**

- 1 Install a Type A low flow inlet filter for inlets with a peak flow rate less than 1 ft<sup>3</sup>/sec, the inlet drain area grade is less than 5%, and the immediate drainage area (5-foot radius around the inlet) grade is less than 1%. Do not use for areas receiving concentrated flow.

##### **815.1.1.3.2 Type B Medium Flow, Low Velocity Inlet Filters**

- 1 Install a Type B medium flow, low velocity inlet filter for inlets with a peak flow rate less than 3 ft<sup>3</sup>/sec, the inlet drain area grade is less than 5%, and the flow velocity to the inlet does not exceed 3 ft/sec. Use this type of filter where an overflow capacity is not required to prevent excessive ponding around the structure.

##### **815.1.1.3.3 Type D High Flow, High Velocity Inlet Filters**

- 1 Install a Type D high flow, high velocity inlet filter for a drainage area up to 2 acres with peak flow rates greater than 3 ft<sup>3</sup>/sec, the inlet drain area grade is greater than 5%, and the flow velocity to the inlet may exceed 3 ft/sec. Use Type D1 filters for median applications. Use Type D2 for sump applications. Use Type D1 or D2 filters where an overflow capacity is required to prevent excessive ponding around the structure and to protect inlet structures not associated with curb inlets. Use to protect structure inlets such as Catch Basin Type 9, yard inlets, Drop Inlet 24 inches by 24 inches, Drop Inlet 24 inches by 36 inches, and manholes.

**815.1.1.3.4 Type E Surface Course Curb Inlet Filters**

- 1 Install a Type E surface course curb inlet filter to protect Catch Basin Types 1, 16, 17, and 18 after the road surface course is placed.

**815.1.1.3.5 Type F Inlet Tubes**

- 1 Type F inlet tubes are classified into two categories: weighted and non-weighted. Install a weighted Type F inlet tube to protect Catch Basin Types 1, 9, 12, 14, 15, 16, 17, and 18, Drop Inlet 24 inches by 24 inches, Drop Inlet 24 inches and 36 inches, manholes, and trench drains where drainage areas are less than 1 acre. Place the weighted inlet tube on gravel, concrete, asphalt, or other hard surfaces around drainage inlet. Install a weighted Type F inlet tube where construction traffic may occur around the inlet. All weighted Type F inlet structure filters are applicable as Type E inlet structure filters.
- 2 Use non-weighted Type F inlet tubes as inlet filters for Catch Basins Type 1, 16, 17, and 18 with drainage areas less than 1 acre. Place non-weighted Type F inlet tubes on subgrade and are applicable until the road base course is placed.
- 3 Use both weighted and non-weighted Type F inlet tubes as weep hole inlet filters. Use non-weighted Type F inlet tubes only where stakes can be driven into the ground or subgrade to secure the tube.

**815.1.1.4 Stabilized Construction Entrance**

- 1 Locate a stabilized construction entrance, which is a temporary stone-stabilized pad with a non-woven geotextile fabric underlining, at defined points of vehicular ingress and egress on construction sites to reduce the amount of mud, dirt, and rocks transported onto public roads by motor vehicles, equipment, and runoff. Taper the edges of the entrance out towards the road to prevent tracking of mud at the edge of the entrance, and so that long vehicles do not leave the stabilized area when turning onto or off the paved roadway.

**815.1.1.5 Bonded Fiber Matrix (BFM)**

- 1 Use a bonded fiber matrix (BFM) as an allowable substitution for mulch or in temporary seeding applications and seeding applications as outlined in **Section 810**.
- 2 Install BFMs in the following situations:
  - Enhancement of temporary seeding operations to reduce erosion and expedite seed germination.
  - A high performance mulch is required for permanent seeding.
  - Seeding application takes place on highly erodible soil or slopes.
  - Slopes up to 1H:1V.
  - The required functional longevity of soil protection is 6 months or less.
  - The soil is dry and rain is not expected within 48 hours after application.

- There is a high degree of certainty that heavy rains will not follow application.
- 3 Do not use a BFM as Type A temporary erosion control blanket, channel liners, or in areas receiving concentrated flow.

#### **815.1.1.6 Flexible Growth Matrix (FGM)**

- 1 Install a flexible growth matrix (FGM) in the following situations:
- As a Type A temporary erosion control blanket,
  - On slopes up to 2H:1V.
  - As an infill for a TRM on slopes greater than 2H:1V.
  - Environmentally sensitive wetlands and other wildlife areas not compatible for products containing netting.
  - The site requires strong mechanical and chemical bonds to withstand greater surface flow and/or severe slopes.
  - The required functional longevity of soil protection is up to 1-year.
  - The site requires immediate erosion protection and there is a risk of impending weather.
  - Fast vegetation establishment is required.
  - A high factor of design safety is required.
- 3 Do not use an FGM as a channel liner or for areas receiving concentrated flow.

### **815.2 Materials**

#### **815.2.1 Rolled Erosion Control Products (RECP)**

##### **815.2.1.1 Temporary Erosion Control Blankets**

- 1 When not used with polyacrylamide slope applications, provide temporary erosion control blankets with a core composed primarily of biologically, photochemically or otherwise degradable constituents such as wheat straw, coconut fiber, straw-coconut blends, or aged curled excelsior wood fiber with longevity of approximately 1 to 3 years.
- 2 Ensure that the core is enclosed in double netted matting (i.e., matting with netting on both sides of the blanket) composed of non-organic, photodegradable, or biodegradable polypropylene netting. Ensure that the top netting consists of degradable polypropylene with a maximum mesh opening of 0.75 inch by 0.75 inch, and the bottom netting consists of degradable polypropylene with a maximum mesh opening of 0.50 inch by 0.50 inch. Ensure that netting is stitched together at not more than 2 inches on center. For blankets composed of aged curled excelsior wood fiber, ensure that both the top and bottom netting consist of degradable polypropylene with a maximum mesh opening of 1.0 inch by 1.0 inch and that it consists of aged curled excelsior wood interlocking fibers with 80% of the fibers a minimum of 6 inches long. Ensure that the netting is stitched together at not more than 2 inches on cen-

ter. Do not use jute netting.

- 3 Provide Class A and Class B temporary erosion control blankets with physical properties derived from quality control testing performed by a laboratory accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) and conforming to the following Minimum Average Roll Values (MARV) shown in the following table.

Temporary Erosion Control Blankets	
Physical Properties	MARV
Minimum mass per unit area (ASTM D 6475)	6 oz/yd <sup>2</sup>
Minimum thickness (ASTM D 6525)	0.25 inch
Minimum initial grab tensile strength (ASTM D 6818)	75 x 75 lbs/ft
Minimum roll width	48 inches
Note: For Class B channel applications, a minimum unvegetated shear stress of 1.0 lbs/ft <sup>2</sup> based on short-term peak flow duration of 0.5 hour is required.	

#### 815.2.1.2 Temporary Erosion Control Blankets for Polyacrylamide Slope Applications

- 1 Provide a Class C temporary erosion control blanket for anionic polyacrylamide slope application that is a uniform organic temporary erosion control blanket composed of jute netting or curled excelsior wood fiber or coconut fiber blankets. Do not use blankets containing straw or straw/coconut blends. Ensure that slopes are 2H:1V or flatter for this application.
- 2 For a polyacrylamide slope application, provide a Type C temporary erosion control blanket with physical properties derived from quality control testing performed by a GAI-LAP accredited laboratory and conforming to the following Minimum Average Roll Values (MARV) shown in the following tables.

Jute Netting	
Uniform, open, plain weave netting using un-dyed and unbleached loosely twisted construction yarn that does not vary in thickness by more than 0.5 its normal diameter.	
Minimum roll width	48-inches
Minimum thickness (ASTM D 1777)	0.25 inch
Yarn Warp Count (ASTM D 3775)	19.5 minimum per 1 foot of width
Yarn Weft Count (ASTM D 3775)	14.0 minimum per 1 foot of width

(table continued on the next page)

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<b>Jute Netting</b>	
Minimum mass per unit area (ASTM D 3776)	6 oz/yd <sup>2</sup>
Minimum dry grab tensile strength (ASTM D 4632)	300 x 175 lbs/ft
Minimum wet grab tensile strength (ASTM D 4632)	125 x 65 lbs/ft
Minimum open area	50%
Minimum openings	Approx. 0.5 to 1.0 inch in width and length
<b>Excelsior Blankets</b>	
Double-netted blanket consisting of curled excelsior wood interlocking fibers with 80% of the fibers a minimum of 6-inches long forming a degradable netting with a maximum mesh opening of 1.0 inch by 1.0 inch.	
Minimum roll width	48 inches
Minimum thickness (ASTM D 6525)	0.25 inches
Minimum mass per unit area (ASTM D 6475)	6 oz/yd <sup>2</sup>
MD-Tensile strength (ASTM D 5035)	120 lbs/ft
TD-Tensile strength (ASTM D 5035)	70 lbs/ft
Maximum MD-Elongation (ASTM D 5035)	30%
Maximum TD-Elongation (ASTM D 5035)	20%
<b>Coconut Blankets</b>	
Double-netted blanket consisting of 100% coconut fiber forming degradable netting with a maximum mesh opening of 0.75 inch by 0.75 inch.	
Minimum roll width	48 inches
Minimum thickness (ASTM D 6525)	0.25 inches
Minimum mass per unit area (ASTM D 6475)	6 oz/yd <sup>2</sup>
MD-Tensile strength (ASTM D 4595)	190 lbs/ft
TD-Tensile strength (ASTM D 4595)	190 lbs/ft
Maximum MD-Elongation (ASTM D 4595)	20%
Maximum TD-Elongation (ASTM D 4595)	20%



### **815.2.1.3 Turf Reinforcement Matting (TRM)**

#### **815.2.1.3.1 Type 1**

- 1 Provide a Type 1 TRM consisting of a web of mechanically or melt bonded polymer netting, monofilaments or fibers entangled to form a strong three-dimensional stable net structure utilizing bonding methods including polymer welding, thermal or polymer fusion or the placement of fibers between two high-strength biaxial oriented nets mechanically bound by parallel stitching with polyolefin thread. The RCE may allow a degradable fiber matrix to be used to provide immediate coverage for bare soil.

#### **815.2.1.3.2 Type 2**

- 1 Provide a Type 2 TRM consisting of a web of mechanically or melt bonded polymer netting, monofilaments or fibers that are entangled to form a strong three-dimensional stable net structure utilizing bonding methods including polymer welding, thermal or polymer fusion or the placement of fibers between two high-strength biaxial oriented nets mechanically bound by parallel stitching with polyolefin thread. The RCE may allow a degradable fiber matrix to provide immediate coverage for bare soil.

#### **815.2.1.3.3 Type 3**

- 1 Provide a Type 3 TRM consisting of a web of mechanically or melt bonded polymer netting, monofilaments or fibers that are entangled to form a strong three-dimensional stable net structure utilizing bonding methods including polymer welding, thermal or polymer fusion or the placement of fibers between two high-strength biaxial oriented nets mechanically bound by parallel stitching with polyolefin thread. Do not use a TRM manufactured from discontinuous or glued netting in this category. Ensure that the material is 100% synthetic and resistant to biological, chemical, and ultraviolet degradation.

#### **815.2.1.3.4 Type 4 (High Survivability)**

- 1 Provide a Type 4 TRM consisting of a geosynthetic matrix that exhibits a very high interlock and reinforcement capacities with both soil and root systems, demonstrates a high tensile modulus, and is specially designed for erosion control applications on steepened slopes and vegetated waterways. Do not use a TRM manufactured from discontinuous netting, netting loosely held together by stitches or glue, or composites. Ensure that the material is 100% synthetic and resistant to biological, chemical, and ultraviolet degradation. Furnish a Type 4 TRM with high loading and/or high survivability capabilities for field conditions such as long term maintenance, structural backfills protecting critical structures, utility cuts, and traffic areas with the potential for high abrasion, higher required factors of safety, and/or general durability concerns.

#### **815.2.1.3.5 Physical Properties**

- 1 Ensure that TRM materials have Minimum Average Roll Values (MARV) derived from quality control testing performed by a GAI-LAP accredited labo-

ratory and conforming to the values shown in the following table.

Turf Reinforcement Matting					
Property	Test Method	MARV for Type 1	MARV for Type 2	MARV for Type 3	MARV for Type 4 <sup>(5)</sup>
Mass per Unit Area	ASTM D 6475	6-8 oz/yd <sup>2</sup>	8-10 oz/yd <sup>2</sup>	10-12 oz/yd <sup>2</sup>	12-14 oz/yd <sup>2</sup>
Thickness	ASTM D 6525	0.25 inches	0.35 inches	0.40 inches	0.40 inches
Grab Tensile Strength <sup>(1)</sup>	ASTM D 6818	145 x 110 lbs/ft	170 x 130 lbs/ft	400 x 300 lbs/ft	3100 x 1500 lbs/ft
Tensile Elongation <sup>(1)</sup>	ASTM D 6818	50% (max)	50% (max)	50% (max)	55% (max)
UV Resistance <sup>(2)</sup>	ASTM D 4355	80 % @ 1000 hrs	80 % @ 1000 hrs	80% @ 1000 hrs	90 % @ 1000 hrs
Ground Cover Factor <sup>(3)</sup>	Light Projection Analysis	60%	70%	70%	75%
Slopes	--	2H:1V or Flatter	1.5H:1V or Flatter	1H:1V or Flatter	1H:1V or Greater
Short-term Vegetated Velocity <sup>(4)</sup>	--	< 10 ft/sec	10 to 15 ft/sec	15 to 20 ft/sec	20 to 25 ft/sec
Shear Stress <sup>(4)</sup>	--	0 – 4 lbs/ft <sup>2</sup>	4 – 6 lbs/ft <sup>2</sup>	6 – 8 lbs/ft <sup>2</sup>	8 – 12 lbs/ft <sup>2</sup>
Notes: 1. Values of both machine and cross machine directions, respectively, under dry or saturated conditions. 2. Tensile strength retained of structural components after exposure. 3. Ground cover factor represents "% shade" from lumite light projection test. 4. Maximum permissible design values based on short-term (0.5-hr), vegetated data obtained at SCDOT-approved independent hydraulics testing facility on an erodible soil bed and/or by Colorado state university hydraulics laboratory or the Texas DOT's Texas Transportation Institute (TTI) hydraulics and erosion control laboratory for "flexible channel liner applications." 5. High factor of safety and high survivability required.					

**815.2.1.4 Quality Assurance Sampling, Testing, and Acceptance**

- 1 Ensure that the RECP meets the requirements of the standards given in this specification or the approved industry equivalent.
- 2 Sample and test the RECP to verify conformance with this specification. Sample in accordance with ASTM D 4354.
- 3 Acceptance of the RECP is granted in accordance with ASTM D 4759 based on testing performed by GAI-LAP accredited laboratory of either conformance samples obtained using Procedure A of ASTM D 4354 or based on the manufacturer's certification and testing of quality control samples obtained using Procedure B of ASTM D 4354.
- 4 Quality Assurance sampling and testing is waived for products manufactured at an ISO 9002 certified manufacturing facility. Provide documentation of ISO 9002 certification upon request.
- 5 Provide an RECP from the list in the most recent edition of **SCDOT Qualified Product Lists 55** and **56** in the appropriate category.

**815.2.1.5 Manufacturing Quality Control**

- 1 For TRM Types 1, 2, 3 and 4, perform the Manufacturing Quality Control (MQC) testing at a GAI-LAP accredited laboratory at the frequency in ASTM D 4354 with the exceptions indicated by the following minimum acceptable testing frequency in the following table.

Testing Requirements for TRM Type 1, 2, 3, and 4		
Property	Test Method	Test Frequency tests/m <sup>2</sup> (tests/yd <sup>2</sup> ) of production
Mass Per Unit Area	ASTM D 6475	1/20,000 (1/24,000)
Tensile Strength	ASTM D 6818	1/20,000 (1/24,000)
Tensile Elongation	ASTM D 6818	1/20,000 (1/24,000)
Ground Cover Factor	Light Projection Analysis	1/20,000 (1/24,000)

- 2 Obtain and furnish to the RCE a certification signed by a responsible representative of the manufacturer within 24 hours of each truckload or shipment of material delivered to the construction site.

**815.2.2 Fiber Roving****815.2.2.1 Type A Fiberglass Roving**

- 1 Provide fiberglass roving consisting of fiberglass material formed from continuous fibers drawn from molten glass, coated with a chrome-complex sizing compound, collected into strands, and lightly bound together into a roving without the use of a binding agent or other deleterious substances. Ensure that the roving is wound into a package such that the material can be continu-

**815.2.2.1****815.2.3.1**

ously withdrawn using a compressed air ejector to expand the fiber roving into a mat on the soil surface.

- 2 Furnish an electrical grade fiberglass roving material meeting the requirements indicated in the following table.

<b>Requirements for Type A Fiberglass Roving</b>		
<b>Physical Property</b>	<b>Limits</b>	<b>Test Methods</b>
Strands / Rove	50 - 70	End Count
Fiber Diameter, inches (Nominal)	0.00035 - 0.00045	ASTM D 578
Yards/lb. of Rove	170 - 300	ASTM D 578

**815.2.2.2 Type B Polymer Roving**

- 1 Provide material formed from continuous strands of fibrillated polymer yarns, collected into a roving without the use of a binding agent or other deleterious substances. Fibrillation is defined as a net-like physical structure of the yarn created by splitting the yarn in a precise pattern during the manufacturing process. Provide roving that is packaged so that it can be continuously withdrawn using a compressed air ejector to expand the roving into a mat of polymer fibers on the soil surface.
- 2 Furnish Type B polymer roving that meets the physical property requirements indicated in the following table.

<b>Requirements for Type B Polymer Roving</b>		
<b>Physical Property</b>	<b>Limits</b>	<b>Test Methods</b>
Strands/Rove	20 - 30	End Count
Yards/lbs of Rove	170 - 520	ASTM D 1907
Organic Content % Max.	1.0	ASTM D 1907
UV Stability	70% Strength Retained	ASTM D 4355

**815.2.3 Sediment Tubes****815.2.3.1 Sediment Tubes for Ditch Checks**

- 1 Provide a sediment tube for ditch checks produced by a manufacturer experienced in sediment tube manufacturing. Ensure that the sediment tube is composed of compacted geotextile, curled excelsior wood fiber, natural coconut fiber, hardwood mulch, or a mixture of these materials enclosed by a flexible netting material and utilize an outer netting that consists of seamless, high-density polyethylene, photodegradable material treated with ultraviolet stabilizers or a seamless, high-density polyethylene, non-degradable material.

**815.2.3.1****815.2.3.2**

- 2 Do not use straw, straw fiber, straw bales, pine needles and/or leaf mulch.
- 3 Do not use curled excelsior wood fiber or natural coconut fiber rolled erosion control products (RECP) rolled up to create a sediment tube device.
- 4 Furnish steel posts minimum of 48 inches long and meeting the minimum physical requirements specified in **Subsection 815.2.12**.
- 5 Provide sediment tubes for ditch check applications that meet the following minimum performance requirements indicated in the following table.

<b>Minimum Performance Requirements for Sediment Tubes</b>		
<b>Property</b>	<b>Test Method</b>	<b>Value</b>
Diameter	Field Measured	18.0 inch minimum 24.0 inch maximum
Mass per Unit Length	Field Measured	3.0 lbs/ft $\pm$ 10% for 18-inch diameter or 4.0 lbs/ft $\pm$ 10% for 24-inch diameter
Fiber Length	Field Measured	80% of the fiber materials at least 4 inches in length
Length per Tube	Field Measured	10 foot minimum *
Netting Unit Weight	Certified	0.35 oz/ft minimum
* Select a length to minimize the number of sediment tubes needed. If the ditch check length (perpendicular to the water flow) is 15 feet, then one 15-foot sediment tube is preferred over two overlapped 10-foot sediment tubes.		

**815.2.3.2 Quality Assurance**

- 1 Before installation of sediment tubes, provide the following information from the manufacturer:
  - Written Quality Control program conforming to the requirements of **Subsection 815.2.3.3**.
  - Documentation of field and/or laboratory testing that quantifies the erosion control and sediment retention performance of the products conforming to the requirements of **Subsection 815.2.3.3**.
  - Guarantee that the products perform to the minimum performance standards under the specific conditions stated in this specification.
- 2 Ensure that each sediment tube bears complete identification including, but not limited to, the following:
  - Manufacturer's name and location,
  - Manufacturer's telephone number and fax number,
  - Manufacturer's e-mail address and web address, and

### 815.2.3.2

### 815.2.4.2.1

- Sediment tube name, model, and/or serial number.
- 3 Furnish sediment tubes from the most recent edition of *SCDOT Qualified Product List 57*.

#### 815.2.3.3 Quality Control

- 1 Before installation of sediment tubes, provide the following information from the manufacturer:
- Written description of the manufacturer's Quality Control program of field and/or laboratory testing that quantifies the performance of the product. Performance testing must take place at a laboratory accredited to perform tests required for the product tested.
  - Instructions on the proper installation and maintenance of the sediment tube.
  - Certification of the testing requirements upon request.
- 2 Provide verification of conformance with manufacturer's published specifications, the certification, which at a minimum, identifies the following:
- Independent qualified test facility,
  - Manufacturer,
  - Product ID,
  - Test ID, and
  - Test date.

### 815.2.4 Inlet Filters

#### 815.2.4.1 Type A Low Flow Inlet Filters

##### 815.2.4.1.1 Filter Fabric Inlet Protection

- 1 Provide filter fabric from the most recent edition of *SCDOT Qualified Product List 34*.
- 2 Furnish steel posts a minimum of 60 inches long and meeting the minimum physical requirements specified in **Subsection 815.2.12**.
- 3 Provide heavy-duty plastic ties to attach the fabric to posts.

##### 815.2.4.1.2 Sediment Tubes

- 1 Refer to the **Subsection 815.2.3** for sediment tube material and performance requirements. Provide sediment tubes from the most recent edition of *SCDOT Qualified Product List 57*.

#### 815.2.4.2 Type B Medium Flow, Low Velocity Inlet Filters

##### 815.2.4.2.1 Hardware Fabric and Stone Inlet Protection

- 1 Provide hardware fabric or comparable wire mesh with maximum openings of 0.5 inch x 0.5 inch as the supporting material.

**815.2.4.2.1****815.2.4.3**

- 2 Furnish steel posts a minimum of 36 inches long and meeting the minimum physical requirements for steel post specified in **Subsection 815.2.12**.
- 3 Provide heavy-duty plastic ties to attach the wire mesh material to posts. Place aggregate No. 5 washed stone against the hardware fabric on all sides.

**815.2.4.3 Type D High Flow, High Velocity Inlet Filters**

- 1 Provide a Type D high flow, high velocity inlet filter composed of a geotextile fabric connected to a rigid structure that completely surrounds the inlet, where the geotextile fabric is non-biodegradable and resistant to degradation by ultraviolet exposure and to contaminants commonly encountered in storm water. Ensure that the rigid structure is composed of high molecular weight, high-density polyethylene copolymer with a UV inhibitor. Provide a rigid structure that is reusable and recyclable.
- 2 Provide an inlet filter using filter fabric constructed of 100% continuous polyester non-woven engineering fabric and conforms to the guidelines in ASTM D 1117. Ensure that the filter fabric is fabricated to provide a direct fit adjacent to the associated rigid structure and is capable of reducing effluent sediment concentrations by not less than 80% under typical sediment migration conditions.
- 3 Provide a Type D high flow, high velocity inlet filter that has a two-stage design. Ensure that the first stage conveys normal flows at a minimum clean water flow rate of 100 gallons per minute per square foot, and the second stage conveys high flow rates with a minimum apparent opening of 0.5 inch per square inch (No. 12 standard sieve opening). Ensure that the Type D1 inlet structure filter has a first stage with a minimum height of 9 inches and a maximum height of 12 inches in order to allow greater overflow capacity and to prevent ponding in the median.
- 4 Provide a filter fabric with the following Minimum Average Roll Values (MARV) properties as shown in the following table.

<b>Type D Inlet Filters</b>			
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>MARV</b>
Weight	ASTM D 3776	oz/yd <sup>2</sup>	3.0
Grab Tensile Strength	ASTM D 4632	lbs	80
Grab Tensile Elongation	ASTM D 4632	%	50
Puncture Strength	ASTM D 4833	lbs	40

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<b>Type D Inlet Filters</b>			
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>MARV</b>
Mullen Burst Strength	ASTM D 3786	psi	150
Trapezoid Tear Strength	ASTM D 4533	lbs	30
Fabric Opening Size	ASTM D 4751	US Std Sieve (max)	50
Permittivity	ASTM D 4491	sec <sup>-1</sup>	1.5
Water Flow Rate	ASTM D 4491	gal/min/ft <sup>2</sup>	100
Ultraviolet Resistance	ASTM D 4355 (500 hrs)	%	70

- 5 Provide a high-flow, high-velocity inlet filter that has lifting devices or structures to assist in the installation and to allow inspection of the storm water system.

#### **815.2.4.4 Type E Surface Course Inlet Filters**

- 1 Furnish a Type E surface course inlet filter that has a minimum height or diameter of 9 inches and a minimum length 2 feet longer than the length of the curb opening. Do not completely block the inlet opening with surface course inlet filters.
- 2 Provide a Type E surface course inlet filter constructed with a synthetic material that allows storm water to freely flow through while trapping sediment and debris. Ensure that the geotextile is non-biodegradable, resistant to degradation by ultraviolet exposure, and resistant to contaminants commonly encountered in storm water. Do not use straw, straw fiber, straw bales, pine needles, or leaf mulch as filter materials.
- 3 Provide a Type E surface course inlet filter with aggregate compartments for stone, sand, or other weighted materials or mechanisms to hold the unit in place.
- 4 Ensure that the filter fabric of the curb inlet filter is capable of reducing effluent sediment concentrations by no less than 80% under typical sediment migration conditions and has the following Minimum Average Roll Values (MARV) for physical properties shown in the following table.



Filter Fabric Properties for Curb Inlet Filters			
Property	Test Method	Units	MARV
Weight	ASTM D 3776	oz/yd <sup>2</sup>	3.0
Grab Tensile Strength	ASTM D 4632	lbs	80
Grab Tensile Elongation	ASTM D 4632	%	50
Puncture Strength	ASTM D 4833	lbs	40
Mullen Burst Strength	ASTM D 3786	psi	150
Trapezoid Tear Strength	ASTM D 4533	lbs	30
Apparent Opening Size	ASTM D 4751	US Std Sieve (max)	50
Permittivity	ASTM D 4491	second <sup>-1</sup>	1.5
Water Flow Rate	ASTM D 4491	gal/min/ft <sup>2</sup>	100
Ultraviolet Resistance	ASTM D 4355 (500 hrs)	%	70

#### 815.2.4.5 Type F Inlet Tubes

##### 815.2.4.5.1 Weighted Inlet Tubes

- 1 Provide a Type F weighted inlet tube produced by a manufacturer experienced in sediment tube manufacturing. Provide an inlet tube composed of compacted geotextile, age curled excelsior wood fiber, natural coconut fiber, hardwood mulch, or a mix of these materials, and enclosed by a flexible netting material. Do not use straw, straw fiber, straw bales, pine needles, or leaf mulch.
- 2 Ensure that the outer netting consists of seamless, high-density polyethylene, photodegradable material treated with ultraviolet stabilizers or seamless, high-density polyethylene, non-degradable material.
- 3 Do not use a curled wood excelsior fiber or a natural coconut fiber rolled erosion control product (RECP) rolled up to create an inlet tube device.
- 4 Provide a Type F weighted inlet tube that is a sediment tube capable of staying in place without external stabilization measures and has a weighted inner core or other weighting mechanism to keep it in place. Provide a weighted inlet tube that meets the minimum requirements shown in the following table.

Minimum Requirements for Weighted Inlet Tubes		
Property	Test Method	Value
Diameter	Field Measured	6.0 inch to 12.0 inch
Mass per Unit Length	Field Measured	6 inch = 6 lbs/ft min. 12 inch = 12 lbs/ft min.
Fiber Length	Field Measured	80% of the fiber materials at least 4-inches in length
Length per Tube	Field Measured	6 foot minimum
Netting Unit Weight	Certified	0.35 oz/ft minimum

#### 815.2.4.5.2 Non-Weighted Inlet Tubes

- 1 Provide a Type F non-weighted inlet tube that is produced by a manufacturer experienced in sediment tube manufacturing, composed of compacted geotextile, curled excelsior wood fiber, natural coconut fiber, hardwood mulch, or a mixture of these materials, and enclosed by a flexible netting material. Do not use straw, straw fiber, straw bales, pine needles, or leaf mulch.
- 2 Provide a non-weighted inlet tube with outer netting that consists of seamless, high-density polyethylene, photodegradable material treated with ultra-violet stabilizers or seamless, high-density polyethylene, non-degradable material.
- 3 Do not use curled wood excelsior fiber or natural coconut fiber rolled erosion control products (i.e., RECP) rolled up to create an inlet tube device.
- 4 Provide stakes or other means to stabilize non-weighted inlet tubes to keep them safely in place. Secure non-weighted inlet tubes with wooden stakes (1 inch x 1 inch) or steel posts (1.25 lbs/linear ft) a minimum of 3 feet in length placed on 2-foot centers. Provide Type F non-weighted inlet tubes that meet the minimum requirements shown in the following table.

Minimum Requirements for Non-weighted Inlet Tubes		
Property	Test Method	Value
Diameter	Field Measured	6.0 inch to 12.0 inch
Mass per Unit Length	Field Measured	6.0 inch = 1.0 lbs/ft minimum 12.0 inch = 2.0 lbs/ft minimum
Fiber Length	Field Measured	80% of the fiber materials at least 4 inches in length
Length per Tube	Field Measured	6 feet minimum
Netting Unit Weight	Certified	0.35 oz/ft minimum

**815.2.4.6 Quality Assurance**

- 1 Before installation of inlet structure filters, provide the RCE with the following information from the manufacturer:
  - Written Quality Control program conforming to the requirements of **Subsection 815.2.4.7**.
  - Documentation of field and/or laboratory testing that quantifies the erosion control and sediment retention performance of the product conforming to the requirements of **Subsection 815.2.4.7**.
  - Guarantee that the product performs to the minimum performance standards under the specific conditions as stated in this specification.
- 2 Ensure that each inlet structure filter bears complete identification including, but not limited to, the following:
  - Manufacturer's name and location,
  - Manufacturer's telephone number and fax number,
  - Manufacturer's e-mail address and web address, and
  - Inlet structure filter, BMP, or Sediment Tube name, model, and/or serial number.
- 3 Provide an inlet structure filter from a manufacturer with a minimum of 3 years experience at manufacturing inlet structure filters for use as sediment control equipment and experienced in the installation of equivalent applications. Provide a list of at least 20 references of installations if requested by the RCE.
- 4 Provide inlet structure filters from the most recent edition of *SCDOT Qualified Product List 58* in the appropriate category.

**815.2.4.7 Quality Control**

- 1 Before installation of sediment tubes, provide the RCE with the following information from the manufacturer:
  - Written description of the manufacturer's Quality Control program of field and/or laboratory testing that quantifies the performance of the product. Performance testing must be at a laboratory accredited to perform such tests required for the product tested.
  - Instructions on the proper installation and maintenance of the inlet structure filter.
  - Certification of the testing requirements upon request.
- 2 Provide certification of the product's conformance with the required performance specifications, which at a minimum, identifies the following:
  - Independent qualified test facility,
  - Manufacturer,
  - Product ID,
  - Test ID, and

- Test date.

### 815.2.5 Silt Fences

- 1 Provide material for silt fence complying with the requirements specified herein, on the Plan details, or as approved by the RCE.

#### 815.2.5.1 Posts

- 1 Furnish steel posts a minimum of 60 inches long and meeting the minimum physical requirements specified in **Subsection 815.2.12**.
- 2 When heavy clay soils are present on site, use the steel posts specified above with the addition of a metal plate welded near the bottom so that when the post is driven to the proper depth, the plate is below the ground level for added stability. In areas where conditions warrant, larger posts or reduced post spacing may be required to provide an adequate fence to handle the stress from sediment loading.

#### 815.2.5.2 Filter Fabric

- 1 Provide a filter fabric from the most recent edition of *SCDOT Qualified Product List 34*. Ensure that the filter fabric is composed of fibers consisting of long chain, synthetic polymers composed of at least 85% by weight of polyolefins, polyesters, or polyamides. Ensure that the fibers are formed into a network so that the filaments or yarns retain dimensional stability relative to each other. Do not treat or coat the filter fabric, which might adversely alter its physical properties after installation. Do not use fabric with defects or flaws that significantly affect its physical and/or filtering properties. Provide a filter fabric with a minimum width of 36 inches.
- 2 Protect the filter fabric with a suitable wrapping for protection against moisture and extended ultraviolet exposure before placement.
- 3 Provide filter fabric meeting the following minimum physical requirements in the following table.

Minimum Requirements for Filter Fabric		
Physical Property*	Test Method	Required Value
Tensile Strength	ASTM D 4632	90 lbs.
Elongation	ASTM D 4632	<50% - fabric self supporting
Maximum Apparent Opening Size (AOS)	ASTM D 4751	0.60 mm maximum
Permittivity	ASTM D 4491	0.05 per second
Ultraviolet Stability (retained strength after 500 hrs of ultraviolet exposure)	ASTM D 4355	70%
* Unless otherwise indicated, numerical values represent the MARV.		

### 815.2.6 Floating Turbidity Barriers

- <sup>1</sup> Provide floating turbidity barrier for sediment protection for fill placed in water or areas affected by tidal flow. Provide floating turbidity barrier meeting the requirements in the following table.

Minimum Requirements for Floating Turbidity Barriers			
	Light Duty	Medium Duty	Heavy Duty
Fabric – Polyester Reinforced Vinyl (oz/yd <sup>2</sup> )	18	22	22
Flotation <sup>(1)</sup> (lbs/ft)	13	22	22
Top Load Cable	---	---	10,000 lbs ( <sup>5</sup> / <sub>16</sub> inch, galvanized)
Stress Plates	---	---	<sup>5</sup> / <sub>8</sub> inch Polypropylene
Rope Retainer	<sup>5</sup> / <sub>8</sub> inch Polypropylene	<sup>5</sup> / <sub>8</sub> inch Polypropylene	<sup>5</sup> / <sub>8</sub> inch Polypropylene
Grommets	#4 Brass	#4 Brass	#4 Brass
Seams Heat Welded	Yes	Yes	Yes
Bottom Load Chain	0.63 lbs/ft (min) ( <sup>1</sup> / <sub>4</sub> inch, galvanized)	0.95 lbs/ft (min) ( <sup>5</sup> / <sub>16</sub> inch, galvanized)	0.95 lbs/ft (min) ( <sup>5</sup> / <sub>16</sub> inch, galvanized)
Connecting Hardware	Galvanized Steel	Galvanized Steel	Galvanized Steel
Standard Depth	5 ft.	5 ft.	5 ft.
Standard Length <sup>(2)</sup>	50 & 100 ft.	50 & 100 ft.	50 & 100 ft.
Notes: (1) Flotation for barriers of depths greater than 10 feet is to be 60 pounds per foot. Flotation must be sufficient to maintain the top of the barrier at an elevation 3 inches above the water. (2) The maximum length for barriers of depth greater than 10 feet is 50 feet.			

- <sup>2</sup> If specified, provide buoys complying with the South Carolina Department of Natural Resources *Marine Law Enforcement Buoy Specifications* in conjunction with the floating turbidity barrier.

**815.2.7 Corrugated Metal Pipe for Sediment Dams**

- 1 Provide corrugated metal pipe complying with the applicable requirements of **Section 714**.

**815.2.8 Temporary Seeding**

- 1 Provide materials conforming to the applicable requirements of **Section 810**.

**815.2.9 Stabilized Construction Entrance**

- 1 Provide a stabilized construction entrance composed of the following materials:
- Non-woven geotextile fabric.
  - No. 1 aggregate (see ASTM C 33) with the gradation in the following table.

<b>Gradation Table for Stabilized Construction Entrance Material</b>	
<b>Nominal Size (Sieves With Square Openings)</b>	<b>Percent Passing</b>
4 inch	100
3½ inch	90 to 100
2½ inch	25 to 60
1½ inch	0 to 15
¾ inch	0 to 5

- 2 Provide a non-woven geotextile fabric that meets the requirements of **Subsection 804.2.11**.

**815.2.10 Bonded Fiber Matrix (BFM)**

- 1 Provide a bonded fiber matrix (BFM) from the most recent edition of *SCDOT Qualified Product List 65* and is composed of long non-toxic, degradable, strand fibers held together by cross-linked hydrocolloid bonding agents that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil. Use a BFM that does not form a water-insensitive crust that can inhibit plant growth. Provide a BFM that is completely photodegrade or biodegrade. Do not use materials listed or used for hydro-mulching applications, or organic and mineral bonding agents such as dry polyacrylamide, starch, guar, and plantago mixed with fibers. Seed, lime, and fertilizer may be added to the BFM mixture according to the requirements of **Section 810**.
- 2 Provide a BFM meeting the following requirements:
- Passed a free liquid quality control test when mixed as liquid slurry (liquids separate from fibrous solids no greater than 1-inch per minute as measured on a standard test board).

- Does not dissolve or disperse upon re-wetting.
- Has no holes greater than 1 mm in size.
- Has no gaps between the BFM and the soil.
- Has minimum water holding capacity of 1000g per 100g (1000%).
- Has no germination or growth inhibiting factors and does not form a water-resistant crust.

- 3 Furnish BFM components pre-packaged by the manufacturer to assure material performance and compliance with the following typical values in the following tables when applied at a rate of 3500 pounds per acre.

BFM Properties	
Property	Required Value
Wood Fiber by Weight	85% ± 5%
Bonding Agent/Crosslinked Hydro-Colloid Polymer Tackifiers	10% ± 1%
Moisture Content	12% ± 3%
Organic Matter	95% minimum
pH Range	4.8 ± 2
Color	Colored to contrast application area, does not stain concrete or painted surfaces

BFM Properties and Test Methods		
Property	Test Method	Required Value
Mass Per Unit Area	ASTM D 6566	11.5 oz/yd <sup>2</sup>
Thickness	ASTM D 6525	0.10 inch minimum
Ground Cover	ASTM D 6567	99%
Water Holding Capacity	Proposed ASTM	1000%
Functional Longevity	Observed	Up to 6 months
Cover Factor (6 in/hr event)	ECTC Test Method #2	0.10 maximum
% Effectiveness	ECTC Test Method #2	90% minimum
Cure Time	ECTC Test Method #2	98% effective 48 hours after application
Vegetation Establishment	ECTC Test Method #4	350% minimum

- 4 Provide BFM from manufacturer listed on the most recent edition of *SCDOT Qualified Product List 65* and provide documentation of testing at an

approved independent laboratory demonstrating performance based on reduced water runoff, reduced soil loss, and enhanced plant germination.

#### 815.2.11 Flexible Growth Matrix (FGM)

- 1 Provide a flexible growth matrix (FGM) that combines both chemical and mechanical bonding techniques to lock the engineered matrix in place. Provide a FGM that is hydraulically applied and is a flexible erosion control matrix composed of long strands of thermally processed wood fibers, crimped man-made and organic interlocking fibers, and performance enhancing additives that forms a lofty, interlocking matrix, which creates air space and water-absorbing cavities that improves seed germination, reduces the impact of raindrop energy, and minimizes soil loss.
- 2 Furnish a FGM that requires no curing period and, when applied, uses water insoluble tackifiers and flocculants to form an intimate bond with the soil surface to create a continuous erosion resistant matrix that allows rapid germination and accelerated plant growth. Do not use materials listed or used for hydro-mulching applications. Do not use organic and mineral bonding agents such as dry polyacrylamides, starch, guar, and plantago mixed with fiber.
- 3 Seed, lime, and fertilizer may be added to the FGM mixture according to **Section 810**. Furnished FGM components pre-packaged by the manufacturer to assure material performance and compliance with the following typical values when applied at a rate of 3500 pounds per acre.
- 4 Ensure that the FGM provided meets the requirements in the following tables.

Flexible Growth Matrix	
Property	Value
Wood Fiber by Weight	85% ± 3%
Cross-linked Hydro-Colloid Polymer Tackifiers	10% ± 1%
Crimped Inter-Locking Fibers	5% ± 1%
Moisture Content	12% ± 3%
Color	Colored to contrast application area, does not stain concrete or painted surfaces

Flexible Growth Matrix Properties and Test Methods		
Property	Test Method	Value
Mass Per Unit Area	ASTM D 6566	11.5 oz/yd <sup>2</sup>

(table continued on the next page)



(table continued from the previous page)

Flexible Growth Matrix Properties and Test Methods		
Property	Test Method	Value
Thickness	ASTM D 6525	0.15 inch minimum
Ground Cover	ASTM D 6567	99%
Water Holding Capacity	Proposed ASTM	1500%
Flexural Rigidity (wet)	ASTM D 6575	5 oz-yd maximum
Functional Longevity	Observed	Up to 1 year
Cover Factor (6 in/hr event)	ECTC Test Method #2	0.01 maximum
% Effectiveness	ECTC Test Method #2	99% minimum
Cure Time	ECTC Test Method #2	98% effective 2 hours after application
Shear Stress	ECTC Test Method #3	0.75 lbs/ft <sup>2</sup> minimum
Vegetation Establishment	ECTC Test Method #4	500% minimum

- 5 Provide a FGM from a manufacturer listed on the most recent edition of *SCDOT Qualified Product List 66* and provide documentation of testing at an approved independent laboratory demonstrating performance based on reduced water runoff, reduced soil loss, and enhanced plant germination.

#### 815.2.12 Steel Posts

- 1 Provide steel posts for use with inlet structure filters, sediment tubes, and silt fences meeting the following minimum physical requirements:
- Composed of high strength steel with minimum yield strength of 50,000 psi.
  - Standard "T" cross-section with a nominal face width of 1.38 inches and nominal "T" length of 1.48 inches.
  - Weighs 1.25 pounds per foot ( $\pm 8\%$ )
  - Painted with water based baked enamel paint.

#### 815.2.13 Temporary Pipe Slope Drains

- 1 Ensure that pipe for slope drains conforms to the requirements of **Subsection 803.2**.

#### 815.3 Equipment

- 1 Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

- 2 Use the following equipment for applying fiber roving and asphalt:
  - Pneumatic ejector capable of applying fiber roving at the rate of 2 pounds per minute (approximately 8 square yards per minute),
  - Air compressor capable of applying 40 cubic feet per minute at 80 to 100 psi and acceptable air base for supplying air to areas inaccessible to compressor, and
  - Asphalt distributor with hoses and hand spray bar for areas inaccessible to distributor.

## **815.4 Construction**

### **815.4.1 General**

- 1 Promptly install temporary erosion control measures when problem conditions exist or when potential problems are anticipated in certain areas in order to minimize soil erosion and siltation. Properly maintain the temporary erosion control measures until permanent erosion control features are functioning properly.
- 2 Coordinate the temporary erosion control provisions with the permanent erosion control features provided elsewhere in these specifications to the extent practical to assure economical, effective, and continuous erosion control during construction. Permanent seeding, sodding, riprap, concrete gutter, asphalt gutter, slope drains, and concrete slope protection are considered permanent erosion control items and are covered in other sections of these specifications.
- 3 Coordinate erosion control measures with the grading operations throughout the duration of the project in accordance with **Subsection 107.26**.
- 4 Use temporary erosion control measures to correct conditions where problems are anticipated or to correct conditions that develop during construction.
- 5 Remove temporary erosion control items if no longer needed in an area after establishment of permanent vegetation and completion and proper functioning of other permanent erosion control items as directed by the RCE. Restore these areas to a condition similar to the surrounding areas after removal.

### **815.4.2 Rolled Erosion Control Products (RECP)**

#### **815.4.2.1 Site Preparation**

- 1 Grade areas to be treated with RECP and compact as indicated or as directed by the RCE or the manufacturer's representative.
- 2 Remove large rocks, soil clods, vegetation, and other sharp objects that could keep the RECP from intimate contact with subgrade.
- 3 Prepare seedbed by loosening the top 2 to 3 inches of soil above final grade.

#### 815.4.2.1

#### 815.4.2.2

- 4 Select and apply soil amendments, lime, fertilizer, and seed required by the seeding plan or by the RCE or the manufacturer's representative to a scarified soil surface prior to the installation of the RECP.

#### 815.4.2.2 Installation of RECP

##### 815.4.2.2.1 General

- 1 Follow the manufacturer's installation procedures included with each RECP. If requested by the RCE, arrange for a manufacturer's representative to be on-site to oversee and approve the initial installation. Provide a letter from the manufacturer approving the installation when requested by the RCE.
- 2 Install the RECP at the elevation and the alignment indicated on the Plans.
- 3 Use stakes, pins, or staples with a minimum length of 6 inches to secure temporary erosion control blankets. Use 12-inch anchors for specific erosion control blankets in sandy, loose, or wet soils or as directed by the RCE or the manufacturer's representative.
- 4 Use stakes, pins, or staples with a minimum length of 12 inches to secure permanent TRM. Use longer anchors for specific permanent TRM in sandy, loose, or wet soils or as directed by the RCE or the manufacturer's representative.
- 5 Use the following table to determine the minimum anchoring frequency.

TRM Anchoring Requirements	
Slope Grade	Anchoring Frequency
Up to 3H:1V	1 anchor/square yard
3H:1V to 2H:1V	1.5 anchors/square yard
2H:1V to 1H:1V	2 anchors/square yard
Steeper than 1H:1V and Channel Bottoms	2.5 anchors/square yard

- 6 Obtain RCE and manufacturer's representative approval before execution of alternate installation methods to those specified herein.

##### 815.4.2.2.2 Slope Installation

- 1 At the top of the slope, construct a 6-inch (deep) x 12-inch (wide) anchor trench to inhibit undermining from stray surface water. Extend the upslope terminal end of the RECP 30 inches past the anchor trench.
- 2 Use stakes or staples to fasten the RECP material into the upslope anchor trench on 12-inch centers. Backfill the trench with soil and compact. Apply seed to the backfill soil surface and cover this area with the remaining 12 inches of the RECP terminal end. Stake or staple the terminal end down slope of the anchor trench on 12-inch centers.

- 3 Securely fasten all RECP materials to the soil by installing stakes or staples at a minimum rate of 1.5 stakes per square yard. Select anchors that have sufficient ground penetration to resist pullout. Increase the anchoring frequency if the RCE or the manufacturer's representative deems it necessary due to site conditions (i.e., loose or wet soils).
- 4 Unroll the RECP parallel to the primary direction of water flow and place in direct contact with the soil surface. Do not stretch or allow the material to bridge over surface inconsistencies. Overlap the edges of adjacent (vertically down the slope) RECP a minimum of 3 inches with the upslope roll overlapping on top of the down slope roll in shingle style.
- 5 Overlap the edges of parallel (horizontal across the slope) blankets 3 to 6 inches depending on the type of RECP used.

#### **815.4.2.2.3 Channel Installation**

- 1 Excavate anchor trenches and/or staple check slots perpendicular to the flow direction across the entire width of the channel at 25-foot intervals and at the terminal end of the channel reach.
- 2 Construct a 6-inch (deep) x 12-inch (wide) beginning anchor trench. Extend the downstream end of the RECP 30 inches past the anchor trench and use the slack RECP material to cover the backfilled soil. Fasten the RECP material into the anchor trench on 12-inch centers.
- 3 Excavate 6 inch x 6 inch check slots every 25 feet along the length of the channel.
- 4 If directed by the RCE, replace excavated check slots with a double row of staples or stakes. For staple or stake check slots, place the two rows of stakes or staples 4 inches apart and install each row of staples or stakes on 12-inch centers. Drive all stakes and staples flush with the soil surface.
- 5 Beginning at the downstream end in the center of the channel, place the initial end of the first RECP in the anchor trench, and secure it with ground anchor devices at 12-inch intervals.
- 6 Position adjacent rolls in the anchor trench in the same manner, overlapping the proceeding roll a minimum 3 inches. Secure the RECP at 12-inch intervals along the anchor trench, backfill and compact with specified soil or as directed by the RCE or the manufacturer's representative.
- 7 Unroll center strip of RECP upstream over compacted trench. Stop at next check slot or terminal anchor trench. Unroll adjacent rolls of RECP upstream in similar fashion, maintaining a 3-inch overlap.
- 8 Fold and secure the RECP snugly into transverse check slots. Lay material in bottom of the slot, then fold the material back against itself. Anchor through both layers of RECP at 12-inch intervals. Backfill with soil and compact. Continue unrolling the RECP widths upstream over compacted slot to next check slot or terminal anchor trench.

- 9 Secure RECP to channel bottom with ground anchoring devices at a frequency of 2.5 anchors per square yard. Select anchors that have sufficient ground penetration to resist pullout. Increase the anchoring frequency if the RCE or the manufacturer's representative deems it necessary due site conditions (i.e., loose or wet soils).
- 10 Cut longitudinal anchor slots 4 inches x 4 inches at the top of each slope. Fasten the RECP material into the longitudinal anchor slots on 12-inch centers.

#### **815.4.2.3 Delivery, Storage, and Handling**

- 1 Follow the requirements of ASTM D 4873 for RECP labeling, shipment and storage. Ensure that product labels clearly show the manufacturer or supplier name, style name, and roll number. Include with each shipping document a notation certifying that the material is in accordance with the manufacturer's certificate.
- 2 Wrap each RECP roll with a material that protects the geotextile from damage due to shipment, water, sunlight, and contaminants. Maintain the protective wrapping during shipment and storage.
- 3 During storage, elevate the RECP rolls off the ground and adequately cover to protect them from the following: site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F, and other environmental conditions that can damage the physical properties of RECP.

#### **815.4.2.4 Inspection and Maintenance of RECP**

- 1 Check areas protected by RECP for dislocation or failure every 7-calendar days.
- 2 Ensure that the pinning or stapling pattern is consistent with that shown on the manufacturer's installation sheet. If there is evidence that the RECP is not securely fastened to the soil, install extra pins or staples to inhibit the RECP from becoming dislodged.
- 3 Inspect regularly until grass or vegetation is firmly established.
- 4 Repair damaged areas immediately by restoring the soil on slopes or channels to its finished grade, re-applying fertilizer and seed, and replacing the appropriate RECP material as needed.

#### **815.4.2.5 Acceptance**

- 1 Obtain RCE acceptance and approval for RECP installations.

#### **815.4.3 Brush Barriers**

- 1 Install brush barriers as shown on the Plans or as directed by the RCE. Construct brush barriers from selected materials from the clearing and grubbing operation.

- 2 Construct brush barriers for erosion control measures as soon as brush is readily available from the clearing operation. Do not use the barriers in residential or commercial areas, or in areas where development is anticipated within the next few years. Construct brush barriers parallel to the toes of slopes of embankments constructed of erodible material to heights of 15 feet or more. Use brush barriers when natural ground is level or sloping away from project. Leave the brush barriers in place. Do not construct barriers at any site that has high visibility and detracts from the appearance of either the adjacent property or the completed highway.
- 3 Form the brush barriers by placing brush, limbs, small trees, and other vegetative growth in a small continuous ridge or piles as close as practicable not more than 15 feet outside of and generally parallel to the toe of the proposed embankment. Place some of the heavier material on top to secure the barrier. Intermingle the brush logs and tree limbs to prevent the formation of a solid dam and allow water to filter through it. If a gutter is proposed as a permanent erosion control measure along the toe of an embankment, place the brush barrier outside the construction limits of the gutter. Construct the barrier with mechanical equipment and "walk down" with a bulldozer to produce a barrier that is dense with relatively uniform height between 3 to 5 feet and width between 5 to 10 feet.

#### **815.4.4 Fiber Roving**

- 1 Place the fiber roving within 24 hours after performing seeding operations in accordance with **Section 810**, except do not apply mulch to the area where fiber roving is being placed.
- 2 Spread Type A fiberglass roving uniformly over the designated areas at a minimum rate of 0.30 pounds per square yard. Spread Type B polymer roving uniformly over the designated areas at a minimum rate of 0.15 pounds per square yard.
- 3 Immediately after placing the roving, anchor it to the ground with the same type asphalt material used in the seeding operation and meeting the requirements of **Section 810**. Apply the asphalt uniformly over the specified fibers at a rate of 0.25 to 0.35 gallons per square yard. At the upgrade and downgrade ends, bury the roving to a depth of 1 foot to ensure that water does not pass under the roving.

#### **815.4.5 Sediment Tubes**

##### **815.4.5.1 Site Preparation**

- 1 Remove all rocks, clods, vegetation, or other obstructions that would prevent the installed sediment tube from having direct contact with the underlying soil or surface.

##### **815.4.5.2 Installation**

- 1 If requested by the RCE, provide a manufacturer's representative on-site to oversee and approve the initial installation of sediment tubes. Provide a letter

from the manufacturer approving the installation if requested by the RCE.

- 2 Install the sediment tube by laying it flat on the ground. Construct a small trench to a depth that is 20% of the sediment tube diameter. Lay the sediment tube in the trench and compact the upstream sediment tube-soil interface. Do not completely bury the sediment tube during installation. Review all project specifications for special installation requirements. Install sediment tubes ensuring that no gaps exist between the soil and the bottom of the sediment tube. Lap the ends of adjacent sediment tubes a minimum of 6 inches to prevent flow and sediment from passing through the field joint. Never stack sediment tubes on top of one another.
- 3 Avoid damage to the sediment tube during installation. If a sediment tube becomes damaged during installation, place a stake on both sides of the damaged area, terminating the tube segment, and install a new tube segment. Perform field monitoring to verify that installation procedures do not damage sediment tubes. Replace sediment tubes damaged during installation as directed by the RCE or the manufacturer's representative at no expense to the Department.
- 4 Install sediment tubes in swales or drainage ditches perpendicular to the flow of water and extend them up the side of the slopes a minimum of 1-foot above the design flow depth. Space sediment tubes according to the following table.

Sediment Tube Spacing	
Slope	Maximum Sediment Tube Spacing
Less than 2%	150 feet
2%	100 feet
3%	75 feet
4%	50 feet
5%	40 feet
6%	30 feet
Greater than 6%	25 feet

- 5 Install sediment tubes using wooden stakes (1-inch x 1-inch) or steel posts specified in **Subsection 815.2.3.1**. Space posts or stakes 2-foot centers and drive them into the ground to a minimum depth of 2.0 feet leaving less than 1-foot of stake above the exposed sediment tube.
- 6 Intertwine the posts or stakes with the outer mesh on the downstream side
- 7 An acceptable alternative installation is driving stakes on 2-foot centers on each side of the sediment tube and connecting them with natural fiber twine or steel wire to inhibit the sediment tube from moving vertically. Sediment

tubes can also be secured by installing the stakes on 2-foot centers in a crossing manner ensuring direct soil contact at all times.

- 8 Select the sediment tube length to minimize the number of sediment tubes needed to span the width of the drainage conveyance. If the required ditch check length (perpendicular to the water flow) is 15 feet, then one 15-foot sediment tube is preferred compared to two overlapping 10-foot sediment tubes.
- 9 Install sediment tubes for ditch checks over bare soil, mulched areas or erosion control blankets. Keep sediment tubes for ditch checks in place until fully established vegetation and root systems have completely developed and can survive on their own.

#### **815.4.5.3 Delivery, Storage, and Handling**

- 1 Follow the manufacturer's written storage and handling procedures for sediment tube labeling, shipment, and storage. Clearly show the manufacturer or supplier name, sediment tube diameter and length on product labels.
- 2 Store and cover sediment tubes off the ground and cover adequately to protect them from the following: construction damage, precipitation, extended exposure to ultraviolet radiation including sunlight, on-site chemicals, flames including welding sparks, excessive temperatures, and other environmental conditions that can damage the physical properties of sediment tubes.

#### **815.4.5.4 Inspection and Maintenance of Sediment tubes**

- 1 Inspect sediment tubes after installation to ensure that no gaps exist under the sediment tubes or between the joints of adjacent ends of the sediment tubes. Inspect sediment tubes every 7 days. Repair rills, gullies, and undercutting near the sediment tubes.
- 2 Remove sediment deposits that impair the filtration capability of a sediment tube when the sediment reaches one-third of the height of the exposed sediment tubes. Remove and/or replace installed sediment tubes as required to adapt to changing construction site conditions.
- 3 When the functional longevity of the sediment tubes is exceeded as determined by the RCE or the manufacturer's representative, remove them from the site. Gather and dispose of them in regular means as non-hazardous, inert material. Before final stabilization, backfill all trenches, depressions or all other ground disturbances caused by the removal of sediment tubes.

#### **815.4.5.5 Acceptance**

- 1 Obtain RCE acceptance and approval of sediment tube installations. When requested by the RCE, ensure that a manufacturer's representative is on site to oversee and approve the initial installation of sediment tubes. Obtain a letter from the manufacturer approving the installation when requested by the RCE.



**815.4.6 Silt Fences**

- 1 Construct the silt fence in accordance with Plans or *SCDOT Standard Drawings* or as approved by the RCE. Place silt fences before the major construction in an area is started.
- 2 Maintain the silt fence until its capacity has been reached or erosion activity in the area has stabilized. Remove sediment accumulated along the fence when it reaches approximately one-third of the height of the fence, especially if heavy rains are expected. Remove trapped sediment or stabilize on site.
- 3 Inspect the silt fence every 7 days. Immediately correct any deficiencies. Remove filter fabric and replace whenever it has deteriorated to such extent that it reduces the effectiveness of the silt fence. In addition, review daily the location of silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure that the silt fences are properly located for effectiveness. Install additional silt fences as directed by the RCE where deficiencies exist.
- 4 If a silt fence or portion of a fence is located in an area where removing the sediment is not possible, then install a second silt fence, if necessary, at the discretion of the RCE. In this case, payment for both silt fences and portions involved is made at the unit price for silt fence.
- 5 Remove silt fence within 30 days after final stabilization is achieved or after temporary Best Management Practices (BMP) are no longer needed. Permanently stabilize disturbed areas resulting from fence removal. The fence materials remains the property of the Contractor and may be used at other locations provided the materials meet the appropriate requirements contained in this specification and/or on the Plans.

**815.4.7 Floating Turbidity Barriers**

- 1 Place floating turbidity barrier at the location shown on the Plans and in accordance with the manufacturer's recommendations. Anchor the ends on the undisturbed shoreline with sufficient support to secure the barrier in place during turbulent conditions. Place vertical supports and/or anchors along the barrier as necessary to prevent the barrier from drifting. Maintain the floating turbidity barrier until all disturbed areas have stabilized sufficiently to control erosion.

**815.4.8 Silt Basins**

- 1 Construct silt basins by excavating in berm ditches, parallel roadway ditches, at culvert inlets and outlets, and other locations as directed by the RCE. Construct in accordance with the Plans and the *SCDOT Standard Drawings*. Remove sediment as necessary to ensure that the basin functions properly.

**815.4.9 Silt Ditches**

- 1 Construct temporary silt ditches in accordance with the Plans and the *SCDOT Standard Drawings* at locations shown on the Plans or as directed by

the RCE. Silt ditches are generally constructed adjacent and parallel to the toe of the slope in relatively rolling areas where there is a possibility of property damage from sheet-type erosion. This type ditch is not intended to carry large volumes of water, but to catch sediment from runoff.

#### **815.4.10 Sediment Dams**

- 1 Construct temporary sediment dams in accordance with the Plans and **the SCDOT Standard Drawings** at locations shown on the Plans or as directed by the RCE.

#### **815.4.11 Inlet Structure Filters**

##### **815.4.11.1 Site Preparation**

- 1 Remove all rocks, clods, vegetation, or other obstructions so that the installed pre-fabricated inlet protection BMP has direct contact with the underlying surface.

##### **815.4.11.2 Installation**

###### **815.4.11.2.1 General**

- 1 Install inlet structure filters in accordance with the manufacturer's written installation instructions, in compliance with these specifications and with all OSHA, local, state, and federal codes and regulations.

###### **815.4.11.2.2 Type A - Low Flow Inlet Filters**

###### **815.4.11.2.2.1 Filter Fabric Inlet Protection**

- 1 Excavate a trench 6 inches deep around the outside perimeter of the inlet unless the fabric is pneumatically installed. Extend the filter fabric a minimum of 12 inches into the trench. Backfill the trench with soil or crushed stone and compact over the filter fabric unless the fabric is pneumatically installed.
- 2 Install steel posts specified in **Subsection 815.2.4.1.1**. Space the posts around the perimeter of the inlet a maximum of 3 feet apart and drive them into the ground a minimum of 24 inches.
- 3 Install the filter fabric to a minimum height of 24 inches above grade. Cut the filter fabric from a continuous roll to the length of the protected area to avoid the use of joints. When joints are necessary, wrap filter fabric together only at a support post with both ends securely fastened to the post, with a minimum 6-inch overlap. Attach fabric to the posts with heavy-duty plastic ties. Attach four evenly spaced ties in a manner to prevent sagging or tearing of the fabric. In all cases, affix ties in not less than four places.

###### **815.4.11.2.2.2 Sediment Tubes**

- 1 Install sediment tubes in accordance with **Subsection 815.4.5.2**.

###### **815.4.11.2.3 Type B - Medium Flow, Low Velocity Inlet Filters**

###### **815.4.11.2.3.1 Hardware, Fabric, and Stone Inlet Protection**

- 1 Excavate a trench 6 inches deep around the outside perimeter of the inlet.

Use hardware fabric or comparable wire mesh with maximum openings 0.5 inch x 0.5 inch as the supporting material. Extend the fabric a minimum of 6 inches into the ground. Backfill the trench with soil or crushed stone and compact over the fabric.

- 2 Install steel posts specified in **Subsection 815.2.4.2.1**. Space the posts a maximum of 3 feet apart around the perimeter of the inlet and drive them into the ground a minimum of 18 inches.
- 3 Install the wire mesh fabric above grade a minimum of 18 inches without exceeding 24 inches. Use heavy-duty wire ties spaced a maximum of 6 inches apart to attach the wire mesh material to the steel posts. Place Aggregate No. 5 washed stone to a minimum height of 12 inches and a maximum height of 24 inches against the hardware fabric on all sides.

#### **815.4.11.2.4 Type D - High Flow, High Velocity Inlet Filters**

##### **815.4.11.2.4.1 Rigid Inlet Filters**

- 1 Install rigid inlet filters in accordance with the manufacturer's written installation instructions. Properly install rigid inlet protection so that the inlet is completely enclosed.

##### **815.4.11.2.5 Type E - Surface Course Curb Inlet Filters**

- 1 Use surface course inlet filters in conjunction with Catch Basin Types 1, 16, 17, and 18 after the placement of the road surface course. Place surface course inlet filters where sediment may spill over sidewalks and curbs.
- 2 Install surface course inlet filters in front of curb inlet openings. Ensure that the filter has a minimum height or diameter of 9 inches and a minimum length 2 feet longer than the length of the curb opening to allow sufficient length to cover the inlet with at least 1-foot of clearance beyond the inlet on both ends. Do not completely block the inlet opening with surface course inlet filters. Install surface course inlet filters in a manner to allow overflows to enter the catch basin. Fill the aggregate compartment to a level (at least half full) that keeps the surface course inlet filter in place and creates a seal between the surface course inlet filter and the road surface.

#### **815.4.11.2.6 Type F - Inlet Tubes**

##### **815.4.11.2.6.1 Weighted Inlet Tubes**

- 1 Weighted inlet tubes do not require posts or additional techniques to keep them in place. Install weighted inlet tubes lying flat on the ground with no gaps between the soil or underlying surface and the inlet tube. Never stack weighted inlet tubes on top of one another. Do not completely block inlets with weighted inlet tubes. Install weighted inlet tubes so that all overflow or overtopping water has the ability to enter the inlet unobstructed. To avoid possible flooding, two or three concrete blocks may be placed between the weighted inlet tubes and the inlet.

**815.4.11.2.6.2 Non-Weighted Inlet Tubes**

- 1 Install non-weighted inlet tubes immediately after grading and construction of Catch Basin Types 1, 16, 17, and 18 boxes. Maintain non-weighted inlet tubes during subgrade and base preparation until the base course is placed. Review all project specifications for special installation requirements. Install non-weighted inlet tubes using 1-inch x 1-inch wooden stakes or 1.25 lb./linear ft. steel posts a minimum of 36 inches in length, placed on 2-foot centers. Intertwine the stakes with the outer mesh on the downstream side of the inlet tube. Drive stakes in the ground to a minimum depth of 12 inches, leaving less than 12 inches of stake exposed above the non-weighted inlet tube.
- 2 An acceptable alternative installation is driving stakes on 2-foot centers on each side of the non-weighted inlet tubes and connecting them with a natural fiber twine or steel wire to inhibit the non-weighted sediment tube from moving vertically. Another acceptable alternative installation for non-weighted inlet tubes is installing stakes on 2-foot centers in a crossing manner maintaining direct soil contact at all times. Install non-weighted inlet tubes so that the top is below the top of the installed curb line to ensure that all overflow or overtopping water has the ability to enter the inlet unobstructed.

**815.4.11.3 Delivery, Storage, and Handling**

- 1 Follow the manufacturer's written procedures for inlet structure filter labeling, shipment, and storage. Ensure that the manufacturer or supplier name, the structure size, shape, and weight clearly show on product labels.
- 2 Store inlet structure filters off the ground and cover adequately to protect them from the following: construction damage, precipitation, extended exposure to ultraviolet radiation including sunlight, on-site chemicals, flames, including welding sparks, excessive temperatures, and other environmental conditions that can damage the physical properties of the inlet filters.

**815.4.11.4 Inspection and Maintenance of Inlet Structure Filters****815.4.11.4.1 General**

- 1 Inspect inlet structure filters after installation for gaps that may permit sediment to enter the storm drainage system. Inspect inlet filters every 7 days. Immediately handle all damage or necessary repairs. Remove all accumulated sediment and debris from the surface and vicinity of inlet filters after each rainfall event or as directed by the RCE or the manufacturer's representative. Remove sediment when it reaches approximately one-third of the height of the inlet filter. If a sump is used, remove sediment when it fills approximately one-third of the depth of the hole. Maintain the pool area, always providing adequate sediment storage volume for the next storm event.
- 2 Remove, move, and/or replace inlet filters as required to adapt to changing construction site conditions. Remove inlet structure filters from the site when the functional longevity is exceeded as determined by the RCE or the manufacturer's representative. Dispose of inlet filters no longer in use at an appro-

appropriate recycling or solid waste facility. Before final stabilization backfill and repair trenches, depressions, and all other ground disturbances caused by the removal of inlet filters. Remove all construction material and sediment and dispose of them properly. Grade the disturbed areas to the elevation of the inlet structure crest. Stabilize all bare areas immediately.

#### **815.4.11.4.2 Type A - Low Flow Inlet Filters**

##### **815.4.11.4.2.1 Filter Fabric Inlet Protection**

- 1 Replace the fabric if it becomes clogged, or as directed by the RCE. Take care not to damage or undercut the fabric when removing the sediment.

##### **815.4.11.4.2.2 Sediment Tubes**

- 1 Inspect sediment tubes after installation for gaps under the sediment tubes and for gaps between the joints of adjacent ends of sediment tubes. Repair rills, gullies, and all undercutting near sediment tubes. Remove and/or replace installed sediment tubes as required to adapt to changing construction site conditions. Remove all sediment tubes from the site when the functional longevity is exceeded as determined by the RCE or the manufacturer's representative. Dispose of sediment tubes as non-hazardous, inert material.

#### **815.4.11.4.3 Type B - Medium Flow Low Velocity Inlet Filters**

##### **815.4.11.4.3.1 Hardware, Fabric, and Stone Inlet Protection**

- 1 If the stone becomes clogged with sediment, pull the stones away from the inlet and clean or replace them. Because cleaning gravel at a construction site may be difficult, an alternative approach would be to use the clogged stone as fill and put fresh stone around the inlet.

#### **815.4.11.4.4 Type D - High Flow, High Velocity Inlet Filters**

##### **815.4.11.4.4.1 Rigid Inlet Protection Device**

- 1 Inspect Type D inlet filters after installation to ensure that no gaps exist that may permit sediment to enter the storm drain system. Remove and/or replace rigid inlet filters to adapt to changing construction site conditions. Clean the rigid inlet protection filter material when it becomes covered or clogged with deposited sediment. Replace the rigid inlet protection filter material as directed by the RCE.

#### **815.4.11.4.5 Type E - Surface Course Curb Inlet Filters**

- 1 Because ponding is likely if sediment is not removed regularly, inspect surface course curb inlet filters on a regular basis and immediately after major rain events. Clean the surface course curb inlet filter if a visual inspection shows silt and debris build up around the filter.

#### **815.4.11.4.6 Type F - Inlet Tubes**

##### **815.4.11.4.6.1 Weighted Inlet Tubes**

- 1 Weighted inlet tubes may be temporarily moved during construction as needed. Replace weighted inlet tubes damaged during installation as di-

rected by the RCE or the manufacturer's representative at no expense to the Department.

#### **815.4.11.4.6.2 Non-Weighted Inlet Tubes**

- 1 Non-weighted inlet tubes may be temporarily moved during construction as needed. Replace non-weighted inlet tubes damaged during installation as directed by the RCE or the manufacturers' representative at no expense to the Department.

#### **815.4.11.5 Acceptance Criteria**

- 1 Obtain RCE approval of inlet structure filter installations. When requested by the RCE, ensure that a manufacturer's representative is on-site to oversee and approve the initial installation of inlet structure filters. Obtain a letter from the manufacturer approving the installation when requested by the RCE.

#### **815.4.12 Temporary Pipe Slope Drains**

- 1 Construct optional temporary pipe slope drains as required or as directed by the RCE. Ensure that the flexible pipe is of sufficient size to carry the anticipated volume of water, but in no case less than 8 inches in diameter. Ensure that pipe conforms to the requirements of **Section 803**.
- 2 Install temporary slope drains as a part of the grading operation where applicable and adjust as directed by the RCE.
- 3 Construct an earth berm at the top of cut or fill sections to channel the water into the slope drain and to prevent collected water from spilling over the edge of the slope.
- 4 When the temporary slope drains are removed, dress and seed the area in accordance with **Section 810**. The removed pipe drain becomes property of the Contractor, and it may be used again at other temporary locations if the pipe is in a condition acceptable to the RCE.

#### **815.4.13 Temporary Seeding**

- 1 Perform Temporary Seeding in accordance with **Section 810** as applicable.

#### **815.4.14 Stabilized Construction Entrance**

##### **815.4.14.1 Application**

- 1 Install a stabilized construction entrance at all defined points where traffic enters or leaves a construction site and moves directly off or onto a public road. Use construction entrances in conjunction with the stabilization of construction roads to reduce the amount of mud picked up by vehicles.
- 2 Ensure that the stabilized construction entrance is a minimum of 24 feet wide by 100 feet long and modify as necessary to accommodate site constraints. Taper the edges of the entrance out towards the road to prevent tracking of mud at the edge of the entrance.
- 3 If washing is used, make provisions to intercept the wash water and trap the sediment before it is carried offsite. Require washdown facilities as

needed. In general, establish washdown facilities with crushed stone and drain into a sediment trap or sediment basin.

- 4 Remove all vegetation and any objectionable material from the foundation area. Divert all surface runoff and drainage from the stones to a sediment trap or basin. Install a non-woven geotextile fabric before placing any stone. If necessary, install a culvert pipe across the entrance to provide positive drainage. Place the aggregate at a minimum depth of 6 inches uniform on top of the geotextile fabric.

#### **815.4.14.2 Inspection and Maintenance of Stabilized Construction Entrances**

- 1 Inspect stabilized construction entrances every 7 days. Check for mud and sediment build-up and pad integrity. Wash, replace, or add stone whenever the entrance fails to perform effectively or as directed by the RCE. Wash or replace the stone in the entrance whenever the entrance fails to reduce the amount of mud being carried offsite by vehicle tires. Wash frequently to extend the useful life of the stone.
- 2 Re-shape stone pad as needed for drainage and runoff control. Brush or sweep up soil that has been tracked offsite immediately and properly dispose of it. Use flushing only when the water can be discharged to a sediment trap or basin. Maintain the stabilized construction entrance until the remainder of the construction site has been fully stabilized. Repair any broken pavement immediately.
- 3 For sites with wash racks at each site entrance, construct and maintain sediment traps for the life of the project.
- 4 If the aggregate material is being tracked offsite, limit larger vehicles from the construction site or use a larger diameter stone. If excessive sediment is being tracked onto the roadway, increase the length of the stabilized construction entrance.

#### **815.4.14.3 Acceptance Criteria**

- 1 Obtain RCE acceptance and approval for stabilized construction entrance installations and for the replacement of stone.

### **815.4.15 Bonded Fiber Matrix (BFM)**

#### **815.4.15.1 Application**

- 1 Use BFM with all components pre-packaged by the manufacturer to assure material performance. Do not field mix materials, additives, or components.
- 2 Examine substrates and conditions before applying materials. Do not proceed with installation until unsatisfactory conditions are corrected. Apply BFM to geotechnically stable slopes that are constructed to divert runoff water away from the face of the slope eliminating damage to the slope face caused by the surface flow from above the slope.

- 3 Use personnel or subcontractors certified and trained by the manufacturer in the proper procedures for mixing and applying the BFM. Strictly comply with the manufacturer's mixing recommendations and installation instructions. Use approved hydraulic seeding/mulching machines with fan-type nozzle (50-degree tip) for BFM applications. Apply BFM from opposing directions to the soil surface in successive layers, reducing the "shadow effect" to achieve maximum coverage of all exposed soil. Do not apply the BFM immediately before, during, or after rainfall. Allow the BFM a minimum of 24 hours to dry after installation.
- 4 Do not exceed maximum slope length of 100 feet when slope gradients are steeper than 4H:1V. Install BFMs at a general application rate of 3500 pounds per acre.

#### **815.4.15.2 Delivery, Storage, and Handling**

- 1 Have BFM components delivered in factory labeled packages. Store and handle in strict compliance with the manufacturer's instructions and recommendations. Ensure that packaging is composed of UV resistant bags with a UV resistant pallet cover. Protect stored BFM from damage caused by weather, excessive temperatures, and construction operations. Clean all spills promptly.

#### **815.4.15.3 Maintenance**

- 1 Prepare a maintenance plan that includes the following:
  - Reapplication of BFM as directed by the RCE to disturbed areas that require continued erosion control.
  - Maintenance of equipment to provide uniform application rates.
  - Rinsing of all BFM mixing and application equipment thoroughly with water to avoid formation of residues and appropriate discharge of all rinse water.
- 2 Degradation of BFM can be expected to occur as a result of mechanical degradation, chemical, and biological hydrolysis, sunlight, salt, and temperature. Where necessary, reapply BFM in accordance with manufacturer's instructions. Reapplication is not required unless BFM treated soils are disturbed or turbidity or water quality shows the need for an additional application. If BFM-treated soils are left undisturbed, the necessity of reapplication will be determined by the RCE.

#### **815.4.15.4 Acceptance Criteria**

- 1 Obtain RCE acceptance and approval of BFM installations. When requested by the RCE, ensure that a manufacturer's representative is on-site to oversee and approve the initial installation of BFM. Obtain a letter from the manufacturer approving the installation when requested by the RCE.



### 815.4.16 Flexible Growth Matrix (FGM)

#### 815.4.16.1 Application

- 1 Use flexible growth matrix (FGM) with components pre-packaged by the manufacturer to assure material performance. Do not field mix materials, additives, or components.
- 2 Examine substrates and conditions before materials are applied. Apply FGM to geotechnically stable slopes that constructed to divert runoff away from the face of the slope. Do not proceed with installation until satisfactory conditions are established.
- 3 Use personnel or subcontractor certified and trained by the manufacturer in the proper procedures for mixing and application of the FGM. Strictly comply with the manufacturer's mixing recommendations and installation instructions. Use approved hydraulic seeding/mulching machines with fan-type nozzles (50-degree tip) for FGM applications. Apply FGM from opposing directions to the soil surface in successive layers, reducing the "shadow effect" to achieve maximum coverage of all exposed soil. FGM does not require a cure time and is effective immediately; therefore, FGM may be applied before, during or after a rainfall event. Install FGM materials at the general application rates in the following table.

Flexible Growth Matrix Application Rates	
Condition	Application Rate
Slope Applications	3500 pounds per acre
Below TRM	1500 pounds per acre

#### 815.4.16.2 Delivery, Storage, Handling

- 1 Use FGM with components pre-packaged by the manufacturer to assure material performance. Have materials and products delivered in UV and weather resistant factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures, and construction operations. Clean all spills promptly.

#### 815.4.16.3 Maintenance

- 1 Prepare a maintenance plan that includes the following:
  - Reapplication of FGM as directed by the RCE to disturbed areas that require continued erosion control.
  - Maintenance of equipment to provide uniform application rate.
  - Rinsing all FGM mixing and application equipment thoroughly with water to avoid formation of residues and appropriate discharge of rinse water.
- 2 Degradation of FGM can be expected to occur because of mechanical and chemical degradation and biological hydrolysis, sunlight, salt, and tempera-

ture. Reapply FGM in accordance with the manufacturer's instructions. Reapplication is not required unless FGM treated soils are disturbed or turbidity or water quality shows the need for an additional application. If FGM-treated soils are left undisturbed, the necessity of reapplication will be determined by the RCE.

#### **815.4.16.4 Acceptance Criteria**

- 1 Obtain RCE acceptance and approval of FGM installations. When requested by the RCE, ensure that a manufacturer's representative is on-site to oversee and approve the initial installation of the FGM. Obtain a letter from the manufacturer approving the installation when requested by the RCE.

#### **815.5 Measurement**

- 1 The quantity of the pay item Fiber Roving Type (A or B) is the surface area covered by the roving including in anchor trenches and is measured by the square yard (SY) of fiber roving in-place, complete, and accepted.
- 2 The quantity of the pay item Turf Reinforcement Matting (TRM) Type (1, 2, 3, or 4) or Temporary Erosion Control Blanket (ECB) Class (A, B, or C) is the surface area covered by the rolled erosion control product, including seams, overlaps, anchor trenches, and wastage and is measured by the one-thousand square yard (MSY) unit of material in-place, complete, and accepted. Products damaged by the Contractor's operations are not included in the measurement.
- 3 The quantity for the pay item Sediment Tube is the length of sediment tube installed, including overlaps and wastage and is measured by the linear foot (LF) of sediment tube in-place, complete, and accepted. Sediment tubes damaged by the Contractor's operations are not included in the measurement. The installation of the sediment tubes may require written acceptance by the manufacturer's representative before the quantity is accepted.
- 4 The quantity for the pay item Silt Fence is the length of silt fence installed and maintained and is measured by the linear foot (LF) of silt fence in-place, complete, and accepted.
- 5 The quantity for the pay item Removal of Silt Retained by Silt Fence is the length of silt fence in front of which silt deposit was removed as ordered by the RCE and is measured by the linear foot (LF) along the line of the silt fence, complete, and accepted.
- 6 The quantity for Replace/Repair of Silt Fence is the length of silt fence repaired or replaced because of failure of the silt fence not the fault of the Contractor and is measured by the linear foot (LF) along the line of the silt fence, complete, and accepted.
- 7 The quantity for the item Floating Turbidity Barrier (Light, Medium, or Heavy Duty) is the length of floating turbidity barrier if the depth is specified in the Contract, or if the depth is not specified, then by the surface area of the floating turbidity barrier furnished, installed, maintained and is measured by either the linear foot (LF) or the square foot (SF) as applicable for type of barrier in-

place, complete, and accepted. Measurement of accumulated material removed and disposed of each time the device is cleaned out is included in the quantity for Cleaning Silt Basins.

- 8 The quantity for the pay item Silt Basins is the volume of material excavated for the construction and backfilling of silt basins and is measured by the cubic yard (CY) of material moved during each operation, complete, and accepted. Each operation is measured separately.
- 9 The quantity for the pay item Cleaning Silt Basins is the volume of sediment deposits removed from silt ditches and silt basins as directed by the RCE, measured by the cubic yard (CY) of material removed, complete, and accepted. The quantity also includes sediment deposits removed from erosion control devices as directed and approved by the RCE, except from in front of silt fences. Measurements will be taken each time sediment is removed. Proper disposal of the sediment removed is considered incidental work in this item and is not measured for payment.
- 10 The quantity for the pay item Silt Ditches is of material excavated for the construction and backfilling of silt ditches and is measured by the cubic yard (CY) of material moved, complete, and accepted. Each operation is measured separately.
- 11 The quantity for the pay item Inlet Structure Filter Type (B, D1, D2, E CBT-1, E CBT-16, E CBT-17, or E CBT-18) is measured by the each (EA) filter furnished and installed, complete, and accepted. The quantity for Inlet Structure Filter Type A, F (Weighted), or F (Non-weighted) is the length of inlet structure filter furnished and installed, including overlaps and wastage and is measured by the linear foot (LF) of filter in-place, complete, and accepted. Inlet structure filters damaged by the Contractor's operations are not included in the quantity. The proper removal and disposal of deposited sediment around inlet structure filters is included in the quantity for Cleaning Silt Basins.
- 12 The quantity for the pay item Filter Material for Inlet Structure Filter Type D1 or Filter Material for Inlet Structure Filter Type D2 is measured by each (EA) inlet structure filter around which the filter fabric is replaced not due to the fault of the Contractor's operations, complete, and accepted. This measurement only includes replacement filter fabric, not the replacement of the frame for the Type D1 or Type D2 inlet structure filters.
- 13 The quantity for the pay item Temporary Flexible Pipe Slope Drains - (diameter in inches) is the length of the flexible pipe drains furnished and installed, measured by the linear foot (LF) along of pipe in-place, complete, and accepted. This item includes any excavation necessary for the installation of the pipe drains; and therefore, no measurement is made for the excavation work.
- 14 The quantity for the pay item Stabilized Construction Entrance is the surface area of the stabilized construction entrance in-place and is measured by the square yard (SY), complete, and accepted. When replacement stone is authorized by the RCE, the area of replacement stone in the stabilized construction entrance is measured and added to the quantity for this item.

- 15 The quantity for the pay item Bonded Fiber Matrix (BFM) is the surface area covered by the bonded fiber matrix applied at the recommended rate and is measured by the one-thousand square yard (MSY) units of matrix in-place, complete, and accepted. The installation of the BFM may require written acceptance by the manufacturer's representative before acceptance for payment.
- 16 The quantity for the pay item Flexible Growth Matrix (FGM) is the surface area covered by the flexible growth matrix applied at the recommended rate and is measured by the one-thousand square yard (MSY) units of matrix in-place, complete, and accepted. The installation of the FGM may require written acceptance by the manufacturer's representative before acceptance for payment.
- 17 Brush barriers are not measured for payment. The material and labor to construct brush barriers are considered incidental to the clearing and grubbing operations.
- 18 The quantity for Temporary Seeding is measured in accordance with **Subsection 810.5**.
- 19 Temporary pipe slope drains installed are considered incidental to work of the erosion control items; and therefore, they are not measured for payment.

#### **815.6 Payment**

- 1 Unless otherwise noted, payment for the accepted quantity for each pay item, measured in accordance with **Subsection 815.5**, is determined using the contract unit bid price for the applicable item, and the payment includes all direct and indirect costs and expenses required to complete the work.
- 2 Payment for Fiber Roving Type (A or B) is full compensation for installing fiber roving as specified or directed and includes furnishing, spreading and maintaining fiber roving; application of asphalt tackifier; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 3 Payment for Turf Reinforcement Matting (TRM) Type (1, 2, 3, or 4) or Temporary Erosion Control Blanket (ECB) Class (A, B, or C) is full compensation for installing TRM or ECB as specified or as directed and includes furnishing, placing, and maintaining the erosion control matting or blankets; providing anchor devices and trenches; quality control testing; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 4 Payment for Sediment Tubes is full compensation for installing the sediment tubes as specified or directed and includes furnishing, placing, maintaining, inspecting, removing, and disposing of the sediment tubes; providing wooden stakes, steel posts, proper storage facilities, documentation of Quality Control and Quality Assurance programs; and all other materials, labor,

equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

- 5 Payment for Silt Fence is full compensation for installing silt fence as specified or directed and includes furnishing, placing, maintaining, inspecting, removing, and disposing of silt fences; providing filter fabric, posts, and ties; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 6 Payment for Replace/Repair of Silt Fence is full compensation for repairing or replacing damaged or malfunction silt fences as specified or directed and includes furnishing or repairing filter fabric, posts, and ties, and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 7 Payment for Floating Turbidity Barrier (*Light, Medium, or Heavy Duty*) is full compensation for installing floating turbidity barriers as specified or directed and includes furnishing, installing, maintaining, removing and disposing of the floating turbidity barriers; providing attachments to the shore, anchors, vertical supports, anchor buoys, buoyed warning signs, and lighted buoys; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 8 Payment for Silt Basins is full compensation for constructing silt basins as specified or directed and includes excavating, grading, and backfilling of silt basins; disposing of surplus material; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 9 Payment for Cleaning Silt Basins is full compensation for removing and disposing of sediment deposits accumulated in silt basins as well as other sediment retention devices as specified or directed and includes all materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 10 Payment for Silt Ditches is full compensation for constructing silt ditches as specified or directed and includes excavating, grading, and backfilling of silt ditches; disposing of surplus material; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 11 Payment for Inlet Structure Filter (of the type required) is full compensation for installing the inlet structure filters as specified or directed and includes furnishing, installing, maintaining, inspecting, removing and disposing of the

inlet structure filters; providing posts, fabric, ties, anchor trenches, proper storage facilities, and documentation of Quality Control and Quality Assurance programs; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

- 12 Payment for Stabilized Construction Entrance is full compensation for constructing stabilized construction entrances as specified or directed and includes furnishing, installing, inspecting, maintaining, reshaping, removing, and disposing of the stabilized construction entrance (and exit); providing wash-down facilities, drainage, and geotextile under the aggregate; sweeping adjacent roadway as necessary or directed; and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 13 Payment for Bonded Fiber Matrix (BFM) or Flexible Growth Matrix (FGM) is full compensation for installing BFM or FGM as specified or directed and includes furnishing, applying, and maintaining the erosion control matrix including testing and documentation of Quality Control and Quality Assurance programs and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.
- 14 Brush barriers are not paid for directly, but are considered incidental to the clearing and grubbing operation. The cost for brush barriers is included in the contract lump sum bid price for Clearing and Grubbing.
- 15 The payment for Temporary Seeding is made in accordance with the applicable provisions of **Subsection 810.6**.
- 16 Pay items under this section include the following:

Item No.	Pay Item	Unit
8151000	Fiber Roving	SY
8151010	Bonded Fiber Matrix (BFM)	MSY
8151020	Flexible Growth Matrix (FGM)	MSY
8151101	Turf Reinforcement Matting (TRM) Type 1	MSY
8151102	Turf Reinforcement Matting (TRM) Type 2	MSY
8151103	Turf Reinforcement Matting (TRM) Type 3	MSY
8151104	Turf Reinforcement Matting (TRM) Type 4	MSY

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Item No.	Pay Item	Unit
8151111	Temporary Erosion Control Blanket (Class A)	MSY
8151112	Temporary Erosion Control Blanket (Class B)	MSY
8151113	Temporary Erosion Control Blanket (Class C)	MSY
8152004	Inlet Structure Filter - Type F (Weighted)	LF
8152006	Inlet Structure Filter - Type F (Non-Weighted)	LF
8152007	Sediment Tube	LF
8153000	Silt Fence	LF
8153090	Replace/Repair Silt Fence	LF
8153100	Floating Turbidity Barrier - Light Duty	SF
81531XX	Floating Turbidity Barrier - Light Duty ((X)' Deep)	LF
8153200	Floating Turbidity Barrier -Medium Duty	SF
81532XX	Floating Turbidity Barrier - Medium Duty ((X)' Deep)	LF
8153300	Floating Turbidity Barrier - Heavy Duty	SF
81533XX	Floating Turbidity Barrier - Heavy Duty ((X)' Deep)	LF
8154000	Silt Basins	CY
8154010	Cleaning Silt Basins	CY
8154050	Removal of Silt Retained by Silt Fence	LF
8155000	Silt Ditches	CY
8156205	Inlet Structure Filter - Type D1	EA
8156207	Filter Material for Inlet Structure Filter - Type D1	EA
8156210	Inlet Structure Filter - Type B	EA
8156211	Inlet Structure Filter - Type E (Catch Basin Type 1)	EA
8156212	Inlet Structure Filter - Type E (Catch Basin Type 16)	EA

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815.6

815.6

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Item No.	Pay Item	Unit
8156213	Inlet Structure Filter - Type E (Catch Basin Type 17)	EA
8156214	Inlet Structure Filter - Type E (Catch Basin Type 18)	8156214
8156215	Inlet Structure Filter - Type D2	EA
8156217	Filter Material for Inlet Structure Filter - Type D2	EA
8156219	Inlet Structure Filter - Type A	LF
8156490	Stabilized Construction Entrance	SY