

APPENDIX I
VDOT Road and Bridge Standards

INTRODUCTION

This appendix contains excerpts from the Virginia Department of Transportation (VDOT) Road and Bridge Specifications 2002 (*Specifications*), which became effective in February 2002. These excerpts are intended to provide a concise reference document of all specifications relevant to VDOT's Stormwater Management, Erosion and Sediment Control, and Virginia Pollutant Discharge Elimination System Permit Programs. These excerpts serve to support and provide the contractual basis for the design, review, and implementation of Erosion and Sediment Control and Stormwater Management Plans, and therefore are included as a component of VDOT's annual submittal of Erosion and Sediment Control and Stormwater Management Specifications to the Department of Conservation and Recreation (DCR).

These *Specifications* are standard for all contracts awarded by the Commonwealth Transportation Board. The requirements stated herein may be revised or amended from time to time but only to the extent permitted under the special provisions and special provision copied notes included in the specific contract.

Reference (date and title) will be made to these *Specifications* on plans and contract documents. A complete digital copy (.pdf) of the *Specifications* may be downloaded from VDOT's website at <http://www.virginiadot.org/business/const/spec-default.asp> or hard copies may be obtained from the Office of the Contract Engineer at 1401 East Broad Street, Richmond, Virginia 23219.

Revisions to Road and Bridge Specifications

These Specifications are periodically revised and updated thru the use of special provisions and special provision copied notes. While this generally occurs throughout the year, revisions to the specifications related to Erosion and Sediment Control and Stormwater Management are consolidated into two major revision dates: May and November. The revisions corresponding to these dates in 2003 are provided Appendices I.B. – November, and I.C. – May. Appendix I.A. provides general instructions and guideline tables for the use of revisions.

TABLE OF CONTENTS

INTRODUCTION	i
TABLE OF CONTENTS	ii
DIVISION I GENERAL PROVISIONS	1
SECTION 101—DEFINITIONS OF ABBREVIATIONS, ACRONYMS, AND TERMS	2
101.02—Terms.....	2
SECTION 103—AWARD AND EXECUTION OF CONTRACTS	8
103.05—Requirements of Contract Bond.	8
SECTION 104—SCOPE OF WORK	9
104.01—Intent of Contract.....	9
104.02—Alteration of Quantities or Character of Work.	9
104.03—Differing Site Conditions.	10
104.04—Maintenance During Construction.	10
104.05—Removing and Disposing of Structures and Obstructions.	12
104.06—Cleanup.	12
SECTION 105—CONTROL OF WORK	14
105.01—Authority of Engineer.	14
105.02—Plans and Working Drawings.	14
105.03—Conformity with Plans and Specifications.....	15
105.05—Coordination of Plans, Standard Drawings, Specifications, Supplemental Specifications, Special Provisions, and Special Provision Copied Notes.....	15
105.06—Cooperation of Contractor.	15
105.07—Cooperation With Regard to Utilities.	16
105.08—Cooperation among Contractors.	16
105.11—Authority and Duties of Inspector.	17
105.12—Inspection of Work.	17
105.13—Removal of Unacceptable and Unauthorized Work.	18
105.15—Acceptance.	18
SECTION 106—CONTROL OF MATERIAL	19
106.01—Source of Supply and Quality Requirements.	19
106.02—Material Inspection.....	19
106.03—Local Material Sources (Pits and Quarries).	19
106.04—Disposal Areas.....	21
106.05—Rights for and Use of Materials Found on Project.....	22
106.06—Samples, Tests, and Cited Specifications.	22
106.07—Plant Inspection.	22
106.08—Storing Materials.	23
106.09—Handling Materials.	23
106.10—Unacceptable Materials.	23
106.11—Material Furnished by the Department.	23
SECTION 107—LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC	24
107.01—Laws To Be Observed.	24
107.02—Permits, Certificates, and Licenses.....	24
107.09—Construction Over or Adjacent to Navigable Waters.	25
107.12—Protecting and Restoring Property and Landscape.	25
107.13—Responsibility for Damage Claims.	25
107.14—Environmental Stipulations.	26
107.16—Contractor’s Responsibility for Work.....	28
107.18—Furnishing Right of Way.....	28
107.19—Personal Liability of Public Officials.	28
107.20—No Waiver of Legal Rights.....	28
SECTION 108—PROSECUTION AND PROGRESS OF WORK	29

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

108.01—Subcontracting.....	29
108.02—Notice to Proceed.	29
108.03—Prosecution of Work.....	29
108.05—Limitation of Operations.	29
108.07—Character of Workers, Work Methods, and Equipment.....	29
108.08—Progress Schedule.....	30
108.09—Determination and Extension of Contract Time Limit.	30
108.10—Suspension of Work Ordered by the Engineer.....	31
108.11—Failure To Complete on Time.	31
108.12—Liquidated Damages.....	31
108.13—Default of Contract.....	31
108.14—Termination of Contract.....	32
108.15—Termination of Contractor’s Responsibilities.....	33
DIVISION II MATERIALS	34
SECTION 203—COARSE AGGREGATE	35
203.01—Description.....	35
203.02—Materials.....	35
203.03—Detail Requirements.....	35
SECTION 204—STONE FOR MASONRY, RIPRAP, POROUS BACKFILL, AND GABIONS	37
204.01—Description.....	37
204.02—Detail Requirements.....	37
SECTION 239—SODIUM CHLORIDE AND CALCIUM CHLORIDE	38
239.01—Description.....	38
239.02—Detail Requirements.....	38
SECTION 240—LIME.....	39
240.01—Description.....	39
240.02—Detail Requirements.....	39
SECTION 242—FENCES.....	40
242.01—Description.....	40
242.02—Detail Requirements.....	40
SECTION 244—ROADSIDE DEVELOPMENT MATERIALS.....	41
244.01—Description.....	41
244.02—Detail Requirements.....	41
SECTION 245—GEOSYNTHETICS	45
245.01—Description.....	45
245.02—Detail Requirements.....	45
245.03—Testing and Documentation.....	45
DIVISION III ROADWAY CONSTRUCTION.....	47
SECTION 301—CLEARING AND GRUBBING	48
301.01—Description.....	48
301.02—Procedures.....	48
301.03—Measurement and Payment.....	48
SECTION 302—DRAINAGE STRUCTURES	50
302.01—Description.....	50
302.02—Materials.....	50
302.03—Procedures.....	50
302.04—Measurement and Payment.....	55
SECTION 303—EARTHWORK	58
303.01—Description.....	58
303.02—Materials.....	58
303.03—Erosion and Siltation Control.....	58

303.04—Procedures.....	59
303.05—Tolerances.....	64
303.06—Measurement and Payment.....	65
DIVISION IV BRIDGES AND STRUCTURES.....	70
SECTION 401—STRUCTURE EXCAVATION.....	71
401.01—Description.....	71
401.02—Materials.....	71
401.03—Procedures.....	71
401.04—Measurement and Payment.....	73
SECTION 402—SHEET PILES.....	75
402.01—Description.....	75
402.02—Materials.....	75
402.03—Procedures.....	75
402.04—Measurement and Payment.....	75
SECTION 411—PROTECTIVE COATINGS OF METAL IN STRUCTURES.....	76
411.03—Certifications.....	76
411.08—Environmental Protection.....	76
SECTION 413—DISMANTLING AND REMOVING EXISTING STRUCTURES OR REMOVING PORTIONS OF EXISTING STRUCTURES.....	79
413.01—Description.....	79
413.02—Procedures.....	79
413.03—Measurement and Payment.....	80
SECTION 414—RIPRAP.....	81
414.01—Description.....	81
414.02—Materials.....	81
414.03—Procedures.....	81
414.04—Measurement and Payment.....	84
SECTION 415—CONCRETE SLOPE PROTECTION.....	85
415.01—Description.....	85
415.02—Materials.....	85
415.03—Procedures.....	85
415.04—Measurement and Payment.....	86
SECTION 418—TIMBER STRUCTURES.....	87
418.01—Description.....	87
418.02—Materials.....	87
418.03—Procedures.....	87
418.04—Measurement and Payment.....	89
DIVISION V INCIDENTAL CONSTRUCTION.....	90
SECTION 501—UNDERDRAINS.....	91
501.01—Description.....	91
501.02—Materials.....	91
501.03—Procedures.....	91
501.04—Measurement and Payment.....	91
SECTION 506—RETAINING WALLS.....	92
506.01—Description.....	92
506.02—Materials.....	92
506.03—Procedures.....	92
506.04—Measurement and Payment.....	93
SECTION 511—ALLAYING DUST.....	94
511.01—Description.....	94
511.02—Procedures.....	94

511.03—Measurement and Payment.....	94
SECTION 520—WATER AND SANITARY SEWER FACILITIES.....	95
520.01—Description.....	95
520.02—Materials.....	95
520.03—Procedures.....	95
520.05—Disinfecting Water Mains.....	101
520.06—Measurement and Payment.....	101
DIVISION VI ROADSIDE DEVELOPMENT.....	103
SECTION 602—TOPSOIL.....	104
602.01—Description.....	104
602.02—Materials.....	104
602.03—Procedures.....	104
602.04—Measurement and Payment.....	104
SECTION 603—SEEDING.....	105
603.01—Description.....	105
603.02—Materials.....	105
603.03—Procedures.....	105
603.04—Measurement and Payment.....	106
SECTION 604—SODDING.....	107
604.01—Description.....	107
604.02—Materials.....	107
604.03—Procedures.....	107
604.04—Measurement and Payment.....	107
SECTION 605—PLANTING.....	108
605.01—Description.....	108
605.02—Materials.....	108
605.03—Procedures.....	108
605.04—Care of Plants.....	110
605.05—Establishment Period.....	110
605.06—Guarantee.....	110
605.07—Measurement and Payment.....	110
SECTION 606—SOIL RETENTION COVERINGS.....	112
606.01—Description.....	112
606.02—Materials.....	112
606.03—Procedures.....	112
606.04—Measurement and Payment.....	112
SECTION 607—HERBICIDE SPRAYING.....	113
607.01—Description.....	113
607.02—Materials.....	113
607.03—Procedures.....	113
607.04—Measurement and Payment.....	113
SECTION 608—MOWING.....	114
608.01—Description.....	114
608.02—Equipment.....	114
608.03—Measurement and Payment.....	114
SECTION 609—TREE WELLS AND TREE WALLS.....	115
609.01—Description.....	115
609.02—Procedures.....	115
609.03—Measurement and Payment.....	115
SECTION 610—GABIONS.....	116
610.01—Description.....	116
610.02—Materials.....	116

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

610.03—Procedures.	116
610.04—Measurement and Payment.....	116

DIVISION I GENERAL PROVISIONS

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program
SECTION 101—DEFINITIONS OF ABBREVIATIONS, ACRONYMS, AND TERMS

101.02—Terms.

In these specifications and in other contract documents, the following terms and pronouns used in place of them shall be interpreted as follows:

-A-

Advertisement, Notice of. A public announcement, as required by law, inviting bids for work to be performed or materials to be furnished that indicates approximate principal quantities, location of work to be performed, character and quantity of materials to be furnished, and time and place for opening bids.

Alkali soil. Soil in which total alkali chlorides calculated as sodium chloride are more than 0.10 percent based on total solids.

Award. The decision of the Board to accept the bid of the lowest responsive and responsible bidder for the work. The award is subject to the execution and approval of a satisfactory Contract therefor, and such conditions as may be specified or required by law.

Award date. The date on which the decision is made by the Board to accept the bid of the lowest responsive and responsible bidder.

-B-

Backfill. Material used to replace or the act of replacing material removed during construction; may also denote material placed or the act of placing material adjacent to structures.

Balance point. The approximate point, based on estimated shrinkage or swell, where the quantity of earthwork excavation and borrow, if required, is equal to the quantity of embankment material plus any surplus excavation material.

Base course. A layer of material of specified thickness on which the intermediate or surface course is placed.

Base flood. The flood or tide having a one percent chance of being exceeded in any given year.

Bid. The offer of a bidder, submitted on the proposal, to perform the work and furnish the materials and labor at the prices set forth therein; valid only when properly signed and guaranteed.

Bidder. Any individual, partnership, corporation, or joint venture that formally submits a bid for the work contemplated, or for any portion thereof, acting directly or through a duly authorized representative.

Bids, Invitation for. See **Advertisement, Notice of.**

Board. Commonwealth Transportation Board of Virginia.

Borrow. Suitable material from sources outside the roadway that is used primarily for embankments.

Brackish water. Water in which total alkali chlorides calculated as sodium chloride are more than 0.10 percent based on total solids.

Bridge. A structure, including supports, that is erected over a depression or an obstruction, such as water, a highway, or a railway, that has a track or passageway for carrying traffic.

-C-

Calendar day. Any day shown on the calendar.

Camber. A vertical curvature induced or fabricated into beams or girders and a deck slab or slab span formwork; a vertical curvature set in the grade line of a pipe culvert to accommodate differential settlement.

Channel. A water course or drainage way.

Commissioner. Commonwealth Transportation Commissioner.

Composite hydrograph. A graph showing the mean daily discharge versus the calendar day, indicating trends in high and low flow for a one year period.

Construction area. The area where authorized construction occurs.

Construction limits. The intersection of side slopes, including slope rounding, with the original ground, plus slopes for drainage ditches or incidental construction.

Contract. The written agreement executed between the Department and the Contractor that sets forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, furnishing of materials and labor, and basis of payment. The Contract also includes these specifications; supplemental specifications; special provisions; special provision copied notes; plans;

standard drawings; change orders; and work orders and agreements that are required to complete the construction of the specified work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument. Oral representations or promises shall not be considered a part of the Contract.

Contract Engineer. The Engineer's authorized representative for administering the advertisement, receiving bids, and awarding contracts for the Department.

Contract item. A specifically described unit of work for which a price is provided in the Contract.

Contract time limit. The number of calendar days or calendar date that specifies the time allowed for completion of the work described in the Contract, including authorized extensions.

Contractor. Any individual, partnership, corporation, or joint venture that contracts with the Department to perform the prescribed work.

Cul-de-sac. An area at the terminus of a dead-end street or road that is constructed for the purpose of allowing vehicles to turn around.

Culvert. A structure that is not classified as a bridge which provides an opening under any roadway.

Cut. The portion of a roadway formed by excavating below the surface of the earth.

-D-

Day. Unless otherwise stated, a calendar day.

Deflection. The vertical movement occurring between the supports of a bridge superstructure or its components (beams, girders, and slabs) that results from their own weight and from dead and live loads. Although all parts of a structure are subject to deflections, usually only those deflections that occur in the superstructure are of significance during construction.

Department. Virginia Department of Transportation.

Deputy Commissioner. The assistant to the Commissioner who performs such of the Commissioner's duties as have been delegated to him by the Commissioner.

Design flood. The magnitude of flood that a given structure can convey without exceeding a designated flood level.

Disincentive. A monetary deterrent used to discourage the Contractor from exceeding the contract time limit.

Disposable material. Material generally found to be unsuitable for roadway construction or material that is surplus.

Disposal areas. Areas generally located off the project right of way where unsuitable or surplus material is deposited.

Drainage ditch. An artificial depression constructed to carry off surface water.

-E-

Earthwork. The work consisting of grubbing, drainage, roadway excavation, embankment excavation, borrowing, grading, placing rock, and preparing subgrades.

Easement (Right of way). A grant of the right to use property for a specific use.

Embankment. A structure of soil, soil aggregate, or broken rock between the existing ground and subgrade.

Employee. Any person working on the project specified in the Contract who is under the direction or control of or receives compensation from the Contractor or subcontractor.

Engineer. The Chief Engineer, who acts directly or through his duly authorized representative. The representative acts within the scope of the particular duties assigned to him or the authority given to him.

Equipment. Machinery, tools, and other apparatus, together with the necessary supplies for upkeep and maintenance, that are necessary for acceptable completion of the work.

Extra work. An item of work that is not provided for in the Contract as awarded but that is found to be essential to the satisfactory fulfillment of the Contract within its intended scope.

-F-

Falsework. A framework of wood or steel used to support forms for the construction of concrete slab spans or t-beams, or provide temporary support for structural units during the construction or reconstruction of permanent supports.

Federal agencies or officers. An agency or officer of the federal government and any agency or officer succeeding in accordance with the law to the powers, duties, jurisdictions, and authority of the agency or officer mentioned.

Flood frequency. A statistical average recurrence interval of floods of a given magnitude.

Force account work. Prescribed work of a contractual status performed by the Contractor and compensated for as specified in Section 109.05.

Formwork. A temporary structure or mold used to retain the plastic or fluid concrete in its designated shape until it hardens. Formwork shall be designed to resist the fluid pressure exerted by plastic concrete and additional fluid pressure generated by vibration and temporary construction loads.

Frontage street or road. A local street or road auxiliary to and located on the side of a highway for service to abutting property and adjacent areas and control of access.

-G-

Gage. U.S. Standard Gage.

Grade separation. Any structure that provides a traveled way over or under another traveled way or stream.

-H-

Highway. The entire right of way reserved for use in constructing or maintaining the roadway and its appurtenances.

Historical flood level. The highest flood level that is known to have occurred at a given location.

Holidays. The days specifically set forth in Section 105.09.

Hydrologic data sheet. A tabulation of hydrologic data for facilities conveying a 100 year discharge equal to or greater than 500 cubic feet per second.

-I-

Incentive. A monetary amount used to encourage the Contractor to complete work prior to the time limit specified in the Contract.

Inspector. The Engineer's authorized representative who is assigned to make detailed inspections of the quality and quantity of the work and its conformance to the provisions of the Contract.

Invert. The lowest point in the internal cross section of a pipe or other drainage structure.

-J-K-

Joint venture. Two or more individuals, partnerships, corporations, or combinations thereof that join together for the purpose of bidding on and constructing a project.

-L-

Laboratory. The testing laboratory of the Department or any other testing laboratory that may be designated by the Engineer.

Liquidated damages. Compensatory damages as set forth in the Contract, paid by the Contractor to the Department when the Contractor fails to complete the project within the time frame specified in the Contract. These damages include, but are not limited to, additional costs associated with administration, engineering, supervision and inspection of the project.

-M-

Material. Any substance that is used in the work specified in the Contract.

Median. The portion of a divided highway that separates the traveled ways.

-N-

Notice to Proceed. A written notice to the Contractor that advises him of the date on which prosecution of the work shall begin.

-O-

Ordinary high water. A water elevation based on analysis of all daily high waters that will be exceeded approximately 25 percent of the time during any 12 month period.

Overtopping flood. The magnitude of flood that just overflows the traveled way at a given structure and/or on the approach traveled way of such structure.

-P-Q-

Pavement structure. The combination of subbase, base, and surface courses that is placed on a subgrade to support the traffic load and distribute it to the roadbed.

Pay item. A specifically described unit of work for which a price is provided in the Contract.

Phase inspection. The inspection of work at predetermined stages in lieu of continuous inspection.

Plans. The approved plans and standard drawings, profiles, typical cross sections, computer output listings, supplemental drawings or exact reproductions thereof, and all subsequent approved revisions thereto that show the location, character, dimensions, and details of the work specified in the Contract.

Prequalification. The procedure used to assure the Department of the Contractor's ability to perform the work, experience in similar work, and sufficiency of equipment to accomplish the work and that the Contractor's financial resources will permit financing the work.

Profile grade. The line of a vertical plane intersecting the top surface of the proposed wearing surface, usually along the longitudinal center line of the roadbed.

Project. The work specified to be performed in the Contract.

Project showing. The scheduled event at which the Department's representative meets with prospective bidders to describe and answer questions regarding the proposed work.

Proposal. The document sent by the Department to prospective bidders that describes the work for which bids will be accepted; includes the official form on which the Department requires bids to be submitted for the work described.

-R-

Ramp. A connecting roadway between two highways or traveled ways or between two intersecting highways at a grade separation.

Right of way. A general term denoting land, property, or interest therein, usually in a strip, that is acquired for or devoted to transportation facilities but is not meant to denote the legal nature of ownership.

Road. A general term denoting a public way for purposes of vehicular travel including the entire area within the right of way; the entire area reserved for use in constructing or maintaining the roadway and its appurtenances.

Roadbed. The graded portion of a highway within the top and side slopes that is prepared as a foundation for the pavement structure and shoulders.

Roadbed material. The material below the subgrade in cuts, embankments, and embankment foundations that extends to a depth which affects the support of the pavement structure.

Roadside. A general term that denotes the area within the right of way that adjoins the outer edges of the roadway; extensive areas between the roadways of a divided highway.

Roadside development. Items that are necessary to complete a highway that provide for the preservation of landscape materials and features; rehabilitation and protection against erosion of areas disturbed by construction through placing seed, sod, mulch, and other ground covers; and such suitable plantings and other improvements as may increase the effectiveness and enhance the appearance of the highway.

Roadway. The portion of a highway within the limits of construction and all structures, ditches, channels, and waterways that are necessary for the correct drainage thereof.

-S-

Sea water. Water in which total alkali chlorides calculated as sodium chloride are more than 0.10 percent of total solids.

Select borrow. Borrow material that has specified physical characteristics.

Select material. Material obtained from roadway cuts, borrow areas, or commercial sources that is designated or reserved for use as a foundation for the subbase, subbase material, shoulder surfacing, or other specified purposes.

Shoulder. The portion of the roadway contiguous with the traveled way that is for the accommodation of stopped vehicles, emergency use, and lateral support of the base and surface courses.

Sidewalk. The portion of the roadway constructed primarily for the use of pedestrians.

Skew. The acute angle formed by the intersection of a line normal to the center line of the roadway with a line parallel to the face of the abutments or, in the case of culverts, with the center line of the culverts.

Special provision. A document that sets forth specifications or requirements for a particular project.

Special provision copied note. A document that sets forth specifications or requirements, usually limited in scope, for a particular project.

Specialty item. An item of work designated as "Specialty Item" in the proposal that is limited to work which requires highly specialized knowledge, craftsmanship, or equipment that is not ordinarily available in contracting organizations prequalified to bid and is usually limited to minor components of the overall Contract.

Specifications. A general term that includes all directions, provisions, and requirements contained herein and those that may be added or adopted as supplemental specifications, special provisions, or special provision copied notes. All are necessary for the proper fulfillment of the Contract.

Standard drawings. Unless otherwise specified, applicable drawings in VDOT's *Road and Bridge Standards* and such other standard drawings as are referred to on the plans.

State. Commonwealth of Virginia.

Station. When used as a definition or term of measurement, 100 linear feet.

Street. A general term denoting a public way for purposes of vehicular travel including the entire area within the right of way; the entire right of way reserved for use in constructing or maintaining the roadway and its appurtenances.

Structures. Bridges, culverts, catch basins, inlets, retaining walls, cribs, manholes, end walls, buildings, steps, fences, sewers, service pipes, underdrains, foundation drains, and other features that may be encountered in the work and are not otherwise classed herein.

Subbase. A layer(s) of specified or selected material of designed thickness that is placed on a subgrade to support a base course.

Subcontractor. Any individual, partnership, corporation, or joint venture to whom the Contractor, with the written consent of the Department, subcontracts part of the Contract.

Subgrade. The top surface of a roadbed shaped to conform to the typical section on which the pavement structure and shoulders are constructed.

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

Substructure. The part of a structure that is below the bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames, together with the back walls, wingwalls, and wing protection railings.

Superintendent. The executive representative of the Contractor who is authorized to receive and fulfill instructions from the Engineer and who supervises and directs the construction.

Superstructure. The portion of a structure that is not defined as substructure.

Supplemental specifications. Additions and revisions to these specifications that are adopted after the issuance of the printed book.

Surety. A corporate entity bound with and for the Contractor for full and complete fulfillment of the Contract and for payment of debts pertaining to the work. When applied to the proposal guaranty, it refers to the corporate body that engages to be responsible in the execution by the bidder, within the specified time, of a satisfactory Contract and the furnishing of an acceptable payment and contract bond.

Surface course. One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and disintegrating effects of weather. The top layer is sometimes called the wearing course.

Surplus material. Material that is present on a project as a result of unbalanced earthwork quantities, excessive swell, slides, undercutting, or other conditions beyond the control of the Contractor.

Suspension. A written notice issued by the Engineer to the Contractor that orders the work on a project to be stopped wholly or in part as specified. The notice will include the reason for the suspension.

-T-U-

Temporary structure. Any structure that is required to maintain traffic while permanent structures or parts of structures specified in the Contract are constructed or reconstructed. The temporary structure shall include earth approaches.

Theoretical maximum density. The maximum compaction of materials that can be obtained in accordance with the values established VTM-1.

Ton. A short ton; 2,000 pounds avoirdupois.

Top of earthwork. The uppermost surface of the embankment excavation, exclusive of select material, that is shaped to conform with the typical section.

Traveled way. The portion of the roadway for the movement of vehicles, exclusive of shoulders.

-V-

Vouchered. The action of approval by the Department; constitutes the date of release to the State Comptroller for payment.

-W-X-Y-Z-

Wearing course. See **Surface course.**

Work. The furnishing of all materials, labor, tools, equipment, and incidentals necessary or convenient for the successful completion of the project and the carrying out of the duties and obligations specified in the Contract.

Working drawings. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data the Contractor is required to submit to the Engineer for review.

Work order. A written order issued by the Engineer to the Contractor that specifies changes in the plans or quantities or both within the scope of the Contract and that establishes the basis of payment and time adjustments for the work affected by the changes.

SECTION 103—AWARD AND EXECUTION OF CONTRACTS

103.05—Requirements of Contract Bond.

Within 15 calendar days after notification, the successful bidder shall furnish the following bonds for contracts in excess of \$100,000:

1. a performance bond in the sum of the Contract amount, conditioned upon the faithful performance of the Contract in strict conformity with the plans, specifications and conditions of the Contract, and
2. a payment bond in the sum of the Contract amount, conditioned upon the prompt payment for all labor, materials, public utility services and rental of equipment used in the prosecution of the work for the Contract.

Bidders will not be awarded an unbonded contract when their bid plus the balance of other unbonded contracts exceed \$100,000.00 or if their current Ability Factor is less than 8.0, as determined by their prequalification status.

The bonds shall be made on official forms furnished by the Department and shall be executed by the Contractor and a surety company authorized to do business in Virginia in accordance with the laws of Virginia and the rules and regulations of the State Corporation Commission. In order to be considered properly executed, the bonds shall include authorized signatures and titles.

In lieu of payment or performance bonds, the Contractor may furnish a certified check or cash escrow in the face amount required for each of the bonds, which will be held for the full statutory period as applicable for each bond.

Upon written request from the Contractor, the contract bonds may be reduced on contracts having planting items with an establishment period after acceptance of all contract work and during the establishment period. The amount of contract bonds for the duration of the remaining establishment period shall be equal to 35 percent of the total contract price of the planting items.

SECTION 104—SCOPE OF WORK

104.01—Intent of Contract.

The intent of the Contract is to provide for completion of the work specified therein.

104.02—Alteration of Quantities or Character of Work.

The Engineer reserves the right to make, in writing, at any time during the work, such changes in quantities and such alterations in the work as are necessary to satisfactorily complete the project. Such changes in quantities and alterations shall not invalidate the contract nor release the surety, and the Contractor agrees to perform the work as altered.

If the alterations or changes in quantities significantly change the character of the work under the contract, whether or not changed by any such different quantities or alterations, an adjustment, excluding anticipated profits, will be made to the contract. The basis for the adjustment shall be agreed upon prior to the performance of the work. If a basis cannot be agreed upon, then an adjustment will be made either for or against the Contractor in such amount as the Engineer may determine to be fair and equitable.

At the option of the Engineer, the Contractor may be directed to accomplish the work on a force account basis in accordance with the requirements of Section 109.05.

If the alterations or changes in quantities do not significantly change the character of the work to be performed under the contract, the altered work will be paid for as provided elsewhere in the contract.

The term "significant change" shall be construed to apply only to the following circumstances:

- (a) When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction or
- (b) When a major item of work, as defined elsewhere in the contract is increased or decreased more than 25 percent of the original contract quantity. Any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed or
- (c) When overruns and underruns of piling amount to more than 25 percent of the original bid quantity, whether or not such item has been designated as a major item.

Value engineering proposals: The Contractor may submit to the Engineer written VEPs for modifying the plans, specifications, or other requirements of the Contract for the purpose of reducing the total cost of construction without reducing the design capacity or quality of the finished product. If the VEP is accepted by the Department, the net savings will be equally divided by the Department and Contractor.

Each VEP shall result in a net savings over the contract cost without impairing essential functions and characteristics of the item(s) or of any other part of the project, including, but not limited to, service life, reliability, economy of operation, ease of maintenance, aesthetics, and safety. At least the following information shall be submitted with each VEP:

- (a) statement that the proposal is submitted as a VEP
- (b) statement concerning the basis for the VEP and benefits to the Department and an itemization of the contract items and requirements affected by the VEP
- (c) detailed estimate of the cost under the existing Contract and under the VEP
- (d) proposed specifications and recommendations as to the manner in which the VEP changes are to be accomplished
- (e) statement as to the time by which a contract work order adopting the VEP must be issued so as to obtain the maximum cost-effectiveness

The Department will process the VEP in the same manner as prescribed for any other proposal that would necessitate issuance of a work order. The Department may accept a VEP in whole or part by issuing a work order that will identify the VEP on which it is based. The Department will not be liable to the Contractor for failure to accept or act on any VEP submitted pursuant to these requirements or for delays in the work attributable to any VEP. Until a VEP is put into effect by a work order, the Contractor shall remain obligated to the terms and conditions of the existing Contract. If an executed work order has not been issued by the date on which the Contractor's proposal specifies that a decision should be made or such other date as the Contractor may subsequently have specified in writing, the VEP shall be deemed rejected.

The work order effecting the necessary modification of the Contract will establish the net savings agreed on, provide for adjustment of the contract prices, and indicate the net savings. The Contractor shall absorb all costs incurred in preparing a VEP. Reasonably incurred costs for reviewing and administering a VEP will be borne by the Department. The Department may include in the agreement any

conditions it deems appropriate for consideration, approval, and implementation of the VEP. The Contractor's 50 percent share of the net savings shall constitute full compensation to him for effecting all changes pursuant to the agreement.

Unless specifically provided for in the work order authorizing the VEP, acceptance of the VEP and performance of the work thereunder will not change the contract time limit.

The Department may adopt a VEP for general use in contracts administered by the Department if it determines that the VEP is suitable for application to other contracts. VEPs identical with or similar to previously submitted VEPs will be eligible for consideration and compensation under these provisions if they have not been previously adopted for general application to other contracts administered by the Department. When a VEP is adopted for general use, compensation pursuant to these requirements will be applied only to those awarded contracts for which the VEP was submitted prior to the date of adoption of the VEP.

Proposed changes in the basic design of a bridge or pavement type or that require different right-of-way limits will not normally be considered an acceptable VEP. If a VEP is based on or is similar to a change in the plans, specifications, or special provisions adopted by the Department prior to submission of the VEP, the Engineer will not accept the VEP.

The Engineer will be the sole judge of the acceptability of a VEP. The requirements herein apply to each VEP initiated, developed, and identified as such by the Contractor at the time of its submission to the Engineer. However, nothing herein shall be construed as requiring the Engineer to consider or approve a VEP.

Subject to the provisions contained herein, the Department or any other public agency shall have the right to use all or part of an accepted VEP without obligation or compensation of any kind to the Contractor.

If a VEP is accepted by the Department, the provisions of (a) herein that pertain to the adjustment of contract unit prices attributable to alterations of contract quantities will not apply to the items adjusted or deleted as a result of putting the VEP into effect by a work order.

104.03—Differing Site Conditions.

During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, are encountered at the site, the party discovering such conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

Upon written notification, the Engineer will investigate the conditions, and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding anticipated profits, will be made and the contract modified in writing accordingly. The Engineer will notify the contractor of the determination whether or not an adjustment of the contract is warranted.

No contract adjustment which results in a benefit to the Contractor will be allowed unless the Contractor has provided the required written notice.

No contract adjustment will be allowed under this clause for any effects caused on unchanged work.

104.04—Maintenance During Construction.

The Contractor shall maintain the work from the beginning of construction operations until final acceptance. Maintenance shall constitute continuous and effective work prosecuted day by day with adequate equipment and forces to such end that the roadway and structures, including barricades and warning signs as provided for in accordance with the requirements of Section 107.10, are maintained in a satisfactory condition at all times.

When a Contract specifies placing a course on another course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

The road shall be kept open to all traffic while undergoing improvements. The Contractor shall keep the portion of the project being used by public, pedestrian, and vehicular traffic in such condition that traffic will be adequately accommodated. However, removal of snow and control of ice on roads open to public travel will be performed by the Department.

The Contractor shall bear all costs of performing maintenance work before final acceptance and of constructing and maintaining necessary approaches, crossings, intersections, and other features without direct compensation except as provided for herein. However, when the Contractor confines his operation to the surface of the roadway and reasonable width of the shoulder and the surface is not disturbed or damaged by his operations or equipment, he shall not be responsible for the maintenance of the surface that remains undisturbed or undamaged.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

The Contractor shall keep the portions of the road being used by the public free from irregularities and obstructions that could present a hazard or annoyance to traffic. When directed by the Engineer, allaying of dust shall be performed and paid for in accordance with the requirements of Section 511. Holes in hard surface pavements shall be filled with approved asphalt patching material.

- (a) **Detours:** Detours may be indicated on the plans or in the special provisions or used with the approval of the Engineer. Detours over existing state roads will be designated, marked, and maintained by the Department. If any project is located wholly or in part within the corporate limits of a municipality and through traffic is to be detoured at the request of the municipality, the municipality will provide and maintain the detours within the corporate limits and will furnish and erect all directional markings. The Department will furnish and erect all directional markings for through traffic on off-project detours authorized or requested by the Engineer. The provision of detours and marking of alternate routes will not relieve the Contractor of the responsibility for ensuring the safety of the public or from complying with any requirements of these specifications affecting the rights of the public, including those concerning lights and barricades. Maintenance of all other detours shall be the responsibility of the Contractor.

Right of way for temporary highways or bridges required by these provisions will be furnished by the Department.

- (b) **Maintenance of Traffic During Suspension of Work:** During any suspension of work, the Contractor shall temporarily open to traffic such portions of the project and temporary roadways as may be agreed on by the Contractor and Engineer.
- (c) **Flagging Traffic:** Certified flaggers shall be provided in sufficient number and locations as necessary for control and protection of vehicular and pedestrian traffic in accordance with the requirements of *MUTCD*. Flaggers shall use sign paddles to regulate traffic in accordance with the requirements of *MUTCD*.

Certification for flaggers will be awarded upon a candidate's satisfactory completion of an examination. Certification cards shall be carried by flaggers while performing flagging duties. Flaggers found not in possession of their certification card shall be removed from the flagging site and operations requiring flagging will be suspended by the Engineer. Further, flaggers performing duties improperly will have their certifications revoked.

- (d) **Delays:** Unless otherwise approved, two-way traffic shall be maintained at all times. The Contractor shall not stop traffic without permission.

If one-way traffic is approved, the Contractor shall provide flaggers to direct the traffic. When specified in the Contract as a pay item, pilot vehicles shall be furnished in accordance with the requirements of Section 512. Upon request from the Contractor and where deemed appropriate by the Department, the Department will install traffic signals that may be used for the control of one-way traffic. The Contractor shall pay the costs of installation, removal when no longer needed, electrical service, maintenance or repair work, and a predetermined rental charge per day for the signals.

- (e) **Connections and Entrances:** Connections with other roads and public and private entrances shall be kept in a reasonably smooth condition at all times. Connections or entrances shall not be disturbed by the Contractor until necessary. Once connections or entrances have been disturbed, they shall be maintained and completed as follows:
 1. **Connections:** Connections that had an original paved surface shall be brought to final grade through the intersection. At least two lanes shall be paved as soon as possible after connections are disturbed. Other connections shall be brought to final grade through the intersection, and the required material or a temporary aggregate stabilization course shall be placed as soon as possible after connections are disturbed.

If there are delays in prosecution of work for connections, connections that were originally paved shall have at least two lanes maintained with a temporary paved surface. Those that were not originally paved shall be maintained with a temporary aggregate stabilization course.

2. **Entrances:** Entrances shall be graded concurrently with the roadway with which they intersect. Once an entrance has been disturbed, it shall be completed as soon as is practicable, including placing the required base and surface course or stabilization. If the entrance must be constructed in stages, such as when there is a substantial change in the elevation of the roadway with which it intersects, the surface shall be covered with a temporary aggregate stabilization course or other salvaged material until the entrance can be completed and the required base and surface or stabilization course can be placed.

When directed by the Engineer, stabilization or surfacing material shall be applied to connections and entrances. When specified in the Contract, such material will be paid for at the contract unit price. Otherwise, the cost shall be included in other pay items of the Contract.

The Contractor shall schedule construction operations so that approved continuous access is provided for all property adjacent to the construction when the property is shown on the plans to require access. When frontage roads are shown on the plans, they shall be constructed prior to the closing of any access routes unless other approved access is provided and is acceptable to the property owner.

- (f) **Grading Operations:** When the Contractor elects to complete the rough grading operations for the entire project or exceed the length of one full day's surfacing operations, the rough grade shall be machined to a uniform slope from the top edge of the existing pavement to the ditch line.

When the surface is to be widened on both sides of the existing pavement, construction operations involving grading or paving shall not be conducted simultaneously on sections directly opposite each other.

The surface of pavement shall be kept free from soil and other materials that might be hazardous to traffic. Prior to opening of new pavement to traffic, shoulders shall be roughly dressed for a distance of 3 feet from the edge of the paved surface.

- (g) **Hydraulic Embankment:** Where the Contractor's suction or discharge pipes cross the surface of an existing traveled highway, they shall be bridged as directed by the Engineer. Traffic shall be protected by the display of warning signals both day and night. If dredging operations damage an existing traveled highway, the Contractor shall cease operations and repair damages to the highway.
- (h) **Patching Operations:** Where existing hydraulic cement concrete pavement is to be patched, the operation of breaking and excavating old pavement shall extend for a distance of not more than 2 miles. Patching shall be coordinated with excavating so that an area of not more than 1/2 mile in which excavated patches are located shall be left at the end of any day's work. Necessary precautions shall be taken to protect traffic during patching operations.
- (i) **Temporary Structures:** The Contractor shall construct, maintain, and remove temporary structures and approaches necessary for use by traffic. Unless otherwise specified in the Contract, the cost of these operations shall be included in pay items for the new structure. After new structures have been opened to traffic, temporary structures and approaches shall be removed. The materials contained therein shall remain the property of the Contractor.

The proposed design of temporary structures shall be submitted to the Engineer prior to the beginning of construction in accordance with the requirements of Section 105.02.

- (j) **Failure To Maintain Roadway or Structures:** If the Contractor fails to remedy unsatisfactory maintenance immediately after receipt of a notice by the Engineer, the Engineer may proceed with adequate forces, equipment, and material to maintain the project. The cost of the maintenance, plus 25 percent for supervisory and administrative personnel, will be deducted from monies due the Contractor for the project.
- (k) **Haul Route:** The Contractor shall select haul routes between the project and material source(s) that will minimize disturbance to the community. The Contractor shall furnish the Engineer, for review, his plan for the haul route and for minimizing the adverse effects of hauling operations on persons who reside adjacent to the haul route or who otherwise use a portion of the haul route for ingress or egress to their residential area. The Department may select alternate haul routes, divide the hauling traffic over several routes, and impose other restrictions deemed necessary to minimize the impact of the hauling operation on local residents.

104.05—Removing and Disposing of Structures and Obstructions.

The Contractor shall remove and dispose of or store, as directed by the Engineer, fences, buildings, structures, or encumbrances within the construction limits unless separate pay items for this work are included in the Contract. Payment for these operations will be in accordance with the requirements of Section 301.03. Materials so removed, including existing drains or pipe culverts, shall become the property of the Contractor.

- (a) **Signs:** The Contractor shall relocate street name signs, no parking signs, and other traffic signs within the construction limits that conflict with construction work as approved by the Engineer. Signs that are not needed for the safe and orderly control of traffic during construction as determined by the Engineer shall be removed and stored at a designated location within the project limits. The removed signs shall be stored above ground in a manner that will preclude damage and shall be reinstalled in their permanent locations prior to final acceptance. If any of the removed signs are not to be reinstalled, the Contractor shall notify the Engineer at the time the signs have been properly stored. Such signs will be removed from the storage area by the Department. Any sign that is damaged or lost because of the fault of the Contractor shall be repaired or replaced at his expense. Costs for removing, storing, protecting, and reinstalling such signs shall be included in the price bid for other items in the Contract, and no additional compensation will be made.
- (b) **Mailboxes and Newspaper Boxes:** When removal of mailboxes and newspaper boxes is made necessary by construction operations, the Contractor shall place them in temporary locations so that access to them will not be impaired. Prior to final acceptance, boxes shall be placed in their permanent locations as designated by the Engineer and left in as good condition as when found. Boxes or their supports that are damaged through negligence on the part of the Contractor shall be replaced at his expense. The cost of removing and resetting boxes shall be included in other pay items of the Contract.

104.06—Cleanup.

Removal from the project of rubbish, scrap material, and debris caused by the Contractor's personnel or construction operations shall be a continuing process throughout the course of the work. The work site shall have a neat and orderly appearance at all times.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Before final acceptance, the highway, borrow pits, quarries, disposal areas, storage areas, and all ground occupied by the Contractor in connection with the work shall be cleaned of rubbish, surplus materials, and temporary structures. All parts of the work shall be left in a neat and orderly condition.

Within 30 days after final acceptance, the Contractor shall remove his equipment from the right of way and property adjacent to the project that he does not own or control.

SECTION 105—CONTROL OF WORK

105.01—Authority of Engineer.

During prosecution of the work, the Engineer will answer all questions that may arise as to the quantity, quality, and acceptability of materials furnished and work performed; rate of progress of the work; interpretation of the plans and specifications; acceptable fulfillment of the Contract by the Contractor; disputes and mutual rights between contractors; and compensation.

The Engineer has the authority to suspend the work wholly or in part if the Contractor fails to correct conditions that are unsafe for workers or the general public or carry out the provisions of the Contract. The Engineer may also suspend work for such periods as he may deem necessary because of unsuitable weather in accordance with the requirements of Section 108.10, conditions considered unsuitable for prosecution of the work, or any other condition or reason deemed to be in the public interest.

105.02—Plans and Working Drawings.

Plans consisting of general drawings and showing such details as are necessary to give a comprehensive understanding of the work specified will be furnished by the Department. Except as otherwise shown on the plans, dimensions shown on the plans are measured in the respective horizontal or vertical planes. Dimensions that are affected by gradients or vertical curvatures shall be adjusted as necessary to accommodate actual field conditions and shall be specifically denoted on the working drawings.

The Contractor shall furnish working drawings as may be required. Working drawings shall not incorporate any changes from the requirements of the Contract unless the changes are specifically denoted, together with justification, and are approved in writing by the Engineer. Working drawings and submittals shall be identified by the complete state project and job designation numbers. Items or component materials shall be identified by the specific contract item number and specification reference in the Contract.

The Contractor may authorize the fabricator in writing to act for him in matters relating to working drawings. Such authorization shall have the force and effect of any other representative of the Contractor's organization.

Working drawings for steel structures, including metal handrails, shall consist of shop detail, erection, and other working drawings showing details, dimensions, sizes of units, and other information necessary for the fabrication and erection of metal work.

Working drawings for falsework supporting a bridge superstructure shall be certified by a Professional Engineer, holding a valid license to practice engineering in the Commonwealth of Virginia.

Working drawings for concrete structures and prestressed concrete members shall provide such details as required for the successful prosecution of the work and which are not included in the plans furnished by the Department. Drawings shall include plans for items such as prestressing strand details and elongation calculations, falsework, bracing, centering, form work, masonry, layout diagrams and bending diagrams for reinforcing steel when necessary or when requested.

The Contractor shall submit to the Department for review three sets of required working drawings. Working drawings shall be submitted in sufficient time to allow discussion and correction prior to the beginning of the work they reference. Work shall not be performed or materials ordered prior to review of the working drawings. One set of working drawings marked with any suggested modifications or comments will be returned to the Contractor. The other sets will be retained by the Department.

Reviewed working drawings will be returned to the Contractor within 30 days from the date of receipt by the Department. If a railroad, municipality, or other entity as specified in the Contract or on the plans is required to review the working drawings, the reviewed working drawings will be returned within 45 days from the date of receipt by the Department. If the working drawings are not returned by the time specified, no additional compensation will be allowed except that an extension of time in accordance with the requirements of Section 108.09 will be considered. Upon completion of the work, the original tracings, if required, shall be supplied to the Department.

Prior to fabrication or construction, the Contractor shall submit for review one original and six copies of each working drawing and design calculation and a Professional Engineer's certification of such design for lighting, signal and pedestal poles, overhead and bridge mounted sign structures, breakaway support systems, anchor bolts, framing units, panels, and foundations. All sheets of these submittals shall include the Professional Engineer's stamp or seal. Certification for foundations will be required only when the designs are furnished by the Contractor. The design shall be in accordance with *AASHTO'S Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals*. The certification shall be made by a Professional Engineer holding a valid license to practice engineering in Virginia.

When specified, and prior to manufacture of reinforced concrete pipe, the Contractor shall furnish to the Department a certification of the acceptability of the design of such pipe, as determined from a review which shall be made for the Contractor by a Professional Engineer holding a valid license in the Commonwealth of Virginia. Such certification shall cover all design data, supporting calculations and materials. Pipe designs previously certified or approved by the Department will not require recertification.

The Department's review of the Contractor's working drawings will relate to conformance to the requirements of the Contract. The review shall not be considered as authorization for any deviation from the requirements of the Contract unless the deviation, including

explicit supporting justification, is specifically described. The review will not relieve the Contractor from responsibility for errors in the working drawings. If working drawings detailing a change(s) initiated by the Contractor require more than two resubmissions or revisions, the cost of additional reviews by the Department or its designated representative(s) will be assessed to the Contractor.

The cost of working drawings furnished by the Contractor shall be included in the cost of appropriate contract items.

105.03—Conformity with Plans and Specifications.

Values for materials to be used in the work shall be in close conformity with the specified values or range of values specified in the Contract. Less than complete conformity may be tolerated if obtaining exact or complete conformity would not be feasible and if authorized by the Engineer.

Permissible tolerances for the elevation of earthwork and thickness of the several courses of select material, subbases, and bases are specified in these specifications. If permissive tolerances are exceeded or if consistent deviations from the plans or abrupt changes in grade occur, even though within the tolerances, the affected areas shall be reconstructed to conform to the specified tolerance and provide a smooth riding surface. When it is not feasible to reconstruct the areas, payment will be made in accordance with the requirements of the applicable specification for each material placed.

When the plans require the finished surface to tie into any structural item whose elevation is fixed, the elevation of the finished surface shall coincide with the elevation of the structural item.

105.05—Coordination of Plans, Standard Drawings, Specifications, Supplemental Specifications, Special Provisions, and Special Provision Copied Notes.

The plans, standard drawings, these specifications, supplemental specifications, special provisions, special provision copied notes, and supplementary documents are parts of the Contract. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of a discrepancy, the following will apply:

1. Calculated dimensions, unless obviously incorrect, will govern over scaled dimensions.
2. Supplemental specifications will govern over these specifications.
3. Plans will govern over these specifications, supplemental specifications, and the standard drawings.
4. Special provisions will govern over these specifications, supplemental specifications, and plans.
5. Special provision copied notes will govern over these specifications, supplemental specifications, plans, and special provisions. The pay items and pay units listed in the proposal have the same status as special provision copied notes.

The Contractor shall not take advantage of any apparent error or omission in the plans or specifications. If the Contractor discovers an error or omission, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Contract.

105.06—Cooperation of Contractor.

The Contractor will be supplied with at least two sets of the contract assemblies. Two copies of VDOT’s Road and Bridge Specifications and two copies of VDOT’s Road and Bridge Standards will be furnished on request without charge.

Plans will be furnished to the Contractor without charge as follows:

Original Contract Amount in Dollars		Number of Plan Sets	
From	To	Full Size	Half Size
0	1,999,999	4	6
2,000,000	4,999,999	6	8
5,000,000	9,999,999	8	10
10,000,000+		10	10

Plan revisions issued while the project is under construction will be furnished to the Contractor in the same kind and number. The Contractor shall keep one complete set of plans, standard drawings, contract assemblies, and specifications available on the project at all times except for maintenance projects, certain sign projects, and other projects having no field office or on which the Contractor has no office.

The Contractor shall give the work the constant attention necessary to facilitate progress and shall cooperate with the Engineer, Inspector, and other contractors in every way possible. If any portion of a project is located within the limits of a municipality, military installation, or other federally owned property, the Contractor shall cooperate with the appropriate officials and agents in the prosecution of the work to the same extent as with the Department.

The Contractor shall have on the project at all times a competent superintendent capable of reading and understanding the plans and specifications and experienced in the type of work being performed who shall receive instructions from the Engineer or his authorized representatives. The superintendent shall have full authority to execute the orders and directions of the Engineer without delay and supply promptly such materials, equipment, tools, labor, and incidentals as may be required.

105.07—Cooperation With Regard to Utilities.

The adjustment of utilities consists of the relocation, removal, replacement, rearrangement, reconstruction, improvement, disconnection, connection, shifting, or altering of an existing utility facility in any manner.

Existing utilities at the design stage of the project will be indicated on the plans. Preliminary arrangements for adjusting these utilities will be made by the Department prior to project construction. Existing private and public utilities that require adjustment will be adjusted by the utility owner or shall be adjusted by the Contractor as a contract item. The new location of such utilities will not normally be shown on the plans. Some utilities may remain or be adjusted within the construction limits simultaneously with project construction operations.

The Contractor shall coordinate project construction with planned utility adjustments and take all necessary precautions to prevent disturbance of the utility facilities. The Contractor shall report to the Engineer any failure on the part of the utility owner to cooperate or proceed with the planned utility adjustments.

The Contractor shall perform contract utility work in a manner that will cause the least inconvenience to the utility owner and those being served by the utility owner.

Existing, adjusted, or new utility facilities that are to remain within the right of way shall be properly protected by the Contractor to prevent disturbance or damage resulting from construction operations. If an existing utility that requires adjustment is encountered by the Contractor, he shall not interfere with the utility but shall take the proper precautions to protect the facility and shall promptly notify the Engineer of the need for adjustment.

Prior to preparing a bid, the bidder shall contact known utility owners to determine the nature, extent, and location of existing, adjusted, or new utility facilities. Any additional cost resulting therefrom shall be reflected in the bid price for other items in the Contract.

If the Contractor desires the temporary or permanent adjustment of utilities for his own benefit, he shall conduct all negotiations with the utility owners and pay all costs in connection with the adjustment.

Except as otherwise specified herein, the Department will not be responsible for any claims for additional compensation from the Contractor resulting from delays, inconvenience, or damage sustained by him attributable to interference by utility appurtenances, or the operation of moving the same, other than a consideration of an extension of time.

If it is determined that interference by utility appurtenances caused a delay of such magnitude or otherwise altered project operations so as to increase significantly the Contractor's cost of performing the work, the Engineer may consider additional compensation limited to the actual costs incurred by the Contractor. The determination of the severity of the interference, its impact on the Contractor's costs, and the amount, if any, of compensation shall be at the sole discretion of the Engineer. Prior to the Engineer's review, the Contractor shall present sufficient documentation to substantiate fully the request for additional compensation. Nothing herein shall be construed as requiring acceptance of the Contractor's presentation or payment of additional compensation.

105.08—Cooperation among Contractors.

The Department may at any time contract or approve concurrent contracts for performance of other work on, near, or within the same geographical area of the work specified in an existing contract. Contractors shall not impede or limit access to such work by others.

When separate contracts are awarded within the limits of one project, contractors shall not hinder the work being performed by other contractors. Contractors working on the same project shall cooperate with each other. In case of dispute, the Engineer shall be the referee, and his decision shall be binding on all parties.

When contracts are awarded to separate contractors for concurrent construction in a common area, the contractors, in conference with the Engineer, shall establish a written joint schedule of operations based on the limitations of the individual contracts and the joining of the work of one contract with the others. The schedule shall set forth the approximate dates and sequences for the several items of work to be performed and shall ensure completion within the contract time limit. The schedule shall be submitted to the Engineer for review and approval no later than 30 days after the award date of the later contract and prior to the first monthly progress estimate. The schedule shall be agreeable to, signed by, and binding on each Contractor. The Engineer may allow modifications of the schedule when benefit to the contractors and the Department will result.

Any modification of the schedule shall be in writing, mutually agreed to and signed by the contractors, and shall be binding on the contractors in the same manner as the original agreement.

If the contractors fail to agree on a joint schedule of operations, they shall submit their individual schedules to the Engineer, who will prepare a schedule that will be binding on each Contractor.

The joint schedule and any modification thereof shall become a part of each contract involved. The failure of any Contractor to abide by the terms of the joint schedule shall be justification for declaring the Contractor in default of his Contract.

Each Contractor shall assume all liability, financial or otherwise, in connection with his Contract and shall protect and save harmless the State from any and all damages and claims that may arise because of any inconvenience, delay, or loss he experiences as a result of the presence and operations of other contractors working in or near the work covered by his Contract. He shall also assume all responsibility for any of his work not completed because of the presence or operation of other contractors.

Except for an extension of the contract time limit, the Department will not be responsible for any inconvenience, delay, or loss experienced by a Contractor as a result of his failure to gain access to the work at the time contemplated. When the failure to gain access is not due to any fault or negligence of the Contractor, an extension of the contract time limit will be allowed on the basis of the amount of time delayed.

The Department will not assume any responsibility for acts, failures, or omissions of one contractor that delay the work of another except as provided herein.

105.11—Authority and Duties of Inspector.

Inspectors employed by the Department are authorized to inspect all work performed and materials furnished. Inspection may extend to all or any part of the work and to the preparation, fabrication, and manufacture of the materials to be used. The Inspector is not authorized to alter or waive the provisions of these specifications or make changes in the plans.

The Inspector is not authorized to make final acceptance of the project, approve any operation or item, or act as foreman for the Contractor. However, the Inspector will have the authority to reject defective work and material and suspend work that is being improperly performed, subject to the concurrence of the Engineer. Such inspection shall not relieve the Contractor of any obligation to furnish acceptable materials or provide completed construction that is in accordance with the plans and specifications.

The Inspector will exercise only such additional authority as may be delegated by the Engineer. The Engineer will advise the Contractor in writing of delegations of authority that will affect his operations.

105.12—Inspection of Work.

Inspection will be performed at critical stages. However, all stages, materials, and details of the work are subject to inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished such information and assistance by the Contractor as are required to make a complete and detailed inspection. The Engineer and his appointed representatives shall have ready access to machines and plant equipment used in processing or placing materials.

Prior to the beginning of operations, the Engineer will meet with the Contractor to establish an understanding of the critical stages of work that shall be performed in the presence of the Inspector. In order for the Department to schedule inspection of the work, the Contractor shall keep the Engineer informed of planned operations in accordance with the requirements of Section 103.06(e).

If the Engineer requests it, the Contractor shall remove or uncover such portions of the finished work as may be directed at any time before final acceptance. If necessary, the Contractor shall restore such portions of the work to comply with the specifications. If the work exposed is acceptable, the uncovering or removing and replacing the covering or making good the parts removed will be paid for as extra work in accordance with the requirements of Section 104.03. If the work is unacceptable, the cost of uncovering or removing and replacing the covering or making good the parts removed shall be borne by the Contractor.

When any unit of government, political subdivision, or public or private corporation is to pay a portion of the cost of the work specified in the Contract, its representatives shall have the right to inspect the work. The exercise of this right shall not be construed as making them a party or parties to the Contract or conferring on them the right to issue instructions or orders to the Contractor.

If materials are used or work is performed without inspection by an authorized representative of the Department, the Contractor may be ordered to remove and replace the work or material at his own expense unless the Department's representative failed to inspect the work or material after having been given reasonable notice in writing that the material was to be used or the work was to be performed.

If an inspection reveals that work has not been properly performed, the Contractor will be so advised and shall immediately inform the Department of his schedule for correcting such work and the time at which a reinspection can be made.

105.13—Removal of Unacceptable and Unauthorized Work.

Work that does not conform to the requirements of the Contract will be considered unacceptable work.

Unacceptable work shall be remedied or removed immediately and replaced in an acceptable manner at the Contractor's expense. The Engineer may accept the work at a reduced price when acceptance is considered to be in the best interest of the public.

No work shall be done until the lines and grades have been established by the Engineer. Work that is done contrary to the instructions of the Engineer, beyond the lines shown on the plans or as designated by the Engineer except as specified herein, or without authority will be considered unauthorized and will not be paid for. Such work may be ordered removed or replaced at the Contractor's expense.

The Contractor shall not perform destructive sampling or testing of the work without written authorization of the Engineer. Unauthorized destructive sampling or testing will cause the work to be considered unacceptable.

In the event the Contractor is granted authorization to perform destructive sampling or testing, the Engineer must approve the method and location of each test prior to beginning such sampling or testing. In addition, destructive sampling and testing shall be performed in the presence of the Engineer.

If the Contractor fails to comply immediately with any order of the Engineer made under the provisions of this section, the Engineer will have the authority to cause unacceptable work to be removed and replaced and unauthorized work to be removed and to deduct the cost from any monies due or to become due the Contractor.

105.15—Acceptance.

- (a) **Partial Acceptance:** If at any time during the prosecution of the project the Contractor completes a unit or portion of the project, such as a structure, an interchange, slopes, pavement, or a section of a roadway, in its entirety, he may ask the Engineer to make final inspection of such work. If the Engineer finds upon inspection that the work conforms to the requirements of the Contract and that acceptance is in the interest of the public, he may accept the work as being completed, and the Contractor will be relieved of further responsibility for the work as specified in Section 107.16. Partial acceptance shall in no way void or alter any terms of the Contract.

If any damage attributable to causes beyond the control of the Contractor is sustained by the accepted unit or portion of the project, the Engineer may authorize the Contractor to make necessary repairs. In the absence of contract prices covering the items of repair, the work will be paid for in accordance with the requirements of Section 109.05.

- (b) **Final Acceptance:** Upon receipt of a written notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. If all work specified in the Contract has been completed, the inspection will constitute the final inspection and the Engineer will make the final acceptance. The Contractor will be notified of final acceptance in writing within 5 days.

If the inspection discloses that any work, in whole or in part, is incomplete or unacceptable, the Contractor shall immediately correct the deficiency. Upon completion or correction of the work, another inspection will be made that will constitute the final inspection. In such event, the Engineer will make the final acceptance and the Contractor will be notified of final acceptance in writing within 5 days. In any event, the Contractor shall maintain the project until final acceptance except under conditions that may be specifically exempted.

SECTION 106—CONTROL OF MATERIAL

106.01—Source of Supply and Quality Requirements.

The materials used throughout the work shall conform to the requirements of the Contract. The Contractor shall regulate his supplies so that there will be a sufficient quantity of tested material on hand at all times to prevent any delay of work. Except as otherwise specified, materials, equipment, and components shall be new. Within 30 days after the date of the letter to the Contractor advising that the Department will recommend that the Board award the Contract, but not later than 7 days prior to the beginning of construction operations under the Contract, the Contractor shall file a statement of the known origin, composition and manufacture of all materials to be used in the work, including optional or alternate items. Material requirements not previously reported shall be submitted at least 60 days prior to their use on the project, but not less than two weeks prior to delivery. The Contractor's statement shall be identified by the complete state project number, and all items or component materials shall be identified by the specific contract item number and the specification reference shown in the Contract.

At the option of the Engineer, materials may be approved at the source of supply. If it is found during the life of the Contract that previously approved sources of supply do not supply materials or equipment conforming to the requirements of the Contract, do not furnish the valid test data required to document the quality of the material or equipment, or do not furnish valid quantities to document payment, the Contractor shall change the source of supply and furnish material or equipment from other approved sources. The Contractor shall notify the Department of this change, and provide the same identifying information noted hereinbefore, at least 60 days prior to their use on the project, but not less than two weeks prior to delivery.

Materials shall not be furnished from a source that has been identified by the Office of Federal Activities as being on the EPA's list of violating facilities.

When optional materials are included in the Contract, the Contractor shall advise the Engineer in writing of the specific materials selected. Thereafter, the Contractor shall use the selected materials throughout the project unless a change is authorized in writing by the Engineer. However, when the Contractor has an option as to the type of pipe that may be used, he may use any one of the approved types for each size of pipe, but he shall use the same type for a particular line. The Engineer may authorize other types and sources in an emergency that will unreasonably delay delivery of the selected material.

Equipment and material guaranties or warranties that are normally given by a manufacturer or supplier, or are otherwise required in the Contract, shall be obtained by the Contractor and assigned to the State in writing. The Contractor shall also provide an inservice operation guaranty for at least 6 months, beginning on the date of final acceptance, on all mechanical and electrical equipment and related components.

106.02—Material Inspection.

The Contractor shall advise the Engineer at least 2 weeks prior to the delivery of any material from a commercial source. The Contractor shall provide the Engineer with one copy of all invoices (prices are not required) for materials delivered to the project with the following exceptions: asphalt concrete; dense graded aggregate, to include aggregate base, subbase, and select material; fine aggregate; open graded coarse aggregate; crusher run aggregate; and road stabilization aggregate. The printed weights of each load of these materials, as specified in Section 109.01, shall accompany the delivery, and such information shall be made available to the Inspector at the project.

106.03—Local Material Sources (Pits and Quarries).

The requirements set forth herein apply exclusively to pits and quarries from which materials are obtained for use on contracts awarded by the Department.

Local material sources shall be concealed from view from the completed roadway and any existing public roadway. Concealment shall be accomplished by selectively locating the pit or quarry and spoil pile, providing environmentally compatible screening between the pit or quarry site and the roadway, or using the site for another purpose after removal of the material. The foregoing requirements shall also apply to any pit or quarry opened or reopened by a subcontractor or supplier. However, the requirements will not apply to commercial sand and gravel and quarry operations actively processing material at the site prior to the date of the Notice of Advertisement.

The Contractor shall furnish the Engineer a statement signed by the property owner in which the property owner agrees to the use of his property as a source of material for the project. Upon completion of the use of the property as a material source, the Contractor shall furnish the Engineer a release signed by the property owner indicating that the property has been satisfactorily restored. This requirement will be waived for commercial sources, sources owned by the Contractor, and sources furnished by the Department.

Local material pits and quarries shall not be opened or reopened without authorization by the Engineer. The Contractor shall submit for approval a site plan, including, but not limited to, (1) the location and approximate boundaries of the excavation with a slope gradient of 3:1 or greater; (2) procedures to minimize erosion and siltation; (3) provision of environmentally compatible screening; (4) restoration; (5) cover vegetation; (6) other use of the pit or quarry after removal of material, including the spoil pile; (7) the drainage pattern on and away from the area of land affected, including the directional flow of water; (8) constructed or natural waterways used for discharge; (9) a sequence and schedule to achieve the approved plan and; (10) the total drainage area for temporary sediment traps shall be shown. The

site plan shall also include sediment basins if required. Sediment basins are required if the runoff from a watershed area of three acres or more flows across a disturbed area of 10,000 square feet or greater. The Contractor shall design, construct and maintain the basin to accommodate the anticipated sediment loading from the land disturbing activity. The Contractor shall certify that the sediment basin design is in compliance with the Virginia Erosion and Sediment Control Regulations.

The Contractor's design and restoration shall be in accordance with the Contract and in accordance with the requirements of the federal, state, and local laws and regulations.

If the approved plan provides for the continued use or other use of the pit or quarry beyond the date of final acceptance, the Contractor shall furnish the Department a bond made payable to the Commonwealth of Virginia in an amount equal to the Engineer's estimate of the cost of performing the restoration work. If the pit or quarry is not used in accordance with the approved plan within 8 months after final acceptance, the Contractor shall perform restoration work as directed by the Engineer, forfeit his bond, or furnish the Engineer with evidence that he has complied with the applicable requirements of the State Mining Law.

Topsoil on borrow sites shall be stripped and stockpiled as directed by the Engineer for use as needed within the construction limits of the project or in the reclamation of borrow and disposal areas.

If the Contractor fails to provide necessary controls to prevent erosion and siltation, such efforts are not made in accordance with the approved sequence, or the efforts are found to be inadequate, he shall take immediate action to abate erosion and siltation. The Department may cause the Contractor to cease all contributing operations and direct efforts toward corrective action or may perform the work with state forces or other means determined by the Engineer. If the work is not performed by the Contractor, the cost of performing the work, plus 25 percent for supervisory and administrative personnel, will be deducted from monies due the Contractor.

Costs for applying seed, fertilizer, lime, and mulch; restoration; drainage; erosion and siltation control; regrading; haul roads; and screening shall be included in the contract price for the type of excavation or other appropriate items.

If the Contractor fails to fulfill the provisions of the approved plan for screening or restoring material sources, the Department may withhold and use for the purpose of performing such work any monies due the Contractor at the time of the final estimate. The Contractor will be held liable for penalties, fines, or damages incurred by the Department as a result of his failure to prevent erosion or siltation.

After removing the material, the Contractor shall remove metal, lumber, and other debris resulting from his operations and shall shape and landscape the area in accordance with the approved plan for such work.

If payment is to be made for material measured in its original position, material shall not be removed until cross sections have been taken. The material shall be reserved exclusively for use on the project until completion of the project or until final cross-sections have been taken.

- (a) **Sources Located by the Department:** The Department may indicate on the plans where certain materials are known to exist. The Department usually holds no title in such sources. However, an option for the use of the material may have been obtained by the Department. Existing exploration and test data for such sources, together with existing options, will be available for inspection upon request at the office of the District or State Materials Division Administrator. The Contractor may have such instruments of option assigned to him. In such event, the Contractor shall advise the property owner of his acceptance in accordance with the instrument prior to entering such pits or quarries and shall assume all responsibility for doing so. The Department makes no guarantee as to the legal sufficiency of the instruments obtained hereunder.

The Department's exploration and test data for a local material source shall in no way constitute a guarantee of the quality and quantity of materials in the deposit. The Contractor shall perform exploration and tests as is necessary to determine the amount of selective excavating, processing, and admixing he shall perform in order to furnish the specified material. The cost of exploring, testing, processing, and admixing, including the cost of the admixture material, shall be borne by the Contractor.

- (b) **Sources Furnished by the Department:** Sources furnished by the Department will be made available to the Contractor together with the right to use such property as may be required for a plant site, stockpiles, and haul roads. The Contractor shall confine his excavation operations to those areas of the property specified in the Contract.

The Contractor shall be responsible for excavation that shall be performed in order to furnish the specified material.

- (c) **Sources Furnished by the Contractor:** When the Contractor desires to use local material from sources other than those located or furnished by the Department, he shall first secure the approval of the Engineer. The use of material from such sources will not be permitted until test results have been approved by the Engineer and written authority for its use has been issued.

The Contractor shall acquire the necessary rights to take material from sources he locates and shall pay all related costs, including costs that may result from an increase in the length of the haul. Costs of exploring, sampling, testing, and developing such sources shall be borne by the Contractor. The Contractor shall obtain representative samples from at least two borings in parcels of 10 acres or less and at least three additional borings per increment of 5 acres or portion thereof to ensure that lateral changes in material are recorded. Drill logs for each test shall include a soil description and the moisture content at intervals where a soil change is observed or at least every 5 feet of depth for consistent material. Samples obtained from the boring shall be tested by an approved laboratory for grading, Atterberg limits, CBR, maximum density, and optimum moisture. The

Department will review and evaluate the material based on test results provided by the Contractor. The Department may reject any material from a previously approved source that fails a visual examination or whose test results show that it does not conform to the specifications.

106.04—Disposal Areas.

Unsuitable or surplus material shown on the plans shall be disposed of as shown herein. Material not used on the project shall be disposed of by the Contractor off the right of way. The Contractor shall obtain the necessary rights to property to be used as an approved disposal area. For the purpose of this specification an approved disposal area is defined as that which is owned privately and has been approved by the Department for use in disposing of material not used on the project.

When neither unsuitable nor surplus material is shown on the plans, the Contractor shall dispose of it as shown herein. If the Contractor, having shown reasonable effort, is unsuccessful in obtaining the necessary rights to property to be used as an approved disposal area, the Department will obtain rights for disposal. Compensation, if not shown in the Contract, will be in accordance with the requirements of Section 104.02.

Prior to VDOT approving a disposal area, the Contractor shall submit a site plan. The plan shall show (1) the location and approximate boundaries of the disposal area, (2) all procedures to minimize erosion and siltation, (3) haul roads, (4) provision for environmentally compatible screening, (5) restoration of and permanent cover vegetation in accordance with the Roadside Development Sheet for the area following the deposit of material, (6) the drainage pattern on and away from the area affected, including constructed or natural waterways used for drainage and calculations to determine the need for channel improvements if the natural channel will not accommodate the 2-year storm or the man-made channel will not accommodate the 10-year storm in accordance with the Virginia Erosion and Sediment Control Regulations, (7) the streams or tributaries receiving the discharge, (8) a sequence and schedule to complete the work, and (9) total drainage area for temporary sediment traps. The site plan shall also include sediment basins if required. Sediment basins are required if the runoff from a watershed area of 3 acres or more flows across a disturbed area of 10,000 square feet or greater. The Contractor shall design, construct and maintain the basin to accommodate the anticipated sediment loading from the land disturbing activity. Costs for applying seed, lime, fertilizer, and mulch, reforestation, drainage, erosion and siltation control, regrading, haul roads, and screening for disposal areas and pits shall be included in the contract price bid for the type of excavation or other appropriate items. The Contractor shall certify that the sediment basin design is in compliance with the Virginia Erosion and Sediment Control Regulations, all local, state, and federal ordinances and Section 107.14.

Disposal areas shall be cleared but need not be grubbed. The clearing work shall not damage grass, shrubs, or vegetation outside the limits of the approved area and haul roads thereto. After the material has been deposited, the area shall be shaped to minimize erosion and siltation of nearby streams and landscaped in accordance with the approved plan for such work or shall be used as approved by the Engineer. The Contractor's design and restoration shall be in accordance with the requirements of the contract and federal, state, and local laws and regulations.

If the Contractor fails to provide the necessary controls to prevent erosion and siltation, or the efforts are found to be inadequate, he shall take immediate action to abate erosion and siltation. The Department may cause the Contractor to cease all contributing operations and direct efforts toward corrective action or may perform the work with state forces or other means determined by the Engineer. If the work is not performed by the Contractor, the entire cost of performing the work, plus 25 percent for supervisory and administrative personnel, will be deducted from monies due the Contractor.

The Contractor shall furnish the Engineer a statement signed by the property owner in which the owner agrees to the use of his property for the deposit of material from the project. Upon completion of the use of the property as an approved disposal area, the Contractor shall furnish the Engineer a release signed by the property owner indicating that the property has been satisfactorily restored. This requirement will be waived for property that is owned by the Contractor.

Material encountered by the Contractor shall be handled as follows:

- (a) **Unsuitable material** for the purpose of this specification is defined as material having poor bearing capacity, excessive moisture content, extreme plasticity or other characteristics as defined by the Engineer and shall be disposed of at an approved disposal area or landfill licensed to receive such material.
- (b) **Surplus material** as shown on the plans shall be disposed of by flattening slopes, used to fill in ramp gores and medians, or disposed of at an approved disposal area or a licensed landfill.
- (c) **Organic materials** such as tree stumps and limbs (not considered merchantable timber), roots, rootmat, leaves, grass cuttings, or other similar materials shall be chipped or shredded and used on the project as mulch, given away or sold as firewood, chipped or shredded and given away or sold as mulch, burned at the Contractor's option if permitted by local ordinance, or shall be disposed of at an approved facility licensed to receive such materials. Organic material shall not be buried in state rights of way or in an approved disposal area.
- (d) **Rootmat** for the purpose of this specification is defined as any material that, by volume, contains approximately 60 percent or more roots and shall be disposed of in accordance with (c) herein.

- (e) **Inorganic materials** such as brick, cinder block, broken concrete without exposed reinforcing steel, or other such material shall be disposed of at an approved disposal area or landfill licensed to receive such materials. If disposed of in an approved disposal area, the material shall have at least 2 feet of backfill cover and restored in accordance with other provisions of this section.

Concrete without exposed reinforcing steel and not blended, may be crushed and used as rock in accordance with Section 303. If approved by the Engineer, these materials may be blended with soils that meet AASHTO M57 requirements and deposited in fill areas within the right-of-way in accordance with the requirements of Section 303 as applicable.

Concrete with exposed reinforcing steel still attached shall not be disposed of at an approved disposal area but may be disposed of at a landfill licensed to receive such material.

- (f) **Excavated rock** in excess of that used within the project site in accordance with the requirements of Section 303 shall be treated as surplus material.

Surplus material stockpile areas on the right-of-way shall be cleared but need not be grubbed. The clearing work shall not damage grass, shrubs, or vegetation outside the limits of the approved area and the haul roads thereto. Placement of fill material shall not adversely affect existing drainage structures. If necessary, modified existing drainage structures, as approved by the Engineer shall be paid for in accordance with Section 109.05. Within 7 days after the material has been deposited, the area shall be shaped and seeded to minimize erosion and siltation.

106.05—Rights for and Use of Materials Found on Project.

With the approval of the Engineer, the Contractor may use in the project any materials found in the excavation that comply with the specifications. Unless otherwise specified, the Contractor will be paid for both the excavation of such materials at the contract unit price and for the pay item for which the excavated material is used. However, the Contractor shall replace at his own expense with other acceptable material the excavation material removed and used that is needed for use in embankments, backfills, approaches, or otherwise. The Contractor shall not excavate or remove any material from within the construction limits that is not within the grading limits, as indicated by the slope and grade lines, without authorization by the Engineer.

106.06—Samples, Tests, and Cited Specifications.

Materials will be inspected and tested by the Engineer before or during incorporation in the work. However, the inspection and testing of such material shall not relieve the Contractor of the responsibility for furnishing material that conforms to the specifications. The Department may retest all materials that have been accepted at the source of supply after delivery and may reject those that do not conform to the specifications. Stored material may be reinspected prior to use. Work in which untested materials are used without the written permission of the Engineer may be considered unacceptable.

Unless reference is made to a specific dated specification, references in these specifications to AASHTO, ASTM, VTM, and other standard test methods and materials requirements shall refer to either the test specifications that have been formally adopted or the latest interim or tentative specifications that have been published by the appropriate committee of such organizations as of the date of the Notice of Advertisement. Unless otherwise indicated, tests for compliance with specification requirements will be made by and at the Department's expense except that the cost of retests, exclusive of the first retest, shall be borne by the Contractor. Samples shall be furnished by the Contractor at his expense, and those that are not tested by the Contractor will be tested by a representative of the Department.

The inspection cost of structural steel items fabricated in a country other than the continental United States shall be borne by the Contractor. Inspection of structural fabrication shall be performed in accordance with the requirements of the appropriate VTM by a commercial laboratory approved by the Department. Additional cleaning or repair necessary because of environmental conditions in transit shall be at the Contractor's expense.

In lieu of testing, the Engineer may approve the use of materials based on the receipt of a certification furnished by the Contractor from the manufacturer. However, furnishing the certificate shall not relieve the Contractor of the responsibility for furnishing materials that conform to the specifications.

Materials requiring an MSDS will not be accepted at the project site for sampling or at the Department's laboratories for testing without the document.

106.07—Plant Inspection.

If the Engineer inspects materials at the source, the following conditions shall be met:

1. The Engineer shall have the cooperation and assistance of the Contractor and producer of the materials.
2. The Engineer shall have full access to parts of the plant that concern the manufacture or production of the materials being furnished.
3. For materials accepted under a quality assurance plan, the Contractor shall furnish equipment and maintain a plant laboratory at locations approved for plant processing of materials. The Contractor shall use the laboratory and equipment to perform quality control testing.

The laboratory shall be of weatherproof construction, tightly floored and roofed, and shall have adequate lighting, heating, running water, ventilation, and electrical service. The ambient temperature shall be maintained between 68 degrees F and 86 degrees F and thermostatically controlled. The laboratory shall have a telephone, intercom, or other electronic communication system connecting the laboratory and scale house if the facilities are not in close proximity. The laboratory shall be constructed in accordance with the requirements of local building codes.

The Contractor shall furnish, install, maintain, and replace, as conditions necessitate, testing equipment specified by the appropriate AASHTO method or VTM being used and provide necessary office equipment and supplies to facilitate keeping records and generating test reports. The Contractor's technician shall maintain current copies of the appropriate test procedures. The Contractor shall also provide and maintain an approved test stand for accessing truck beds for the purpose of sampling and inspection. Cast iron grinding pots and rubber mauls will be furnished by the Department where required. The Department may approve a single laboratory to service more than one plant belonging to the same Contractor.

4. Adequate safety measures shall be provided and maintained.

106.08—Storing Materials.

Materials shall be stored in a manner so as to ensure the preservation of their quality and fitness for the work. When considered necessary by the Engineer, materials shall be stored in weatherproof buildings on wooden platforms or other hard, clean surfaces that will keep the material off the ground. Materials shall be covered when directed by the Engineer. Stored material shall be located so as to facilitate its prompt inspection. Approved portions of the right of way may be used for storage of material and equipment and for plant operations. However, equipment and materials shall not be stored within the clear zone of the travel lanes open to traffic.

Additional required storage space shall be provided by the Contractor at his expense. Private property shall not be used for storage purposes without the written permission of the owner or lessee. Copies of the written permission shall be furnished the Engineer. Upon completion of the use of the property, the Contractor shall furnish the Engineer a release signed by the property owner indicating that the property has been satisfactorily restored.

106.09—Handling Materials.

Materials shall be handled in a manner that will preserve their quality and fitness for the work. Aggregates shall be transported from storage to the work in vehicles constructed to prevent loss or segregation of materials.

106.10—Unacceptable Materials.

Materials that do not conform to the specifications shall be considered unacceptable. Such materials, whether in place or not, will be rejected and shall be removed from the site of the work. If it is not practical for the Contractor to remove rejected material immediately, the Engineer will mark the material for identification. Rejected material whose defects have been corrected shall not be used until approval has been given by the Engineer.

106.11—Material Furnished by the Department.

The Contractor shall furnish all materials required to complete the work except those specified to be furnished by the Department.

Material furnished by the Department will be delivered or made available to the Contractor at the points specified in the Contract. The cost of handling and placing materials after delivery to the Contractor shall be included in the contract price for the item with which they are used.

The Contractor shall be responsible for material delivered to him, including shortages, deficiencies, and damages that occur after delivery, and any demurrage charges.

SECTION 107—LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01—Laws To Be Observed.

The Contractor shall keep fully informed of federal, state, and local laws, bylaws, ordinances, orders, decrees, and regulations of governing bodies, courts, and agencies having any jurisdiction or authority that affects those engaged or employed on the work, the conduct of the work, or the execution of any documents in connection with the work. The Contractor shall observe and comply with such laws, ordinances, regulations, orders, or decrees and shall indemnify and hold harmless the State and its agents, officers, or employees against any claim for liability arising from or based on their violation, whether by himself, his agents, his employees, or subcontractors. The Contractor shall execute and file the documents, statements, and affidavits required under any applicable federal or state law or regulation affecting his bid or Contract or prosecution of the work thereunder. The Contractor shall permit 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 enforcement of such law.

In accordance with Title 2.2, Subtitle II, Part B, Chapter 43, Article 4 of the *Code of Virginia* (Virginia Public Procurement Act), the Contractor shall make payment to all subcontractors, as defined in the Code, within seven days after receipt of payment from the Department; or, shall notify the Department and subcontractor in writing of the intention to withhold all or a part of the amount due along with the reason for nonpayment.

In the event payment is not made as noted, the Contractor shall pay interest at the rate of 1 percent per month, unless otherwise provided in the contract, to the subcontractor on all amounts that remain unpaid after seven days except for the amounts withheld as provided hereinbefore.

These same requirements shall be included in each subcontract and shall be applicable to each lower-tier subcontractor.

107.02—Permits, Certificates, and Licenses.

Permits and certificates obtained by the Department will be included in the contract documents. Construction methods shall conform to the stipulations of the permit. The Contractor shall assume all obligations and cost he incurs by complying with the terms and conditions of the permits and certificates.

If a U.S. Army Corps of Engineers permit is not applicable and additional permits or certificates are required to perform dredging for flotation of construction equipment or for other temporary work as indicated in the Contractor's accepted plan of operations but have not been obtained by the Department, the Contractor shall furnish the Engineer, at least 75 days prior to the proposed activity, all necessary information pertaining to the proposed activity in order for the Department to make application for the permit(s) or certificate(s). The Contractor shall not begin the proposed activity until the additional permit(s) or certificate(s) has been secured and the Contractor has been advised by the Engineer that the proposed activity may proceed. Additional compensation will not be made for delay(s) to the work or for change(s) in the Contractor's proposed methods that may result from the jurisdictional agencies' review process or disapproval of the Contractor's proposed methods except that an extension of time will be considered in accordance with the requirements of Section 108.09 if a permit or permit denial is not issued within the specified 75 days.

- (a) **U.S. Army Corps of Engineers Permit:** If a U.S. Army Corps of Engineers permit is applicable to the project, the proposal will so indicate and the Department will obtain it. If the permit obtained does not cover construction activities that require a permit and the Department determines that the activities are necessary for completion of the work, the Contractor shall furnish the Engineer all necessary information pertaining to the activity so that the Department can apply for an addendum to the permit. Such information shall be furnished at least 180 days prior to the date the activity is to begin. The Contractor shall not begin the activity until directed to do so by the Engineer. Additional compensation will not be made for delay(s) to the work or change(s) in the Contractor's proposed methods of construction that may result from the jurisdictional agencies' review process or disapproval of the Contractor's proposed methods. However, an extension of time will be considered in accordance with the requirements of Section 108.09 if notification to proceed or denial of the proposed construction activity is not issued within 180 days.

The Contractor shall not proceed with work covered by the permit until the work is released in writing by the Engineer. The Engineer may release a portion or all of such work but may order a suspension of the same work after its release.

If the Department has not released work covered by the Corps of Engineers permit and the Contractor has completed all other work within the limits of the project, the Contractor shall so advise the Engineer in writing. Upon receipt of the notification, the Engineer will evaluate the status of the project and advise the Contractor within 45 days of the portion of the project that is acceptable under Section 105.15. If the Engineer determines that all of the work except that encumbered by the permit application is acceptable under Section 105.15, the Contractor will be notified accordingly. The Department or Contractor may then elect to continue or terminate the remaining portion of the Contract.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

The party electing to terminate the Contract shall so advise the other party in writing after the 45-day period. The terms of contract termination will be in accordance with the requirements of Section 108.14. No compensation will be made for delays encountered or for work not performed except for an extension of time as determined in accordance with the requirements of Section 108.09.

If the Contractor elects to maintain contractual obligations with the approval of the Engineer, he shall continue maintenance of uncompleted work and disturbed areas. Upon release by the Department in writing, the Contractor shall complete the remaining work in accordance with the contract requirements.

- (b) **Nationwide Federal Permit:** If a Nationwide Federal Permit is applicable to the project, the proposal will so indicate and a Corps of Engineers permit will not be required. However, the Department may have obtained other permits or certificates for the project.
- (c) **Other Permits, Certificates, and Licenses:** Except as otherwise specified herein, the Contractor shall procure necessary permits, certificates, or licenses that have not been obtained by the Department. The Contractor shall pay all charges, fees, and taxes and give all notices necessary and incidental to the due and lawful prosecution of the work.

107.09—Construction Over or Adjacent to Navigable Waters.

The Contractor shall conduct the work on navigable waters so as to ensure the least possible obstruction to navigation and that the existing navigable depths will not be impaired except as may be allowed by a permit issued by the U.S. Coast Guard. The Contractor shall also provide and maintain temporary navigation lights and signals required by U.S. Coast Guard regulations for the protection of navigation. When the Engineer determines that the work has reached a point where such action may be taken, the channel(s) through the structure shall be promptly cleared of falsework, piling, or other obstructions placed therein or caused by the construction of the structure to the satisfaction of the Coast Guard.

107.12—Protecting and Restoring Property and Landscape.

The Contractor shall preserve property and improvements along the lines of and adjacent to the work unless their removal or destruction is called for by the plans. The Contractor shall use suitable precautions to prevent damage to such property.

When the Contractor finds it necessary to enter on private property, he shall secure from the owner or lessee a written permit for such entry prior to moving thereon. An executed copy of this permit shall be furnished the Engineer.

The Contractor shall be responsible for damage or injury to property during the prosecution of the work resulting from any act, omission, neglect, or misconduct in the method of executing the work or attributable to defective work or materials. This responsibility shall not be released until final acceptance of the project.

When direct or indirect damage is done to property by or on account of any act, omission, neglect, or misconduct in the method of executing the work or in consequence of the nonexecution thereof on the part of the Contractor, the Contractor shall restore such property to a condition similar or equal to that existing before such damage was done by repairing, rebuilding, or restoring, as may be directed by the Engineer, or making settlement with the property owner. The Contractor shall secure from the owner a release from any claim against the Department without additional compensation therefor. A copy of this release shall be furnished the Engineer.

107.13—Responsibility for Damage Claims.

The Contractor shall indemnify and save harmless the State, the Board, and its officers, agents, and employees, as well as the city, town, county, or other municipality in which the work is performed and their officers, agents, and employees, from suits, actions, or claims brought for or on account of any injuries or damages received or sustained by any person, persons, or property resulting from or arising out of the work performed by the Contractor, or by or in consequence of any neglect in safeguarding the work, through the use of unacceptable materials in the construction or the improvement, or resulting from any act or omission, neglect, or misconduct of the Contractor; or by or on account of any claims or amounts recovered by infringement of any patent, trademark, or copyright. The Commissioner may retain as much of the monies due the Contractor under and by virtue of his Contract as the State considers necessary to ensure that a fund will be available to pay a settlement or judgment of such suits, actions, or claims. If no monies are due, the Contractor's surety will be held until all such claims and actions have been settled and suitable evidence to that effect has been furnished the Board. Any extension of time granted the Contractor in which to complete the Contract shall not relieve him or his surety of this responsibility.

It is not intended by any of the provisions of any part of the Contract to create the public or any member thereof as a third party beneficiary hereunder or to authorize anyone not a party to the Contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the Contract.

When any act, omission, or other action of the Contractor occurs that affects the health, safety, or welfare of the public, the Engineer will direct the Contractor to take prompt action to repair, replace, or restore the damage or injury within a time frame established by the Engineer. If the Contractor fails to make such repair, replacement, or restoration within the established time frame, the Engineer will

have the damage or injury repaired, replaced, or restored and will deduct the cost of such repair, replacement, or restoration from monies due the Contractor.

107.14—Environmental Stipulations.

By signing the bid, the bidder shall have stipulated (1) that any facility to be used in the performance of the Contract (unless the Contract is exempt under the Clean Air Act as amended [42 U.S.C. 1857, et seq., as amended by P.L. 91-604], the Federal Water Pollution Control Act as amended [33 U.S.C. 1251 et seq. as amended by P.L. 92-500], and Executive Order 11738 and regulations in implementation thereof [40 C.F.R., Part 15]) is not listed on the EPA's List of Violating Facilities pursuant to 40 C.F.R. 15.20; and (2) that the Department will be promptly notified prior to the award of the Contract if the bidder receives any communication from the Director, Office of Federal Activities, EPA, indicating that a facility to be used for the Contract is under consideration to be listed on the EPA's List of Violating Facilities.

No separate payment will be made for the work or precautions described herein except where provided for as a specific item in the Contract or except where provision has been made for such payment in these specifications.

- (a) **Erosion and Siltation:** The Contractor shall exercise every reasonable precaution, including temporary and permanent measures, throughout the duration of the project to control erosion and prevent siltation of adjacent lands, rivers, streams, wetlands, lakes, and impoundments. Siltation control measures shall be applied to erodible material exposed by any activity associated with construction, including clearing and grubbing, but not limited to local material sources, stockpiles, disposal areas, and haul roads.

The Contractor shall comply with the requirements of Section 301.02. Should the Contractor as a result of negligence or noncompliance leave an area exposed more than 15-days, the cost of temporary seeding and or mulching shall be at Contractor's own expense. If the delay is due to circumstances beyond the Contractor's control, the Department will be responsible for the expense.

Temporary measures shall be coordinated with work to ensure effective, and continuous erosion and siltation control. Permanent erosion control measures and drainage facilities shall be installed as the work progresses.

The Contractor shall have, within the limits of the project, an employee certified by the Department of Conservation and Recreation in Erosion and Sediment Control who shall inspect erosion and siltation control devices and measures for proper installation and deficiencies immediately after each rainfall, at least daily during prolonged rainfall, and weekly when no rainfall event occurs. Deficiencies shall be corrected immediately. Failure on the part of the Contractor to maintain appropriate erosion and siltation control devices in a functioning condition may result in the Engineer notifying the Contractor in writing of specific deficiencies. If the Contractor fails to correct or take appropriate actions to correct the specified deficiencies within 24-hours after receipt of such notification, the Department may do one or more of the following, require the Contractor to suspend work in other areas and concentrate efforts toward correcting the specified deficiencies, hold progress estimates, or proceed to correct the specified deficiencies and deduct the entire cost of such work from monies due the Contractor. Failure of the Contractor to maintain a certified Erosion and Sediment Control employee within the limits of the project will result in the Engineer suspending work related to any land disturbing activity until such time as a certified Erosion and Sediment Control employee is present on the project.

(b) **Pollution:**

1. **Water:** The Contractor shall exercise every reasonable precaution throughout the duration of the project to prevent pollution of rivers, streams, and impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage, paints, sedimentation, and other harmful material shall not be discharged into or alongside rivers, streams, or impoundments or into channels leading to them.

Construction discharge water shall be filtered to remove deleterious materials prior to discharge into state waters. During specified spawning seasons, discharges and construction activities in spawning areas of state waters shall be restricted so as not to disturb or inhibit aquatic species that are indigenous to the waters. Neither water nor other effluence shall be discharged onto wetlands or breeding or nesting areas of migratory waterfowl. When used extensively in wetlands, heavy equipment shall be placed on mats. Temporary construction fills and mats in wetlands and flood plains shall be constructed of approved nonerodible materials and shall be removed by the Contractor to natural ground when the Engineer so directs.

If the Contractor dumps, discharges, or spills any oil or chemical that reaches or has the potential to reach a waterway, he shall immediately notify all appropriate jurisdictional state and federal agencies in accordance with the requirements of Section 107.01 and shall take immediate actions to contain, remove, and properly dispose of the oil or chemical.

Excavation material shall be disposed of in approved areas above the mean high water mark shown on the plans in a manner that will prevent the return of solid or suspended materials to state waters. If the mark is not shown on the plans, the mean high water mark shall be considered the elevation of the top of stream banks.

Constructing new bridge(s) and dismantling and removing existing bridge(s) shall be accomplished in a manner that will prevent the dumping or discharge of construction or disposable materials into rivers, streams, or impoundments.

Construction operations in rivers, streams, or impoundments shall be restricted to those areas where channel changes are shown on the plans and to those that must be entered for the construction of structures. Rivers, streams, and impoundments shall be cleared of falsework, piling, debris, or other obstructions placed therein or caused by construction operations.

The Contractor shall prevent stream constriction that would reduce stream flows below the minimum, as defined by the State Water Control Board, during construction operations.

If it is necessary to relocate an existing stream or drainage facility temporarily to facilitate construction, the Contractor shall design and provide temporary channels or culverts of adequate size to carry the normal flow of the stream or drainage facility. The Contractor shall submit a temporary relocation design to the Engineer for review and acceptance in sufficient time to allow for discussion and correction prior to beginning the work the design covers. Costs for the temporary relocation of the stream or drainage facility shall be included in the contract price for the related pipe or box culvert.

Temporary bridges or other structures shall be used wherever an appreciable number of stream crossings will be made.

Construction operations near rivers, streams, or impoundments may be subject to water quality permit jurisdiction. Clearing and grubbing within 100-feet of the limits of ordinary high water will not be permitted until authorized by the Engineer. Once started, work in a jurisdictional area shall be continuously prosecuted until completed.

2. **Air:** The Contractor shall comply with the provisions of Section 107.01 and the State Air Pollution Control Law and Rules of the State Air Pollution Control Board, including notifications required therein.

Burning shall be performed in accordance with of applicable local laws and ordinances and under the constant surveillance of watchpersons. Care shall be taken so that the burning of materials does not destroy or damage property or cause excessive air pollution. The Contractor shall not burn rubber tires, asphalt, used crankcase oil, or other materials that produce dense smoke. Burning shall not be initiated when atmospheric conditions are such that smoke will create a hazard to the motoring public or airport operations. Provisions shall be made for flagging vehicular traffic if visibility is obstructed or impaired by smoke. At no time shall a fire be left unattended.

Asphalt mixing plants shall be designed, equipped, and operated so that the amount and quality of air pollutants emitted will conform to the Rules of the State Air Pollution Control Board.

Emission standards for asbestos incorporated in the EPA's National Emission Standards for Hazardous Air Pollutants apply to the demolition or renovation of any institutional, commercial, or industrial building, structure, facility, installation, or portion thereof that contains friable asbestos.

3. **Noise:** The Contractor's operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall be not more than 80 decibels. *Noise-sensitive activity* is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.

The Department may monitor construction-related noise. If construction noise levels exceed 80 decibels, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.

The Department may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 10 P.M. and 6 A.M. If other hours are established by local ordinance, the local ordinance shall govern.

Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.

When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

These requirements are not applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

- (c) **Forests:** The Contractor shall take all reasonable precautions to prevent and suppress forest fires in any area involved in construction operations or occupied by him as a result of such operations. The Contractor shall cooperate with the proper authorities of the state and federal governments in reporting, preventing, and suppressing forest fires. Labor, tools, or equipment furnished by the Contractor upon the order of any forest official issued under authority granted the official by law shall not be considered a part of the Contract. The Contractor shall negotiate with the proper forest official for compensation for such labor, tools, or equipment.

- (d) **Archeological, Paleontological, and Rare Mineralogical Findings:** In the event of the discovery of prehistoric ruins, Indian or early settler sites, burial grounds, relics, fossils, meteorites, or other articles of archeological, paleontological, or rare mineralogical interest during the prosecution of work, the Contractor shall act immediately to suspend work at the site of the discovery and notify the Engineer. The Engineer will immediately notify the proper state authority charged with the responsibility of investigating and evaluating such finds. The Contractor shall cooperate and, upon request by the Engineer, assist in protecting, mapping, and removing the findings. Labor, tools, or equipment furnished by the Contractor for such work will be paid for in accordance with the requirements of Section 104.03. Findings shall become the property of the State unless they are located on federal lands, in which event they shall become the property of the U.S. government.

When such work delays the progress of the work, the Engineer will give consideration to adjustments in the contract time limit in accordance with the requirements of Section 108.09.

107.16—Contractor’s Responsibility for Work.

Until final acceptance of the work by the Engineer in accordance with the requirements of Section 105.15, the Contractor shall have charge and care thereof and shall take every precaution against damage to any part thereof by action of the elements or from any other cause. The Contractor shall rebuild, repair, restore, and make good damage to any portion of the work occasioned by any of the foregoing causes before final acceptance and shall bear the expense thereof. The Department may reimburse the Contractor for repair of damage to work attributable to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor.

In case of suspension of work, the Contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the work, provide for erosion control and drainage, and erect any necessary temporary structures, signs, or other facilities at his own expense. During the suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under the Contract and shall take adequate precautions to protect new tree growth and other important vegetation against damage.

107.18—Furnishing Right of Way.

The Department will secure necessary rights of way and easements in advance of construction. The Department will not be responsible for any delay in the acquisition of a right of way other than consideration of an extension of time. Easements for temporary uses and detours requested by the Contractor and approved by the Department in lieu of a detour within the right of way or easement area shall be acquired by the Contractor without the Department being a party to the agreement.

107.19—Personal Liability of Public Officials.

In carrying out any of the provisions of these specifications or in exercising any power or authority granted to them by or within the scope of the Contract, there shall be no liability upon the Board, Commissioner, Engineer, or their authorized representatives, either personally or as officials of the State. In all such matters, they act solely as agents and representatives of the State.

107.20—No Waiver of Legal Rights.

The State shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after final acceptance of the work and payment therefor from showing (1) the true amount and character of the work performed and materials furnished by the Contractor, (2) that any such measurement, estimate, or certificate is untrue or incorrectly made, or (3) that the work or materials do not conform with the provisions of the Contract. The State shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or his surety, or both, such damage as it may sustain by reason of his failure to comply with the terms of the Contract. Neither the acceptance by the Department or any representative of the Department nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Department shall operate as a waiver of any portion of the Contract or of any power herein reserved or of any right to damages. A waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach.

SECTION 108—PROSECUTION AND PROGRESS OF WORK

108.01—Subcontracting.

No portion of the Contract shall be subcontracted or otherwise disposed of without the written consent of the Engineer.

The Contractor shall perform with his own organization work amounting to not less than 30 percent of the original contract value.

The Contractor shall not subcontract any part of the contract work to a Contractor who is not prequalified with the Department in accordance with the requirements of Section 102.01. This restriction does not apply to contract specialty items, consultants, manufacturers, suppliers, or haulers. Consent to subcontract or otherwise dispose of any portion of the contract work shall not relieve the Contractor of any responsibility for the fulfillment of the entire contract.

108.02—Notice to Proceed.

The Engineer will issue a Notice to Proceed within 30 days after execution of the Contract by the Department. The contract time will start at the commencement of work or on the date specified in the Notice to Proceed, whichever is earlier. In no case shall work begin before the Contract is executed by the Department. The Contractor shall notify the Engineer at least 3 days prior to the date on which work will begin.

108.03—Prosecution of Work.

The Contractor shall begin work within 10 days of the date specified in the Notice to Proceed. Work shall be conducted in such a manner and with sufficient materials, equipment, tools, and labor as are necessary to ensure its completion in accordance with the plans and these specifications within the time limit specified in the Contract and these specifications. Once the Contractor has begun work, it shall be prosecuted continuously and to the fullest extent possible except for interruptions caused by weather or delays authorized or ordered by the Engineer. If approval is given to discontinue the work temporarily, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

108.05—Limitation of Operations.

The Contractor shall conduct the work in a manner and sequence that will ensure its expeditious completion with the least interference to traffic and shall have due regard for the location of detours and provisions for handling traffic. The Contractor shall not open any work to the prejudice or detriment of work already started. The Engineer may require the Contractor to finish a section of work before work is started on any other section.

108.07—Character of Workers, Work Methods, and Equipment.

Workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special or skilled work shall have sufficient experience in such work and in the operation of equipment required to perform it properly and satisfactorily.

Any person employed by the Contractor or any subcontractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing the person and shall not be employed again on any portion of the work without the approval of the Engineer. If the Contractor fails to remove the person or furnish suitable and sufficient personnel for proper prosecution of the work, the Engineer may withhold all monies that are or may become due the Contractor and may suspend the work until the Contractor has complied with the request or order.

Equipment shall be of sufficient size and in such mechanical condition as to meet the requirements of the work and produce a satisfactory quality of work. Equipment shall be such that no damage to the roadway, adjacent property, or other highways will result from its use. The Engineer may order the removal and require replacement of unsatisfactory equipment.

When methods and equipment to be used by the Contractor are not prescribed in the Contract, the Contractor is free to use methods or equipment approved by the Engineer that will accomplish the contract work in conformity with the requirements of the Contract.

When the Contract specifies that construction be performed by the use of particular methods and equipment, they shall be used unless others are authorized by the Engineer. If the Contractor desires to use a different method or type of equipment, he may request permission from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment he proposes to use and an explanation of the reasons for desiring to make the change. If permission is given, it will be on the condition that the Contractor shall be fully responsible for producing construction work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not conform to the requirements of the Contract, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining construction with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of the specified quality or take such other corrective action as the Engineer may direct. No change will be made in the basis of payment for the

construction items involved or the contract time limit as the result of authorizing a change in methods or equipment under these provisions.

108.08—Progress Schedule.

The Contractor shall submit a progress schedule satisfactory to the Engineer that shows the proposed order of work and indicates the time required to complete the items of work. The schedule shall conform to the requirements of Section 103.06(e). The schedule may be used as the basis for establishing major construction operations and as a check on the progress of the work. The schedule shall, however, be subject to revision in accordance with the requirements of Section 105.08. Payment for material stockpiled or stored in accordance with the requirements of Section 109.08 will not be considered in determining the Contractor's rate of progress.

108.09—Determination and Extension of Contract Time Limit.

The contract time limit will be determined by the Department and specified in the Contract in calendar days or as a fixed date. No request for an extension of time will be considered that is based on any claim that the contract time limit as originally established was inadequate.

If the satisfactory fulfillment of the Contract with extensions and increases authorized in accordance with the requirements of Sections 104.02 and 104.03 requires the performance of work in greater quantities than those specified in the Contract, the contract time limit may be increased according to one of two options selected at the discretion of the Engineer: (1) the extra time allowances as agreed on and set forth in the extra work order that covers the additional work, or (2) the same ratio that the total cost of work actually performed shall bear to the total cost shown in the bid schedule.

With a fixed-date contract, when the Notice to Proceed is not issued within 45 days after the opening of bids, or the Contractor is unable to commence work because of any failure of the Department, or when the Contractor is delayed because of the fault of the Department, the Contractor may be given a time extension based on the number of days delayed beyond the 45 days. No time extension will be allowed for a delay in the issuance of the Notice of Proceed when the delay is the fault of the Contractor.

During prosecution of the work, the Contractor shall identify the causes for any delays attributable to conditions he deems to be beyond his control and shall identify the particular construction operations affected and the significant dates that encompass the periods of delay. The timely submission to the Engineer of such information is essential for the Department to make an adequate evaluation of any subsequent claim received from the Contractor for an extension of the contract time limit.

If the Contractor has not completed the work within the contract time limit or as extended in accordance with the requirements of this Section, he may make a written claim to the Engineer for an extension of time setting forth the reasons he believes will justify granting the claim. Such claims must be filed within 60 days after the final estimate is paid by the State. If the Engineer determines that the work was delayed because of conditions beyond the control of and without the fault of the Contractor, the Engineer may extend the time for completion as the conditions justify. The extended time shall then be in full force and effect the same as if it had been the original time for completion.

- (a) **Calendar Days:** When the contract time limit is specified in calendar days, the time includes Sundays, holidays, and nonworking days. When the Engineer authorizes the suspension of work in whole or in part in accordance with the requirements of Section 108.10 and such suspension is not attributable to any fault or negligence on the part of the Contractor, the contract time limit will be adjusted. The contract time limit may be adjusted on a day-for-day basis when the work is wholly suspended and on a prorated basis when the work is partially suspended.

To determine the number of calendar days chargeable to the contract time limit for work performed between the effective dates of a partial suspension order, the total dollar value of the Contract will be divided by the number of days in the contract time limit. The result shall be the dollar value of one day's work. The dollar value of all work actually performed during a partial suspension period will be divided by the monetary value of one day's work. The result, in days, will be charged against the contract time limit. In no case will the number of days charged be greater than the total number of calendar days between the effective dates of a partial suspension order. In determining the dollar value of work actually performed during a partial suspension period, the dollar value of adjustments made for work performed prior to the issuance of a partial suspension order and the dollar value of mobilization and stockpiled materials during the period will be excluded.

- (b) **Fixed Date:** When the contract time limit is specified as a fixed date, the Contractor shall take into consideration normal conditions considered unfavorable for the prosecution of the work, and shall place sufficient workers and equipment on the project to complete the work in accordance with the contract time limit.

The Engineer may give consideration for extension of time when a delay occurs due to unforeseen causes beyond the control of and without the fault or negligence of the Contractor. However, consideration will not be given to extensions of time attributable to weather conditions or conditions resulting from weather.

If there is a delay in the progress of the work due to unforeseen causes described hereinbefore, and the delay extends the contract time limit into the period between November 30 of one year and April 1 of the following year and working conditions

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

during such period are unsuitable for the completion of the work, then consideration may be given to granting an extension of time that will encompass a suitable period during which such work can be expeditiously and acceptably performed.

When the Engineer determines that an extension of contract time will be made in accordance with the requirements of Section 108.09, the daily dollar value to be used in computing time extensions resulting from monetary increases will be based on the number of days resulting from deducting 45 days from the number of days between the inclusive dates of the receipt of bids and the fixed completion date.

108.10—Suspension of Work Ordered by the Engineer.

If the performance of all or any portion of the work is suspended or delayed by the Engineer in writing for an unreasonable period of time (not originally anticipated, customary, or inherent to the construction industry) and the Contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, the Contractor shall submit to the Engineer in writing a request for adjustment within 7 calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

Upon receipt, the Engineer will evaluate the Contractor's request. If the Engineer agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or subcontractors at any approved tier, and not caused by weather, the Engineer will make an adjustment (excluding profit) and modify the contract in writing accordingly. The Engineer will notify the Contractor of the determination whether or not an adjustment of the contract is warranted.

No contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time prescribed.

No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of this contract.

108.11—Failure To Complete on Time.

For each calendar day that any work remains incomplete after the contract time limit specified for the completion of the work, the Department will assess liquidated damages against the Contractor. Liquidated damages, assessed in accordance with the Schedule of Liquidated Damages (Table I-1), at the rate applicable to the Contract for each day of additional time consumed, subject to such adjustments as provided in accordance with the requirements of Section 108.09, will be deducted from any monies due the Contractor, not as a penalty but as liquidated damages.

108.12—Liquidated Damages.

The following Schedule of Liquidated Damages, representing the cost of administration, engineering, supervision, inspection and other expenses, will be charged against the Contractor for each calendar day beyond the contract time in which the Contract remains in an incomplete state:

**TABLE I-1
Schedule of Liquidated Damages**

ORIGINAL CONTRACT AMOUNT IN DOLLARS	DAILY CHARGE IN DOLLARS
Plus - 100,000	175
100,000 - 500,000	350
500,000 - 2,000,000	600
2,000,000 - 8,000,000	1000
8,000,000 - 15,000,000	1100
15,000,000 - Plus	1400

108.13—Default of Contract.

The Contractor may be declared in default if he does *any* one of the following:

1. fails to begin the work under the Contract within 10 days of the date specified in the Notice to Proceed
2. fails to perform the work with sufficient workers and equipment or with sufficient materials to ensure prompt completion of the work

3. performs the work unsuitably or neglects or refuses to remove materials or perform anew work that is unacceptable
4. discontinues prosecution of the work
5. fails to resume work that has been discontinued within a reasonable time after notice to do so
6. becomes insolvent, is declared bankrupt, or commits any act of bankruptcy or insolvency
7. allows any final judgment to stand against him unsatisfied for a period of 10 days
8. makes an assignment for the benefit of creditors
9. fails for any other cause whatsoever to carry on the work or contractual obligations in an acceptable manner

If any of these conditions exists, the Engineer will give notice in writing to the Contractor and his surety of the delay, neglect, or default. If within 10 days after such notice the Contractor or his surety has not taken measures that will, in the judgment of the Engineer, ensure satisfactory progress of the work or give assurances satisfactory to the Engineer that the provisions of the Contract will be fully carried out and instructions complied with, the Commissioner may then, or at any time thereafter, declare the Contractor in default. Without violating the Contract, the Commissioner may call upon the Contractor's surety for the satisfactory and expeditious completion of all work under the Contract or may otherwise terminate the Contract in accordance with Section 108.14.

If the Contractor is declared in default, subsequent payments will be made to the surety and further negotiations will be conducted with the surety.

If the Contractor's surety fails or refuses to proceed with the work and make satisfactory progress thereon in accordance with the instructions of the Commissioner, the Commissioner will appropriate and use any or all materials and equipment on the project site that are suitable and acceptable and will enter into an agreement with others for the completion of the work, or he will use such other methods as he deems necessary to ensure the completion of the work.

Costs and charges incurred by the Department, including the cost of completing the work under the Contract, will be deducted from any monies due or that will become due the Contractor and his surety. If the expense incurred by the Department is less than the sum that would have been payable under the Contract if it had been completed by the Contractor, the Contractor and his surety will be entitled to receive the difference. If the expense exceeds the sum that would have been payable under the Contract, the Contractor and his surety shall be liable for and shall pay to the State the amount of the excess.

108.14—Termination of Contract.

- (a) **Conditions for Termination:** The Department may terminate the Contract or any portion thereof because of *any* of the following conditions:
 1. default
 2. national emergency
 3. action by the State, U.S. government, or court order
 4. conditions beyond the control of the Department
- (b) **Provisions of Termination:** Termination will be in accordance with the following:
 1. Disturbed areas shall be promptly placed in an acceptable condition as directed by the Engineer. Payment for such work will be made at the contract unit prices or, in the absence of contract unit prices, in accordance with the requirements of Section 104.03.
 2. Payment will be made for the actual number of units or items of work completed at the contract unit price, or as mutually agreed, for items of work partially completed. No claim for loss of anticipated profits will be considered, and the provisions of Section 104.02 will not apply.
 3. Reimbursement for organizing the work when not specified in the Contract and moving equipment to and from the job will be considered where the volume of work completed is too small to compensate the Contractor for these expenses under the contract unit prices.
 4. At the option of the Engineer, materials the Contractor obtains for the work that have been inspected, tested, and accepted by the Engineer and that have not been incorporated in the work may be purchased from the Contractor at actual costs as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

5. The termination of the Contract or a portion thereof shall not relieve the Contractor of his responsibilities for the completed work, nor shall it relieve his surety of its obligation for and concerning any just claims arising out of the work performed.

108.15—Termination of Contractor’s Responsibilities.

The Contract will be considered complete upon final acceptance. The Contractor will be notified in writing of the final acceptance, and his responsibility will then cease except as set forth in his bond.

DIVISION II MATERIALS

SECTION 203—COARSE AGGREGATE

203.01—Description.

These specifications cover material for use as coarse aggregate in hydraulic cement concrete, asphalt concrete, asphalt surface treatments, and drainage.

203.02—Materials.

Coarse aggregate shall consist of crushed stone, crushed slag, or crushed or uncrushed gravel with clean, hard, tough, and durable pieces free from adherent coatings and deleterious amounts of friable, thin, elongated, or laminated pieces; soluble salts; or organic materials.

- (a) **Crushed hydraulic cement concrete** will be permitted for use as a coarse aggregate provided it conforms to the physical requirements specified herein and shows no adverse chemical reaction. Crushed hydraulic cement concrete will not be permitted in the following: (1) reinforced cement concrete (2) in combination with other materials in contact with geotextile fabric when such fabric is used as a drainage item and (3) in backfill or bedding for perforated pipe.
- (b) **Crushed gravel** shall consist of particles of which at least 80 percent by weight shall have at least one face fractured by artificial crushing. Tests will be performed in accordance with the requirements of VTM-15.
- (c) **Blast furnace slag** shall be relatively free from foreign minerals and glassy or spongy pieces. It shall weigh at least 70 pounds per cubic foot, dry rodded, for size No. 68 and smaller and at least 65 pounds per cubic foot, dry rodded, for larger sizes. Tests will be performed in accordance with the requirements of AASHTO T19. When used in asphalt surface treatments, blast furnace slag shall not contain more than 10 percent nonporous material and shall have an absorption of at least 3 percent. Tests will be performed in accordance with the requirements of AASHTO T85.

203.03—Detail Requirements.

- (a) **Grading:** Open graded aggregates shall conform to the requirements of Table II-3. Tests will be performed in accordance with the requirements of AASHTO T27.
- (b) **Soundness:** Soundness shall conform to the requirements of Table II-4. Tests will be performed in accordance with the requirements of AASHTO T103 or T104.
- (c) **Abrasion Loss:** Abrasion loss shall conform to the requirements of Table II-5. Tests will be performed in accordance with the requirements of AASHTO T96 on aggregate with a grading the most nearly identical with the grading to be used in the work.
- (d) **Deleterious Material:** The amount of deleterious material shall be not more than the following:

Material	% by Weight	AASHTO Test Method
Coal and lignite	0.25	T113
Clay lumps	0.25	T112
Material passing No. 200 sieve by washing ¹	1.00	T11

¹When the material passing the No. 200 sieve by washing is dust of fracture, the percentage of deleterious material may be increased to 1.50 percent.

**TABLE II-4
Soundness**

Use	Max. Soundness Loss (%)	
	Magnesium Sulphate (5 Cycles)	Freeze and Thaw (100 Cycles)
Hydraulic cement concrete	12	5
Asphalt surface courses	15	6
Asphalt and aggregate bases	20	7
Select material (Type I) and subbase	30	12

TABLE II-5
Abrasion

Use	Max. Los Angeles Abrasion Loss (%)	
	100 Rev.	500 Rev.
Grade A stone	9	40
Grade B stone	12	45
Grade C stone	14	50
Slag	12	45
Gravel	12	45

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program
SECTION 204—STONE FOR MASONRY, RIPRAP, POROUS BACKFILL, AND GABIONS

204.01—Description.

These specifications cover aggregate materials used to protect ground slopes from erosion or wave action and those used for drainage, generally behind a back wall or abutment.

204.02—Detail Requirements.

- (a) **Stone for rubble or mortar rubble masonry** shall be sound, durable, and free from seams, cracks, and other structural defects and shall be minimum Grade C stone free from rounded, worn, or weathered surfaces.
- (b) **Stone for riprap and bedding** shall be sound, durable, and free from seams, cracks, and other structural defects. Riprap stone and bedding exposed to the wave action of water shall be of igneous or metamorphic origin. Riprap bedding shall be crushed stone, minimum Grade B.
- (c) **Porous backfill** shall be aggregate size No. 78 or No. 8, minimum Grade B.
- (d) **Gabion stone** shall be durable and free from seams and cracks. Weathered stone shall not be used. Stone shall weigh between 4 and 30 pounds except that approximately 5 percent of the individual stones may weigh less than 4 or more than 30 pounds. At least 50 percent of the stone shall weigh more than 10 pounds.

SECTION 239—SODIUM CHLORIDE AND CALCIUM CHLORIDE

239.01—Description.

These specifications cover chloride used as a stabilizer or to control snow and ice.

239.02—Detail Requirements.

(a) **Sodium chloride** shall conform to the requirements of AASHTO M143, Type I, with the following exceptions:

1. The sodium chloride content shall be at least 97 percent of the dry weight.
2. The moisture content shall be not more than 5 percent.
3. When shipped in bulk, sodium chloride shall contain an anticaking additive.
4. Sodium chloride will be tested in accordance with the requirements of VTM-28.

When practicable, samples will be taken at the source from indoor storage or adequately protected outdoor storage at the rate of approximately one sample per 4,000 tons. Samples will not be taken from uncovered storage.

When inspection at the source is not practicable or when material is shipped from uncovered storage, samples will be taken at the destination at the time of delivery.

When shipments of sodium chloride are made from approved stock at the source, inspection service will be provided when the frequency of shipments makes it economically justified. This inspection will be indicated by the Inspector's stamp on the shipping or delivery report. When inspection service is not provided, the supplier may ship but shall certify that the material came from an approved source. The certification may be stamped on the shipping or delivery report but shall be signed by an authorized representative of the company.

(b) **Calcium chloride** shall conform to the requirements of AASHTO M144.

SECTION 240—LIME

240.01—Description.

These specifications cover lime to be used as a stabilizer or soil conditioner.

240.02—Detail Requirements.

- (a) **Hydrated lime** shall conform to the requirements of ASTM C207, Type N, except that the average percentage of calcium oxide shall be at least 93. Single test results shall not be below 90 percent.
- (b) **Hydraulic lime** shall conform to the requirements of ASTM C141.
- (c) **Agricultural lime:**
 - 1. **Ground limestone** shall be of such fineness that at least 86 percent will pass a No. 20 mesh screen, at least 47 percent will pass a No. 60 mesh screen, and at least 28 percent will pass a No. 100 mesh screen. Material shall have a calcium carbonate equivalent of at least 85 percent.
 - 2. **Pulverized limestone** shall be of such fineness that at least 90 percent will pass a No. 20 mesh screen and at least 66 percent will pass a No. 100 mesh screen. Material shall have a calcium carbonate equivalent of at least 85 percent.
- (d) **Lime for Soil Stabilization** shall be quicklime or hydrated lime conforming to the requirements of AASHTO M216.

SECTION 242—FENCES

242.01—Description.

These specifications cover material requirements for fence components used in the construction of chain link, pedestrian, barbed wire, woven wire, and lawn fences and material specifications for temporary silt fences, geotextile fabric silt barriers, and filter barriers used for erosion control.

242.02—Detail Requirements.

Unless otherwise specified hereinafter, metallic fence materials shall conform to the requirements of AASHTO M181. Steel posts and braces for standard fence and chain link fence may be fabricated from pregalvanized material in lieu of galvanizing after fabrication provided ends and other areas of exposed metal are satisfactorily repaired using a material conforming to the requirements of Section 233...

(c) **Temporary Silt Fences, Geotextile Fabric Silt Barriers, and Filter Barriers:**

1. **Geotextile fabric** shall conform to the requirements of Section 245.
2. **Posts for temporary silt fences** shall be a nominal 2 1/2 by 2 1/2 inch or a 3 inch diameter No. 2 Southern pine, a nominal 2 by 2 inch oak, or steel having a weight of at least 1.25 pounds per linear foot and a length of at least 5 feet.
3. **Wire fence reinforcement for temporary silt fences** using standard strength geotextile fabric shall be at least 36 inches in height, at least 14 1/2 gage, and shall have a mesh spacing of more than 6 inches.
4. **Burlap fabric for temporary filter barriers** shall conform to the requirements of AASHTO M182, Class 3, and shall provide at least 3 months of expected usable construction life.
5. **Supports for temporary filter barriers** shall be a nominal 1 by 2 inch or 1 1/2 inch diameter No. 2 Southern pine or oak, or steel having a weight of at least 1.00 pound per linear foot.

SECTION 244—ROADSIDE DEVELOPMENT MATERIALS

244.01—Description.

These specifications cover the various materials, such as fertilizers, seeds, plants, sod, and mulch, for use in landscaping and materials used for soil retention to help prevent erosion.

244.02—Detail Requirements.

- (a) **Herbicides:** Herbicides shall be registered with the Virginia Department of Agriculture and Consumer Services in accordance with the Virginia Pesticide Law and shall be supplied in the manufacturer's containers clearly labeled as to the composition, brand, and name and address of the manufacturer.

1. **Herbicide for control of broad-leaf weeds** shall contain at least 3 pounds of 2,4-D as an oil-soluble, water-emulsifiable amine salt. It shall have a shelf life of at least 2 years and shall be homogeneous with slight agitation. The type of amine salt and the actual acid equivalent per gallon shall be shown on the container.
2. **Herbicide for stump treatment** shall be dicamba CST, which shall be applied in accordance with the manufacturer's registered label.

- (b) **Topsoil:**

1. **Class A topsoil** shall be stockpiled topsoil that has been salvaged in accordance with the requirements of Section 303.04(a). It shall be free from refuse or any material toxic to plant growth and reasonably free from subsoil, stumps, roots, brush, stones, clay lumps, or similar objects larger than 3 inches in their greatest dimension.
2. **Class B topsoil** shall be topsoil furnished from sources outside the project limits and shall be the original top layer of a soil profile formed under natural conditions, technically defined as the "A" horizon by the Soil Science Society of America. It shall consist of natural, friable, loamy soil without admixtures of subsoil or other foreign materials and shall be reasonably free from stumps, roots, hard lumps, stiff clay, stones, noxious weeds, brush, or other litter. It shall have demonstrated by evidence of healthy vegetation growing or having grown on it prior to stripping that it is reasonably well drained and does not contain substances toxic to plants.
3. **Topsoil for planting plants** shall be furnished by the Contractor and shall have a pH in the range of 6.0 to 7.0 prior to mixing with organic matter. If the pH is not within this range, the pH shall be corrected at the Contractor's expense or a different source of supply shall be selected. Topsoil shall be subject to inspection by the Engineer at the source of supply and immediately prior to use in planting and shall be mixed with organic matter as specified.

- (c) **Seeds:** Kinds and varieties of seeds shall be delivered to the project in separate sacks bearing a green seed label denoting the seed has been inspected and approved by the Virginia Crop Improvement Association. Open bags will not be accepted for use. Seeds shall be mixed under the observation of the Engineer on the project or at other approved locations. Seeds shall comply with applicable state and federal seed laws and contract requirements. Seed shall not be used until approved by the Engineer.

Seed shall be subject to inspection by Virginia State Seed Regulatory Inspectors of the Virginia Department of Agriculture and Consumer Services.

Seed test shall be completed within the nine-month period prior to the beginning of the area scheduled seeding period during which the seed is to be used.

Seed shall not be, or have been, stored in an enclosure where herbicides, kerosene, or other material detrimental to seed germination is stored.

Noxious weed seeds, as defined by the rules and regulations adopted for enforcement of the Virginia Seed Law, will not be permitted. The number of restricted noxious weed seeds shall be not more than the number per ounce or per pound of noxious weed seeds specified in the rules and regulations.

The tag from each sack of seed shall be signed by the Contractor and delivered to the Engineer after each sack is completely used.

- (d) **Fertilizers:**

1. **Fertilizer for seeding and sodding** shall be uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer shall be delivered to the project in bags or other convenient containers, each fully labeled, and shall conform to the applicable state and federal regulations. Additional nutrients shall be added only when specified.

Ureaformaldehyde shall be slow-release fertilizer material containing 38 percent nitrogen. The material shall have an activity index of 40 to 55 percent as determined by tests in accordance with the Association of Official Agricultural Chemists.

2. **Fertilizer for planting plants** shall have an NPK analysis ratio of 3-1-1, 3-1-2 or 4-1-1 slow release. Approximately 75 percent of the nitrogen shall be slow release nitrogen from methylene ureas, also termed ureaformaldehydes, that become slowly available for plants through nitrogen breakdown by soil microbes. Urea nitrogen shall not be used except as specified hereinafter. The phosphate fraction shall be triple superphosphate. Fertilizers to be mixed shall be delivered to the project or another approved location in separate bags bearing the manufacturer’s label and shall be thoroughly mixed in the presence of the Engineer on the job or other approved location in the following amounts: 20 pounds of ureaformaldehyde as specified herein (38 percent N), 5 pounds of urea (45 percent N), 65 pounds of triple superphosphate (46 percent P₂O₅), and 10 pounds of muriate of potash (60 percent K₂O).

- (e) **Lime:** Lime shall be agricultural grade ground limestone. Agricultural grade pulverized limestone may be used at no additional cost to the Department.

The material source shall be registered with and approved by the Virginia Department of Agriculture and Consumer Services in accordance with the Virginia Agricultural Lime Law and shall conform to the requirements of Section 240.

- (f) **Inoculating Bacteria for Treating Leguminous Seeds:** Bacteria shall be a pure culture of nitrogen fixing bacteria selected for maximum vitality. Cultures shall be not more than 1 year old and shall be subject to the approval of the Engineer.

- (g) **Mulch:** Mulch shall conform to the following unless otherwise approved in writing by the Engineer:

1. **Mulch for seeding** (vegetative) shall consist of dry straw or hay, free from noxious weeds. Mulch shall be reasonably bright in color and shall not be musty, moldy, caked, decayed, or very dusty.
2. **Wood cellulose fiber mulch for hydraulic seeding** shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state. Mulch shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry. Mulch, including dye, shall not contain germination inhibiting or growth inhibiting factors. Mulch shall be manufactured and processed so that it will remain in uniform suspension in water under agitation and will blend with seed, fertilizer, and other additives to form a homogeneous slurry. Mulch shall form a blotterlike ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of grass seedlings. Field and equipment performance determinations by the Department shall be prerequisites for the approval of a source of supply for mulch.

The manufacturer shall provide certification that the mulch conforms to the following:

Property	Value
Fiber or particle size	
Length	To approx. 10 mm
Thickness or diameter	Approx. 1 mm
Net dry weight content (VTM-47)	Min. stated on bag
pH range (TAPPI T509 or ASTM D778)	4.0 to 8.5
Ash content	Max. 7.0%
(TAPPI T413 or ASTM D586)	
Water holding capacity (VTM-46)	Min. 90%

Mulch shall not contain elements or compounds at concentration levels that will be phytotoxic.

In addition to making field performance determinations, the Department may sample and perform such other tests on mulch to ensure that it conforms to these specifications. Only those materials that have been evaluated by the Department and appear on its list of approved sources of supply will be accepted.

Mulch shall be delivered in packages of uniform weight bearing the name of the manufacturer, the net weight, and an additional statement of the net dry weight content.

3. **Wood chips** processed from clearing and grubbing operations may be used for mulch on seeded areas as directed by the Engineer. Wood chips shall be not more than 3/8 inch in thickness or 6 square inches in area.
4. **Mulch used in planting plants** shall be pine bark, wood chips, or other material specified on the plans or approved by the Engineer. Mulch shall not be used until it has been inspected and approved by the Engineer.

- (h) **Sod:** Sod shall be cultivated material conforming to the requirements of the State Board of Agriculture for state-approved sod or the State Sod Certification Agency for state certified sod. Root development shall be such that standard size pads will support their own weight and retain their size and shape when suspended vertically from a firm grasp on the uppermost 10 percent of the area. The top growth of sod shall be mowed so that the height of the grass will be 2 to 3 inches at the time of the stripping operation. Sod may be furnished in any standard pad width and length provided the dimensions do not vary from the average by more than 5 percent. Sod shall be machine stripped at a uniform soil thickness of at least 1 inch. Broken, torn, or irregularly shaped pads will be rejected.
- (i) **Trees, Shrubs, Vines, and Other Plants:** The botanical and common name of plants shall be in accordance with the latest edition of *Standardized Plant Names*, prepared by the Editorial Committee of the American Joint Committee on Horticultural Nomenclature, in effect on the date of the Notice of Advertisement.
1. **Quality and size:** Plants shall conform to the requirements of *American National Standard for Nursery Stock*, by the American Association of Nurserymen, Inc., and these specifications. Plants shall be first class representatives of their normal species and varieties; shall have well furnished branch systems and vigorous fibrous root systems characteristic of their respective kinds; shall be nursery grown; and shall bear evidence of proper nursery care, including adequate transplanting and root pruning. Plants shall comply with state and federal laws governing inspection for plant diseases and insect infestation and shall be free from insect pests, plant diseases, disfiguring knots, stubs, sunscalds, bark abrasions, or any other form of damage or objectionable disfigurements. Where a minimum and maximum size or range is specified, an average size shall be furnished. Plants shall not be pruned before delivery or cut back from larger sizes to conform to the sizes specified. Sizes furnished shall be those specified at the time of delivery and before the usual pruning at the time of planting. Nursery-grown trees shall be free from cuts of limbs that are not healing and cuts more than 3/4 inch that have not completely callused over. Deciduous shade trees shall conform to the requirements for street trees as specified in the *American National Standard for Nursery Stock*. Plants from cold storage will not be accepted. Deciduous plants, except those grown in containers, shall be dormant when planted.
 2. **Digging and protection:** Digging shall be done in a manner that will avoid damage to or loss of roots, but roots that are cut, shall be cleanly cut. Balled and burlapped plants shall be properly dug and protected to preserve the natural earth in contact with the roots. Manufactured balls will not be accepted. Balls shall be firmly wrapped and tied with approved materials. Balled plants will not be accepted if the ball is broken, cracked, or loose. After plants are dug, their roots shall be protected from damage. Roots of bare root plants shall be kept moist at all times. Bare root plants shall be further protected by wrapping in wet straw, moss, burlap, or other suitable material.
 3. **Plantable pots:** In lieu of using burlap with balled plants, plants may be dug as specified herein and placed in plantable pots. Pots shall be constructed of material that will readily decompose in soil and shall not be smaller in any dimension than the size specified for balled and burlapped root systems. At the time of planting, the lip or rim of pots shall be broken away, and drainage holes shall be provided as directed. Plants with balls that have been grown in pots or with loose stems will be rejected.
 4. **Container-grown plants:** In addition to the requirements of the *American National Standard for Nursery Stock*, container-grown plants shall conform to the following:
 - a. The space between the rim or top of the container and the soil line within the container shall not be more than 1 1/2 inches for the 1 gallon and 2 gallon sizes and not more than 2 1/2 inches for the 5 gallon size.
 - b. Encircling roots shall not have grown in such a manner that they will cause girdling of the trunk or stems.
 - c. Roots shall not protrude through drainage holes or over the rim of the container to the extent that they will be damaged while the root ball is removed from the container.
 - d. Plants shall have been acclimated to outside conditions. Container grown plants may be used provided their use is approved in writing by the Engineer.
 5. **Collected plants:** Collected plants from wild or native stands shall not be used without the written permission of the Engineer unless specified on the plans. Wild or native plants shall be clean, sound stock, and free from injury, and the quality of the plants shall be similar to that specified for nursery grown material. Stock shall have sufficient root systems to ensure successful transplanting. Balls, when specified, shall be tight and well formed.
 6. **Clumps:** Clumps shall be dug from good soil that has produced a fibrous root system typical of the nature of the plant and shall have earth and incidental vegetation adhering to roots.
- (j) **Miscellaneous Planting Materials:**
1. **Peat moss** shall be granulated, shredded, or milled sphagnum moss, nearly free from woody materials and consisting of at least 75 percent decomposed leaves and stems of sphagnum moss essentially brown in color. The texture may vary from porous to spongy fibrous. Peat moss shall be free from sticks, stones, mineral matter, or other foreign material. Peat moss shall have a pH of from 3.5 to 5.5.

2. **Tree wrap** shall be waterproof paper, 30-30-30 krinklecraft or its equivalent, in strips 4 inches in width.
3. **Twine** for wrapping trees shall be jute twine, at least two-ply.
4. **Soil mixture used to backfill planting pits** shall consist of 1 part peat moss and 4 parts topsoil as specified herein. Prior to use, peat moss and topsoil shall be thoroughly mixed. The method of mixing and the area in which the mixing operation is performed shall be approved by the Engineer.
5. **Water** used in watering plants shall be obtained from fresh water sources and shall be free from chemicals and other toxic substances harmful to plants. Brackish water shall not be used. The source of water will be subject to the approval of the Engineer.

(k) **Soil Retention Coverings:**

1. **Jute mesh** shall be a uniform, open, plain weave of undyed and unbleached single jute yarn. The yarn shall be loosely twisted and shall not vary in thickness by more than its normal diameter. Jute mesh shall be new, and its length shall be marked on each roll.

Between strands lengthwise, openings shall be 0.60-inch \pm 25 percent. Between strands crosswise, openings shall be 0.90-inch \pm 25 percent. Jute mesh shall weigh 0.9 pound per square yard \pm 5 percent.

2. **Soil retention mats** shall consist of a machine-produced mat of wood fibers, wood excelsior, or manmade fiber that shall intertwine or interlock. Matting shall be nontoxic to vegetation and germination of seed and shall not be injurious to the unprotected skin of the human body.

Mats shall be of consistent thickness, with fiber evenly distributed over its entire area, and covered on the top and bottom side with netting having a high web strength or covered on the top side with netting having a high web strength and machine sewn on two inch centers along the longitudinal axis of the material. Netting shall be entwined with the mat for maximum strength and ease of handling.

3. **Soil stabilization mats** shall be from the Department's approved products list for the use specified.

SECTION 245—GEOSYNTHETICS

245.01—Description.

These specifications cover artificial fiber textile products to be used in transportation construction work.

245.02—Detail Requirements.

Geotextile fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable. Geotextile fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours during installation.

Tensile strength requirements are in the machine and cross-machine directions.

245.03—Testing and Documentation.

Geosynthetics shall be tested by an independent commercial laboratory, to verify the material requirements specified herein. The Contractor shall provide written documentation of all tests specified. Documentation shall include style, lot, roll numbers, and actual results of each test. In addition, the name, address, phone number of the testing laboratory, and date of testing shall be provided.

- (a) **Geotextile Fabric for Use in Silt Fences, Silt Barriers, or Filter Barriers:** Fabric shall contain ultraviolet inhibitors and stabilizers to provide at least 6 months of expected, usable construction life at a temperature range of 0 degrees F to 125 degrees F. The tensile strength of the material after 6 months of installation shall be at least 50 percent of the initial strength.

1. **Silt fences:**

Physical Property	Test Method	Requirements (Min.)
Filtering efficiency	VTM-51	75%
Flow rate	VTM-51	0.2 gal/sq ft/minute
Tensile strength @ 20% (max.) elongation	VTM-52	Extra strength: 60 lb/lin inch Standard strength: 30 lb/lin inch

2. **Silt barriers and filter barriers:**

Physical Property	Test Method	Requirements (Min.)
Filtering efficiency	VTM-51	75%
Flow rate	VTM-51	0.2 gal/sq ft/minute
Tensile strength @ 20% (max.)	VTM-52	Standard strength: 30 lb/lin inch

- (b) **Riprap Bedding Material:**

Physical Property	Test Method	Requirements (Min.)
Apparent opening size	ASTM D4751	Equal to or greater than No. 50 sieve
Tensile strength @ 20% (max.) elongation	VTM-52	Min. 30 lb/lin inch
Puncture strength	ASTM D4833	Min. 80 lb

Seams shall be equal in strength to the basic material.

Additional fabric material or noncorrosive steel wire may be incorporated into fabric to increase overall strength.

- (c) **Drainage Fabric:**

Physical Property	Test Method	Requirements
-------------------	-------------	--------------

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Apparent opening size	ASTM D4751	Equal to or smaller than 0.300 mm
Permittivity	ASTM 4491	Min. 0.8 sec
Tensile strength @ 20% elongation	VTM-52	Min. 25 lb/lin inch

(d) **Subgrade Stabilization:**

Physical Property	Test Method	Requirements
Tensile Strength @ 20% elongation	ASTM D4595	80 lbs./lin inch (Min.)
Apparent Opening Size (AOS)	ASTM D4751	Equal to or smaller than 0.85 mm
Secant Modulus @10% Strain	ASTM D4595	500 lbs./lin inch (Min.)
*Soil Fabric Friction Angle	ASTM D5321	24 deg. (Min.)
Tear Strength	ASTM D4533	75 lbs. (Min.)
Puncture Strength	ASTM D4833	75 lbs. (Min.)

*For test, use Ottawa Sand that passes the No. 20 sieve but can be retained on the No. 30 sieve. Use normal loads of 0.5 ton/sq ft, 1.0 ton/sq ft and 2.0 ton/sq ft

(e) **Geotextile for Embankment Stabilization up to 6 feet in height:**

Physical Property	Test Method	Requirements
Tensile Strength (Ultimate)	ASTM D4595	200 lbs./lin inch (Min.)
Apparent Opening Size (AOS)	ASTM D4751	Equal to or smaller than 0.85 mm
Secant Modulus @10% Strain	ASTM D4595	1700 lbs./lin inch (Min.)
*Soil Fabric Friction Angle	ASTM D5321	24 deg. (Min.)
Tear Strength	ASTM D4533	75 lbs. (Min.)
Puncture Strength	ASTM D4833	75 lbs. (Min.)

*For test, use Ottawa Sand that passes the No. 20 sieve but can be retained on the No. 30 sieve. Use normal loads of 0.5 ton/sq. ft., 1.0 ton/sq ft and 2.0 ton/sq ft

DIVISION III ROADWAY CONSTRUCTION

SECTION 301—CLEARING AND GRUBBING

301.01—Description.

This work shall consist of clearing, grubbing, removing, and disposing of vegetation, debris, and other objects within the construction limits except for vegetation and objects that are designated to be preserved, protected, or removed in accordance with the requirements of other provisions of these specifications.

301.02—Procedures.

If approved by the Engineer, the Contractor may clear and grub to accommodate construction equipment within the right of way up to 5 feet beyond the construction limits at his own expense. The Contractor shall install erosion and siltation control devices prior to beginning grubbing operations.

The surface area of earth material exposed by grubbing, stripping topsoil, or excavation shall be limited to that necessary to perform the next operation within a given area. Grubbing of root mat and stumps shall be confined to the area which excavation shall be performed within 15-days following grubbing.

Stumps, roots, other perishable material, and nonperishable objects that will be less than 5 feet below the top of earthwork within the area directly beneath the pavement and shoulders shall be removed. However, such material and objects that will be more than 5 feet below the top of earthwork within the area directly beneath the pavement and shoulders and all such material and objects beneath slopes of embankments shall be left in place unless removal is necessary for installation of a structure. The top of stumps left in place shall be not more than 6 inches above the existing ground surface or low water level.

Branches of trees that overhang the roadway or reduce sight distance and that are less than 20 feet above the elevation of the finished grade shall be trimmed using approved tree surgery practices in accordance with the requirements of Section 601.

Vegetation, structures, or other items outside the construction limits shall not be damaged. Trees and shrubs in ungraded areas shall not be cut without the approval of the Engineer.

Combustible cleared and grubbed material shall be disposed of in accordance with the following:

1. Trees, limbs, and other timber having a diameter of 3 inches and greater shall be disposed of as saw logs, pulpwood, firewood, or other usable material; however, treated timber shall not be disposed of as firewood. Not more than 2 feet of trunk shall be left attached to grubbed stumps.

When specified that trees or other timber is to be reserved for the property owner, such material shall be cut in the lengths specified and piled where designated, either within the limits of the right of way or not more than 100 feet from the right-of-way line. When not reserved for the property owner, such material shall become the property of the Contractor.

2. When specified on the plans or where directed by the Engineer, material less than 3 inches in diameter shall be used to form brush silt barriers when located within 500 feet of the source of such material. Material shall be placed approximately 5 feet beyond the toe of fill in a strip approximately 10 feet wide to form a continuous barrier on the downhill side of fills. Where selective clearing has been done, material shall be piled, for stability, against trees in the proper location. On the uphill side of fills, brush shall be stacked against fills at approximately 100-foot intervals in piles approximately 5 feet high and 10 feet wide. Any such material not needed to form silt barriers shall be processed into chips having a thickness of not more than 3/8 inch and an area of not more than 6 square inches and may be stockpiled out of sight of any public highway for use as mulch.
3. Stumps and material less than 3 inches in diameter that are not needed to form silt barriers and that are not processed into wood chips shall be handled in accordance with the requirements of Sections 106 and 107.

301.03—Measurement and Payment.

Clearing and grubbing will be measured and paid for in accordance with one of the following methods, as specified:

1. **Lump Sum Basis:** No measurement of the area to be cleared and grubbed will be made.
2. **Acre basis:** The work to be paid for will be the number of acres, computed to the nearest 1/10 of an acre, actually cleared and grubbed. Areas within the limits of any existing roadway or local material pit will not be measured.
3. **Unit basis:** The work to be paid for will be determined by the actual count of trees, stumps, structures, or other obstructions removed.

These prices shall include disposing of cleared and grubbed material.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

When clearing and grubbing is not a pay item, the cost thereof shall be included in the price for other appropriate pay items. Allowance will not be made for clearing and grubbing borrow pits or other local material pits.

Payment will be made under:

Pay Item	Pay Unit
Clearing and grubbing	Lump sum, acre, or unit

SECTION 302—DRAINAGE STRUCTURES

302.01—Description.

This work shall consist of installing pipe culverts, endwalls, box culverts, precast concrete and metal arches, storm drains, drop inlets, manholes, spring boxes, junction boxes, and intake boxes and removing and re-placing existing structures in accordance with the requirements of these specifications and in reasonably close conformity with the lines and grades shown on the plans or as established by the Engineer.

302.02—Materials.

- (a) **Pipe** shall conform to the requirements of Section 232 and shall be furnished in accordance with the diameter, wall thickness, class, and strength or corrugation specified for the maximum height of fill to be encountered along the length of the pipe culvert, storm drain, or sewer.
- (b) **End sections** shall conform to the applicable requirements of Section 232. End sections used with rigid pipe shall be concrete. End sections used with asphalt-coated or paved pipe shall not be asphalt coated or paved.
- (c) **Pipe fittings**, such as tees, elbows, wyes, and bends, shall conform to the applicable requirements of Section 232. Fittings shall be of the same type, class, thickness, gage, and strength as the line in which they are used.
- (d) **Steel grates, steel frames and structural steel** shall conform to the requirements of Section 226 and shall be galvanized in accordance with the requirements of Section 233.
- (e) **Concrete blocks** shall conform to the requirements of Section 222 for masonry blocks.
- (f) **Brick** shall conform to the requirements of Section 222.
- (g) **Hydraulic cement mortar** shall conform to the requirements of Section 218.
- (h) **Cast-in-place concrete** shall conform to the requirements of Section 217 for Class A3.
- (i) **Bedding material** shall conform to the requirements of Section 205.
- (j) **Joint material and gaskets** shall conform to the requirements of Section 212.
- (k) **Gray-iron castings** shall conform to the requirements of Section 224.
- (l) **Reinforcing steel** shall conform to the requirements of Section 223, Grade 40 or 60.
- (m) **Curing materials** shall conform to the requirements of Section 220.

302.03—Procedures.

Excavation and backfill operations shall be performed in accordance with the requirements of Section 303. Foundation exploration shall be performed in accordance with the requirements of Section 401 unless otherwise provided herein. Concrete construction shall conform to the requirements of Section 404. Reinforcing steel placement shall conform to the requirements of Section 406. Bearing pile operations shall be performed in accordance with the requirements of Section 403. When specified on the plans or directed by the Engineer, a temporary diversion channel shall be constructed to facilitate installation of a pipe or box culvert.

When lift holes are provided in concrete pipe or precast box culverts, the Contractor shall install a lift hole plug furnished by the manufacturer in accordance with the requirements of Section 232.02 (a) 1. After pipe installation and prior to backfilling, plugs shall be installed from the exterior of the pipe or box culvert and snugly seated.

- (a) **Pipe Culverts:** Not more than one type of pipe shall be used in any one pipeline.

When field cutting corrugated metal pipe is permitted by the Engineer, damaged areas of the protective coating shall be repaired in accordance with the requirements of Section 233.

1. **Jacked method:** The Contractor shall submit to the Engineer a complete plan and schedule for jacked pipe installation prior to beginning such work. The submission shall include complete details of sheeting, shoring, and bracing for protecting the

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

roadbed and materials and equipment. The Contractor shall not proceed with pipe installation until the plan has been reviewed by the Engineer.

When work is stopped, the heading shall be bulkheaded.

The jacked method shall be by means of tunneling or boring. The jacked tunneling method shall be applicable for installing concrete pipe 30 through 108 inches in diameter and smooth-wall steel pipe 30 through 48 inches in diameter. The jacked boring method shall be applicable for installing concrete pipe 12 through 108 inches in diameter and smooth-wall steel pipe 12 3/4 through 48 inches in diameter.

Pipe shall have a design strength and wall thickness so as to withstand the jacking operation.

Construction shall be performed in such a manner that the ground surface above the pipe line will not settle. Installation of the pipeline shall immediately follow heading or tunneling excavation. Voids occurring behind the pipe during installation shall be filled with hydraulic cement grout, placed under pressure, upon completion of the jacking operation.

Joint sealant material on concrete pipe shall be placed ahead of the jacking frame. At his own expense, the Contractor shall replace or repair, as directed by the Engineer, pipe that is damaged during jacking operations. Joints of steel pipe shall be butt welded, watertight, as installation progresses.

2. **Open trench method:**

- a. **Foundation:** The foundation shall be explored below the bottom of the excavation to determine the type and condition of the foundation. However, explorations need not be made for routine entrance or crossover pipe 12 through 30 inches in diameter that is to be installed under fills 15 feet or less in height. Foundation exploration shall extend to a depth equal to 1/2 inch per foot of fill height or 8 inches, whichever is greater. The Contractor shall report findings of foundation exploration to the Engineer for approval prior to placing pipe.

Where unsuitable foundation is encountered at the established grade, as determined by the Engineer, such material shall be removed and replaced.

Backfill for areas where unsuitable material has been removed shall be placed and compacted in accordance with the requirements of Section 303.04(g).

- b. **Bedding:** Bedding material for culvert foundations, including foundations in soft, yielding or otherwise unsuitable material, shall be aggregate No. 25 or 26 conforming to the requirements of Section 205 except where standing or running water is present in the pipe foundation excavation, then pipe bedding material shall be aggregate No. 57 for the depth specified on the plans or as directed by the Engineer, capped with 4 inches of aggregate No. 25 or 26. Where such conditions are discovered in the field and the Contractor is directed by the Engineer to use No. 57 stone, No. 57 stone will be paid for at the existing contract unit price, or if not in the contract, in accordance with Section 109.05.

Pipe bedding shall be lightly and uniformly compacted and shall be carefully shaped so that the lower section of the pipe exterior is in contact with the bedding material for at least ten percent of the overall height of the pipe. Bedding material shall be shaped to accommodate the bell when bell and spigot pipe is used. The depth of bedding material shall be at least 4 inches.

- c. **Placing pipe:** Pipe shall be placed beginning at the downstream end of the pipeline. The lower segment of pipe shall be in contact with the shaped bedding for its entire length. Bell or groove ends of rigid pipe shall be placed facing upstream.

Paved or partially lined pipe shall be placed so that the longitudinal centerline of the paved segment coincides with the flow line.

Pipe will be inspected before backfill is placed. Pipe found to be out of alignment, unduly settled, or damaged shall be taken up and reinstalled or replaced.

- d. **Joining pipe:**

- (1) **Rigid pipe:** The method of joining pipe sections shall be such that ends are fully entered and inner surfaces are reasonably flush and even.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Joints shall be sealed with any one or combination of the following to form a leak-resistant joint: rubber, preformed plastic, or mastic gaskets from the Department's approved list; oakum and mortar; oakum and joint compound; or cold-applied pipe joint sealer.

Rubber ring gaskets shall be installed to form a flexible, leak-resistant seal. Where oakum is used, the joint shall be caulked with this material and then sealed with mortar or joint compound.

- (2) **Flexible pipe:** Flexible pipe sections shall be aligned and firmly joined by approved coupling bands to form a leak-resistant joint.
- e. **Structural plate pipe, pipe arches, and arches:** Erection shall be in accordance with the manufacturer's assembly diagrams and instruction sheets. Splices in the haunch areas of structural plate pipe arches shall be constructed using the reverse shingle method or the side plates shall be provided without longitudinal seams in the haunch areas. The complete line shall be assembled before backfill is placed. Bolts shall be tightened to a torque of 150 to 250 foot-pounds. Elongated pipe shall be erected with the long diameter in a vertical position. If spiraling occurs during erection, bolts shall be loosened and the pipe assembly adjusted to the correct position.
- f. **Arch substructures, end walls, and pipe spillouts:** Each side of an arch shall rest in a groove formed into the masonry or on a galvanized angle or channel securely anchored to or embedded in the substructure. Where the span of the arch is more than 15 feet or the skew angle is more than 20 degrees, a metal bearing surface having a width at least equal to the depth of the corrugation shall be provided.

Metal bearings for arches shall be cold-formed galvanized channel conforming to the requirements of ASTM A569 at least 3/16 inch in thickness, with the horizontal leg securely anchored to the substructure at points spaced on centers of not more than 24 inches. When the metal bearing is not embedded in a groove in the substructure, one vertical leg shall be punched to allow bolting to the bottom row of plates.

- g. **Backfilling:** Backfill material shall be placed alongside the pipe culvert in uniform layers not more than 6 inches, before compaction, and each layer shall be thoroughly compacted as specified in Section 303.04(g). Material shall be compacted thoroughly under haunches of pipe culverts. Each layer shall be compacted by rolling, tamping with mechanical rammers, or hand tamping with heavy metal tampers with a face of at least 25 square inches. If vibratory rollers are used in the backfill operation, vibratory motors shall not be activated until at least 3 feet of backfill has been placed and compacted over the pipe.

Puddling will not be permitted. Rock more than 2 inches in its greatest dimension shall not be placed within 12 inches of pipe.

Backfill and compaction shall be advanced simultaneously on both sides of the pipe. The fill above the top of the pipe shall be completed as specified for embankment construction unless the induced trench method of installation is used.

Culvert backfill material shall conform to the Standard Drawings for Method A Bedding for the type of culvert and soil conditions. Class I Backfill material shall be crusher run aggregate size no. 25 or 26, flowable backfill or compacted soils conforming to AASHTO M145, Group A-1, A-2-4, A-2-5, A-2-6, or A-3 (GW, GP, SW, GM and SM) only. Class II backfill material shall have a minimum CBR of 20 and may be material excavated from within the project limits or may be obtained outside of the project limits when not present onsite. Where trench excavation meets the requirements of Class I or Class II backfill material the Contractor will be required to use trench excavation prior to using borrow material.

Regular backfill material outside of the neatlines of the Class I or Class II backfill areas shown on the Standard Drawings shall be regular excavation conforming to Section 303. Regular and classified backfill shall be placed in uniform layers not more than 6 inches before compaction and each layer shall be thoroughly compacted as specified in Section 303.04(g). Class I backfill material shall be thoroughly compacted under the haunches of pipe culverts. Each layer shall be compacted by rolling, tamping with mechanical rammers, or hand tamping with heavy metal tampers with a face of at least 25 square inches. If vibratory rollers are used in the backfill operations, vibratory motors shall not be activated until at least 3 feet of backfill has been placed and compacted over the pipe. Backfill and compaction shall be advanced simultaneously on both sides of the pipe. The fill above the top of the pipe shall be completed as specified for embankment construction.

Where borrow material is used for backfill operations, the volume of Class I and Class II backfill material shall be deducted from the volume of borrow material prior to payment.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Concrete pipe with a height of cover greater than that shown in the Standard PC-1 table for Class V pipe shall be Special Design pipe with Method A bedding and Class I and II backfill material.

- (b) **Precast Drainage Structures:** Submittal of designs for precast items included in the standard drawings will not be required provided fabrication is in accordance with the standard details. Submittal of designs for precast box culverts on the Department's approved list will not be required provided the Contractor submits a certification that the item will be fabricated in accordance with the preapproved design drawings.

Requests for approval of a precast design shall include detailed plans and supporting computations that have been reviewed and approved by a registered Professional Engineer having at least 5 years experience in structural design of the type of precast structures or components proposed. Concrete shall conform to Section 217 unless otherwise specified and have a design strength at 28 days of at least 4,000 pounds per square inch and an air content of 6 ± 2 percent. The design of the concrete mixture and the method of casting, curing, handling, and erecting shall be subject to review by the Engineer. Precast units may be shipped after reaching 85 percent of the design strength as determined by control cylinders tested in accordance with the requirements of Section 404. However, units shall retain their structural integrity during shipment and shall be subject to inspection at the job site. Approval to use precast units shall not be construed as waiving the size and weight hauling limitations of Section 105.14.

1. **Standard precast drainage units** shall conform to the material requirements of AASHTO M199 and the following:

- a. If the grade on the adjacent gutter is less than 1.5 percent, the grade on the invert of the throat section of the inlet shall be at least 1.5 percent. Precast throats having flat inverts will be permitted in sag locations provided the total length of the required throat opening does not exceed 6 feet.
- b. Pipe openings in precast drainage units shall not exceed 4 inches at any given point between the outside wall of the pipe and the opening in the precast unit regardless of their angle of intersection or the shape of the pipe. Pipe openings shall be formed, drilled, or neatly cut.
- c. The Contractor shall use concrete or brick, masonry block, concrete pipe cutoffs, or native stone in conjunction with mortar to fill the void between pipe culverts and precast structures. With the exception of concrete, such materials shall be thoroughly wetted, bonded with mortar and the remaining exterior and interior voids filled with mortar to the contour of the precast structure.
- d. When precast units are to be located adjacent to the subbase or base course, units with chambers shall be provided with weep holes 3 inches in diameter and hardware cloth and shall be located to drain the subbase or base.
- e. Precast units located adjacent to cast-in-place concrete items, such as flumes, ditches, and gutters, shall be connected to the adjacent unit by means of No. 4 smooth steel dowels spaced on approximately 12-inch centers throughout the contact length and extending at least 4 inches into both the precast unit and the cast-in-place item. If holes to receive the dowels are provided in the precast unit, they shall be not more than 5/8 inch in diameter. Other methods of providing the connection, such as keyed joints, shall be approved by the Department prior to fabrication.
- f. The chamber section shall be installed in the plumb position. The throat and top sections shall have positive restraints, such as adjacent concrete, pavement, or soil on all sides to prevent displacement and shall have a positive interlock, such as dowels, with the chamber section. The throat and top sections shall be installed to conform with the normal slope of the finished grade, and may be canted up to a maximum grade of 10 percent. The chamber may be built up a maximum of 12 inches at any point to provide for complete and uniform bearing of the throat and top sections on the chamber flat slab top or other approved top section. The built up section shall be constructed using whole concrete spacer units where feasible, and partial and whole sections of concrete block or brick with high strength grout and mortar. High strength grout shall be used to provide the final grade adjustment and uniform bearing. The width of the built up section shall match the wall thickness of the chamber section. The concrete block and brick shall be thoroughly bonded with mortar and the inside and outside of the built-up section shall be plastered with mortar except that the concrete spacer unit shall not be plastered.

2. **Precast arches** shall conform to the applicable requirements of AASHTO's *Standard Specifications for Highway Bridges* with the following modifications:

- a. **Combination of loads:** For service load design: E: vertical loads: 1.00; lateral loads: 1.00 and 0.5 (check both loadings).
For load factor design: E: vertical loads: 1.00; lateral loads: 1.30 and 0.5 (check both loadings).
- b. **Protection against corrosion:** The concrete cover of reinforcement shall be at least 1 1/2 inches.

In corrosive or marine environments or other severe exposure conditions, reinforcement shall be epoxy coated in accordance with the requirements of Section 223.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Exposed reinforcing bars, inserts, and plates intended for bonding with future extensions shall be protected from corrosion as directed by the Engineer.

Reinforcement shall be designed and detailed in consideration of fabrication and construction tolerances so that the minimum required cover and proper positioning of reinforcement shall be maintained.

- c. **Anchorage:** Sufficient anchorage shall be provided at the terminus of lines of precast units. Anchorage may consist of a cast-in-place end section at least 3 feet in length with a headwall or collar around the precast unit(s) provided adequate connection can be made between the collar and units.
- d. **Joints:** Joints between units shall be sealed by preformed plastic or mastic gaskets or grout. When preformed gaskets are used, they shall be of a type listed on the Department's approved products list.
- e. **Pipe openings:** Pipe openings will not be allowed in the precast arch but may be provided through the wingwalls. When required, openings shall conform to the requirements of 1.b. herein.

3. **Precast box culverts** shall conform to the applicable requirements of AASHTO M259 or M273 and AASHTO's *Standard Specifications for Highway Bridges* with the following modifications:

- a. **Combination of loads:** For service load design or load factor design: E: new reinforced concrete boxes: vertical loads: 1.00; lateral loads: 1.00 and 0.5 (check both loadings).
- b. **Protection against corrosion:** The following minimum concrete cover shall be provided for reinforcement: For boxes with more than 2 feet of fill over the top slab: 1 1/2 inches. For boxes with less than 2 feet of fill over the top slab: top reinforcement of top slab: 2 1/2 inches; bottom reinforcement of top slab: 2 inches; all other reinforcement: 1 1/2 inches.

The minimum cover for reinforcement may be reduced by not more than 1/2 inch, provided the reinforcement having reduced cover is epoxy coated or the concrete surfaces adjacent to the reinforcement are coated with Class I Waterproofing in accordance with the requirements of Section 421.

Reinforcing steel for box culverts used in 0 to 2 foot fills, used in corrosive or marine environments or used in other severe exposure conditions shall be epoxy coated. When epoxy coated reinforcing steel is required due to these conditions, the minimum cover specified shall not be reduced.

- c. The type of sealant used in joints between units shall be from the Department's approved list of preformed plastic or mastic gaskets.

Where double or greater lines of precast units are used, a buffer zone of 3 to 6 inches between lines shall be provided. This buffer zone shall be backfilled with porous backfill conforming to the requirements of Section 204. The porous backfill shall be drained by a 3-inch diameter weep hole, formed by non-rigid tubing, located at the top of the bottom haunch, centered in the outlet end section and at approximately fifty foot intervals along the length of the box. Weep holes shall be covered with a 3-foot square section of filter barrier cloth firmly attached to the outside of the box. A 3-foot width of filter barrier cloth shall also be centered over the buffer zone for the entire length of the structure after placement of the porous backfill material. Filter barrier cloth shall conform to the requirements of Section 245.

Forming weep holes and furnishing and placing of the filter barrier cloth shall be included in the price bid per linear foot for the Precast Box Culvert.

- d. At the terminus of precast units, sufficient anchorage shall be provided. This anchorage may consist of a cast-in-place end section at least 3 feet in length with a headwall and curtain wall or a collar cast-in-place around the units provided adequate connection can be made between the collar and units.

When the ends of precast units are skewed, the end section shall be cast monolithically. The skew may be provided by forming, saw cutting, or other methods approved by the Engineer. Regardless of the method used, the variation in the precast unit from the exact skew shall be not greater than 1 1/2 inches at any point.

- e. Pipe openings shall conform to the requirements of 1.b. herein.
- f. Bedding shall be at least 6 inches in thickness.

(c) **Drop Inlets, Manholes, Spring Boxes, Intake Boxes, and End Walls:** Masonry construction shall not be initiated when the air temperature is below 40 degrees F in the shade.

Brick and concrete block masonry shall be placed so that each unit will be thoroughly bonded with mortar. Joints shall be full-mortar joints not more than 1/2 inch in width. Where brick masonry is used, headers and stretchers shall be arranged to bond the

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

mass fully. Every seventh course shall be placed entirely with headers. Inside joints shall be neatly pointed, and the outside of such walls shall be plastered with mortar as they are placed.

Iron fittings entering the masonry shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned.

Inlet and outlet pipe connections shall conform to the same requirements as the pipe to which they connect and shall be of the same size and kind. Pipe sections shall be flush on the inside of the structure wall and shall project outside sufficiently for proper connection with the next pipe section. Masonry shall fit neatly and tightly around the pipe.

Immediately following finishing operations, hydraulic cement concrete shall be cured and protected in accordance with the requirements of Section 316.04(j).

Backfilling shall be performed in accordance with the requirements of Section 303.04(g). Surplus material shall be removed, and the site shall be left in a neat and orderly condition.

When grade adjustment of existing structures is specified, frames, covers, and gratings shall be removed and the walls shall be reconstructed as required. Cleaned frames shall be reset at the required elevation. Upon completion, each structure shall be cleaned of silt, debris, and foreign matter and shall be kept clear of such accumulation until final acceptance.

302.04—Measurement and Payment.

Pipe culverts will be measured in linear feet. The quantity will be determined by counting the number of sections and multiplying by the length of the section used. When a partial section is required, the actual length of the partial section will be measured in place.

Structural plate pipe and pipe arches will be measured in linear feet along the invert line.

Pipe tees and elbows will be measured in linear feet of pipe.

Pipe reducers will be measured in linear feet of pipe for payment at the larger pipe size.

Pipe shall be paid for at the contract unit price per linear foot. This price shall include excavating, when not a pay item, sheeting, shoring, dewatering, disposing of surplus and unsuitable material, backfill material, except Class I and II material, and restoring existing surfaces. When unit prices for extended pipelines are not specified, the unit price for new pipe of the same size shall apply. When not a pay item, the cost of the temporary relocation of a stream to facilitate the installation of a drainage facility shall be included in the price for the related pipe or box culvert. The cost of fittings, anti-seepage collars and anchor blocks shall be included in the price for the applicable type of culvert.

Jacked pipe will be measured in linear feet to the nearest 1/10 of a foot and will be paid for at the contract unit price per linear foot.

Reinstalled pipe will be measured in linear feet along a line parallel to the flow line and will be paid for at the contract unit price per linear foot of pipe and per cubic yard of minor structure excavation. This price shall include excavation involved in removing pipe, hauling, cleaning, relaying, backfilling, necessary cutting for joining to other sections of pipe, furnishing new coupling bands, disposing of surplus excavation, and replacing any otherwise usable sections damaged or broken because of the negligence of the Contractor.

End sections and pipe spillouts will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

End walls and arch substructures will be measured in cubic yards of concrete and pounds of reinforcing steel, except that EW-12 endwalls will be measured in units of each complete-in-place. Endwalls and arch substructures will be paid for at the contract unit price per cubic yard of miscellaneous concrete and per pound of reinforcing steel, except that crack control bars shall be included in the price bid for miscellaneous concrete and standard EW-12 endwalls will be paid for at the contract unit price per each.

Minor structure excavation will be measured and paid for in accordance with the requirements of Section 303.06.

Bedding material shall be measured and paid for at the contract unit price per ton for the type(s) specified, which price shall be full compensation for furnishing, placing, compacting, and shaping the material. Section 104.02 that pertains to adjusting contract unit prices because of alterations of contract quantities will not apply to this pay item.

Class I backfill material shall be measured and paid for at the contract unit price per cubic yard or ton, which price will be full compensation for furnishing, placing, compacting and shaping the material in accordance with PB-1 Standards. Section 104.02 that pertains to adjusting contract unit prices because of alterations of contract quantities will not apply to this pay item.

Class II backfill material shall be measured and paid for at the contract unit price per cubic yard or ton, which price will be full compensation for furnishing, placing, compacting and shaping the material in accordance with the PB-1 Standards. Section 104.02 that pertains to adjusting contract unit prices because of alterations of contract quantities will not apply to this pay item.

Box culverts will be measured in cubic yards of concrete and pounds of reinforcing steel and will be paid for at the contract unit price per cubic yard of concrete and per pound of reinforcing steel. These prices shall include waterproofing.

Precast box culverts will be measured in linear feet along the center line of the barrel from face of curtain wall to face of curtain wall and will be paid for at the contract unit price per linear foot. This price shall include designing, casting, reinforcing, installing, waterproofing, sealing joints, anchoring, and providing buffer zones for multiple lines.

If the Contractor elects to furnish and install precast box culverts or precast arches, payment will be made for the original quantities shown on the plans for cast-in-place units. No additional compensation will be made for casting, prestressing, or shipping precast units or performing additional work, such as waterproofing, epoxy coating, or joint sealing, required as a result of the substitution.

Grates and frames will be measured in units of each and will be paid for at the contract unit price per each.

Pipe grate will be measured in linear feet and will be paid for at the contract unit price per linear foot. This price shall include fabricating, furnishing, galvanizing, and installing.

Drop inlets and intake boxes will be measured as complete units, including the frame and grate or cover, and will be paid for at the contract unit price per each. The contract unit price for drop inlets will be adjusted at the rate of 5 percent per foot for increases or decreases in the depth indicated on the plans except that no adjustment will be made for changes amounting to less than 6 inches in the height of a single drop inlet. Where curb or curb and gutter extend along the drop inlet, the contract unit price for drop inlets shall include that part of the curb or gutter within the limits of the structure.

Base sections of pipe tee units used as drop inlets and manholes will be measured in linear feet horizontally and will be paid for at the contract unit price per linear foot of pipe specified. The riser section and additional costs for the tee shall be included in the price for the drop inlet or manhole.

Manholes will be measured in linear feet, vertical measure, from top of foundation slab to top of masonry on which the casting frame is placed. However, when manholes are constructed as tee sections, measurement will be made to the pay limits shown on the plans. Manholes will be paid for at the contract unit price per vertical linear foot exclusive of frame and cover.

Concrete spring boxes will be measured in cubic yards of concrete, pounds of reinforcing steel, and linear feet of pipe and will be paid for at the contract unit price per cubic yard of concrete, per pound of reinforcing steel, and per linear foot of pipe.

Junction boxes will be measured in cubic yards of concrete, pounds of reinforcing steel, pounds of structural steel, and each complete frame and cover assembly and will be paid for at the contract unit price per cubic yard of concrete, per pound of reinforcing steel, per pound of structural steel, and per each frame and cover assembly.

Casting frames and covers will be measured in units of one complete frame and cover and will be paid for at the contract unit price per unit.

Reconstructed manholes will be measured as a complete unit and will be paid for at the contract unit price per each.

Precast arches will be measured in linear feet along the centerline of the invert from face of headwall to face of headwall. When a pay item, precast arches will be paid for at the contract unit price per linear foot. This price shall include designing, forming, casting, reinforcing, excavating, wingwalls, installing, waterproofing, sealing joints, anchoring and bedding, and providing buffer zones for multiple lines. The cost for cast-in-place work other than that specified on the plans shall be included in the price for precast arches.

Temporary diversion channel lining will be measured in square yards for the class specified and will be paid for at the contract unit price per square yard. This price shall include installing the channel lining and removal when no longer required.

Temporary diversion channel excavation will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. This price shall include excavation, temporary pipe culverts and removal of pipe culverts when no longer required, backfilling, site restoration including regrading and seeding.

Excavation, backfill, and disposal of unsuitable or surplus material for drop inlets, intake boxes, manholes both new and reconstructed, spring boxes, junction boxes, and base sections of pipe tee units used as drop inlets and manholes will not be measured for separate payment, and the cost thereof shall be included in the bid price for such items. In the event steps or invert shaping are required, the cost thereof shall also be included in the price for such items.

Storm Water Management Drainage Structure will be measured in linear feet, vertical measure, from top of concrete foundation to the top of the concrete cover. The price bid shall include class A3 concrete, reinforcing steel, concrete cover, debris rack, orifice, steps when required, and class A1 riprap.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Storm Water Management, Riser Pipe will be measured in linear feet for the size specified and will be paid for at the contract unit price per linear foot. The bid price shall include the riser pipe, perforated pipe, steel plate, debris rack, orifice, grate and cover when required, and class A1 riprap.

Temporary Sediment Riser Pipe will be measured in linear feet for the size specified and will be paid for at the contract unit price per linear foot. The price shall include the riser pipe, steel plate, perforated pipe, debris rack, orifice and class A1 riprap, and vortex device when required.

Storm Water Management Dam will be measured and paid for at the contract unit price per cubic yards of concrete and pounds of reinforcing steel.

Payment will be made under:

Pay Item	Pay Unit
Pipe (Size and type)	Linear foot
Structural plate arch (Size)	Linear foot
Jacked pipe (Size)	Linear foot
Reinstalled pipe	Linear foot
End section (Standard and size)	Each
Pipe spillout (Standard)	Each
Concrete (Class)	Cubic yard
Reinforcing steel	Pound
End wall grate and frame (Standard)	Each
Bedding material, aggregate No. ()	Ton

Pay Item	Pay Unit
Class I backfill material	Cubic yard or Ton
Class II backfill material	Cubic yard or Ton
Precast box culvert (Size)	Linear foot
End wall pipe grate (Type)	Linear foot
Drop inlet (Standard and length)	Each
Intake box (Standard)	Each
Structural steel (Type)	Pound
Manhole (Standard)	Linear foot
Frame and cover (Standard)	Each
Reconstructed manhole	Each
Precast arch (Size)	Linear foot
Temporary diversion channel lining (Class)	Square yard
Temporary diversion channel excavation	Cubic yard
Endwall standard EW-12	Each
Storm water management drainage structure (type)	Linear foot
Storm water management riser pipe (size)	Linear foot
Temporary sediment riser pipe (size)	Linear foot

SECTION 303—EARTHWORK

303.01—Description.

This work shall consist of constructing roadway earthwork in accordance with these specifications and in reasonably close conformity with the specified tolerances for the lines, grades, typical sections, and cross sections shown on the plans or as established by the Engineer. Earthwork shall include regular, borrow, undercut and minor structure excavation; constructing embankments; disposing of surplus and unsuitable material; shaping; compaction; sloping; dressing; and temporary erosion control work.

303.02—Materials.

- (a) Borrow excavation shall consist of approved material required for the construction of the roadway and shall be obtained from approved sources outside the project limits. Borrow excavation shall conform to AASHTO M57 and the requirements herein.
- (b) Materials for temporary silt fences, geotextile fabric silt barriers, and filter barriers shall conform to the requirements of Sections 242 and 245.
- (c) Geotextile materials used for embankment stabilization shall conform to the requirements of Section 245.

303.03—Erosion and Siltation Control.

Erosion and siltation shall be controlled through the use of the devices and methods specified herein or as is otherwise necessary. The Department reserves the right to require other temporary measures not specifically described herein to correct an erosion or siltation condition.

Erosion and siltation control devices and measures shall be maintained in a functional condition at all times. Temporary and permanent erosion and sedimentation control measures shall be inspected after each rainfall and at least daily during periods of prolonged rainfall. Deficiencies shall be immediately corrected. The Contractor shall make a daily review of the location of silt fences and filter barriers to ensure that they are properly located for effectiveness. Where deficiencies exist, corrections shall be made immediately as approved or directed by the Engineer.

Sediments shall be removed when the wet storage volume has been reduced by 50 percent. Removed sediment shall be disposed of in accordance with Section 106.04. Sediment deposits remaining in place after the device is no longer required shall be dressed to conform with the existing grade, prepared, and seeded in accordance with the requirements of Section 603.

Geotextile fabric that has decomposed or becomes ineffective and is still needed shall be replaced. In addition, temporary erosion and sediment control devices except brush silt barriers shall be removed within 30 days after final site stabilization or after the temporary devices are no longer needed as determined by the Engineer.

- (a) **Earth Berms and Slope Drains:** The top of earthwork shall be shaped to permit runoff of rainwater. Temporary earth berms shall be constructed and compacted along the top edges of embankments to intercept runoff water. Temporary slope drains shall be provided to intercept runoff and adequately secured to prevent movement. Slope drains may be flexible or rigid but shall be capable of being readily shortened or extended. A portable flume shall be provided at the entrance to temporary slope drains.
- (b) **Incremental Seeding:** Cut and fill slopes shall be shaped and topsoiled where specified. Seed and mulch shall be applied in accordance with the requirements of Section 603 as the work progresses in the following sequence:
 1. Slopes whose vertical height is 20 feet or greater shall be seeded in three equal increments of height. Slopes whose vertical height is more than 75 feet shall be seeded in 25-foot increments.
 2. Slopes whose vertical height is less than 20 but more than 5 feet shall be seeded in two equal increments.
 3. Slopes whose vertical height is 5 feet or less may be seeded in one operation.

Seeding operations shall be initiated within 48 hours after attaining the appropriate grading increment or upon suspension of grading operations for an anticipated duration of greater than 15 days or upon completion of grading operations for a specific area.

- (c) **Check Dams and Silt Settlement Boxes:** As an initial item of work, required check dams shall be constructed at 25-foot intervals, unless otherwise shown on the plans, below the outfall end of drainage structures.

Straw check dams shall not be constructed in streams and shall be installed only where designated on the plans to form settlement pools. Settlement pools shall be cleaned regularly as directed by the Engineer, and material removed shall be transported and deposited at locations where it will not reenter the stream or drainage ways.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

When timber silt settlement boxes or log check dams are required, timber sheeting may be any grade that is structurally sufficient to maintain the general shape and function of the particular box or dam shown on the plans.

- (d) **Baled Straw Silt Barriers:** Baled straw silt barriers may be substituted for temporary filter barriers with the approval of the Engineer in noncritical areas, such as pavement areas and rock locations where filter barriers cannot be installed in accordance with the plans and specifications, and locations where the Engineer determines that streams and water beds will not be affected.
- (e) **Temporary Silt Fences, Geotextile Fabric Silt Barriers, and Filter Barriers:**

- 1. **Temporary silt fences:** Fences shall be erected at locations shown on the plans or determined by the Engineer. Extra-strength geotextile fabric shall be provided and posts shall not be spaced more than 6 feet apart. Posts shall be uniformly installed with an inclination toward the potential silt load area of at least 2 but not more than 20 degrees. Attaching fabric to existing trees will not be permitted.

Fabric shall be firmly secured to the post or wire fence. The bottom of the fabric shall be entrenched in the ground at least 4 inches. Fabric may be spliced only at support posts and with an overlap of at least 6 inches. The top shall be installed with a 1-inch tuck or reinforced top end section. The height of the finished fence shall be a nominal 36 inches.

- 2. **Geotextile fabric silt barriers:** Existing fences or brush barriers used along the downhill side of the toe of fills or below pipe culvert installations shall have standard-strength geotextile fabric attached at specified locations. The bottom of the fabric shall be entrenched in the ground at least 4 inches, and the top shall be installed with a 1-inch tuck or reinforced top end section.

Brush barriers shall be installed prior to any major earth-disturbing activity and trimmed sufficiently to prevent tearing or puncturing fabric. Fabric shall be fastened securely to the brush barrier or existing fence. A 6-inch overlap of fabric for vertical and horizontal splicing shall be maintained and tightly sealed.

- 3. **Temporary filter barriers:** Barriers shall consist of standard-strength geotextile fabric or 10-ounce burlap fabric and shall be securely fastened to wood or metal supports that are spaced at not more than 3-foot intervals and driven at least 12 inches into the ground. At least three supports shall be used. The bottom of the fabric shall be entrenched in the existing ground at least 4 inches. The temporary filter barrier shall be at least 15 but not more than 18 inches in height. The top of the fabric shall be installed with a 1-inch tuck or reinforced top end section.

Temporary filter barriers shall be installed in ditch lines and at temporary locations as directed or approved by the Engineer where construction changes the earth contour and drainage runoff.

- (f) **Sediment Basins:** Sediment basins are required if stormwater runoff flowing across a disturbed area exceeds the standards of the Virginia Erosion and Sediment Control Regulations.

303.04—Procedures.

Loose rock 3 inches or larger shall be removed from the surface of cut slopes.

When slides occur, the Contractor shall remove and dispose of material as directed by the Engineer.

Where required, surface ditches shall be placed at the top of cut slopes or at the foot of fill slopes and at such other points not necessarily confined to the right of way or shown on the plans and shall be of such dimensions and grades as directed by the Engineer.

Allaying dust, when specified, shall be performed in accordance with the requirements of Section 511.

Prior to the beginning of grading operations in the area, necessary clearing and grubbing shall be performed in accordance with the requirements of Section 301.

- (a) **Regular Excavation:** Existing foundations and slabs located within the construction limits shall be removed and disposed of in a location approved by the Engineer. In lieu of removal, foundations and slabs located 5 feet or more below the proposed subgrade may be broken into particles not more than 18 inches in any dimension and reoriented to break the shear plane and allow for drainage.

Cisterns, septic tanks, wells and other such structures shall be cleared in accordance with the requirements of Section 516.

Balance points shown on the plans are theoretical and may vary because of actual field conditions.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

When the material to be excavated necessitates the use of explosives, the requirements of Section 107.11 relating to the use of explosives shall apply. To prevent damage to newly constructed concrete, the Contractor shall schedule blasting operations in the proximity of proposed concrete structures so that work will be completed prior to placement of concrete.

Regular excavation shall consist of removing and disposing of material located within the project limits, including widening cuts and shaping slopes necessary for preparing the roadbed; removing root mat; stripping topsoil; cutting ditches, channels, waterways and entrances; and performing other work incidental thereto. The Engineer may require materials in existing pavement structures to be salvaged for use in traffic maintenance.

Undrained areas shall not be left in the surface of the roadway. Grading operations shall be conducted so that material outside construction limits will not be disturbed.

Where rock or boulders are encountered, the Contractor shall excavate and backfill in accordance with the plans and contract documents.

When the presplitting method of excavation is specified for rock cuts, work shall be performed in a manner to produce a uniform plane of rupture in the rock and so that the resulting backslope face will be unaffected by subsequent blasting and excavation operations within the section. Rock shall be presplit along rock slopes at locations, lines, and inclinations shown on the plans or as determined by field conditions. A test section shall be provided to establish the spacing of drill holes and the proper blasting charge to be used in the presplitting operation. Drill holes shall be spaced not more than 3 feet apart and shall extend to the plan grade or in lifts of not more than 25 feet, whichever is less. If drilled in benches, an offset may accommodate the head of the drill, but no offset shall be more than 12 inches. Presplitting shall extend at least 20 feet ahead of the limits of fragmentation blasting within the section.

Where the project has been designed and slopes have been staked on the assumption that solid rock will be encountered and the Contractor fails to encounter solid rock at the depth indicated, he shall cease excavation in the area and immediately notify the Engineer. If it is necessary to redesign and restake slopes, any additional excavation necessary will be paid for at the contract unit price per cubic yard.

Topsoil stockpiled for later use in the work shall be stored within the right of way unless the working area is such that the presence of the material would interfere with orderly prosecution of the work. Stockpile areas outside the right of way shall be located by the Contractor at his expense. Topsoil used in the work shall be removed first from stockpiles located on private property. Surplus topsoil remaining on private property after completion of topsoiling operations shall be moved onto the right of way and stockpiled, shaped, and seeded as directed by the Engineer.

Stripping topsoil shall be confined to the area over which grading is to be actively prosecuted within 15 calendar days following the stripping operation. Grading operations shall be confined to the minimum area necessary to accommodate the Contractor's equipment and work force engaged in the earth moving work.

- (b) **Borrow Excavation:** The Contractor shall make his own arrangements for obtaining borrow and pay all costs involved in accordance with the provisions of Section 106.03.

If the Contractor places an excess of borrow and thereby causes a waste of regular excavation, the amount of such waste, unless authorized, will be deducted from the volume of borrow as measured at the source or computed by vehicle count as specified in Section 109.01.

When borrow is obtained from sources within the right-of-way and the excavation is performed simultaneously with regular excavation, borrow excavation will be designated as regular excavation. Material secured by widening cuts beyond slope stakes, when taken from previously excavated slopes, will be designated as borrow excavation. When such a procedure is approved, slopes shall be uniform and no steeper than shown on the plans. Borrow excavation areas shall be bladed and left in a shape to permit accurate measurements after excavation has been completed.

- (c) **Undercut Excavation:** Undercut excavation shall consist of removing and disposing of unsuitable material located within the construction limits in accordance with Section 303.06(a)3.

Undercut excavation shall be disposed of in accordance with Section 106.04.

- (d) **Minor Structure Excavation:** Minor structure excavation shall consist of removing material necessary to accommodate the structure, such as box or arch culverts, including pipe arches, structural plate arches, structural plate pipe, pipe culverts, and storm drains with span(s) or opening(s) 48 inches or greater. Minor structure excavation shall also include dewatering, sheeting, bracing, removing existing structures, and backfilling. Removing existing structures shall also include foundations that might be necessary to clear the site.

- (e) **Removing Unsuitable Material:** Where excavation to the finished graded section results in a subgrade or slopes of unsuitable material, such material shall be excavated below the grade shown on the plans or as directed by the Engineer. Areas so excavated shall be backfilled with approved material in accordance with (f) herein.

Excavation for structures shall be carried to foundation materials satisfactory to the Engineer regardless of the elevation shown on the plans. If foundation material is rock, the Contractor shall expose solid rock and prepare it in horizontal beds for receiving the structure. Loose or disintegrated rock and thin strata shall be removed. Excavated material, if suitable, shall be used for backfilling around the structure or constructing embankments.

Material shown on the plans as unsuitable and during construction found to be suitable for use shall first be used in embankments where needed in lieu of borrow. However, the use of this material in lieu of borrow shall not alter the provisions of Section 104.02 regarding underruns.

Material shown on the plans as suitable material but found at time of construction to be unsuitable shall be disposed of as unsuitable material.

Unsuitable material shall be disposed of in accordance with Section 106.04.

- (f) **Backfill for Replacing Undercut Excavation:** Backfill shall be comprised of regular excavation, borrow, select material, subbase material, or other material as directed by the Engineer. Backfilling operations shall be performed in accordance with (g) herein.
- (g) **Backfilling Openings Made for Structures:** Backfill shall be suitable material removed for the structure, although the Engineer may require that backfill material be obtained from a source within the construction limits entirely apart from the structure or other approved material. The opening to be backfilled shall be dewatered prior to backfilling. Backfill shall not be placed against or over cast-in-place box culverts or other structures until the top concrete slab section(s) has been in place 14 days, exclusive of days on which the average high-low ambient temperature is below 40 degrees F in the shade or until the concrete control cylinder(s) has attained a compressive strength equal to 93 percent of the 28-day design compressive strength.

Backfill shall be compacted in horizontal layers not more than 6 inches in thickness, loose measurement, and as specified in (h) herein. Backfill shall be placed in horizontal layers such that there will be a horizontal berm of compacted undisturbed material behind the structure for a distance at least equal to the remaining height of the structure or wall to be backfilled. Backfill shall be placed in a manner to deter impoundment of water and facilitate existing drainage. Backfill around piers in areas not included in the roadway prism shall be constructed in uniformly compacted layers. However, density requirements will be waived.

Box culverts shall not be opened to construction equipment traffic until concrete has attained 100 percent of the 28-day design compressive strength and has a backfill cover of at least 4.0 feet. The minimum height of backfill cover required to protect pipe culverts from construction equipment shall be in accordance with standard drawing PC-1 for the type and size specified.

Where only one side of abutments, wingwalls, piers, or culvert headwalls can be backfilled, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning or excessive pressure against the structure. When both sides of a concrete wall or box structure is to be backfilled, operations shall be conducted so that the backfill is always at approximately the same elevation on both sides of the structure.

Openings subject to flooding shall be backfilled as soon as practicable or as directed by the Engineer.

- (h) **Embankments:** Work shall consist of constructing roadway embankments, placing and compacting approved material within roadway areas where unsuitable material has been removed; and placing and compacting approved material in holes, pits, utility trenches, basements, and other depressions within the roadway area.

Embankment shall be constructed with approved material and placed so as to be uniformly compacted throughout. Embankment shall be placed adjacent to structures in the same manner as for backfill, as described in (g) herein. Embankment shall not contain muck, frozen material, roots, sod, or other deleterious material. Embankment shall not be placed on frozen ground or areas covered with ice or snow.

Unsuitable material used in widening embankments and flattening embankment slopes shall be placed in uniform layers not more than 18 inches in thickness before compaction. Each layer of material placed shall be compacted to the extent necessary to produce stable and reasonably even slopes.

Wherever rock excavation is available on the project, an 8 to 15-inch layer of such materials shall be dump spread over the lower region of embankments in the immediate vicinity of stream crossings and used to cover ditches, channels, and other drainage ways leading away from cuts and fills. However, drainage ways shall be prepared to receive the rock excavation to the extent necessary to avoid reducing their cross section. If rock excavation is not available on the project, rip-rap, jute mesh

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

or soil retention mats shall be used as the covering material and shall be installed in accordance with the requirements of Section 606. Limits of the area to be covered will be as noted on the plans or as directed by the Engineer.

Wherever sufficient right of way exists, surplus materials shall be used to widen embankments and flatten slopes as directed by the Engineer.

Rock excavation may be placed on slopes by uniform end dumping of the material from along the top of the embankment or as directed by the Engineer. Slopes that are covered with rock excavation shall not receive topsoil or seed.

When geotextile drainage fabric is required under rock fills, preparation shall be as specified in Section 414.

The Contractor shall schedule excavation and embankment work in a manner that will minimize the quantity of unsuitable material for which more than one handling is required prior to final placement. Therefore, the provisions for additional payment for each rehandling of material specified in Section 303.06(a) will not apply to placing unsuitable material for widening embankments and flattening embankment slopes.

The surface area directly beneath the pavement and shoulders on which embankments of less than 5 feet in depth are to be constructed shall be denuded of vegetation. These areas shall be scarified and compacted to a depth of 6 inches to the same degree as the material to be placed thereon.

Areas that contain material unsuitable as foundations for embankments shall be undercut and backfilled in accordance with (e) and (f) herein.

Embankments to be placed over saturated areas that will not support the weight of hauling equipment may be constructed by end dumping successive loads in a uniformly distributed layer of a thickness capable of supporting the hauling equipment while subsequent layers are placed. The nose, or leading edge, of the embankment shall be maintained in a wedge shape to facilitate mud displacement in a manner that will prevent its entrapment in the embankment. The front slope of the embankment shall be maintained steeper than 2:1. The use of compacting equipment will not be required on the original course. However, the remainder of the embankment shall be constructed in layers and compacted in accordance with these specifications.

When geotextile for embankment stabilization is required it shall be placed as shown on the plans. Geotextile shall be spliced by an overlap of at least 2 feet or by sewing double stitched seams with stitching spaced $\frac{1}{4}$ inch to $\frac{1}{2}$ inch apart or as shown on the plans. The strength of sewn seams shall be no less than 85 percent to that of the geotextile when tested in accordance with ASTM D4884.

Once geotextile for embankment stabilization is placed, the initial lift of material to be placed atop shall be free draining and shall be end dumped onto the geotextile and spread to thickness as shown on the plans. Free draining material shall be any material having 15 percent or less of which will pass the No. 200 sieve. If the geotextile becomes punctured or torn, the Contractor shall repair the area with geotextile lapped at least 3 feet all around the damaged area.

When embankment is to be placed and compacted on an existing road, the surface shall be scarified to such degree as will permit an ample bond between old and new material. Hydraulic cement concrete and asphalt concrete pavement structures within the proposed roadway prism shall be demolished in accordance with Section 508.

Existing slopes shall be continuously benched where embankments are constructed $\frac{1}{2}$ width at a time, against slopes of existing embankments or hillsides, or across existing embankments, hillsides, and depressions at a skew angle of 30 degrees or more, or the existing slopes are steeper than 4:1. For slopes steeper than 4:1 but not steeper than 1 $\frac{1}{2}$:1, the bench shall be at least 6 feet in width. For slopes steeper than 1 $\frac{1}{2}$:1 but less than 1/2:1, the bench shall be at least 4 feet in width. Benching shall consist of a series of horizontal cuts beginning at the intersection with the original ground and continuing at each vertical intersection of the previous cut. Material removed during benching operations shall be placed and compacted as embankment material.

When excavated material consists predominantly of soil, embankment shall be placed in successive uniform layers not more than 8 inches in thickness before compaction over the entire roadbed area. Each layer shall be compacted within a tolerance of ± 20 percent of optimum moisture content, to a density of at least 95 percent of the theoretical maximum density as defined in Section 101.02.

Material having a moisture content above optimum by more than 30 percent shall not be placed on a previously placed layer for drying unless it is shown that the layer will not become saturated by downward migration of moisture in the material.

Field density determinations will be performed in accordance with AASHTO T191 or T205, modified to include material sizes used in the laboratory determination of density, with a portable nuclear field density testing device or by other approved methods. When a nuclear device is used, density determinations for embankment material will be related to the density of the same material tested in accordance with VTM 1 or VTM 12 and a control strip will not be required.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

As the compaction of each layer progresses, continuous leveling and manipulating will be required to ensure uniform density. Prior to placement of subsequent layers, construction equipment shall be routed uniformly over the entire surface of each layer or the layer shall be scarified to its full depth in the area where the equipment is routed.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the thickness prescribed without crushing, pulverizing, or further breaking down the pieces resulting from excavation methods, such material may be placed in the embankment in layers that are not thicker than the approximate average size of the larger rocks. Rock not more than 4 feet in its greatest dimension may be placed in an embankment to within 10 feet of the subgrade. The remainder of the embankment to within 2 feet of the subgrade shall not contain rock more than 2 feet in its greatest dimension. Each layer shall be constructed so that rock voids are filled with rock spalls, rock fines, and earth. Rock shall be placed, manipulated, and compacted in uniform layers. However, density requirements may be waived. Rock, rock spalls, rock fines, and earth shall be distributed throughout each embankment layer and manipulated as specified herein so that the voids are filled. Rock shall not be end dumped over the edges of the layer being constructed but shall be deposited on the layer and moved ahead so as to advance the layer with a mixture of rock, rock spalls, rock fines, and earth. The 2 feet of the embankment immediately below the subgrade shall be composed of material that can be placed in layers of not more than 8 inches before compaction and compacted as specified herein for embankments. Rock more than 3 inches in its greatest dimension shall not be placed within 12 inches of the subgrade in any embankment.

Rock, broken concrete, or other solid materials shall not be placed in embankment areas where piling is to be placed or driven.

The best material shall be reserved for finishing and dressing the surface of embankments. Work necessary to ensure the reservation of such material shall be the responsibility of the Contractor. The provisions in Section 303.06(a) will not apply to subsequent handling of capping material.

- (i) **Settlement Plates and Surcharge:** The Contractor shall expedite construction of embankment to provide the maximum time possible for settlement prior to completing grading operations.

- 1. **Settlement plates:** The base of settlement plates shall be firmly seated into original ground for the full depth of the steel fins. The base shall be leveled. The Engineer shall be provided time to obtain the elevation of the seated base and the top elevation of the pipe extensions prior to placement of embankment material. Pipe extensions shall not be more than 4 feet in length and shall be vertically installed as the embankment is constructed such that the top of the pipe is not covered. As each extension is added, the Engineer shall be provided time to obtain the top elevation of the existing pipe and the top elevation of the new pipe extension. Pipe extensions shall be properly flagged at all times. Care shall be taken while placing and compacting embankment material around pipe extensions. Settlement plates shall be maintained until no longer required, as determined by the Engineer. Upon completion of the normal embankment plus 2 feet of the specified surcharge, the Contractor shall immediately commence placing the remaining surcharge to the limits shown on the plans or as directed by the Engineer. The remaining surcharge shall be placed in lifts of not more than 1 foot in depth and compacted uniformly with construction hauling and spreading equipment. Each lift shall be completed over the entire surcharge area before the next lift is begun.

If a settlement plate is damaged, the Contractor shall notify the Engineer immediately and promptly repair it under the observation of the Engineer to the nearest undamaged pipe. Excavation, backfill, compaction, and repair of settlement plates shall be at the Contractor's expense. The Engineer shall be provided time to obtain the top elevation of the undamaged connection and the top elevation of each subsequent pipe extension.

Settlement plates shall remain in place until settlement has been completed as indicated by elevation readings taken by the Department at approximately 2-week intervals. Evaluation of the readings by the Engineer will be the final and sole governing factor for releasing embankments for grading operations. Upon written release by the Engineer, extensions of settlement plate pipe shall be removed to at least 2 feet below the subgrade, the pipe capped, and the area backfilled and compacted.

- 2. **Surcharge:** When authorized by the Engineer, surcharge shall be removed to the subgrade and embankment slopes graded to the typical section. Removed surcharge shall be placed in roadway embankments not previously brought to grade or shall be disposed of in accordance with Section 106.04 or as directed by the Engineer.

- (j) **Hydraulic Embankment:** Hydraulic embankment shall consist of dredging and pumping materials approved by the Engineer from designated areas, placing the material in embankments, and dressing and completing the embankment. Material shall be nonplastic and of such grading that not more than 7 percent will pass the No. 200 sieve.

Unless otherwise shown on the plans, material for the embankment shall not be obtained from sources closer than 300 feet from the toe of the slope of the embankment. The Engineer may reject materials considered to be unsatisfactory for use in the embankment, and such materials shall be stripped at the Contractor's expense before the embankment is built. Muck and unsuitable material shall be removed to the line, grade, and section shown on the plans. Unsatisfactory material brought to the top of the embankment shall be removed by the Contractor at his own expense, and satisfactory material shall be substituted.

In placing material in the embankment, the Contractor shall begin at the center line and deposit material in either or both directions toward the toe of slopes. Discharge shall always be in the direction of and parallel to the centerline. The maximum distance from the bottom of the discharge pipe to the surface on which material is being deposited shall be 5 feet unless

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

otherwise directed by the Engineer. Material shall be deposited in a manner that will maintain a higher elevation at the center of the roadway than on either side. The Contractor will not be permitted to construct retaining levees along the roadway of such dimensions as to cause damage to the foundation of the roadway. The Contractor shall conduct operations so as to ensure the completion of an embankment that will conform to the cross section shown on the plans except that he will be permitted to flatten side slopes. However, if material is deposited on private property, the Contractor shall obtain permission in writing from the affected property owner(s). No payment will be made for material beyond the limits of the net pay section.

The embankment shall be placed so as to ensure a minimum relative density of 80 percent of the theoretical maximum density when tested in accordance with (h) herein. If the method of placing the embankment fail to produce the required density, the Contractor shall use approved methods to obtain the specified density.

The Contractor shall take all necessary precautions to prevent placing material in streams. The Contractor shall be responsible for all damage to or caused by the hydraulic embankment. The Contractor shall provide sufficient material to maintain the embankment in accordance with the typical cross section as shown on the plans or as directed by the Engineer until final acceptance.

The Contractor's plan for support of suction or discharge pipes shall be submitted to and approved by the Engineer. Traffic shall be protected by the display of warning devices both day and night. If dredging operations damage an existing traveled highway, the Contractor shall cease operations and repair damage to the highway.

- (k) **Surplus Material:** Surplus material shall not be wasted or sold by the Contractor unless authorized in writing by the Engineer. When authorization has been given for surplus material to be wasted, it shall be disposed of in accordance with Section 106.04.

Material shown on the plans as surplus material will not be considered for overhaul payment.

1. **Disposal of surplus material within the right of way where the haul distance is 2,000 feet or less:** Surplus material shall be used or disposed of where directed within a haul distance of 2,000 feet of its origin. Usage in this manner will not be considered a change in the character of the work.
2. **Disposal of surplus material within the right of way where the haul distance is more than 2,000 feet:** The Department reserves the right to require the Contractor to use surplus material in lieu of furnishing borrow, or as otherwise directed, where the haul distance from the origin of the material is more than 2,000 feet. Disposal of surplus material at locations requiring a haul of more than 2,000 feet will be considered a change in the character of work unless otherwise noted on the plans.

When material is declared surplus during construction and must be transported more than 2,000 feet from its origin, the Department will pay the Contractor \$0.03 per station per cubic yard for overhaul. The quantity of surplus excavation will be determined by vehicle measurement in accordance with the provisions of Section 109.01 or from cross-section measurements by the average end area method. The haul distance will be measured along a line parallel to the centerline of the roadway from the center of the excavated area to the center of the placement area. Overhaul will be the product of the quantity of surplus material in cubic yards and the haul distance in excess of 2,000 feet in 100-foot stations.

303.05—Tolerances.

- (a) **Finished grade of subgrade** shall be 0.10 foot above or below the theoretical grade.
- (b) **Slopes** shall be graded in the following manner:
 1. **Earth excavation slopes:**
 - a. **Slopes steeper than 2:1** shall be grooved in accordance with the standard drawings and shall not deviate from the theoretical plane surface by more than 0.5 foot.
 - b. **Slopes steeper than 3:1 up to and including 2:1** shall be rough graded in a manner to provide horizontal ridges and grooves having no more than 0.5 foot deviation from the theoretical line of the typical cross section as is accomplished by the normal operation of heavy grading equipment.
 - c. **Slopes 3:1 or flatter** shall be uniformly finished and shall not deviate from the theoretical plane surface by more than 0.5 foot.
 2. **Earth embankment slopes:**

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

- a. **Slopes steeper than 3:1** shall not deviate from the theoretical plane slope by more than 0.5 foot and shall be rough graded in a manner to provide horizontal ridges and grooves not more than 0.5 foot from the theoretical line of the typical cross section as is accomplished by the normal operation of heavy grading equipment.
 - b. **Slopes 3:1 and flatter** shall be uniformly finished and shall not deviate from the theoretical plane surface by more than 0.5 foot.
3. **Rock slopes** shall not deviate from a plane surface by more than 2.0 feet and shall not deviate from their theoretical location by more than 2.0 feet measured along any line perpendicular to the theoretical slope line.

Finished excavation and embankment slopes shall not deviate from their theoretical location by more than 0.5 foot measured along any line perpendicular to the theoretical slope line.

303.06—Measurement and Payment.

- (a) **Excavation:** Excavation will be paid for at the contract unit price per cubic yard unless otherwise specified.

Excavation requiring more than one handling prior to final placement will be paid for at the contract unit price for regular excavation for each handling approved by the Engineer unless there is a pay item for the second handling, in which case work will be paid for at the contract price for such handling.

Quantities of regular or borrow excavation used to backfill pipe, pipe culverts and box culverts will not be deducted from quantities due the Contractor for payment.

1. **Regular excavation:** When payment is specified on a cubic yard basis, regular excavation will be measured in its original position by cross sectioning the excavation area. This measurement will include overbreakage or slides not attributable to the carelessness of the Contractor and authorized excavation of rock, muck, root mat, or other unsuitable material except material included in undercut excavation. Volumes will be computed from cross-section measurements by the average end area method.

When it is impractical to measure material by the cross-section method, other acceptable methods involving three-dimensional measurements may be used.

Excavation for benching slopes to accommodate roadway embankments as specified in Section 303.04(h) will not be measured for separate payment. The cost thereof shall be included in the price for the related excavation or embankment item.

Excavation of existing roadways required to incorporate old roadway into new roadway or remove salvageable materials for use in traffic maintenance, other than those covered under Section 508, will be measured as regular excavation.

When presplitting rock cuts is shown on the plans, the work shall be considered incidental to the cost of excavation and will not be measured for separate payment.

In cut sections, excavation of topsoil and root mat and material down to a point 1 foot below the elevation of the top of earthwork or to the depth specified on the plans will be measured as regular excavation. When areas of unsuitable material are shown on the plans, excavation down to a point 1 foot below the elevation of such material shown on the plans will be measured as regular excavation.

In fill sections, excavation of topsoil and root mat and material down to an elevation of 1 foot below the bottom of topsoil and root mat will be measured as regular excavation. When areas of unsuitable material are shown on the plans, excavation down to a point 1 foot below the elevation of such material shown on the plans will be measured as regular excavation.

If slide material approved for measurement cannot be measured accurately, or if the removal of slide material will require different equipment than that being used in the regular excavation operations, payment therefor may be made on a force account basis when authorized by the Engineer.

Excavation of surface ditches specified on the plans or otherwise required by the Engineer will be paid for as regular excavation except that when required after the slopes have been completed and the work cannot be performed with mechanical equipment, the excavation will be paid for as undercut excavation.

2. **Borrow excavation:** Borrow excavation will be measured in its original position by cross sectioning the area excavated. The number of cubic yards will be computed from cross-section measurements by the average end area method. When it is impractical to measure the borrow excavation, vehicular measurement in accordance with Section 109.01 may be used.

3. **Undercut excavation:** Measurement will be made by cross sectioning the undercut area. The number of cubic yards will be computed by the average end area method. When it is impractical to measure material by the cross-section method because of erratic location of isolated deposits, acceptable methods involving three-dimensional measurements may be used.

When unsuitable material must be removed from an area of the project where undercut is not shown on the plans, unsuitable material removed after reaching the depth specified in (a) 1 herein, or 1 foot below original ground in fill sections where topsoil and root mat are not required to be removed, will be measured as undercut excavation.

Excavation of rock or unsuitable material below the elevation of the bottom of the lower theoretical slab or culvert thickness or below the excavation limits shown on the plans or standard drawings for normal earth foundations, whichever is the greater depth, of minor structures having span(s) or opening(s) of less than 48 inches will be measured for payment as undercut excavation. Such excavation for structures having span(s) or opening(s) of 48 inches or greater will be measured as minor structure excavation in accordance with (a)4. herein.

Undercut excavation will be paid for at the contract unit price per cubic yard. This price shall include removal and disposal. When not a pay item, undercut excavation will be paid for at twice the unit price per cubic yard for regular excavation.

4. **Minor structure excavation:** Excavation of material above the elevation of the bottom of the lower theoretical slab or culvert thickness, or above the excavation limits shown on the plans for earth foundations, whichever is the greater depth, for culverts having a maximum span or opening of less than 48 inches will not be measured for payment.

Excavation of material for culverts having span(s) or opening(s) of 48 inches or greater and excavation for minor structures not covered elsewhere in these specifications will be measured in cubic yards of minor structure excavation. The quantity allowed for payment will be the actual volume of material removed as bounded by the bottom of the lower theoretical slab or culvert thickness, or lower excavation limits shown on the plans for earth foundations, whichever is the greater depth; the original ground or regular excavation pay line, whichever is the lower elevation; and vertical planes 18 inches outside the neat lines of the structure (excluding wingwalls and other appurtenances) or bound by vertical planes coincident with the applicable bedding excavation limits shown on the plans. Payment for excavation for wingwalls and other appurtenances to structures will be based on the ratio of the plan area of the wingwalls or appurtenances to the plan area of the barrel. Once the ratio has been determined, the pay quantity for minor structure excavation will be increased accordingly.

If embankment is placed prior to installation of a minor structure, excavation of the embankment area will not be measured for payment.

The volume of the interiors of culverts, drop inlets, and other existing minor structures that must be removed will not be deducted from the overall quantity of minor structure excavation allowed for payment.

The price of minor structure excavation shall include the cost of backfill above the horizontal planes of the neatlines of the Class I or Class II backfill areas to original ground. Class I and Class II backfill shall be measured and paid for in accordance with Section 302.

5. **Earthwork:** When a pay item, earthwork will be paid for at the contract lump sum price, wherein no measurement will be made. This price shall include regular excavation, minor structure excavation, and grading.

(b) **Embankments:**

1. If embankment is not a pay item, the cost of embankment construction will be considered incidental to other items of excavation.
2. If embankment is a pay item and regular excavation is to be paid for on a plan quantity basis, the quantity of embankment for which payment will be made will not be measured separately but will be computed in accordance with the following:
 - a. The regular excavation plan quantity will be adjusted in accordance with (c) herein.
 - b. The quantity of unsuitable material will be measured and subtracted from the adjusted regular excavation quantity determined in 2.a. herein. Quantities of unsuitable material removed from fill areas or below the subgrade in cut areas will be determined by using plan dimensions and may be adjusted for deviations based on actual measurement. Actual dimensions will be used to determine the quantity of any other unsuitable material.
 - c. The total quantity shown on the plans will be adjusted for quantities not anticipated on the plans, such as changes in grade or undercut determined to be necessary during construction.
 - d. The quantity of suitable material determined in 2.b. herein will be subtracted from the adjusted total fill quantity determined in 2.c. herein. The resultant quantity will be the embankment quantity for which payment will be made.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

The Contractor shall be responsible for determining the effect of the shrinkage or swell factor of the material, and no adjustment will be made in pay quantities for this factor.

Hydraulic embankment will be paid for as embankment.

3. When embankment is a pay item and regular excavation is to be paid for on the basis of measured quantities, the quantity of embankment will be measured in cubic yards computed by the average end area method from the dimensions of the embankment cross section.

Cross sections of the area to be covered by the embankment will be taken after the denuding or removal of unsuitable material and before any material is placed thereon. These cross sections shall extend laterally from the centerline to the toes of slopes as indicated on the typical cross section. The elevations as determined by these sections will be considered the original ground line. The pay quantity to be measured will be the volume of material included in the section above the original ground and below the upper limits of the typical cross section.

When regular excavation is a pay item, the embankment area to be cross-sectioned will exclude that portion of the fill constructed from regular excavation. Material outside the limits of typical cross sections as shown on the plans will not be measured or paid for.

4. Extra embankment required for subsurface consolidation will be determined by the use of settlement plates. The total settlement recorded at each settlement plate will be allowed across 75 percent of the lateral width of each section. Volumes will be computed using the average end area method. Embankment quantities will be adjusted as specified herein to include extra embankment for subsurface consolidation.

Settlement plates will be measured and paid for in units of each, complete-in-place. This price shall include furnishing, installing, maintaining, and removing when no longer required.

Surcharge placement and removal will be measured in cubic yards as determined by plan quantity and will be paid for at the contract unit price per cubic yard. This price shall include furnishing, placing, and removing surcharge material and disposing of surplus and unsuitable materials.

5. When geotextile drainage fabric is a pay item, measurement and payment will be in accordance with Section 504.
6. **Geotextile** for embankment stabilization will be measured in square yards complete-in-place. Overlaps and seams will not be measured for separate payment. The accepted quantity of geotextile will be paid for at the contract unit price per square yard, which price shall be full compensation for furnishing, placing, lapping or seaming material and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

- (c) **Plan Quantities:** The quantity of regular excavation for which payment will be made when plan quantities are specified will be that specified in the Contract. However, borrow excavation, excavation for entrances, unsuitable material below the top of earthwork, undercut excavation, slide excavation, rock excavation that changes the slopes or causes undercut, and side, inlet, and outlet ditches not covered by plan cross sections will be measured in its original position by cross sections and computed in cubic yards by the average end area method.

Where there are authorized deviations from the lines, grades, or cross sections, measurements will be made and the volume computed in cubic yards by the average end area method for these deviations. The plan quantity will then be adjusted to include these quantities for payment.

When unauthorized deviations occur, allowances will not be made for overruns. However, if the deviation decreases the quantities specified in the Contract, only the actual yardage excavated will be allowed.

- (d) **Backfill:** Furnishing and placing backfill material, including backfill for undercut, will be included in the price for excavation and will not be measured for separate payment unless specific material is a pay item for backfill or unless suitable material is not available within the construction limits. When a specific material is a pay item, the unit of measure of the material will be in accordance with the unit specified in the Contract. When suitable backfill is not available within the construction limits, the material furnished and placed by the Contractor will be paid for in accordance with Section 109.05.

(e) **Erosion Control Items:**

1. Limiting the scope of construction operations, shaping the top of earthwork, and constructing temporary earth berms and brush silt barriers for temporary erosion and siltation control will not be measured for payment but shall be included in the price for other appropriate pay items.
2. Erosion control riprap will be measured and paid for in accordance with Section 414.04.
3. Temporary protective covering will be measured and paid for in accordance with Section 606.04.

4. **Check dams and silt settlement basins** will be paid for at the contract unit price per each. This price shall include furnishing, excavating, constructing, maintaining, and removing check dams or silt settlement basins when no longer required.
5. **Temporary silt fences** will be measured in linear feet, complete-in-place, excluding laps, and will be paid for at the contract unit price per linear foot. Decomposed or ineffective geotextile fabric replaced after 6 months from the installation date will be measured in linear feet of temporary silt fence and paid for at 1/2 the contract unit price for temporary silt fence. Decomposed geotextile fabric required to be replaced prior to 6 months after installation will not be measured for payment. This price shall include furnishing and installing the fence, including wire reinforcement; maintaining, removing, and disposing of the fence; and dressing the area.
6. **Geotextile fabric** attached to brush barriers or existing fence or used for another function specified on the plans and not included in other pay items will be measured in square yards, complete-in-place, excluding laps, and will be paid for at the contract unit price per square yard. The brush barrier will not be measured for payment. The cost thereof shall be included in the price for clearing and grubbing. This price shall include trimming the brush barrier; furnishing, installing, maintaining, and removing the fabric; and dressing the area.
7. **Temporary filter barriers** will be measured in linear feet, complete-in-place, excluding laps, and will be paid for at the contract unit price per linear foot. Decomposed or ineffective geotextile fabric replaced after 6 months from the installation date and decomposed or ineffective burlap fabric replaced after 3 months from the installation date will be measured in linear feet of temporary filter barrier and paid for at 1/2 the contract unit price for temporary filter barrier. Decomposed geotextile fabric required to be replaced prior to 6 months and decomposed burlap fabric required to be replaced prior to 3 months after installation will not be measured for payment. When permitted, baled straw silt barrier used in lieu of temporary filter barrier will be paid for in linear feet of temporary filter barrier, complete-in-place. This price shall include furnishing, installing, maintaining, and removing the filter barrier; dressing the area; and disposing of the filter barrier. If the Contractor is permitted to use baled straw silt barrier in lieu of temporary filter barrier, payment will be made at the price for temporary filter barrier.
8. When silt cleanout is approved or directed by the Engineer it will be measured as siltation control excavation in cubic yards of vehicular measurement in accordance with the requirements of Section 109.01 for the full volume of the vehicle.

Silt removal and sediment cleanout will be paid in cubic yard of siltation control excavation. Payment shall be full compensation for removal of silt and sediment approved or directed by the Engineer and for transportation and disposal of the material.

If approved or directed by the Engineer, the installation of additional temporary silt fence and temporary filter barrier in lieu of silt cleanout will be measured in linear feet as specified in Section 303.06(e)5. and 7. herein.
9. Seeding materials will be measured and paid for in accordance with Section 603.
10. Temporary erosion and siltation measures required to correct conditions created because of the Contractor's negligence, carelessness, or failure to install permanent controls in accordance with the plans and sequence for performance of such work will not be measured for payment.
11. **Slope drains** will be measured in units of each, per location regardless of size or length and will be paid for at the contract unit price per each. Raising of the slope drain and addition of pipe lengths will not be measured as a new location. This price shall include furnishing, installing, maintaining, and removing the drain and end section or portable flume.
12. **Sediment basins** will be measured in cubic yards of sediment basin excavation and will be paid for at the contract unit price per cubic yard. This price shall include excavation, maintenance, and backfill or removing to original ground when no longer needed.
13. **Storm Water Management Basin Excavation** will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. The price shall include excavation, maintenance, and shaping of basin.
14. **Temporary Sediment Basin Excavation** will be measured in cubic yards and will be paid for at the contract unit price per cubic yard. The price shall include excavation, maintenance and when no longer required the removal of dam, pipe, riser pipe, trash rack, backfill and site restoration.
15. **Drop Inlet Silt Trap** will be measured in units of each and paid for only one time during the life of the project.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Payment will be made under:

Pay Item	Pay Unit
Regular excavation	Cubic yard
Borrow excavation	Cubic yard
Sediment basin excavation	Cubic yard
Siltation control excavation	Cubic yard
Undercut excavation	Cubic yard
Minor structure excavation (Item)	Cubic yard
Earthwork	Lump sum
Embankment	Cubic yard
Silt settlement basin	Each
Settlement plate	Each
Surcharge placement and removal	Cubic yard
Geotextile (Embankment stabilization)	Square yard
Check dam (Type) (Log, rock, or straw)	Each
Temporary silt fence	Linear foot
Geotextile fabric	Square yard
Temporary filter barrier	Linear foot
Slope drain	Each
Storm water management basin excavation	Cubic yard
Temporary sediment basin excavation	Cubic yard
Drop inlet silt trap (Type)	Each

DIVISION IV BRIDGES AND STRUCTURES

SECTION 401—STRUCTURE EXCAVATION

401.01—Description.

This work shall consist of excavating and backfilling or disposing of material necessary for constructing substructures and superstructures of new bridges and altering existing bridges in accordance with the requirements of these specifications and in reasonably close conformity with the lines and grades shown on the plans or as established by the Engineer.

401.02—Materials.

- (a) **Backfill** shall be approved by the Engineer and shall be free from large or frozen lumps, wood, or rocks more than 3 inches in their greatest dimension or other extraneous material. Porous backfill shall conform to the requirements of Section 204.
- (b) **Pipe underdrains** shall conform to the requirements of Section 232.

401.03—Procedures.

Excavated material shall generally be used for backfilling and constructing embankments over and around the structure. Surplus or unsuitable material shall be disposed of in a place and manner such that it will not affect or re-enter streams or otherwise impair the hydraulic efficiency or appearance of the structure or any part of the roadway.

Where practicable, substructures shall be constructed in open excavation and, where necessary, the excavation shall be sheeted, shored, braced, or protected by other means. If footings can be placed in the dry without the use of sheeting or cofferdams, forms may be omitted with the approval of the Engineer and the entire excavation filled with concrete to the required elevation of the top of the footing. When forms are eliminated measurement and payment for structure excavation and concrete will be on a plan quantity basis wherein no adjustments will be made.

Unless tremie placement of concrete is specified, foundations for footings shall be kept free from standing or surface water until concrete and backfill operations have been completed. However, if the foundation is rock or the footing is supported on piles, other than for shelf abutments, dewatering need be performed only during concrete and backfill operations.

- (a) **Preserving the Channel:** Excavation shall not be performed outside caissons, cribs, cofferdams, or sheet piles. The natural streambed adjacent to the structure shall not be disturbed. Material deposited in the stream area because of the Contractor's operations shall be removed, and the stream area shall be freed from obstructions caused by the Contractor's operations.

Prior to beginning work, the Contractor shall submit a plan that shall include the specific location of temporary structures or other obstructions that will constrict the stream flow, a description of construction activities that will contribute to constricting the stream flow, the dimensions and number of temporary structures and constrictions that are to be placed in the stream at any one time, and a dimensional elevation view of the stream and proposed temporary structures and constrictions.

- (b) **Depths of Foundations:** Elevations denoting the bottom of footings shown on the plans shall be considered approximate only. Foundations shall not be considered satisfactory until approved by the Engineer.

When requested, the Contractor shall explore foundations by rod soundings or drillings to determine, to the satisfaction of the Engineer, the adequacy for the foundations to support the structure. If explorations indicate that satisfactory foundations can be obtained, variations from plan depths to foundations of open column abutments and solid or column piers shall be made only by adjusting stem lengths. Footing depths shown on the plans shall be considered minimum depths. Plan depths of concrete for footings may be increased not more than 24 inches at points of local irregularity over solid rock foundations.

Variations from plan depths to foundations of solid or deep curtain-wall abutments shall be made only by adjusting the depths of footings. Plan depths shall be considered minimum depths and shall not be exceeded by more than 3 feet.

If explorations reveal that foundations or subfoundations are inadequate for the structure, or are not within the limits of permissible variation from the bottom of footing elevations, the Engineer shall be consulted for instructions for further action or redesign.

- (c) **Preparing Foundations for Footings:** Hard foundation material shall be freed from loose material, cleaned, and cut to a firm surface, either level, stepped, or serrated as directed by the Engineer. Seams shall be cleaned out and filled with concrete as directed by the Engineer.

When concrete is to rest on an excavated surface other than rock, the bottom of the excavation shall not be disturbed. The final removal of foundation material to grade shall not be performed until just prior to concrete placement.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

When the elevation of the bottom of a footing is above the level of the original ground, the footing shall not be placed until the approach embankment has been placed and compacted to the elevation of the top of the footing and excavation has been performed through the embankment to the elevation of the bottom of the footing. When a footing is to be placed over material subject to movement because of pressure from overlying or adjacent fill, the footing or piles for the footing shall not be placed until after the fill has been placed and compacted. Excavation for shelf abutment footings shall be limited to a perimeter extending not more than 18 inches outside the neat lines at the bottom of the footing.

When the material on which a foundation is to be placed using piles is declared unsatisfactory by the Engineer, the excavation shall be undercut for a depth of 6 to 12 inches as directed and backfilled with crusher run aggregate, select borrow, or other material approved by the Engineer.

- (d) **Holes for Drilled-In Caissons:** Foundation bearing areas shall be cut to an approximately level surface except that they may be stepped or serrated on hard rock. If material is encountered that is not sufficiently cohesive to maintain the proper diameter of the hole, casing shall be used.
- (e) **Cofferdams:** Cofferdams for foundation construction shall be as watertight as practicable and carried to a depth that will allow them to function properly without displacement. The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction of forms and inspection of their exteriors and permit pumping from outside the forms. Cofferdams that are tilted or moved laterally during sinking shall be realigned to provide the required clearance.

If conditions are encountered that render it impracticable to dewater the foundation, the Contractor may be required to construct a concrete foundation seal of the dimensions necessary to ensure that the balance of the concrete can be placed in the dry. When weighted cofferdams are employed and the weight is used to overcome the hydrostatic pressure acting against the bottom of the foundation seal, anchorage, such as dowels or keys, shall be provided to transfer the entire weight of the cofferdam into the foundation seal. Cofferdams that are to remain in place shall be ported at the low water level.

Cofferdams shall be constructed in a manner to prevent damage to fresh concrete from a sudden rising of the stream and prevent damage to the foundation by erosion. Timber or bracing left in cofferdams shall not extend into the substructure concrete.

Cofferdams, including sheeting and bracing, shall be removed after completion of the substructure in a manner that will not disturb or damage the finished concrete.

- (f) **Pumping:** Pumping from the interior of a foundation enclosure shall be performed in a manner to preclude the possibility of water moving through any fresh concrete. Pumping will not be permitted during concrete placement or for at least 24 hours thereafter unless it is performed from a suitable sump separated from the concrete work.
- (g) **Protecting Existing Structures or Utilities:** When foundations are located such that excavation may endanger or interfere with an existing structure or utility, the location of bracing and method of protection shall be subject to approval by the owner of the structure or utility.
- (h) **Inspection:** After each excavation has been completed, the Contractor shall notify the Engineer and request his inspection and approval. Concrete shall not be placed until the depth of the excavation and the character of the foundation material have been approved.
- (i) **Backfilling:** Excavated spaces that are not occupied by abutments, piers, or other permanent work shall be backfilled with soil to the surface of the surrounding ground. Backfill shall be uniformly compacted, and the top surface shall be neatly graded.

The fill around the perimeter of abutments, wing walls, and retaining walls shall be placed in horizontal layers not more than 6 inches in loose thickness and compacted at ± 20 percent of optimum moisture to a density of at least 95 percent as compared to the theoretical maximum density as defined in Division II. Tests for compliance with density requirements will be performed in accordance with the requirements of VTM-12. As the work progresses, backfill in front of units shall be placed and compacted in horizontal layers to the same elevation as the layers behind units until the final elevation in front is reached. Backfill shall be placed in a manner to prevent wedging action against the concrete. Slopes bounding excavation for abutments, wingwalls, or retaining walls shall be destroyed by stepping or serrating. Jetting of the fill behind abutments, wingwalls, or retaining walls will not be permitted.

Fills and backfills around piers not included in the roadway prism shall be constructed in uniformly compacted layers and placed alternately to maintain a uniform elevation on both sides of the structure. However, the density requirement will be waived.

Provision shall be made for drainage of backfill. Two-inch crusher run aggregate, conforming to the requirements of Section 205, shall be placed at the back of weep holes to extend 18 inches behind the entrance to the hole, 18 inches above the elevation of the bottom of the hole, and 18 inches laterally on each side of the center line of the hole.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Backfill shall not be placed against abutments or wingwalls until concrete has been in place 14 days, exclusive of days on which the average high-low air temperature is below 40 degrees F in the shade or until test cylinders have attained a compressive strength equal to 93 percent of the required 28-day design compressive strength.

Backfill shall be placed as soon as practicable following attainment of the required compressive strength or lapse time specified in Table IV-2 for removal of formwork but not later than 30 days after concrete placement. Excavation openings shall be maintained as dry as practicable at the time of backfilling. Backfill shall be placed in a manner to deter impoundment of water and facilitate existing drainage.

- (j) **Filled Spandrel Arches:** Fill for spandrel arches within 1 1/2 times the height of the arch shall be placed in a manner to load the ring uniformly and symmetrically. Fill material shall be homogeneous soil and shall be placed in horizontal layers not more than 6 inches in loose thickness, compacted in accordance with the requirements of Section 303.04(h), and brought up simultaneously from both haunches. Wedge-shaped sections of fill material against spandrels, wings, or abutments will not be permitted.
- (k) **Approach Embankment:** Approach embankment shall be constructed in accordance with the requirements of Section 303.04(h).

401.04—Measurement and Payment.

Structure excavation will be measured in cubic yards of material removed from the limits of vertical planes within 18 inches outside the neat lines of footings or of neat work that does not have footings directly beneath it, such as curtain walls or cantilevered wing walls. It will be measured from the surface of the original ground or approach roadway down to the bottom of the foundation shown on the plans or such foundation as the Engineer may approve, or down to 18 inches below the bottom of the neat work not directly over footings, or to the top of existing concrete where excavation is to permit placing new concrete over existing concrete.

When specified on the plans, structure excavation will include material removed outside the limits specified for the substructure, in the vicinity of the substructure on which a superstructure rests, and to a depth of 18 inches below the lowest beam or bottom of the slab of the superstructure, or to such depth as shown on the plans. The width of such excavation shall be limited to 18 inches outside the exterior beams or edges of the slab or as shown on the plans.

Excavation above the bottom of a proposed channel change or roadway template or an overpassed road will not be included as structure excavation.

Structure excavation will be paid for at the contract unit price per cubic yard. This price shall include clearing and grubbing, sheeting, shoring, bracing, placing and compacting backfill, dewatering, furnishing and placing aggregate for weep holes, disposing of unsuitable or surplus material, and clearing the channel of obstructions caused by construction operations.

Excavation for drilled-in caissons will be measured in linear feet of drilled hole from the existing ground to the bottom of the finished hole as measured along the center line of the hole and will be paid for at the contract unit price per linear foot. This price shall include drilling, under reaming, casing, and preparing the hole.

Furnishing and placing backfill will be included in the price for structure excavation and will not be measured for separate payment unless specific material is required by the Engineer and no suitable material is available within the construction limits. When specific material is required for backfill by the Engineer, measurement and payment will be in accordance with the requirements of Section 104.03.

Porous backfill, when a pay item, will be measured in cubic yards of material within the limits shown on the plans or as otherwise directed by the Engineer and will be paid for at the contract unit price per cubic yard.

Pipe underdrains, when a pay item, will be measured in linear feet and will be paid for at the contract unit price per linear foot.

Unsuitable materials removed below the plan foundation will be measured and paid for as structure excavation.

Foundation seals required by the Engineer and that are properly placed for structural adequacy as a part of the planned footing will be accepted as part of the permanent footing. Measurement and payment will be in accordance with the requirements of Section 404.08. Foundation seals that are not required by the Engineer will be included in the price for structure excavation.

Clearing and grubbing within the area defined by lines connecting the extremities of the substructure units, regardless of whether excavation is involved, shall be included in the price for structure excavation unless otherwise specified in the Contract.

Cofferdams will be measured in units of each per foundation and will be paid for at the contract unit price per each. This price shall include furnishing, erecting, maintaining, and removing.

Payment will be made under:

Pay Item	Pay Unit
Structure excavation	Cubic yard

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Drilled holes	Linear foot
Porous backfill	Cubic yard
Pipe underdrain (Size)	Linear foot
Cofferdams	Each

SECTION 402—SHEET PILES

402.01—Description.

This work shall consist of furnishing and installing the type of sheet piles shown on the plans or specified by the Engineer to be left in place or removed as part of the finished structure. Other sheet piles used by the Contractor shall be considered incidental nonpay items.

402.02—Materials.

- (a) **Timber sheet piles** shall conform to the requirements of Section 236 and may be of any species of wood that can be driven satisfactorily. Piles shall be free from worm holes, loose knots, wind shakes, decayed or unsound portions, or other defects that might impair their strength or tightness.
- (b) **Concrete and reinforcing steel for concrete sheet piles** shall conform to the requirements of Sections 217 and 223.
- (c) **Steel sheet piles** shall conform to the requirements of Section 228.

402.03—Procedures.

- (a) **Timber Sheet Piles:** Piles shall be sawed with square corners and provided with tongues and grooves of ample proportions, either cut from the solid material or made with three planks securely fastened together. Piles shall be drift sharpened at the lower ends to wedge the adjacent piles tightly together.

The top of piles shall be cut off to a straight line. Piles shall be braced with waling strips that are lapped and joined at splices and corners. Wales shall be in one length between corners and bolted near the top of the piles.

- (b) **Concrete Sheet Piles:** Concrete sheet piles shall be manufactured in accordance with the requirements of Section 403, 404, or 405, as applicable. Installation shall be in accordance with the requirements of Section 403.
- (c) **Steel Sheet Piles:** When assembled in place, pile sections shall be practically watertight at the joints. Painting of steel sheet piles shall be performed in accordance with the requirements of Section 403. Piles shall be provided with tongues and grooves of ample proportions for securely fastening together. Wales and structural supports shall be provided as necessary to ensure structural integrity.
- (d) **Temporary Sheet Piling:** When shown on the plans or directed by the Engineer will be measured in square feet. The horizontal dimensions will be measured continuously along the outer face of the sheet piling. The bottom limit will be the bottom of the excavation shown on the plans or as authorized. The top limit will be original ground line or in areas adjacent to traffic, three feet above original ground line, or as otherwise shown on the plans.

402.04—Measurement and Payment.

Sheet piles will be measured in square feet of piles remaining in place and will be paid for at the contract unit price per square foot. The horizontal dimensions will be measured continuously along the outer face of the piling. For steel sheet piles, the horizontal dimension used shall be not more than the sum of the laying widths or driving dimensions of the individual piles.

Payment for temporary sheet piling will be made at the contract unit price per square foot which price shall be full compensation for furnishing, driving and removing the piling.

Payment will be made under:

Pay Item	Pay Unit
Sheet piles (Type)	Square foot
Temporary sheet piling	Square Foot

SECTION 411—PROTECTIVE COATINGS OF METAL IN STRUCTURES

411.03—Certifications

- (a) **QP-1:** Effective August 1, 2001, the Contractor shall be certified to perform coating operations on all new and existing steel structures, Types A and B. Prior to performing coatings application, the Contractor shall submit proof of certification meeting the criteria of SSPC QP-1 Standard Procedure for Evaluating Qualifications of Painting Contractors, Field application in Complex Structures.
- (b) **DPOR:** If the project work involves the removal of greater than 100 square feet of coating from a Type B Structure or is anticipated to generate greater than $30 \mu\text{g}/\text{m}^3$ lead per structure, the Contractor shall be licensed as an organization to perform removal operations from Type B structures. Additionally, the Contractor shall provide an individual with a supervisor level license in lead-based paint abatement to oversee operations and individuals with worker level certification in lead-based painting abatement. All licenses shall be issued by Virginia Department of Professional and Occupational Regulation (DPOR).
- (c) **Professional Engineer:** If the project involves the erection of any containment structure with the bridge serving as the primary means of support, then the Contractor shall describe such system as specified in Section 411.08 (a) and provide certification by a Professional Engineer, licensed in the Commonwealth of Virginia. This requirement is waived for any containment structure with a total weight bearing capacity of less than 1000 pounds.

411.08—Environmental Protection

In accordance with the requirements of Section 107, the Contractor shall protect the public and the environment from leaded paint or hazardous material resulting from coating preparation (cleaning) removal operations, blast abrasive, rust and over spray.

Depositing or dropping waste materials into water, onto the ground, or onto roadways or outside the containment system will not be permitted. Waterways and all travel-ways shall be protected against coating drift and overspray. All equipment and containment devices shall arrive at the site in a decontaminated condition and shall be decontaminated prior to relocating or moving unless otherwise properly disposed. All residues from decontamination and any disposable items shall be properly disposed of according to all applicable federal, state and local regulations.

The Contractor shall at all times be in compliance with these specifications and the regulations of, but not exclusive to, the following agencies: U. S. Environmental Protection Agency, U. S. Department of Transportation, Department of Environmental Quality, Virginia Department of Labor and Industry, Virginia Department of Professional and Occupational Regulations and the U. S. Coast Guard.

The Contractor shall make all necessary notifications, obtain the necessary permits and pay required fees in accordance with applicable state law and Virginia Department of Labor and Industry regulations.

- (a) **Plan:** The Contractor shall submit a detailed site-specific environmental plan to the Engineer for Department records and review for completeness only, not approval. The Contractor shall provide one comprehensive plan that covers all facets of operation. No work shall proceed until the Engineer has notified the Contractor that the plan contains all the necessary elements. The Environmental Plan shall include controls for capture, containment, collection, storage and transportation of waste material generated by the work. The Contractor shall use the most effective method possible for capture, collection, containment and transportation operations. Plans shall include measures for accidental spill cleanup.

The Environmental Plan shall be certified by a DPOR Licensed Lead Supervisor (LLS) or a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene. If the project design involves the erection of a supported containment system with a total weight bearing capacity of greater than 1000 pounds, the plan shall also be reviewed and certified by a Professional Engineer, registered in the Commonwealth of Virginia as to the design acceptability for the structural load of the containment system on the bridge.

After project award but not less than three weeks prior to commencing operations covered by this plan, the Environmental Plan shall be submitted to the Engineer. Within two weeks of receipt, the Department will review the submitted plan for completeness. Should deficiencies in the plan exist, the plan will be returned to the Contractor for incorporation of revisions as noted by the Engineer. The Contractor shall make such revisions and submit completed plans for the Engineer's record prior to commencing operations. In no case shall the Contractor begin work prior to the Engineer's receipt and review of a satisfactorily complete plan.

- (b) **Monitoring:** Visual inspections of the containment structures, dust collector and abrasive recycling equipment shall be continuously performed to detect and control any emissions into the unconfined air space. Emissions will not be permitted outside the containment system. Visual emissions outside the containment system shall immediately be corrected to comply with emission standards. Minimal visible air emissions will be allowed for properly operating vacuum-assisted power tools provided that a secondary means for collecting large particles is employed and the technology is applied using usual and customary industry practices. Excessive emissions caused by improperly operated or functioning equipment shall be immediately corrected. Adequate lighting shall be provided as necessary to aid visual inspections.

Perimeter air monitoring shall be performed using high volume air samplers equipped for the collection of total suspended particulate (TSP) samples. The filters shall be analyzed for lead in accordance with EPA 40 CFR Part 50 Appendix G for a minimum of 8 hours per day of operation. Samples shall be collected within 500 feet downwind of paint abatement, dust collection and abrasive recycling equipment. Perimeter monitoring results shall be maintained below the National Ambient Air Quality Standard for lead (40 CFR Part 50) using the Adjusted Daily Allowance (ADA) procedure outlined in SSPC-Guide 6 Method D. The results of all sample analysis shall be submitted to the Engineer as soon as they are available. Should emissions exceed the limits set herein or material begin to reach the ground or enter state waters, the Contractor shall notify the Engineer and operations shall be halted until such time that corrective actions are implemented.

- (c) **Waste Characterization and Disposal:** Material removed from Type A structures shall be disposed of as a non-hazardous waste in accordance with the requirements of paragraph (d) 1 herein.

Material removed from Type B structures shall be contained, collected, and stored in closed 55-gallon DOT approved steel drums or portable metal roll-off containment refuse disposal bins.

The Contractor shall under the direction of the Engineer; collect a minimum of one composite sample per three containers of waste material (with a minimum of three samples per structure) and provide to the Department for analysis. All samples shall be randomly collected and shall be representative of the contained waste. Waste shall not accumulate for more than 30 days before samples are collected. A laboratory certified by the American Industrial Hygiene Association to perform lead analysis and approved by the Department shall perform the testing. The Department shall pay the cost of all tests performed by the laboratory. If the material is determined to be a hazardous waste, the Contractor in accordance with the requirements of paragraph (d) 2 herein shall dispose of the material.

Each structure shall have a separate lockable storage area for waste material located immediately adjacent to the structure. The Contractor shall collect the material at the end of each workday and shall transport the waste material to the storage area in a closed container that will not permit leakage. Each container shall be marked indicating the origin of the material; the date the material was placed in the storage area; and a 24-hour telephone number of the Contractor and VDOT representative. Prominent warning signs shall be displayed around the perimeter of the storage. The signs shall be located at a distance from the storage area that will allow personnel to read the sign and take the necessary protective actions required before entering the storage area. All warning signs and notices shall be posted in accordance with CFR 29 Part 1926, Section 62.

One centralized storage site may be used to store waste materials from structures at adjacent projects provided that transport of waste over roads open to the public is not required and that the materials shall be labeled and stored separately. If a centralized storage location is used, suitable security fencing shall be installed around the perimeter of the centralized storage area to prevent unauthorized access. The Contractor shall establish this site, with Department approval, prior to beginning any coating removal.

The site for the temporary storage of the waste material shall be approved by the Engineer and shall not be located within a flood plain or drainage area or where water will pond. The site shall have a berm around the perimeter to ensure spill control. Containers of waste material shall have tops secured and be covered with waterproof coverings, and the site shall be secured. If such a site is not available immediately adjacent to the structure, an alternate location on state property shall be used as approved by the Engineer.

- (d) **Disposal**

1. Solid waste material from Type A structure or waste from a Type B structure that is determined by the Department not to be a hazardous waste shall be disposed of in a sanitary (*RCRA Subtitle D*) or licensed industrial landfill that has a permit from the Virginia Department of Environmental Quality or an equivalent state or federal agency for out-of-state disposal facilities. The Contractor shall identify the landfill used by name, address and permit number and shall certify that the waste material was properly disposed.
2. Liquid waste from Type A and Type B structures that is determined by the Department not to be a hazardous waste shall be legally disposed of in a Publicly Owned Treatment Works Facility (POTW). The Contractor shall identify the POTW used by name, address and permit number and shall certify that the waste material was properly disposed.
3. If waste material from Type B structures is classified as hazardous by the Department, the Contractor shall obtain a provisional hazardous waste generator number from Virginia Department of Environmental Quality in accordance with applicable federal and state regulations, and shall legally store, pack, label and ship such material by a transporter with a RCRA Hazardous Waste Transporter permit to a RCRA Subtitle C, Treatment Storage and Disposal Facility (TSDF) for treatment and disposal. The Contractor shall prepare the hazardous waste shipping manifest and provide to the Engineer for signature. One copy of the manifest shall be signed and dated by the licensed TSDF designated in the manifest and shall be forwarded by the Contractor to the Engineer for his records.

- (e) **Certifications:** The Environmental Plan shall be implemented in accordance with the provisions contained therein; any deviations from the plan shall be separately approved by the Engineer. The individual providing the plan certification shall at a minimum be present during startup and removal operations to ensure that the plan is fully implemented. Within one week

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

following completion of the lead-based paint activities, the Contractor shall submit for the Engineer's record, written certification by the LLS or CIH, including notations of any areas of non-compliance and corrective actions taken, that all work has been completed in full compliance with all applicable regulations and requirements as set forth in these specifications and that the plans on record were fully implemented. The Contractor shall forward for the Engineer's record one copy of the Environmental Plan complete with all revisions and results from the air monitoring activities, including notations of any areas of non-compliance and corrective actions taken.

SECTION 413—DISMANTLING AND REMOVING EXISTING STRUCTURES OR REMOVING PORTIONS OF EXISTING STRUCTURES

413.01—Description.

This work shall consist of dismantling and removing all or portions of existing structures in accordance with these specifications and in reasonably close conformity with the lines, grades, and details shown on the plans or as established by the Engineer.

413.02—Procedures.

- (a) **Dismantling and Removing Existing Structure:** Dismantling and removing existing structures shall include removing the entire superstructure, substructure, and slope protection. The substructure shall be removed down to the stream bed or to an elevation of at least 2 feet below the natural ground or finished grade of embankment that is to remain in place. Removal shall include any part of the substructure or foundation piling that will interfere with the new construction. For bridges crossing streams under the jurisdiction of the U.S. Coast Guard, the substructure shall be removed to or below the bed of the stream as required by the Coast Guard.
1. **Dismantling structures for retention by Contractor:** Removed materials shall become the property of the Contractor and shall be removed from the project. The Contractor shall assume all personal and property liability associated with such materials and shall protect and save harmless the Department from any and all damages and claims associated with the handling, transportation, storage or use of such materials. The Department does not warrant the condition nor the physical or chemical characteristics of the materials.
 2. **Dismantling structures for retention by Department:** Dismantling shall be in accordance with a method approved by the Engineer and shall be such as to preserve the existing condition of materials.

Units shall be match marked for re-erection according to an approved diagram provided by the Department.

Material shall be stored as directed within 1/2 mile of the site of the existing structure.

- (b) **Removing Portion of Existing Structure:** The portions to be removed shall be the areas designated on the plans. Concrete shall not be removed by blasting or other methods that may damage concrete or reinforcement that will remain in the completed structure. The weight of pneumatic hammers shall be not more than 90 pounds for widening work or 30 pounds for deck repair work. The use of tractor-mounted demolition hammers will not be permitted.

Disturbed areas shall be uniformly graded to natural ground contours in a manner that will facilitate drainage and prevent impoundment of water.

Materials or portions of existing structures removed shall be handled in accordance with the requirements of Section 413.02 (a)1 of this special provision.

- (c) **Environmental and Worker Protection:** Heating, welding, flame cutting, grinding, chipping, needle gun cleaning, manual scraping, heat gun cleaning, drilling, straightening, and other construction operations, or demolition of Type B structures, as defined in Section 411.01(b), that disturbs areas coated with a hazardous material shall require environmental and worker protection.
1. **Environmental protection** shall be in accordance with Section 411.08, except work involving the removal of 100 square feet or less of protective coating from a Type B Structure will not require the Contractor to submit and implement an environmental plan as specified in Section 411.08 (a) and 411.08(b). However, the Contractor shall comply with appropriate local, state and federal codes and regulations and shall employ appropriate measures to prevent the release of hazardous materials in the environment. Hazardous materials generated from the Contractor's operation shall be disposed of in accordance with Sections 411.08(c) and 411.08(d).
 2. **Worker health and safety protection** shall be in accordance with Section 411.09, except work involving the removal of 100 square feet or less of protective coating from a Type B Structure will not require the Contractor to submit and implement a worker health and safety plan as specified in Section 411.09 (a) and 411.09 (b). However, the Contractor shall comply with applicable codes and regulations regarding public, worker, health and safety.

Upon completion of the project, the Contractor shall submit a written statement of certification for the Engineer's record, complete with all revisions including notations of any areas of non-compliance and corrective actions taken, that certifies both the Environmental Protection Plan and the Worker Health and Safety Plan were fully implemented during the performance of the work covered by this specification.

413.03—Measurement and Payment.

Dismantling and removing an existing structure will be paid for at the contract lump sum price.

Removing a portion of an existing structure will be paid for at the contract lump sum price.

Environmental and worker protection when a pay item, will be paid for at the contract lump sum price per structure. This price shall include containment operations, regulation compliance, plan approval services, worker protection, and other related costs.

Material disposal when a pay item, will be paid for at the contract lump sum price per structure. This price shall include transporting, storing, and legal disposal of material.

If not shown as a pay item, the cost for worker and environmental protection and material disposal shall be included in other appropriate bid items.

Payment will be made under:

Pay Item	Pay Unit
Dismantle and remove existing structure (B or Str. No.)	Lump sum
Remove portion of existing structure (B or Str. No.)	Lump sum
Environmental and worker protection (B No. or Str. No.)	Lump sum
Material Disposal (B No or Str. No. and Type)	Lump sum

SECTION 414—RIPRAP

414.01—Description.

This work shall consist of placing the specified type of riprap in accordance with the plans and these specifications.

414.02—Materials.

- (a) **Riprap** shall conform to the requirements of Section 204.
- (b) **Sand** shall conform to the requirements of Section 202. Grading A, B, or C sand may be used in mortared or grouted riprap.
- (c) **Mortar and grout** shall conform to the requirements of Section 218.
- (d) **Geotextile bedding** shall conform to the requirements of Section 245.
- (e) **Welded wire fabric** shall conform to the requirements of Section 223.

414.03—Procedures.

- (a) **Dry Riprap:** The classes of dry riprap shall be as follows:
 1. **Class I:** Stones shall weigh between 50 and 150 pounds each. At least 60 percent shall weigh more than 100 pounds, and approximately 10 percent may weigh 50 pounds or less.
 2. **Class II:** Stones shall weigh between 150 pounds to 500 pounds each. At least 50 percent shall weigh more than 300 pounds, and approximately 10 percent may weigh 150 pounds or less.
 3. **Class III:** Stones shall weigh from 500 pounds to 1,500 pounds each. At least 50 percent shall weigh more than 900 pounds, and approximately 10 percent may weigh less than 500 pounds.
 4. **Class AI:** Stones shall weigh between 25 and 75 pounds each, except that approximately 10 percent may weigh 25 pounds or less and 10 percent may weigh 75 to 100 pounds.

Dry riprap shall be placed as follows:

Grading: Slopes shall be finished to a reasonably smooth and compact surface within a tolerance of 6 inches from the surface lines shown on the plans.

Immediately prior to placement of riprap bedding, the prepared base will be inspected. Riprap or bedding shall not be placed until the prepared base has been approved.

Bedding: Riprap bedding shall be placed on the embankment to form a backing for riprap. Riprap bedding shall be spread uniformly on the prepared base. Compaction of the bedding material will not be required, but material shall be finished to a reasonably even surface, free from mounds or depressions.

When geotextile bedding material is required, the entire perimeter of the material shall be turned down and buried at least 9 inches for anchorage. Adjacent strips of material shall run only up and down the slope and shall overlap at least 18 inches. Geotextile bedding material shall not be used on slopes greater than 1:1. If sewed, strips shall overlap at least 4 inches and shall be double stitched with a prayer seam, Type SSa 1. Damaged material shall be replaced or repaired with a patch of the same material overlapping the damaged area by at least 18 inches on all sides. Displaced material shall be repositioned, including, if necessary, removing and replacing riprap stone, at the Contractor's expense. Material shall be placed loosely so that positioning riprap will not stretch or tear it.

Placing stones: Riprap shall be placed on the embankment as soon as practicable after bedding has been finished, but no later than 15 days, in a manner that will produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids. Riprap shall be placed to its full course thickness in one operation and in a manner to avoid displacing underlying material. Riprap stone shall not be dropped onto fabric from a height greater than 1 foot. Smaller-sized material shall not be dropped onto fabric from a height greater than 3 feet. Larger stones shall be reasonably well distributed.

Finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Hand placing may be required to the extent necessary to secure the results specified and form uniform slopes.

A tolerance of $\pm 1/4$ of the thickness of the maximum-size stone from the lines and grades shown on the plans will be allowed in the finished surface. However, the extremes of such tolerance shall be not continuous over an area of more than 200 square feet. Riprap shall be keyed into the natural ground in an approved manner and to a depth equal to the bed thickness or to solid rock.

The desired distribution of various sizes of stones throughout the mass may be obtained by selective loading at the source, controlled dumping of successive loads during final placement, or a combination of these methods. Placing riprap by dumping into chutes or similar methods likely to cause segregation of the various sizes will not be permitted.

Riprap protection shall be maintained until the riprap is accepted by the Department. Displaced material shall be replaced to the lines and grades shown on the plans at the Contractor's expense.

(b) **Dumped Riprap:** The types of dumped riprap shall be as follows:

1. **Type I:** Core riprap shall be composed of compact angular pieces of derrick stone weighing from 3/4 ton to 2 tons each, with an average weight of approximately 1 ton. Approximately 10 percent by weight may weigh less than 3/4 ton.
2. **Type II:** Heavy riprap shall be composed of compact angular pieces of derrick stone weighing from 3 to 10 tons each, with an average weight of approximately 4 tons. Approximately 10 percent by weight may weigh less than 3 tons.

Dumped riprap shall be placed in the same manner described for dry riprap in (a) herein. Dumped riprap shall not be placed in layers.

(c) **Mortared Riprap for Slopes:** Stone shall be the same size as specified for dry riprap, Class II, and shall be selected to secure fairly large, flat-surfaced stones that will produce a true and even surface with a minimum of voids. Stone shall be placed on a slope not steeper than the natural angle of repose of the fill material. Fifty percent of the mass shall be broad flat stones placed with the flat surface uppermost and parallel to the slope. Stones shall be placed first and roughly arranged in close contact, with the larger stones placed near the base of the slope. Spaces between larger stones shall be filled with stones of suitable size, leaving the surface reasonably smooth and tight and conforming to the contour required. Stones shall be placed in a manner so as to ensure for plane surfaces a maximum variation from a true plane of not more than 1 1/4 inches in 4 feet. Warped and curved surfaces shall have the same accuracy as specified for plane surfaces.

As each larger stone is placed, it shall be surrounded by fresh mortar, and adjacent stones shall be shoved into contact. After larger stones are in place, spaces or openings between them shall be filled with mortar, and smaller stones shall then be placed by shoving them into position, forcing excess mortar to the surface, ensuring that each stone is carefully and firmly bedded laterally.

After the work is complete, excess mortar forced up shall be spread uniformly to fill surface voids completely. Surface joints shall then be pointed roughly with flush or shallow smooth-raked joints.

(d) **Grouted Riprap for Slopes:** Grout shall consist of 1 part hydraulic cement and 3 parts sand, thoroughly mixed with water to produce grout having a thick, creamy consistency.

Stones shall be of the same sizes and placed in the same manner as specified for dry riprap, Class I. Care shall be taken during placing to keep earth or sand from filling spaces between stones. After stones are in place, spaces between them shall be filled with grout from bottom to top and the surface swept with a stiff broom. Riprap shall not be grouted in freezing weather. In hot, dry weather, the work shall be protected from sunlight and kept moist for at least 3 days after grouting by the use of saturated burlap.

(e) **Erosion Control Stone:** Erosion control stone shall conform to the requirements of Section 414.03 (a) for weight.

1. **Class I dry riprap** shall be placed in a manner to present an irregular or rough surface. The depth shall be not less than two feet.
2. **Class II dry riprap** shall be placed in a manner to present an irregular or rough surface. The depth shall be not less than three feet.

(f) **Erosion Control Riprap:** Riprap shall consist of sound, nonerodible shot rock or rock excavation, which may be obtained from within the typical section on the project. Erosion control riprap rock shall be not more than 15 inches in its greatest dimension and shall contain a sufficient percentage of smaller rocks to provide a reasonably dense mass with a thickness of at least 8 inches. Riprap shall be placed where shown on the plans or as directed by the Engineer in accordance with the requirements of Section 303.04(h).

(g) **Concrete Riprap in Bags:**

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

1. **Wet mixture:** Riprap shall consist of Class C1 concrete in suitable burlap bags except in brackish or tidal water, where concrete shall be Class A3. Bags shall weigh approximately 100 pounds when 2/3 filled with concrete. Each bag shall be securely tied and immediately placed in the work. When used for foundation protection, bags shall be placed in accordance with the provisions governing placement of stone riprap for foundation protection as specified. When used for slope protection, riprap shall be placed in conformance with the provisions governing placement of dry riprap.
2. **Dry mixture:** Riprap shall conform generally to the requirements for wet mixtures except that the mixture shall consist of the dry ingredients and the requirements for water, consistency, and air will be waived.

Burlap or paper bags will be permitted. Riprap shall be a rectangular solid approximately 3 inches in thickness and shall weigh approximately 80 pounds per bag. Paper bags shall be perforated throughout on approximate 1-inch centers and shall be of adequate seal, thickness, and strength to maintain the integrity of the riprap until setting of the concrete mixture. Bag compositions shall be such that bags will disintegrate without presenting environmental problems.

- (h) **Stone Riprap for Foundation Protection:** Riprap for pier, abutment, and bridge spill slope protection shall conform to the requirements of the applicable specifications.

(i) **Concrete Slab Riprap for Stream Crossings:**

1. **Materials:** Riprap shall consist of Class A3 concrete, cast-in-place, 6 inches in thickness. Concrete shall have a consistency that will permit placement without the use of top forms.

Welded wire fabric shall be No. 6 gage wire, spaced 6 inches center to center.

2. **Excavation and fine grading:** The finished embankment slope shall be reasonably smooth and dense. A trench shall be dug at the toe of the slope to accommodate the toe of the slab. Slab riprap shall not be placed until the slope has been approved by the Engineer.
3. **Construction methods:** Riprap shall be constructed in accordance with the applicable requirements of Section 404, except as modified herein, and shall be cured in accordance with the requirements of Section 316.04(j). Welded wire fabric shall be positioned at the center of the slab, shall run continuously throughout the slab, and shall lap approximately 6 inches at the edges of each sheet of fabric.

The berm portion of the slab shall be placed on a slope of approximately 12:1, draining away from the abutment. Where the edge of the slab is placed against the abutment, the joint shall be sealed to a depth of at least 1/2 inch with hot-poured joint sealer conforming to the requirements of Section 212.

The toe of the slab shall extend to an elevation at least 3 feet below the elevation of the toe of fill, and the lower edge of the slab shall be increased approximately 6 inches in thickness, tapering to its nominal thickness 3 feet up the slope from the lower edge of the slab. The tapering shall be on the underside of the slab. The slab shall be placed using one of the following methods:

- a. **Block method:** The slab shall be placed in alternate blocks having dimensions approximately 4 feet square.
- b. **Strip method:** The slab may be placed in alternate, continuous strips having scored or formed joints perpendicular to construction joints. Strips shall be placed in alternating widths of 4 feet and 5 feet, or 4 feet 6 inches each. Joints shall be at least 1 inch in depth and spaced approximately 4 feet 6 inches apart. The width of the joint shall be as small as possible.

Successive courses or strips shall not have joints that line up with the joints in the preceding courses or strips. Horizontal joints shall be normal to the slope. Joints shall be closed without filler.

After concrete is placed, it shall be consolidated and the surface struck off by means of a strike board. Concrete shall be float finished with a wooden or cork float. The surface shall not vary more than 1/2 inch under a 10-foot straightedge.

414.04—Measurement and Payment.

Dry riprap will be measured in square yards of surface area or tons as specified.

Mortared riprap will be measured in square yards of surface area.

Grouted riprap will be measured in square yards of surface area or tons as specified.

Stone riprap for foundation protection will be measured in square yards of surface area or tons as specified.

Dumped riprap will be measured in square yards of surface area or tons as specified.

Concrete riprap in bags will be measured in cubic yards.

Concrete slab riprap will be measured in square yards. When an optional riprap is used in lieu of concrete slab riprap, bedding material will not be measured for payment and the riprap will be paid for at the contract unit price for concrete slab riprap.

Erosion control riprap will be measured in square yards of surface area or tons as specified.

Riprap will be paid for at the contract unit price. This price shall include furnishing and placing riprap, including welded wire fabric, mortar, or grout; excavation; and riprap bedding.

Erosion control stone will be measured in square yards of surface area or tons as specified for the class specified and will be paid for at the contract unit price per square yard or ton. This price shall include excavating and backfilling, furnishing and placing dry riprap.

These prices shall include Geotextile bedding material when not a separate pay item, The price bid shall include preparing the surface, furnishing and installing geotextile bedding material, overlaps, repair work and excavating and backfilling toe-ins.

Payment will be made under:

Pay Item	Pay Unit
Dry riprap (Class and depth)	Square yard or ton
Mortared riprap (Depth)	Square yard
Grouted riprap (Depth)	Square yard or ton
Stone riprap (Depth)	Square yard or ton
Dumped riprap (Type and depth)	Square yard or ton
Concrete riprap in bags	Cubic yard
Concrete slab riprap	Square yard
Erosion control riprap (Depth)	Square yard or ton
Erosion control stone (class, st'd)	Square yard or ton

SECTION 415—CONCRETE SLOPE PROTECTION

415.01—Description.

This work shall consist of furnishing and installing precast concrete blocks in a bed of coarse sand or installing a concrete slab on embankments at or near bridge abutments as shown on the plans or as specified by the Engineer.

415.02—Materials.

- (a) **Precast concrete blocks** shall conform to the requirements of Section 222.
- (b) **Mortar** shall be nonshrinking and shall conform to the applicable requirements of Section 218.
- (c) **Foundation course** shall be Grading B sand conforming to the requirements of Section 202 or approved local material similar in nature.
- (d) **Concrete** shall be Class A3 conforming to the requirements of Section 217.
- (e) **Welded wire fabric** shall be No. 6 gage, 6 inches center to center each way, conforming to the requirements of Section 223.
- (f) **Herbicide** shall conform to the requirements of Section 244.

415.03—Procedures.

- (a) **Precast Concrete Block Slope Protection:** The subgrade shall be constructed at the required distance below the finished surface of the slope. Soft sections and unsuitable material shall be removed and replaced. The subgrade shall be compacted and shaped to a smooth, uniform surface.

The foundation course shall be spread on the subgrade to a depth of 2 inches and treated with an approved highly insoluble soil sterilent. Material shall be in a dry form and have a maximum solubility rate of 250 parts per million. Material shall be uniformly applied at the maximum rate recommended by the manufacturer.

Blocks shall be bedded in the foundation course perpendicular to the finished surface in straight rows, with the longest dimension horizontal. Blocks shall be placed with continuous joints extending horizontally on the face of the slope and with broken (staggered) joints extending perpendicular thereto, up or down the slope. Blocks shall be rammed until the surface is firm and conforms to the finished slope. Joints shall be filled with mortar.

Cast-in-place edging for block slope protection shall be placed as specified in (b) herein.

- (b) **Concrete Slab Slope Protection:** The subgrade shall be prepared as for block slope protection. The cast-in-place concrete slab shall be 4 inches in thickness and shall be placed in accordance with the requirements of Section 414.03(i).

Except at railroad grade separations, the Contractor may provide a combination concrete slab and stone slope protection in lieu of the specified concrete slab slope protection. Protection shall be in accordance with the following:

1. Concrete portions, consisting of a paved ditch and a strip of concrete approximately 3 feet in width placed on the berm along the face of the abutment, shall be furnished as required for concrete slab slope protection. Stone shall be placed at a depth of 7 to 9 inches over the remaining area to be covered with slope protection.
2. The subgrade for concrete and stone shall be prepared in accordance with the requirements of Section 414.03(i). The portion of the slope to be protected with stone shall be treated with a herbicide in accordance with the requirements of (a) herein. Care shall be taken to confine application to areas designated for sterilization.
3. Stone shall be crushed gravel or stone conforming to the requirements of Section 205.02. Sizes furnished shall be not smaller than the sizes specified in Table II-5 for aggregate size No. 1, nor shall the pieces be larger than 8 inches in their greatest dimension. Stone shall be in a sufficient range of sizes to create a stable and reasonably uniform slope.

The condition of the subgrade and method of placing stone shall be such that pieces of stone in contact with the subgrade shall be partially embedded where practicable. Stone immediately adjacent to concrete shall not project more than 3 inches above the concrete.

Approved splash blocks connecting with the paved ditch shall be provided under downspouts draining onto the slope protection.

415.04—Measurement and Payment.

Concrete slope protection will be measured in square yards of surface area and will be paid for at the contract unit price per square yard. If limits are not shown on the plans, measurements will be from the outside edge to outside edge, including curb, and from the edge of slope protection at abutment to the bottom of the curtain wall or outside edge of the paved ditch as appropriate. This price shall include the foundation course and treatment.

Payment will be made under:

Pay Item	Pay Unit
Concrete block slope protection	Square yard
Concrete slab slope protection (Depth)	Square yard

SECTION 418—TIMBER STRUCTURES

418.01—Description.

This work shall consist of furnishing and erecting timber materials required to complete a structure in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or as established by the Engineer.

418.02—Materials.

- (a) **Lumber and Timber:** Lumber and timber shall conform to the requirements of Section 236.
- (b) **Structural Shapes:** Rods, plates, shapes, and eyebars shall conform to the requirements of Section 226.
- (c) **Castings:** Castings shall be cast steel or gray iron, as shown on the plans, conforming to the applicable requirements of Section 224.
- (d) **Hardware:** Machine bolts, drift bolts, and dowels shall conform to the requirements of Section 226. Washers may be ogee gray iron or malleable castings or may be cut from mild steel plate as shown on the plans.

Machine bolts shall have square heads and nuts. Nails shall be cut or round wire of standard form. Spikes shall be cut, wire, or boat spikes as shown on the plans.

Nails, spikes, bolts, dowels, washers, and lag screws shall be black or galvanized, as specified on the plans.

Other hardware, except malleable iron connectors, shall be galvanized in accordance with the requirements of Section 233 or cadmium plated in accordance with the requirements of ASTM A165, Type OS.

- (e) **Paint:** Paint shall conform to the requirements of Section 231.

418.03—Procedures.

- (a) **Storing Material:** Lumber and timber on the work site shall be stored in stacks or ricks.

Material shall be stacked at least 12 inches above the ground surface and sloped. It shall be protected from weather by a suitable covering. The ground underneath and in the vicinity of material shall be cleared of weeds and rubbish.

Untreated material shall be open stacked, and treated material shall be close stacked.

- (b) **Treated Timber:** Treated timber shall be handled with rope slings without sudden dropping, breaking of outer fibers, or bruising or penetrating of the surface with tools such as cant hooks, peaveys, pikes, or hooks.

Cutting, framing, and boring of treated timbers shall be performed before treatment insofar as is practicable. When treated timbers are to be placed in water infested by marine borers, as determined by the Engineer, untreated cuts, borings, or other joint framings below the high water elevation shall be avoided.

Cuts in treated piles or timbers and abrasions, after having been carefully trimmed smooth, shall be brush coated with at least two applications of the preservative used in the treatment of the pile.

Bolt holes bored after treatment shall be treated with a preservative. After being treated, unfilled holes shall be plugged,

Whenever forms or temporary braces are attached to treated timber with nails or spikes, holes shall be filled by driving galvanized nails or spikes flush with the surface or by plugging as required for bolt holes.

- (c) **Untreated Timber:** Ends, tops, and contact surfaces of sills, caps, floor beams, stringers, and bracing and truss units shall be thoroughly coated with two coats of preservative before assembly. The back faces of bulkheads and other timber that will be in contact with earth, metal, or other timber shall be similarly treated.

- (d) **Treatment of Pile Heads:** After required cutting to receive caps and prior to placement of caps, pile heads shall be treated to prevent decay. Heads of timber piles shall be protected by one of the following methods, as indicated on the plans. If not otherwise indicated, Method A shall be used.

1. **Method A--zinc covering:** The sawed surface shall be brush coated with three applications of a preservative. Before the cap is placed, a sheet of 12 gage (0.028 inch) zinc shall be placed on each pile head. The sheet shall be of sufficient size to project at

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

least 4 inches outside the pile and shall be bent down, neatly trimmed, and securely fastened to the face of the pile with large-headed galvanized roofing nails.

2. **Method B--fabric covering:** Heads of piles shall be covered with alternate layers of hot pitch and cotton fabric for waterproofing, using four applications of pitch and three layers of fabric. The cover shall measure at least 6 inches more in dimension than the diameter of the pile and be neatly folded down over the pile and secured by large-headed galvanized nails or by binding with at least seven complete turns of galvanized wire securely held in place by large-headed galvanized nails and staples. Edges of fabric projecting below the wire wrapping shall be trimmed to present a neat appearance.
- (e) **Holes for Bolts, Dowels, Rods, and Lag Screws:** Holes for round drift bolts and dowels shall be bored with a bit 1/16 inch less in diameter than the bolt or dowel to be used. The diameter of holes for square drift holes or dowels shall be equal to the least dimension of the bolt or dowel.
- Holes for machine bolts shall be bored with a bit the same diameter as the bolt.
- Holes for rods shall be bored with a bit 1/16 inch greater in diameter than the rod.
- Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread.
- (f) **Bolts and Washers:** A washer shall be used under bolt heads and nuts that would otherwise come in contact with wood. Bolts shall be checked after nuts have been finally tightened.
- (g) **Countersinking:** Countersinking shall be performed wherever smooth faces are required. Recesses in horizontal surfaces shall be painted with a preservative and filled with hot pitch after the bolt or screw is in place.
- (h) **Framing:** Lumber and timber shall be cut and framed to a close fit so that the joints will have an even bearing over the contact surfaces. Mortises shall be true to size for their full depth, and tenons shall fit snugly. Shimming will not be permitted in making joints, and open joints will not be accepted.
- (i) **Pile Bents:** Preparing and driving piles shall be in accordance with the requirements of Section 403.
- Piles for any one bent shall be carefully selected as to size to avoid undue bending or distortion of the sway bracing. Care shall be taken in distributing piles of varying sizes to secure uniform strength and rigidity in bents of any given structure.
- Cutoffs shall be accurately made to ensure a uniform bearing between the cap and piles of a bent.
- (j) **Framed Bents:**
1. **Mud sills:** Untreated timber used for mud sills shall be of heart cedar, heart cypress, redwood, or other durable timber. Mud sills shall be firmly and evenly bedded to solid bearing and tamped in place.
 2. **Concrete pedestals:** Concrete pedestals for the support of framed bents shall be finished so that sills or posts will take an even bearing. Dowels or anchor bolts at least 3/4 inch in diameter shall be set in pedestals when they are cast for anchoring sills or posts.
 3. **Sills:** Sills shall have a true and even bearing on mud sills, piles, or pedestals. They shall be drift bolted to mud sills or piles with bolts at least 3/4 inch in diameter and extending into the mud sills or piles at least 6 inches. When possible, earth shall be removed from contact with sills so that there will be free air circulation.
 4. **Posts:** Posts shall be fastened to pedestals with dowels at least 3/4 inch in diameter, extending at least 6 inches into the posts.
- Posts shall be fastened to sills by one of the following methods, as indicated on the plans: by dowels at least 3/4 inch in diameter, extending at least 6 inches into posts and sills, or by drift bolts at least 3/4 inch in diameter driven diagonally through the base of the post and extending at least 9 inches into the sill.
- (k) **Caps:** Timber caps shall be placed, with ends aligned, in a manner to secure an even and uniform bearing over the tops of supporting posts or piles. Caps shall be secured by drift bolts at least 3/4 inch in diameter, extending at least 9 inches into the posts or piles. Drift bolts shall be in the approximate center of the post or pile.
- (l) **Bracing:** Ends of bracing shall be bolted through the pile, post, or cap with a bolt at least 5/8 inch in diameter. Intermediate intersections shall be bolted or spiked with wire or boat spikes, as indicated on the plans. In all cases, spikes shall be used in addition to bolts.

- (m) **Stringers:** Stringers shall be sized at bearings and placed in position so that knots near edges will be in the top portions of stringers.

Outside stringers may have butt joints with ends cut on a taper, but interior stringers shall be lapped to take bearing over the full width of the floor beam or cap at each end. Lapped ends of untreated stringers shall be separated at least 1/2 inch for the circulation of air and securely fastened by drift bolting where specified. Where stringers are two panels in length, joints shall be staggered.

Cross bridging between stringers shall be neatly and accurately framed and securely toenailed with at least two nails in each end. Cross-bridging units shall have full bearing at each end against the side of stringers. Cross bridging shall be placed at the center of each span.

- (n) **Plank Floors:** Planks shall be surfaced on four sides (S4S).

Single-plank floors shall consist of a single thickness of plank supported by stringers or joists. Planks shall be carefully graded as to thickness and placed so that no two adjacent planks shall vary in thickness by more than 1/8 inch. Each plank shall be placed heart side down, firmly jacked together, and securely fastened to each joist.

- (o) **Wheel Guards and Railings:** Wheel guards and railings shall be erected true to line and grade. Wheel guards, rails, and rail posts shall be surfaced on four sides (S4S). Wheel guards shall be laid in sections at least 12 feet in length.

- (p) **Painting:** Rails and rail posts, untreated timber, or timber treated with a preservative shall be painted with three coats of paint.

Metal parts, except hardware, shall be given one coat of shop paint and, after erection, three coats of field paint.

Timber shall be painted with No. 11 paint.

418.04—Measurement and Payment.

Lumber and timber will be measured in units of 1,000 foot-board-measure (MFBM) for materials placed in the finished structure and will be paid for at the contract unit price per MFBM. Computations for lumber quantities will be based on nominal sizes, complete-in-place. No other allowance for waste will be made.

Structural steel will be paid for in accordance with the requirements of Section 407.

Painting timber structures, when a pay item, will be paid for at the contract lump sum price. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

These prices shall include preparing surfaces and preservative treatment.

Payment will be made under:

Pay Item	Pay Unit
Lumber (Treated or untreated)	MFBM
Painting timber structures	Lump sum

DIVISION V INCIDENTAL CONSTRUCTION

SECTION 501—UNDERDRAINS

501.01—Description.

This work shall consist of constructing underdrains, using pipe, aggregate, and geotextile fabric, in accordance with these specifications and in reasonably close conformity to the lines and grades shown on the plans or as designated by the Engineer.

501.02—Materials.

- (a) **Pipe** shall conform to the requirements of Section 232.
- (b) **Aggregate** shall conform to the requirements of Section 202 or 203.
- (c) **Geotextile drainage fabric** shall conform to the requirements of Section 245.

501.03—Procedures.

- (a) **Installing Pipe:** Perforated pipe shall be placed with the perforations down. Pipe sections shall be joined with appropriate couplings. Semiround underdrain pipe shall be placed with the rounded section down.

Wherever the depth of the trench is modified to a lesser depth than shown on the standard drawings, concrete or corrugated pipe shall be used.

Pipe shall be placed with the bell end upgrade. Open joints shall be wrapped with tarpaper.

Upgrade ends of pipe, except for combination underdrains, shall be closed with suitable plugs. Where an underdrain connects with a manhole or catch basin, a suitable connection shall be made through the wall of the manhole or catch basin.

Geotextile drainage fabric shall be installed in accordance with the requirements of Section 504.03.

After the pipe installation has been approved by the Engineer, aggregate backfill material shall be placed and compacted. Pipe and covering at open joints shall not be displaced during subsequent operations.

- (b) **Combination Underdrain Outlets:** Nonperforated pipe shall be placed in the trench with sections securely joined. After pipe installation has been approved by the Engineer, the trench shall be backfilled with aggregate material in layers not more than 6 inches in depth and thoroughly compacted.

501.04—Measurement and Payment.

Underdrains and combination underdrains will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot. The contract unit price for underdrains installed at depths greater than that shown in the standard drawings will be increased 20 percent for each 1-foot increment of increased depth. No adjustment in the contract unit price will be made for an increment of depth less than 6 inches. When drains are to be placed under pavement that was not constructed under the Contract, the contract unit price shall include removing and replacing pavement.

Geotextile drainage fabric, when a pay item, will be measured and paid for in accordance with the requirements of Section 504.

These prices shall include geotextile drainage fabric when not a pay item, excavating, backfilling, disposing of surplus and unsuitable material, and installing outlet markers.

Outlet pipe for underdrains will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot.

Payment will be made under:

Pay Item	Pay Unit
Underdrain (Standard)	Linear foot
Combination underdrain (Standard)	Linear foot
Outlet pipe	Linear foot

SECTION 506—RETAINING WALLS

506.01—Description.

This work shall consist of constructing rubble and hydraulic cement concrete retaining walls in accordance with the plans and these specifications and in reasonably close conformity to the lines and grades shown on the plans or as established by the Engineer.

506.02—Materials.

- (a) **Dry rubble and mortar rubble retaining walls** shall be constructed of stone conforming to the requirements of Section 204 and mortar conforming to the requirements of Section 218.
- (b) **Hydraulic cement concrete retaining walls** shall be constructed of concrete conforming to the requirements of Section 217.
- (c) **Reinforced concrete crib walls** shall be constructed of precast concrete units. Concrete shall conform to the requirements of Section 217 except that No. 7 aggregate may be used in lieu of No. 57 aggregate. Crib units shall be free from cracks, depressions, spalls, patched or plastered surfaces or edges, and any other defects that might impair their strength or durability.
- (d) **Drain pipe** shall conform to the requirements of Section 232.
- (e) **Reinforcing steel** shall conform to the requirements of Section 223, Grade 40 or 60.
- (f) **Porous backfill** shall conform to the requirements of Section 204.
- (g) **Granular backfill within crib walls** shall be any material available within the project limits consisting of sand, sandy loam, gravel, rock, or a combination thereof. Materials containing a high percentage of fines, such as clay and silt soils, shall not be used.
- (h) **Piles** shall conform to the requirements of Section 403.

506.03—Procedures.

Excavation, backfill and foundation exploration shall conform to the requirements of Section 401.

Concrete construction shall be performed in accordance with the requirements of Section 404. Immediately following finishing operations, concrete shall be cured and protected in accordance with the requirements of Section 404.03.

- (a) **Dry Rubble and Mortar Rubble Retaining Walls:** Stones shall not be placed in freezing weather or when stone contains frost.

Each stone shall have a thickness of at least 8 inches, a width of at least 1 1/2 times the thickness, and except for headers, a length at least equal to 1 1/2 times the width. The thickness of courses, if varied, shall diminish from the bottom to the top of the wall.

Header stones in the heart of the wall shall be the same size as in the face and shall extend at least 12 inches into the core or backing. They shall occupy at least 1/5 of the face area of the wall and shall be evenly distributed. Header stones in walls 2 feet or less in thickness shall extend entirely through the wall.

Stones shall be roughly squared on joints, beds, and faces. Selected stone, roughly squared and pitched to line, shall be used at angles and ends of walls.

Stones shall be placed to line and in courses roughly leveled. Bottom or foundation courses shall be composed of large, selected stones. Courses shall be placed with bearing beds parallel to the natural bed of the material.

Shaping or dressing of stone shall be performed before stone is placed in the wall. Dressing or hammering that will loosen the stone will not be permitted after placement.

1. **Dry rubble retaining walls:** Face joints shall be not more than 1 inch in width.

Each stone shall have a firm bearing on the underlying course at no fewer than three points. Open joints, both front and rear, shall be chinked with spalls fitted to take firm bearing on their top and bottom surfaces and shall have a firm bearing throughout the length of the stone.

2. **Mortar rubble retaining walls:** Each stone shall be cleaned and thoroughly wetted with water before it is placed, and the bed that is to receive it shall be cleaned and moistened. Stones shall be bedded in freshly prepared mortar. Mortar joints shall be

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

full, and stones shall be carefully settled in place before mortar has set. Spalls will not be permitted in beds. Joints and beds shall not have an average thickness of more than 1 inch.

Whenever possible, face joints shall be properly pointed before mortar has set. Joints that cannot be pointed shall be prepared for pointing by raking them out to a depth of 2 inches before mortar has set. Face surfaces of stones shall not be smeared with mortar forced out of joints.

Vertical joints in each course shall break joints with those in adjoining courses by at least 6 inches. A vertical joint shall not be located directly above or below a header.

If a stone is moved or a joint is broken, the stone shall be taken up, mortar shall be thoroughly cleaned from the bed and joints, and stone shall be placed in fresh mortar.

Joints that are not pointed at the time stone is placed shall be thoroughly wetted with clean water and filled with mortar. Mortar shall be driven into joints and finished with an approved pointing tool. The wall shall be kept wet while pointing is being done. In hot or dry weather, pointed masonry shall be protected from the sun and kept wet by saturated burlap for at least 3 days after completion.

After pointing is completed and mortar has set, the wall shall be thoroughly cleaned and left in a neat, orderly condition.

- (b) **Concrete Retaining Walls:** Concrete retaining walls shall be constructed in accordance with the requirements of Sections 403, 404, and 406.
- (c) **Reinforced Concrete Crib Walls:** Crib units that are damaged during erection shall be removed and replaced at the Contractor's expense.

Granular backfill shall be used inside and approximately 2 feet in back of and beyond each end of a crib. Backfilling for the crib wall shall follow closely the erection of successive tiers of units. The wall shall not be placed higher than 3 feet above the backfilled portion. Backfill shall be placed carefully to avoid distorting the crib wall.

506.04—Measurement and Payment.

Standard retaining walls will be measured in cubic yards, complete-in-place, within the limiting dimensions shown on the plans, and will be paid for at the contract unit price per cubic yard. This price shall include rubble stone, concrete, joint material, and weep holes.

Concrete and reinforcing steel for special design retaining walls will be measured and paid for in accordance with the requirements of Sections 404.08 and 406.04, respectively.

Reinforced concrete crib walls will be measured in cubic feet of the net volume of concrete in crib units, complete-in-place, and will be paid for at the contract unit price per cubic foot. This price shall include concrete and reinforcing steel.

Granular backfill will be measured and paid for as regular excavation in accordance with the requirements of Section 303.06.

Porous backfill for retaining walls will be measured and paid for in accordance with the requirements of Section 401.04.

Piles for retaining walls will be measured and paid for in accordance with the requirements of Section 403.08.

Excavation for retaining walls will be measured in accordance with the requirements of Section 401.04, and will be paid for at the contract unit price per cubic yard. This price shall include excavation, foundation exploration, sheeting and shoring, placing and compacting backfill and disposal of surplus material, and porous backfill when not specified as a separate pay item.

Payment will be made under:

Pay Item	Pay Unit
Retaining wall (Standard)	Cubic yard
Concrete crib (Standard)	Cubic foot
Retaining wall excavation	Cubic yard

SECTION 511—ALLAYING DUST

511.01—Description.

This work shall consist of applying either moisture, calcium chloride, or both on areas designated by the Engineer for the purpose of allaying dust.

511.02—Procedures.

The Contractor shall furnish a truck(s) equipped with a water tank having a capacity of at least 1,000 gallons and pumps for furnishing, loading, and applying water to the roadway.

Equipment and operators shall be available at all times.

Calcium chloride conforming to the requirements of Section 239 shall be applied at the rate specified on the plans or by the Engineer.

The Contractor shall plan and prosecute the work so as to expedite completion of the pavement structure as soon as is practicable.

511.03—Measurement and Payment.

Allaying dust will be measured and paid for on the basis of the time the truck is in service on this work or per ton of calcium chloride. Loading time allowed for payment shall be not more than 30 minutes per thousand gallons of water. Truck hours shall be evidenced by daily time reports submitted by the Contractor and approved by the Engineer. This price shall include water and calcium chloride.

When in-place base material is used as a riding surface to maintain traffic or as a haul route, truck hours or tons of calcium chloride used for allaying dust will be paid for in accordance with the provisions herein.

Payment will be made under:

Pay Item	Pay Unit
Allaying dust	Hour or ton

SECTION 520—WATER AND SANITARY SEWER FACILITIES

520.01—Description.

This work shall consist of furnishing and installing necessary materials for water distribution systems and sanitary systems in accordance with these specifications and in reasonably close conformity to the dimensions, lines, and grades shown on the plans or as established by the Engineer.

520.02—Materials.

- (a) **Pipe, fittings, and flanges** shall conform to the requirements of Section 232.
- (b) **Gaskets and joint materials** shall conform to the requirements of Section 212.
- (c) **Casing pipe** shall be 14-gage corrugated metal half-circle pipe conforming to the requirements of Section 232 except as modified for securing interlocked or nested connections.
- (d) **Concrete blocks** shall conform to the requirements of Section 222.
- (e) **Bricks** shall conform to the requirements of Section 222.
- (f) **Hydraulic cement mortar** shall conform to the requirements of Section 218.
- (g) **Concrete** shall conform to the requirements of Section 217 and shall be Class A3.
- (h) **Reinforcing steel** shall conform to the requirements of Section 223.
- (i) **Curing material for concrete** shall conform to the requirements of Section 220.
- (j) **Timber skids** shall conform to the requirements of Section 236, and the preservative and treatment shall conform to the requirements of Section 236.
- (k) **Valves** shall conform to the requirements of AWWA C500, C504, C506, C507, C508, or C509 for the types and features specified.
- (l) **Fire hydrants** shall conform to the requirements of AWWA C502 or C503 with the various features specified.
- (m) **Water meters** shall conform to the requirements of AWWA C700, C701, C702, C703, C704, C706, C707, C708, or C710 for the type and features specified. Each meter shall be furnished with a meter box.
- (n) **Corporation stops** shall be made of bronze or red brass conforming to the requirements of ASTM B62. The fitting design and thread dimension shall conform to the requirements of AWWA C800. The working pressure of the corporation stop shall be equal to that of the water main to which it is attached.
- (o) **Castings** shall conform to the requirements of Section 224.
- (p) **Nonshrink waterproof grout** shall conform to the requirements of Section 218.
- (q) **Aggregate** shall conform to the requirements of Section 203. Aggregate for drain fields shall be No. 5.

520.03—Procedures.

The Contractor shall be responsible for anticipating and locating underground utilities and obstructions in accordance with the requirements of Section 105.07.

When construction appears to be in close proximity to existing utilities, the trench(es) shall be opened a sufficient distance ahead of the work or test pits made to verify the exact locations and inverts of the utility to allow for changes in line or grade.

Connections to existing lines shall be made only after the proposed line is completed and approved by the Engineer. Connections shall be made in the minimum time possible with minimum interruption of service. Work and interruptions in existing service shall be scheduled with the utility owner.

Existing water and sewer lines and appurtenances and manholes not required in the completed system shall be abandoned as directed by the Engineer. Abandoned materials shall become the property of the Contractor, unless otherwise noted on the plans, upon satisfactory replacement with the new installation. Abandoned pipe that is not removed shall be cleaned of debris and plugged at open ends with Class A3 concrete.

Existing manholes that are not required in the completed system shall be removed to at least 2 feet below the proposed subgrade or natural ground line and shall be filled with approved backfill in accordance with the requirements of Section 302.03 (a) 2. g.

Disturbed property shall be restored prior to final acceptance. Restoration shall include, but not be limited to, replacing shrubbery, sod, or topsoil, including lime, fertilizer, seed, and mulch; replacing paved or finished surfaces with similar materials; and performing other work in accordance with the requirements of Section 107.12.

Sidewalks and streets shall be kept open for passage. The Contractor shall provide and maintain adequate and safe passage over excavations to accommodate pedestrians or vehicles as directed by the Engineer.

- (a) **Protecting Water Supplies:** During the course of construction, the Contractor shall protect water supply facilities within the construction limits from contamination by sewage. The Contractor shall use the following criteria to govern the installation of water and sewer facilities in proximity of each other:
1. **Parallel separation:** Except as specified hereinafter, water lines shall be placed at least 10 feet horizontally from existing or proposed sanitary sewer lines, combination sewer lines, and sanitary sewer manholes. Sanitary sewer lines shall be placed at least 10 feet horizontally from existing and proposed water lines. This distance shall be measured from edge to edge. If local conditions prevent a lateral separation of 10 feet, a water line may be placed closer than 10 feet to a sewer or a sewer line may be placed closer than 10 feet to a water line if the top of the sewer pipe is at least 18 inches below the bottom of the water line. Where the vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint water pipe. Gravity sewers shall be pressure tested, in place, to 50 pounds per square inch without leakage prior to backfilling. Force main sanitary sewer shall be pressure tested in accordance with the requirements of Section 520.04 (c).
 2. **Crossings:** Water and sewer lines that cross shall be placed to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer line. Where this vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint or other approved water pipe for at least 10 feet on each side of the crossing.

Sanitary sewers and combined sewers crossing over a water line shall have a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line. The support shall be adequate to prevent excessive deflection of joints and the settling on and breaking of the water line. The water or sewer line shall be centered at the point of the crossing so that joints will be equidistant and as far from each other as practicable.

Water lines shall not pass through or come in contact with any part of a sanitary sewer, combined sewer, or sanitary sewer manhole.

The Contractor shall immediately notify the Engineer if he becomes aware that the work will result in the violation of these criteria. Upon such notification, the Engineer will issue instructions concerning remedial measures.

- (b) **Excavation:** Excavation, backfill, and compaction shall be performed in accordance with the requirements of Section 302 except that stone larger than 1 inch in diameter shall not be used in backfill until the pipe has a cover of at least 1 foot. The remainder of backfill to the original ground or to within 12 inches of the finished subgrade shall not include stone larger than 10 inches in its greatest dimension. Pipelines installed outside the roadway shall be backfilled in 8-inch layers and compacted to approximately 85 percent of the theoretical maximum density.

Trenches for pipelines shall be excavated generally along straight lines, and bottoms shall be uniformly graded as required. Bedding material shall be placed in accordance with the plans. Where the trench bottom is in rock, it shall be excavated to at least 8 inches below the bottom of the pipe and backfilled with approved local or commercial bedding material. Pipe shall have a uniform bearing on a solid foundation for its entire length. Where pipe foundations are yielding, pipe shall be bedded on at least 8 inches of approved local or commercial bedding material. Bell holes, where applicable, shall be of sufficient size to ensure the making of proper joints.

Trenches below the grade line of the pipe shall be dewatered during installation of pipelines.

When work is not in progress for any reason, lines shall be securely closed.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Where adjacent pavements are to be retained, pavement removed for pipeline trenches shall be replaced in kind with equal or better material or as otherwise specified. After backfilling, the Contractor shall maintain a smooth riding surface until pavement repairs are completed.

- (c) **Inspecting Pipe and Fittings:** Pipe and fittings shall be inspected for cracks and defects before they are lowered into the trench. Faulty pipe and fittings shall be removed from the site.
- (d) **Placing Pipe:** Water mains shall have a cover of at least 36 inches, and water service lines shall have a cover of at least 24 inches. Pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench to prevent damage to materials, protective coatings, and linings. Materials shall not be dropped or dumped into the trench.

If pipe, fittings, valves, hydrants, or accessories are damaged during handling, the damage shall be immediately brought to the Engineer's attention. The Contractor shall then submit to the Engineer, for approval, a method for repairing the damaged item. Damaged items shall be repaired as approved by the Engineer or shall be removed from the project.

Lumps, blisters, and excess coating shall be removed from ends of pipes that are to be joined. The inside of the bell and the outside of the spigot shall be wire brushed, wiped clean, dry, and free from oil and grease before pipe is placed. Foreign material shall be kept from entering pipe during placement.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to the correct line and grade. Pipe shall be secured in place with approved backfill material tamped under it except at bells. Precautions shall be taken to prevent dirt from entering the joint space. If it becomes necessary to deflect water main pipe during construction, the amount of deflection shall not exceed the manufacturer's recommendation.

- (e) **Cutting Pipe:** Pipe for fittings or closure pieces shall be cut in a neat and orderly manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. The lining of the pipe shall not be damaged. Flame cutting of ductile iron or cast iron pipe with an oxyacetylene torch will not be permitted.
- (f) **Joining of Pipe:** Gasket and joint lubricant for water facilities shall be nontoxic, tasteless, odorless substance that will not support bacteria. Gasket end joint lubricant for sewer facilities shall be as recommended by the manufacturer or as approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured.

1. **Ductile iron pipe** shall be joined in accordance with AWWA C-111 and AWWA C-600.
2. **Steel pipe** shall be joined by field welding unless otherwise specified on the plans. Pipe ends shall be in accordance with AWWA C-206 for type of field joint specified. Field welded joints shall be in accordance with AWWA-206; flanged joints shall be in accordance with AWWA C-207 and rubber gasket joints shall be in accordance with AWWA M11.
3. **Galvanized steel pipe** shall be joined by fittings in accordance with the manufacturer's recommendation.
4. **Copper pipe or tubing** shall be joined by fittings in accordance with the manufacturer's recommendation.
5. **PVC pipe** shall be joined by gasketed bell and socket joints in accordance with AWWA C-900.
6. **Concrete pipe** for water facilities shall have joints of the round rubber gasket type, unless otherwise specified, using either a bell and spigot joint or a double spigot and sleeve joint. Either joint shall be so that when the pipe is laid and the joint completed, the gasket will be confined within a groove or by shoulders on the bell and spigot. The contact surface in the joint shall be such as to not cause cutting of the rubber gasket during installation.

Concrete pipe for sewer facilities shall be joined by using rubber gaskets. The gasket shall be continuous and fit snugly into the annular space between the overlapping surfaces of the assembled pipe joint to form a flexible watertight seal. The annular space between the gasket bearing surface of the assembled and centered joint shall be more than 75 percent of the uncompressed thickness of the applied gasket including the manufacturer's tolerances of the joint and gasket.

7. **Vitrified clay pipe** shall be joined with compression joints in accordance with ASTM C-12 and manufacturer's recommendation.
8. **PE pipe** shall be joined in accordance with AWWA C-901 and the manufacturer's recommendation.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

9. **ABS pipe** shall be joined with a solvent cement joint in which pipe solvent cements into a coupling socket to form the joint. Primer for priming solvent cement joints shall be MEK (methylethyl ketone) and the cement shall be MEK containing a minimum of 20 percent by weight of dissolved ABS. Type OR joint is a mechanical-seal joint in which a gasket shall be compressed between the pipe and the bell coupling to form the joint closure.
- (g) **Plugs, Caps, Tees, and Bends:** Plugs, caps, tees, and bends shall be anchored with reaction backing. Backing shall be concrete reaction blocks, metal reaction harnesses, or a combination thereof. Concrete shall be placed in accordance with the requirements of Section 404 and cured in accordance with the requirements of Section 316.04(j). Metal harness tie rods and clamps shall be of adequate strength to prevent movement and shall be galvanized or rustproofed by approved means.
- (h) **Encasement Pipe:** Encasement pipe shall be installed in accordance with the requirements of Section 302.
- (i) **Casing Pipe and Concrete:** Casing pipe and concrete shall be constructed in accordance with plan details and the applicable requirements of Sections 302, 303, 316, and 406, with the half-circle sections of casing pipe nested or interlocked to obtain a satisfactory union of the two sections of pipe. Prior to installation, existing pipe to be encased shall be cleaned and foreign material removed.
- (j) **Valves, Valve Boxes, and Manholes:** The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve with the box cover flush with the surface of the finished pavement. Manholes shall be constructed to permit minor valve repairs and protect the valve and pipe from impact where they pass through the walls.
- (k) **Fire Hydrants:** Wherever a hydrant is set in pervious soil, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6 inches above the waste opening in the hydrant and to a distance of 1 foot around the elbow.
- Wherever a hydrant is set in clay or other impervious soil, a drainage pit 2 feet in diameter and 3 feet in depth shall be excavated below each hydrant. The pit shall be filled compactly with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant to a level 6 inches above the waste opening. The drainage pit shall not be connected to a sewer.
- (l) **Installing Corporation Stops:** Corporation stops shall be installed while the main is under pressure and at a 45-degree angle to the horizontal plane.
- (m) **Concrete Encasement:** Concrete encasement shall be constructed in accordance with the requirements of Sections 302, 303, 316.04(j), 404, and 406.
- (n) **Water Meters and Yokes:** The meter box shall not transmit shock or stress to the meter and shall be centered and plumb over the meter. The top of the box shall be flush with the surrounding surface.
- (o) **Jacked Encasement Pipe:** Jacked encasement pipe shall be installed in accordance with the requirements of Section 302.03(a)1.
- (p) **Sanitary Service Lateral Connection:** Connection shall be performed by approved methods prior to installation using wyes, bends, adapters, cleanouts, and necessary pipe. Existing service laterals shall mate with the new fitting, adapter, or pipe to produce a watertight joint.
- (q) **Sanitary Manholes and Manhole Frames and Covers:** These items shall be constructed in accordance with the requirements of Section 302.03(c). A secure bond between the pipe and manhole wall shall be obtained. Flexible insert gaskets shall be used to obtain a watertight joint. The gasket style and composition shall be subject to the approval of the Engineer. Precast wall sections shall be seated with flexible joint sealant for their full circumference. Lift holes, defects, joints between sections, and frames and covers shall be sealed with nonshrink waterproof grout.
- (r) **Sanitary Drop Connections:** Connections shall be constructed in accordance with the requirements of Sections 302, 303, 404, and 406.
- (s) **Sewer Cleanouts:** Cleanouts shall be constructed in accordance with the requirements of Sections 302, 303, 404, and 406.
- (t) **Conveying Sewage:** When it is necessary to contain or pump sewage during the adjustment of or connection to existing sewers, sewage shall be carried by a watertight conveyor to sewers or manholes approved by the Engineer or shall be disposed of in accordance with local and state health codes. Sewage shall not be allowed to flow onto or over any open surface.
- (u) **Manhole frame and covers, valve boxes and other castings** located within the paved roadway, shoulder or sidewalk shall be constructed within a tolerance of ± 0.05 feet of the finished grade.
- (v) **Reconstruct existing sanitary manhole** shall consist of the removal of the existing manhole to the point indicated on the plans or directed by the Engineer. Reconstruction shall be accomplished by using existing units and pavement rings or new units and adjustment rings to attain the proposed finished grade.

520.04—Testing.

Water and sewer mains, appurtenances, and materials shall be tested for leakage after installation. Testing shall be performed in the presence of the Engineer. The Contractor shall provide water, plugs, equipment, tools, labor, materials, and incidentals necessary to perform the testing. If any section of a main or manhole under test shows leakage in excess of that specified, the Contractor shall make necessary repairs or replacements at his own expense. Testing shall be repeated until satisfactory results are obtained. Visible leaks shall be repaired regardless of the amount of allowable leakage.

- (a) **Water Mains and Appurtenances:** New water mains and appurtenances shall be tested for leakage using the hydrostatic pressure test method in accordance with Section 4 of AWWA C600 and the following:
1. The duration of each test shall be at least 2 hours. Sections of main with concrete reaction backing shall not be tested until at least 5 days after the backing is placed. If the backing is high-early-strength concrete, the test may be performed 2 days after backing is placed.
 2. Testing of tie-ins with existing mains shall be performed under the normal working pressure of the main involved. Visible leakage at these points will not be allowed during a period of at least 2 hours.
 3. **The hydrostatic test pressure** shall be 100 pounds per square inch or 1.5 times the working pressure, whichever is greater, based on the elevation of the lowest point in the line or section under test and shall be corrected to the elevation of the test gage. The Contractor shall ascertain the specific working pressure of the water main from the utility owner. Leakage loss shall not exceed the allowable leakage (L) as determined by the following formula:

$$L = \frac{ND\sqrt{P}}{7,400}$$

Where:

L = the allowable leakage in gallons per hour;

N = the number of joints in the length of pipe line tested;

D = the nominal inside diameter of the pipe in inches; and

P = the average test pressure during the leakage test in pounds per square inch.

- (b) **Gravity Sanitary Sewers:** Leakage shall be not more than 200 gallons per inch of pipe diameter per mile per day (24 hours) for pipe up to and including 24 inches in diameter and not more than 4,800 gallons per mile per day for pipe more than 24 inches in diameter for any section of the system, including manholes, when subjected to at least 4 feet of head above the line crown at the upstream manhole of the section being tested.
1. **Infiltration test:** When in the opinion of the Engineer the trench or excavation is sufficiently saturated as a result of natural ground water, tests may be made on the basis of infiltration. The Contractor shall measure the flow of water at the nearest downgrade manhole. Three series of measurements shall be made at not less than 1-hour intervals, and the results shall be reduced to an average. The average for a 24-hour period shall then be computed. If the pipeline or manholes fail to meet the test requirements, leaks shall be repaired and defective pipe and manholes shall be replaced at the Contractor's expense. The test shall be repeated until satisfactory results are obtained.
 2. **Exfiltration test:** An exfiltration test shall be performed when the trench or excavation is dry and infiltration will not occur. The test shall be conducted as follows: The pipe shall be plugged at the lower manhole. The line and manhole shall be filled with water to a 4-foot level or to the top of the straight section if the manhole is less than 4 feet in height. The water shall stand until the pipe has reached maximum absorption and until trapped air has escaped (at least 4 hours). After maximum absorption has been reached, the manhole shall be filled to the original level. After 1 hour has elapsed, the difference in the level shall be recorded in terms of gallons. The 24-hour loss shall then be computed. If the pipe line system and manholes fail to meet test requirements, leaks shall be repaired at the Contractor's expense. The test shall be repeated until satisfactory results are obtained.
 3. **Air test:** In lieu of the infiltration or exfiltration test for leakage, the Contractor may test the sewers by using low air pressures. In the event low air pressure tests are used, the manholes shall be tested by exfiltration. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested. The stoppers shall be positioned in the lines far enough from the manhole to insure testing of those portions of the lines not air tested. The manhole shall then be filled with water to the top and a 12-hour soaking period shall be allowed prior to test measurement. The manhole shall be refilled to a mark and at the end of 1 hour, the amount of leakage should be measured. Leakage shall not exceed ½ gallon per hour. If the manhole fails to meet test requirements, leaks shall be repaired at the Contractor's expense. The test shall be repeated until satisfactory results are obtained. Low air pressure test shall be in accordance with the following:

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

- a. After backfilling and prior to air testing, the Contractor shall eliminate discernable water leaks and remove debris. Tests shall be conducted from manhole to manhole or from manhole to terminus. Personnel shall not be allowed in manholes once testing has begun.
- b. Immediately before testing, the Contractor shall provide securely braced test plugs at each manhole and a suitable means of determining the depth of the ground water level above the inverts.
- c. The Contractor shall slowly add air to the portion of the pipe being tested until the internal air pressure is at a test pressure of 4 pounds per square inch above the invert or ground water table, whichever is greater, or until the pressure is equal to the hydraulic gradient, whichever is greater. If the test plug shows leakage, as determined by the Engineer, the Contractor shall relieve the pressure for at least 2 minutes. The Contractor shall then disconnect the hose and compressor. If the pressure decreases to 3.55 pounds per square inch, the time shall be recorded for the amount of time required for the pressure to drop from 3.5 to 2.5 pounds per square inch. The minimum allowable holding times will be as specified herein. Pipes that fail to maintain minimum holding times will not be accepted. Repairs, replacement, and retesting as specified by the Engineer shall be performed at the Contractor's expense.

The minimum allowable holding time for an 8-inch sanitary sewer pipe that is required for the pressure to drop from 3.5 to 2.5 pounds per square inch is:

Line Length	Time (sec)
25	18
50	35
75	53
100	70
125	88
150	106
175	123
200	141
225	158
250	176
275	194
300	211
350	227
400	227

The minimum allowable holding time for a 12-inch sanitary sewer pipe that is required for the pressure to drop from 3.5 to 2.5 pounds per square inch is:

Line Length	Time (sec)
25	40
50	79
75	119
100	158
125	198
150	238
175	277
200	317
225	340
250	340
275	340
300	340
350	340
400	340

- (c) **Force Main Sanitary Sewers:** Leakage shall not exceed the allowable leakage (L) as determined by the following formula:

$$L = \frac{ND\sqrt{P}}{1850}$$

Where:

L = the allowable leakage in gallons per hour;

N = the number of joints in the length of pipe line tested;

D = the nominal inside diameter of the pipe in inches; and

P = the average test pressure during the leakage test in pounds per square inch.

The hydrostatic test pressure shall be maintained for at least 30 minutes at 100 pounds per square inch or 1.5 times the working pressure, whichever is greater, based on the elevation of the lowest point in the line or section under test, and shall be corrected to the

elevation of the test gage. The Contractor shall ascertain the specific working pressure of the force main from the utility owner. Visible leaks shall be satisfactorily repaired regardless of the amount of allowable leakage.

- (d) **Offsets of Existing Pipe:** Offsets will not be subjected to hydrostatic pressure testing unless specified on the plans. After installation and connection to the existing mains, the offset shall be placed in service and left uncovered for visual inspection for at least 2 hours. Visible leaks shall be repaired to the satisfaction of the Engineer prior to acceptance of the offset. Offset of existing pipe for water mains shall be disinfected in accordance with AWWA C-651, Section 9.

520.05—Disinfecting Water Mains.

New, relocated, and modified water mains and accessories shall be disinfected prior to tie-ins in accordance with AWWA C651.

If the initial disinfection fails to yield satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. After each group of samples is taken, the Contractor shall submit a written report to the Engineer that states the results of the tests.

520.06—Measurement and Payment.

Excavation and replacement of pavement removed for pipe trenches will not be measured for separate payment unless otherwise shown. However, minor structure excavation will be measured and paid for in accordance with the requirements of Section 303.06. When excavation is required below the proposed trench bottom, necessitating additional bedding material, the bedding will be measured and paid for in accordance with the requirements of Section 302.04.

Water mains, water service lines, sanitary sewer pipe, and sanitary sewer force mains will be measured in linear feet of pipe through all valves and fittings, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include excavating; testing; disinfecting; backfilling; compacting; dewatering; disposing of surplus and unsuitable material; sheeting and shoring; bedding material; installing pipe; connecting to existing lines or manholes; fittings less than 16 inches in diameter; reaction blocking; concrete anchor block; watertight welds; restrained joints; abandoning or removing lines, manholes, and other appurtenances; and restoring property. Pipe of one size, except for cast iron and ductile iron pipe, shall be combined into one contract item for the respective size of water main sanitary sewer pipe. The salvage value of abandoned materials shall accrue to the Contractor and shall be reflected in the contract unit price for the respective replacement facility.

Encasement pipe and casing pipe and concrete will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include excavating, dewatering, sheeting and shoring, blocking, installing pipe, grouting, concrete encasement, reinforcing steel, masonry blocks, watertight bulkheads, backfilling, compacting, disposing of surplus and unsuitable material, and restoring property.

Jacked encasement pipe will be measured and paid for in accordance with the requirements of Section 302.04. This price shall include excavating, backfilling, disposing of surplus and unsuitable material, sheeting and shoring, blocking, bulkheads, and jacking.

Concrete encasement will be measured in linear feet of encased pipe or cubic yard of concrete, complete-in-place, and will be paid for at the contract unit price per linear foot or cubic yard. This price shall include excavating, sheeting and shoring, concrete, reinforcing steel, backfilling, compacting, and disposing of surplus and unsuitable material.

Sanitary service lateral connections will be measured in linear feet, complete-in-place, from the center line of the sewer main to the point of connection of sanitary service lateral, and will be paid for at the contract unit price per linear foot. This price shall include excavating, backfilling, compacting, disposing of surplus and unsuitable material, sheeting and shoring, connecting to existing service lateral, and restoring property.

Sanitary drop connections will be measured in linear feet, vertical measure, complete-in-place, from the invert of the upper inlet pipe to the invert of the lower inlet pipe, and will be paid for at the contract unit price per linear foot. This price shall include pipe and fittings, concrete, reinforcing steel, connections to sewer lines and manholes, excavating, bedding material, backfilling, compacting, disposing of surplus and unsuitable material, and restoring property.

Sanitary sewer manholes, frames and covers and watertight frames and covers will be measured and paid for in accordance with the requirements of Section 302.04.

Sewer cleanouts (main or lateral) will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include fittings; riser pipe, frame, cover, and box; excavating; backfilling; compacting; disposing of surplus and unsuitable material; and restoring property.

Reconstruct Existing Sanitary Manhole will be measured in linear feet, vertical measure, from the point of the removed section to the top of masonry on which the frame and cover is placed, and will be paid for at the contract unit price per linear foot. This price shall include removing, salvaging and resetting frame and cover, reconstruction of manhole, new materials, excavation, backfilling, compaction, disposal of surplus of unsuitable material and restoring property.

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

Fire hydrants will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include excavating, dewatering, backfilling, compacting, connections, concrete blocking, pipe straps, crushed stone drain, disposing of surplus and unsuitable material, restoring property, and testing.

Water meters and boxes; water meter boxes and yokes; valves and boxes or manholes; and tapping sleeves, valves, and boxes or manholes will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each. This price shall include excavating, backfilling, and restoring property.

Bends, plugs or caps, reducers, and branches (tees, wyes, and crosses) will be measured in units of each and will be paid for at the contract unit price per each. This price shall include restrained joints, excavating, reaction blocking, testing, backfilling, sheeting and shoring, watertight welds, abandoning or removing existing lines as noted on the plans, and restoring property.

Offsetting existing pipe will be measured in linear feet of pipe parallel to the flow line between tie-in points, complete-in-place, and will be paid for at the contract unit price per linear foot. This price shall include fittings, couplings, restrained joints, excavating, testing, disinfecting, backfilling, compacting, dewatering, disposing of surplus or unsuitable material, sheeting and shoring, bedding material, installing pipe, connecting existing lines as noted on the plans, reaction blocking, watertight welds, abandoning or removing existing lines as noted on the plans, and restoring property.

Leak detectors will be measured in units of each. This price shall include pipe, return bends, bird screens, clamps, excavating, backfilling, and restoring property.

These prices shall include containing or pumping sewage during adjusting or connecting existing sewers and providing and maintaining adequate and safe passage over excavations to accommodate pedestrians or vehicles as directed by the Engineer.

Payment will be made under:

Pay Item	Pay Unit
Water main (Size and type)	Linear foot
Water service line (Size)	Linear foot
Encasement pipe (Size and type)	Linear foot
Casing pipe and concrete (Size)	Linear foot
Leak detector (Standard)	Each
Bend (Size)	Each
Reducer (Size)	Each
Plug or cap (Size)	Each
Branch (Size)	Each
Offset existing pipe (Size)	Linear foot
Valve and (box or manhole) (Size and type)	Each
Tapping sleeve, valve, and (box or manhole)	Each
Fire hydrant (Standard and type)	Each
Water meter and box (Size)	Each
Water meter box and yoke (Size)	Each
Jacked encasement pipe (Size and type)	Linear foot
Sanitary sewer pipe (Size and type)	Linear foot
Sanitary service lateral connection (Size)	Linear foot
Sanitary sewer force main (Size)	Linear foot
Bend-force main (Size)	Each
Reducer-force main (Size)	Each
Plug or cap-force main (Size)	Each
Branch-force main (Size)	Each
Offset existing pipe-force main (Size)	Linear foot
Sanitary sewer manhole (Standard)	Linear foot
Manhole frame and cover (Standard)	Each
Sanitary drop connection	Linear foot
Valve and (box or manhole) (Size and type)-force main	Each
Tapping sleeve, valve, and (Box or manhole) (Size)-force main	Each
Concrete encasement (Standard)	Linear foot or cubic yard
Reconstruct existing sanitary manhole	Linear foot
Watertight manhole frame and cover (Standard)	Each

DIVISION VI ROADSIDE DEVELOPMENT

SECTION 602—TOPSOIL

602.01—Description.

This work shall consist of applying topsoil in accordance with the requirements of these specifications and in reasonably close conformity to the depths and limits shown on the plans or as established by the Engineer.

602.02—Materials.

- (a) **Class A topsoil** shall conform to the requirements of Section 244.02(b)1.
- (b) **Class B topsoil** shall conform to the requirements of Section 244.02(b)2.

602.03—Procedures.

- (a) **Preparing Areas To Receive Topsoil:** Unless otherwise directed by the Engineer, areas designated to receive topsoil shall be graded, shaped, and then scarified or tilled by disking, harrowing, or other approved methods to a depth of approximately 2 inches. Topsoil shall be applied only when the subsoil is in a loose, friable condition.

Subsoil on slopes that have been horizontally grooved in accordance with the plans shall not be loosened.

- (b) **Applying Topsoil:** The loose depth of topsoil shall be sufficient to allow the area to conform to the elevations shown on the plans after topsoil settles.

After topsoil has been applied, large clods, hard lumps, and stones more than 3 inches in diameter; brush; roots; stumps; litter; and foreign material shall be removed from the area. When the operation is complete, the area shall be in a condition to receive seed, sod, or plants without further soil preparation. Areas shall be seeded within 15 days after topsoil is applied.

602.04—Measurement and Payment.

Topsoil will be measured in acres of surface area computed to the nearest 1/10 acre and will be paid for at the contract unit price per acre. This price shall include preparing areas to receive topsoil; furnishing, loading, transporting, and applying topsoil; finishing areas; and restoring damaged areas prior to final acceptance.

Payment will be made under:

Pay Item	Pay Unit
Topsoil (Class and depth)	Acre

SECTION 603—SEEDING

603.01—Description.

This work shall consist of furnishing and applying fertilizer, lime, mulch, and seed in the quantities specified for areas designated on the plans or selected by the Engineer.

603.02—Materials.

- (a) **Seed** shall conform to the requirements of Section 244.02(c).
- (b) **Fertilizer** shall conform to the requirements of Section 244.02(d).
- (c) **Lime** shall conform to the requirements of Section 244.02(e).
- (d) **Mulch** shall conform to the requirements of Section 244.02(g).

603.03—Procedures.

Unless otherwise specified, seeding operations shall be performed at the times specified in Sections 303.03(b) and 602.03(b). Seeding operations shall not be performed when the ground is frozen or when soil or weather conditions would prevent proper soil preparation and subsequent operations. When hydroseeding is performed, nozzles or sprays shall not be directed toward the ground in a manner that will cause erosion or runoff. The Contractor shall notify the Engineer at least 48 hours prior to beginning seeding operations.

- (a) **Applying Lime:** Lime shall be uniformly applied to areas to be seeded at the rate of 2 tons per acre. Any approved method may be used.
- (b) **Preparing Soil:** After lime is applied, areas to be seeded shall be prepared in accordance with the following: Slopes 3:1 or flatter shall be loosened to a depth of approximately 3 inches by disking, harrowing, or other approved methods. Loosening of soil on excavated slopes steeper than 3:1 will not be required except to eliminate hard or crusted surfaces. Shoulders and embankment slopes steeper than 3:1 shall be loosened to a depth of approximately 1 inch. Clods, loose stones, and other foreign material larger than 3 inches in any dimension shall be removed and disposed of in accordance with the requirements of Section 106.04 or as approved by the Engineer. Gullies, washes, and disturbed areas that develop subsequent to final dressing shall be repaired before they are seeded.

Topsoil, when specified, shall be applied in accordance with the requirements of Section 602.

- (c) **Applying Fertilizer:** When dry fertilizer is used, it shall be applied uniformly to the seeding areas at the time of seeding at the rate of 600 pounds of 15-30-15 fertilizer, or an equivalent quantity of 1-2-1 fertilizer, per acre.

When applied in liquid form or mixed with water, fertilizer shall provide the same value of nutrients per acre as specified for dry fertilizer. Fertilizer applied in liquid form shall be agitated during application.

- (d) **Applying Seed:** Regular seeding shall consist of uniformly applying seed, fertilizer, and mulch on prepared areas.

Overseeding shall consist of applying seed and fertilizer on areas prepared as directed by the Engineer.

For hydroseeding, seed shall be put in the mixture slowly to result in a uniform mixture before application. Hydroseeding mixtures shall be constantly agitated from the time of mixing until application on the seedbed and used within 8 hours from the beginning of mixing.

If special seed is required in addition to the regular mixture, it will be furnished by the Department and shall be applied with the regular mixture at the Contractor's expense.

Leguminous seeds shall be inoculated or treated with approved cultures as specified by the manufacturer or directed by the Engineer before they are applied or mixed with other seeds to be applied. Seed shall be applied within 24 hours after treatment. When the hydroseeding method is used, leguminous seeds shall be treated with 5 times the amount of inoculant recommended by the manufacturer.

- (e) **Applying Mulch:** Mulch shall be applied within 48 hours after completion of the seeding operation. When straw or hay mulch is used, it shall be applied on seeded areas at the rate of approximately 2 tons per acre. When wood cellulose fiber mulch is used, it

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

shall be uniformly applied at the rate of approximately 1,500 pounds (net dry weight) per acre. Mulch will not be required on overseeded areas.

Straw and hay mulch shall be applied to a uniform thickness in such a manner that not more than 10 percent of the soil surface will be exposed. Wet straw or wet hay shall not be used. Straw or hay mulch shall be anchored to the seeded surface by spraying with wood cellulose fiber mulch at the rate of 750 pounds per acre; spraying with an emulsified asphalt at the rate of at least 100 gallons per ton of mulch in a manner that will protect adjacent property and pedestrian traffic areas; disking or punching the mulch partially into the soil; using approved netting; or using other materials or methods approved by the Engineer. The Contractor may use more than one method on the same project.

603.04—Measurement and Payment.

Lime will be measured in tons and will be paid for at the contract unit price per ton.

Fertilizer will be measured in tons and will be paid for at the contract unit price per ton. When a grade different than that specified in the Contract is used, the tonnage quantity will be adjusted to the grade specified.

Seed will be measured in pounds of seed used and will be paid for at the contract unit price per pound. When bags of seed are transferred from project to project, certified scales shall be used for weighing the seed. Open bags will not be accepted for use.

Prices for seed, fertilizer, and lime shall include preparing seed beds; furnishing and applying seed; furnishing and applying mulch; and maintaining seeded areas until final acceptance.

Overseeding will be paid for at the contract unit price per pound of seed. This price shall include preparing seedbeds and furnishing and applying seed and additional fertilizer.

Mulch will not be measured for separate payment. The cost thereof shall be included in the price for seed.

Payment will be made under:

Pay Item	Pay Unit
() seed	Pound
() overseeding	Pound of seed
Fertilizer (Ratio)	Ton
Lime	Ton

SECTION 604—SODDING

604.01—Description.

This work shall consist of preparing sod beds; furnishing and placing sod; and furnishing and applying lime, fertilizer, topsoil, and water at locations designated on the plans or by the Engineer.

604.02—Materials.

- (a) **Sod** shall conform to the requirements of Section 244.02(h).
- (b) **Fertilizer** shall conform to the requirements of Section 244.02(d).
- (c) **Lime** shall conform to the requirements of Section 244.02(e).

604.03—Procedures.

- (a) **Preparing Sod Beds:** Soil on which sod is to be placed shall be shaped to an even surface and graded to such an elevation that sod and adjacent surfaces will have a smooth contour.

Lime shall be uniformly applied to areas designated to receive sod at the rate of approximately 2 tons per acre.

Fertilizer shall be uniformly applied to areas designated to receive sod at the rate of 16 1/2 pounds of 15-30-15 fertilizer, or an equivalent quantity of 1-2-1 fertilizer, and 10 pounds of ureaformaldehyde per 1,000 square feet. Following application of lime and fertilizer, the soil shall be thoroughly cultivated to a depth of 2 to 3 inches and sprinkled with sufficient water to moisten the cultivated soil.

- (b) **Placing Sod:** Sod shall not be placed between June 1 and September 1 or at any time the ambient temperature is below 32 degrees F. Frozen sod shall not be placed, and sod shall not be placed on frozen soil. Sod shall be placed by hand, and joints shall tightly abut without overlapping. Open joints and gaps shall be plugged with sod that has been cut to the size and shape of the opening.

Sod shall be placed on sloping areas beginning at the bottom of the slope. Sod shall be placed in horizontal strips with the long edges of rectangular pads parallel to the contour. When practicable, horizontal joints shall be reasonably straight and vertical joints staggered. In areas where sod pads may be displaced by foot traffic during sodding operations, ladders or treaded planks shall be used.

Sod placed on slopes steeper than 2:1 shall be anchored in place with wood stakes driven flush with the top of the sod. Stakes shall be at least 8 inches in length with a cross-sectional area of approximately 1 square inch. The number and spacing of stakes shall be adequate to hold sod securely in place. Special attention shall be given to anchoring sod placed in drainage ditches, channels, and swales.

After sod has been placed, joints and gaps that were too small to be effectively plugged with sod shall be filled with loamy topsoil.

Sodded areas shall be watered thoroughly and rolled or tamped to press the root system of the sod into full contact with underlying soil.

Sodded areas shall be kept watered to maintain the life and growth of the sod until final acceptance.

604.04—Measurement and Payment.

Sod will be measured in square yards of surface area, complete-in-place, and will be paid for at the contract unit price per square yard of surface area. This price shall include preparing sod beds; furnishing and applying lime, fertilizer, sod, and water; and maintaining sodded areas until final acceptance.

Payment will be made under:

Pay Item	Pay Unit
Sod	Square yard

SECTION 605—PLANTING

605.01—Description.

This work shall consist of furnishing and planting trees, shrubs, vines, and other plants of the kinds, sizes, and quantities specified on the plans or by the Engineer and maintaining and replacing plants as specified herein.

605.02—Materials.

- (a) **Plants** shall conform to the requirements of Section 244.02(i).
- (b) **Planting materials** shall conform to the requirements of Section 244.02(j).

605.03—Procedures.

The Contractor shall notify the Department at least 48 hours prior to beginning work.

- (a) **Sources of Supply:** Plants shall be obtained from approved sources. The Department may withdraw its approval of sources that do not consistently furnish acceptable plants.
- (b) **Inspecting and Identifying Plants:** Plants will be inspected and identified in accordance with the *Standardized Plant Names* prepared by the Editorial Committee of the American Joint Committee on Horticultural Nomenclature. The Engineer may inspect and reject plants at any time and place. Plants will be inspected immediately prior to being planted. If they are planted prior to inspection and found to be unsatisfactory, they shall be replaced with approved plants at the Contractor's expense.
- (c) **Substitutions:** No change in the quantity, size, kind, or quality of plants from those specified will be permitted without the approval of the Engineer. When requesting permission to substitute, the Contractor shall submit written evidence that the specified plants are not available and shall suggest substitute plants that conform to the requirements of the Contract. The Contractor shall indicate the reduced cost, if any, that will accrue to the Department as a result of the substitution. The Engineer may delete plants from the Contract in lieu of approving substitutions.
- (d) **Layout:** Plant locations and outlines of areas to receive plants shall be staked or marked in ample time to allow inspection and approval by the Engineer before digging is started. Unforeseen conditions such as the location of traffic signs and drainage items may necessitate adjustments in plant locations, and such adjustments will be permitted when approved by the Engineer.
- (e) **Delivery:** The Contractor shall notify the Engineer at least 48 hours in advance of the anticipated delivery date for plants. A legible copy of the invoice showing the kinds and sizes of plants in each shipment shall be furnished the Engineer. A copy of the current Certificate of Nursery Inspection shall accompany each shipment of plants.
- (f) **Labeling:** Representative samples of each shipment of plants shall be legibly labeled as to the genus, species, size, and quantity of the plants. When plants are in bales, bundles, boxes, or other containers, a legible label indicating the genus, species, size, and quantity of the plants shall be attached to each container.
- (g) **Transporting and Protecting:** Plants transported to the project in open vehicles shall be covered with suitable covers securely fastened to the body of the vehicle. Closed vehicles shall be adequately ventilated to prevent overheating plants. Plants shall be kept moist, fresh, and protected at all times.
- (h) **Storing:** When plants are to be stored, they shall be stored at a location approved by the Engineer. Plants stored for more than 30 days shall not be used unless they are approved by the Engineer. Unless other methods of storage are approved by the Engineer, bare-root plants that are not planted within 24 hours after delivery shall be heeled-in in a moist trench dug in the ground. Bundles shall be opened, and plants shall be separated and placed singly in the trench with the roots spread in a natural position. Roots of each layer of plants shall be immediately covered in a manner satisfactory to the Engineer with moist, pulverized soil; moist sawdust; or other approved material. Root-covering materials shall be kept moist at all times. Shade shall be provided as directed by the Engineer. At the discretion of the Engineer, balled material, container-grown material, and plants in plantable pots that are not planted within 48 hours of delivery shall have their root zone protected by wet sawdust or other approved material. Rejected plants shall be removed from the storage area within 24 hours of rejection or, with the approval of the Engineer, may be marked with yellow paint or otherwise made readily identifiable. If rejected plants have not been removed or acceptably marked within 24 hours, the use of plants from the storage area will not be allowed until rejected plants have been removed or identified.

(i) **Planting:**

1. **Underground conditions:** If underground obstructions or any other unforeseen subsurface conditions that would be detrimental to plant growth are encountered, the Engineer may require that plant pits be enlarged or relocated or that the plants be deleted from the Contract.
2. **Planting trees or shrubs on slopes steeper than 3:1:** Drainage requirements for trees or shrubs on slopes steeper than 3:1 will be determined by percolation tests, with no more than 3 tests per slope, as designated by the Engineer. Slope for this test is determined to be from cut to fill points as shown on the plans.
3. **Preparing planting pits:** Sides of pits that become plastered or glazed shall be scarified. Surplus excavation and unsuitable material shall be disposed of in accordance with the requirements of Section 106.04 or as otherwise approved by the Engineer.
4. **Preparing plant beds:** The entire area of the plant bed shall be cultivated to a depth of at least 4 inches by a rotary cultivator before plant pits are excavated. Grass, sod, and weeds shall be removed from the bed. Rocks, clods, roots, and other objectionable material remaining on the surface shall be removed and disposed of in accordance with the requirements of Section 106.04 or as approved by the Engineer. Unless authorized by the Engineer, soil excavated from plant pits shall not be used in the bed. Individual planting pits shall not be dug until after the bed is prepared to the satisfaction of the Engineer.

Upon completion of planting, the bed shall be hand raked to an even surface and neatly edged. Mulch shall be applied to the entire cultivated area.

5. **Installing plants and backfilling:** Plants shall be installed in pits on a soil mixture conforming to the requirements of Section 244.02(j)4. that has been placed and tamped to the proper depth. Bare roots of plants shall be spread out in a natural position. Broken or bruised roots shall be pruned. The soil mixture shall then be filled in around roots and tamped. Tamping around root balls shall be performed using a mattock handle or similar round-ended instrument. Foot tamping will be permitted in the bottom of pits before plants are installed, around root balls when there is ample room to accommodate the foot without damage to the ball, and in the planting of bare-root plants after roots have been covered with the soil mixture.

Backfill in pits shall be saturated with water. The amount of water applied and method of application shall be to the satisfaction of the Engineer. Failure to water properly at the time each plant is installed will be cause for rejection of the plant. Frozen backfill shall not be used.

After positioning plants in the planting pit and prior to backfilling, root ball wrapping materials, except metal root ball cages, shall be cut and dropped to the bottom of the pit. Root ball wrapping materials shall not be removed from under the root ball. Metal root ball cages shall be cut and removed to approximately 6 inches below finished grade. Wrapping materials within root ball cages shall be cut or unwrapped to the same elevation as the cage.

Potted plants shall not be removed from their container until immediately before planting. Containers shall be removed by approved methods that will not damage roots or loosen soil balls.

When planted, watered, and fully settled, plants shall be vertical and shall stand at a height flush with or slightly below the height at which they were growing.

6. **Handling plants during planting:** Roots of bare-root plants shall be kept covered with moist burlap or other approved material prior to planting. Forest tree seedlings and forest tree transplants shall be carried in a container filled with sufficient mud to puddle roots. When seedling roots have been coated with a protective material, the seedlings shall be protected in accordance with the U.S. Forest Service's recommendations relative to treatment of seedling roots while seedlings are being planted. Plants will be rejected if their roots are exposed to drying conditions at any time.
- (j) **Forming Water Rings and Saucers:** Immediately after installation of each plant, a saucer shall be formed around the plant pit as shown on the plans. Soil used to form the saucer shall be compacted by tamping to prevent runoff of water from the pit. Saucers will not be required for plant beds, forest tree seedlings, or forest tree transplants.
 - (k) **Applying Mulch:** Mulch shall be applied uniformly over the entire area of the plant pit or plant bed within 48 hours after completion of planting. Mulch shall be anchored in a manner satisfactory to the Engineer. Mulch will not be required for forest tree seedlings or forest tree transplants.
 - (l) **Staking and Guying:** Each tree shall be staked or guyed immediately following planting.
 - (m) **Wrapping:** Deciduous trees shall be wrapped within 48 hours after planting but not before the condition of their trunk has been approved by the Engineer.
 - (n) **Pruning:** Plants that have been freshly pruned before delivery will be rejected. Plants shall be pruned either immediately before or within 48 hours after they are planted. Pruning of trees and shrubs shall consist of thinning out approximately 1/3 of the growth.

Care shall be taken to preserve the natural character of the plant. Pruning shall be performed with tools and equipment specifically designed for the pruning to be performed.

- (o) **Pit Drains:** Pit drains shall be installed as shown on the plans.

605.04—Care of Plants.

Plant care shall begin immediately after each plant is satisfactorily installed and shall continue until final acceptance. Care shall include but not be limited to replacing displaced mulch within 7 days, repairing and reshaping water rings or saucers, maintaining stakes and guys as originally installed, watering when needed or directed, and performing any other work required to keep plants in a healthy condition. Dead, defective, or rejected plants shall be immediately removed and replaced at the Contractor's expense.

605.05—Establishment Period.

- (a) **Beginning of Establishment Period:** The establishment period will begin on the date that an inspection by the Engineer confirms that plants have been installed in accordance with the requirements of these specifications and that dead or defective plants have been replaced to the satisfaction of the Engineer.
- (b) **Establishment Period:** During the establishment period, living plants shall be watered as frequently as is necessary to maintain an adequate supply of moisture within the root zone at all times. Water shall not be applied at a force that will displace mulch. The Engineer may require the use of watering needles or other approved methods to prevent displacement of mulch and runoff of water. The Engineer will make periodic inspections to ascertain the moisture content of the soil. When notified by the Engineer that watering is required, the Contractor shall begin watering within 48 hours with sufficient labor and equipment and shall continue to water daily where and as directed, without delays or interruptions, to ensure that the root zone does not become dry at any time. The quantity of water supplied shall not be in excess of that normally required to ensure optimum growing conditions. The Engineer may require or suspend watering at any time.

Work, except watering, shall begin within 10 days after the Engineer notifies the Contractor that the establishment period has begun.

Plants shall be pruned and mulch shall be replaced as required.

Stakes, guys, tree wrap and eroded plant saucers shall be repaired or replaced and removed when no longer required.

Plant beds and mulched areas around plants shall be kept free from grass and weeds, including root growth.

Grass and other vegetation shall be cut between individual plant pits that are not in beds to a height of approximately 4 inches. Mowing shall be performed once in June and once in September.

Herbicides may be used when approved by the Engineer.

Additional work, including pruning and seasonal spraying with approved insecticides and fungicides, shall be performed to ensure plant survival as approved or directed by the Engineer.

Dead plants shall be removed immediately at the Contractor's expense.

- (c) **Termination of Establishment Period:** The establishment period shall end during the ensuing planting season on the date that an inspection by the Engineer shows that the Contractor has complied with the requirements of (b) herein.

Dead, missing, or defective plants shall be replaced as directed by the Engineer, but not prior to November 1. The Engineer shall be notified when replacement is started.

605.06—Guarantee.

The Contractor's performance bond, furnished in accordance with the requirements of Section 103.05, shall provide for necessary maintenance during the establishment period and replacements in kind, or with a substitute acceptable to the Engineer, for plants that are not in a healthy growing condition or that have died back to the crown or beyond the normal pruning limit.

605.07—Measurement and Payment.

Plants will be measured by an actual count of living plants in a healthy growing condition and will be paid for at the contract unit price per each. Plants that the Engineer deleted from the Contract will not be measured for payment. This price shall include furnishing and delivering plants and planting material; preparing planting pits and beds; forming saucers; planting; watering (except during establishment period);

Excerpts from 2002 VDOT R&B Specifications related to VDOT Stormwater Management Program

applying fertilizer; backfilling with approved soil mixture; staking; guying; wrapping; pruning; applying mulch (except to areas designated on the plans as plant beds); replacing plants; cutting or mowing; repairing, replacing and removing stakes when no longer needed; guys and tree wrap and maintaining plants in a healthy condition until final acceptance.

Trees or shrubs planted on a slope steeper than 3:1 with pit modification will be paid for at 125 percent of the price bid. Such price shall also include cost of pit modification, stone and geotextile filter fabric. Percolation tests shall be included in the price bid for plants.

Pit drains will be measured and paid for in units of each, complete-in-place, which price shall include pipe grate, pipe, geotextile fabric and aggregate.

Replacements for plants lost during the establishment period because of theft, damage, or destruction caused by persons or equipment belonging to persons or organizations other than those engaged in performing the work or during delivery of plants will be paid for at the rate of 1/2 the contract unit price per each. This price shall include all costs associated with replacement.

Mulching will be measured in units of 100 square feet of surface area. Mulch for plant beds will be paid for at the contract unit price per 100 square feet. This price shall include furnishing, delivering, and applying mulch. No separate payment will be made for applying mulch around plants that are not in cultivated plant beds. The cost thereof shall be included in the price for the plant.

Watering during the establishment period will be measured in units of 1,000 gallons and will be paid for at the contract unit price per 1,000 gallons. This price shall include furnishing, delivering, and applying water and performing all other work in connection therewith and incidental thereto. No payment will be made for watering at the time of original planting or when replacements are planted.

Payment will be made under:

Pay Item	Pay Unit
(Name of) Plant (Size)	Each
Mulching	Unit (100 square feet)
Watering	Unit (1,000 gallons)

SECTION 606—SOIL RETENTION COVERINGS

606.01—Description.

This work shall consist of furnishing and placing protective coverings for soil retention, including seed, fertilizer, lime, topsoil, and water, in accordance with the requirements of these specifications and in reasonably close conformity to the dimensions, lines, and grades shown on the plans or as established by the Engineer.

606.02—Materials.

Materials shall conform to the requirements of Section 244.02(k).

606.03—Procedures.

- (a) **Preparing Areas:** Two inches of topsoil shall be applied to the area to be covered. Drainage channels shall be shaped in accordance with the cross section shown on the plans and shall be rolled or tamped to compact soil in place before final shaping.

During shaping operations, a seedbed approximately 3/4 inch in depth shall be provided.

Stones, roots, and other objects that will prevent protective covering from making close contact with the seedbed shall be removed before covering is installed.

- (b) **Applying Seed:** Seed shall be applied in accordance with the requirements of Section 603 except that mulch will not be required. Seed, fertilizer, and lime shall be applied prior to installation of protective coverings.

Seeded areas adjacent to the channel or ditch that are disturbed during installation of covering shall be uniformly reshaped, reseeded, and mulched at the Contractor's expense.

- (c) **Installing Soil Retention Coverings:** Coverings shall be installed in accordance with the standard drawings and manufacturer's recommendations.

- (d) **Watering:** After coverings are installed, seeded areas shall be watered sufficiently to saturate the seedbed. Water shall be applied in a spray, and no additional watering will be required.

606.04—Measurement and Payment.

Protective coverings and soil stabilization mats will be measured in square yards of area covered, complete-in-place, in accordance with the nominal plan dimensions, and will be paid for at the contract unit price per square yard. Overlaps, overwidths, and cut slots will not be measured for separate payment. This price shall include furnishing, installing, and stapling soil retention coverings; smoothing and shaping ditch channels and waterways; preparing seed beds; and furnishing and applying topsoil, lime, seed, fertilizer, and water.

Payment will be made under:

Pay Item	Pay Unit
Protective covering (Standard)	Square yard
Soil stabilization mat (Standard and type)	Square yard

SECTION 607—HERBICIDE SPRAYING

607.01—Description.

This work shall consist of applying an approved herbicide for the control of weeds in turfed areas as indicated on the plans or as designated by the Engineer.

607.02—Materials.

Herbicide shall conform to the requirements of Section 244.02(a).

607.03—Procedures.

Herbicide shall be applied in accordance with the manufacturer's recommendations. Herbicide shall not be applied when the ambient temperature is above 85 degrees F or below 60 degrees F. The spray pressure shall be at least 20 but not more than 30 pounds per square inch. Spraying shall not be performed when the vegetation is wet, when it appears that rain is imminent within 6 hours, or when the wind is blowing enough to scatter paper or trash.

607.04—Measurement and Payment.

Herbicide spraying will be measured in units of 1,000 gallons of mixture and will be paid for at the contract unit price per 1,000 gallons. This price shall include furnishing and applying herbicide.

Payment will be made under:

Pay Item	Pay Unit
Herbicide spraying	Unit (1,000 gallons)

SECTION 608—MOWING

608.01—Description.

This work shall consist of mowing designated areas to a height of not less than 4 inches when and as directed by the Engineer until final acceptance.

608.02—Equipment.

Equipment used for mowing operations shall be mechanical with a cutting width of at least 5 feet.

608.03—Measurement and Payment.

When a pay item, mowing will be measured in hours of operation and will be paid for at the contract unit price per hour. This price shall include equipment, operators, fuel, and lubricants.

Payment will be made under:

Pay Item	Pay Unit
Mowing	Hour

SECTION 609—TREE WELLS AND TREE WALLS

609.01—Description.

This work shall consist of constructing wells and walls to protect the root system of trees, shrubs, or other woody plants at the locations shown on the plans or as designated by the Engineer.

609.02—Procedures.

Excavation incidental to and necessary for constructing tree wells and tree walls shall be conducted in a manner that will not damage the root system. Ends and damaged sections of roots shall be cleanly cut. Roots with a diameter of more than 3 inches shall not be cut.

Before any earth fill that will exceed 12 inches in thickness is spread over the feeding root system of trees or shrubs to be protected by tree wells, an aeration layer of coarse gravel or stone ranging from 1/2 to 5 inches in size shall be spread over the entire area for a depth of at least 6 inches or at the rate of 3 inches for every 12 inches of earth fill where such fills will be more than 2 feet in depth. The layer of aggregate shall be covered with sufficient fine screenings to choke the top of the porous fill. Aggregate shall not be placed inside the tree well.

609.03—Measurement and Payment.

Tree wells and tree walls will be measured in cubic yards of masonry, complete-in-place, and will be paid for at the contract unit price per cubic yard of masonry. This price shall include excavation, drainpipe, and backfill, including aggregate.

Payment will be made under:

Pay Item	Pay Unit
Tree well (Standard)	Cubic yard
Tree wall (Standard)	Cubic yard

SECTION 610—GABIONS

610.01—Description.

This work shall consist of furnishing and installing gabions in accordance with the requirements of these specifications and in reasonably close conformity to the lines, dimensions, and grades shown on the plans or as established by the Engineer.

610.02—Materials.

- (a) **Gabions** shall have a uniform horizontal width of at least 36 inches. Their dimensions shall be within ± 3 percent of the manufacturer's stated sizes.
- (b) **Wire mesh** shall conform to the requirements of Section 223.
- (c) **Selvedge (or perimeter) wire** shall be at least 0.148 inch in diameter (9 gage) and shall conform to the requirements of Section 223 for wire mesh.
- (d) **Tie and connection wire** shall conform to the requirements for the wire used in the mesh except that it shall be not more than two gages smaller.
- (e) **Gabion stone** shall conform to the requirements of Section 204.

610.03—Procedures.

Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into rectangular baskets. Gabions shall be of single-unit construction whereby the base, lid, ends, and sides are woven into a single unit or whereby one edge of these units is connected to the base section of the gabion. The strength and flexibility at the point of connection shall be at least equal to those of the mesh.

If the length of the gabion exceeds its horizontal width, the gabion shall be equally divided into cells by diaphragms of the same mesh and gage as the body of the gabion. The length of each cell shall not exceed its width. The gabion shall be furnished with the necessary diaphragms secured in the proper position on the base so that no additional tying at the junction will be necessary.

Perimeter edges of the mesh forming the gabion shall be securely clip bound or selvedged in such a manner that the joints formed by tying the selvedges will have at least the same strength as the body of the mesh.

Tie and connection wire shall be supplied in sufficient quantity to fasten securely all edges of the gabion and diaphragms. At least two cross-connecting wires shall be in each cell whose height is $1/3$ or $1/2$ the width of the gabion. At least four cross-connecting wires shall be in each cell whose height equals the width of the gabion. The wire shall be secured through two open loops of the gage.

Excavating and backfilling for gabions shall be performed in accordance with the requirements of Section 303. Gabions shall be placed on a smooth foundation, and the final line and grade shall be approved by the Engineer.

Each gabion unit shall be assembled by binding the vertical edges with wire ties at approximately 6-inch intervals or by stitching a continuous piece of connecting wire around the vertical edges with a coil approximately every 4 inches. Wire ties or connecting wire shall be used to join units in the same manner as described for assembling. Internal tie wires shall be uniformly spaced and securely fastened in each cell of the structure.

A standard fence stretcher, chain fall, or iron rod may be used to stretch wire baskets and hold the alignment.

Gabions shall be filled with stone in a manner that will ensure alignment, ensure a minimum of voids, and avoid bulges. Rock and connection wires shall be alternately placed until the gabion is filled. After the gabion is filled, the lid shall be bent over until it meets the sides and edges of the gabion. The lid shall be secured to the sides, ends, and diaphragms with wire ties or connecting wire in the manner described for assembling.

610.04—Measurement and Payment.

Gabions will be measured in cubic yards, complete-in-place, and will be paid for at the contract unit price per cubic yard. This price shall include furnishing and installing gabions; excavating; backfilling with suitable material; compacting; and disposing of surplus or unsuitable material.

Minor structure excavation for gabions, when specified on the plans, will be measured and paid for in accordance with the requirements of Section 303.