T. M. DOWDY
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COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION

DIVISION: MATERIALS

REPORT COVER SHEET

Soil Survey and Pavement Design Report
October 22, 2010
Authored By: Wade H. Pence III, P.G. and Travis S. Higgs, P.E.

COMMONWEALTH OF VIRGINIA
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VDOT Materials Division
Salem District
District Materials Engineer

Responsible for Pages: All

Project Description
From: Route 460
To: 0.789 Km East of Christiansburg WCL
Project UPC No.: 8746

VIRGINIA DEPARTMENT OF TRANSPORTATION

SALEM DISTRICT
MATERIALS SECTION

October 21, 2010

Peppers Ferry Road
Project 0114-154-101, PE101
Town of Christiansburg
Montgomery County
UPC# 8746, Ad. Date 09/2011

MEMORANDUM

To : Mr. T. W. DiGiulian, P.E. L.S

Subject: Soil Survey Report

DESCRIPTION:

From: Route 460
To : 0.789 Km. East of Christiansburg WCL

HISTORY

Research revealed that the travel corridor of route 114 has been in existence as long as the Department (VDOT) and possibly longer. The route has undergone many changes in the past century from a soil and gravel path to the current multi lane configuration. With the evolution of this travel corridor in mind, the soil foundation of the existing road is variable due to the many upgrades and minor alignment shifts that have occurred through time. Issues with the foundation soil and discussion of the undisturbed soil will be addressed in this report.

TOPSOIL / ROOT MAT

From field observations and measured depths in borings, the topsoil averages 200mm in depth throughout the project with the following exception: On the right side of construction baseline between stations 10+40 and 13+60, the topsoil averages 300mm. The root mat averages 450mm throughout the project area.

SOIL TYPES

There are residual and alluvial soils within the project area. These soil types were encountered in the proposed cut sections and sporadically as fill in the existing embankments. It should

be noted that the 'undisturbed' soil sampled from proposed cut sections on the project do not precisely represent what is in place beneath the existing road. Soil beneath the existing pavement appears to be a composite of the natural soils, put in place when the road was improved over the past century. The residual soils were encountered on the proposed cut slopes designed for the widening of Peppers Ferry Road. CBR samples #1,#2, and #3 were collected and described in the field as fat clay, which is residual soil from carbonate parent material. CBR #4 was collected at subgrade beneath the existing pavement and was described in the field as clayey silt, which is alluvial in origin. The alluvial soil was also encountered in drainage low areas as embankment foundation material. Samples collected from auger cuttings within the project area were tested and classified as:

- CBR #1 - (AASHTO) A-7-6(25), (ASTM) CH
- CBR #2 - (AASHTO) A-7-6(11), (ASTM) SC
- CBR #3 - (AASHTO) A-7-6(12), (ASTM) SC
- CBR #4 - (AASHTO) A-2-7(3), (ASTM) SC

See the attached CBR test reports for soil details and areas represented by each sample. Note that the subgrade beneath the existing pavement will consist of the aforementioned CBR tested soils and variable composites of the four soil types.

PAVEMENT DESIGN

Existing Pavement Information:

The majority of this project follows the existing alignment of Route 114. However, consideration of existing pavement utilization should only be considered in areas where the proposed final grade is above the existing grade. Existing pavement condition was analyzed based on visual assessments as well as analysis of retrieved pavement cores from the roadway. Based on visual assessments, the existing pavement is in good to very good condition and relatively free of any cracks, patches or other noticeable deteriorations from Sta. 3+00 to Sta. 8+00. From Sta. 8+00 to Sta. 18+30 the pavement is in fair to good condition with some signs of load and age related distresses. The visual assessment of the roadway surface correlates well with the pavement depth checks that were taken as part of the soil survey. The average existing asphalt and aggregate depths on the Route 114 mainline were 225 mm of asphalt and 290 mm of aggregate from Sta. 3+00 to Sta. 8+00 and 170 mm of asphalt and 220 mm of aggregate from Sta. 8+00 to Sta. 18+30. Pavement cores were taken in locations where utilization of the existing pavement is currently proposed. Measured asphalt cores were fairly consistent from Sta. 3+00 to Sta. 5+85, despite the numerous changes in the roadway associated with the development and

commercialization of the Route 460 Business and Route 114 intersection area. Based on the results of the visual assessment, asphalt and aggregate depth checks and asphalt core analysis, utilization of the existing pavement appears to be feasible from Sta. 3+00 to approximate Sta. 8+00. From Sta. 8+00 to Sta. 18+30, the proposed changes in the roadway geometry combined with the measured asphalt depths and condition of the existing pavement makes utilization of the existing pavement in this part of the project generally unfeasible.

CBR Descriptive Statistics:
Average CBR = 9.8
Design CBR = 6.4
Standard Deviation = 1.75
Coeff. of Variation = 18.0%

Resilient Modulus, Mr = 8,300 psi

Traffic Data:
Source: 2009 VDOT Daily Traffic Volume Estimates

Year: 2010
Design Life: 30 years
Two-Way Daily Traffic (ADT): 16,000
Traffic Growth Rate: 1.5%
Design Lane Factor: 90%
Directional Split: 59%
Percent Trailer Trucks: 1.0%
Percent Single Unit Trucks: 2.0%
ESAL Factor for Trailer Trucks: 1.05
ESAL Factor for Single Unit Trucks: 0.46
Total ESALs over Design Life: 2,303,068

Route 114 Pavement Design for New Construction:
Surface : 90 kg/m^2 Asphalt Concrete, Type SM-9.5D
Intermediate : 120 kg/m^2 Asphalt Concrete, Type IM-19.0D
Base : 125mm Asphalt Concrete, Type BM-25.0A
Subbase : 200mm Aggregate Material, Type I, 21-B
Subgrade Stabilization: 200mm No. 1 Open Graded Aggregate

NOTE: Subgrade stabilization layer explained with details in the ***UNSUITABLE MATERIAL / SUBGRADE STABILIZATION*** portion of this report.

Route 114 Rehabilitation Recommendations for Utilization of Existing Pavement (Sta. 3+00 to Sta. 8+00):

- Mill existing pavement as needed to a maximum of 50 mm in order to provide a uniform depth of intermediate and surface asphalt to the design final grade.

- Place 120 kg/m^2 (50 mm) Asphalt Concrete, Type IM-19.0D to a point 37.5 mm below the design final grade.
- Place 90 kg/m^2 (37.5 mm) Asphalt Concrete, Type SM-9.5D to design final grade.

NOTE: Based on the current plans as of the date of this report, the existing connectors with Marshall Drive and Bradley Drive are shown to be overlaid and incorporated into the proposed Route 114 mainline pavement structure. It is unfeasible for any existing connector pavements to be utilized in the proposed Route 114 mainline pavement structure as the existing connectors do not have adequate pavement structures to perform in this capacity.

Pavement Design for Connectors:
Connections shall utilize the Route 114 Pavement Design for New Construction with the exception of Majestic Drive and Stafford Drive due to the length of these connections.

Pavement Design for Majestic Drive and Stafford Drive:

Surface	:	90 kg/m^2 Asphalt Concrete, Type SM-9.5D
Base	:	100mm Asphalt Concrete, Type BM-25.0A
Subbase	:	200mm Aggregate Material, Type I, 21-B

SLOPE RECOMMENDATIONS

The subsurface investigation for this project included solid auger, hollow-stem auger, and hand auger borings in the proposed cut and embankment sections. From these borings SPT and bulk samples were collected for analysis. Samples in the soil from cut sections revealed a repeating pattern of moisture content increasing with depth. Moisture in the soil which will compose subgrade for the proposed road was as much as 72.6% above lab optimum. Of the 30 moisture samples collected during the investigation, 21 were more than 30% over lab optimum and only 3 were below. It should be noted that due to the high plasticity of the CBR samples, the water molecules will adhere to the clay particles and the soils will not readily dry when exposed to the atmosphere. If, at the time of construction, any soil is found to be more than 30% over lab optimum, it should not be placed in the embankment structure unless allowed to dry to accepted tolerances. The basis for precluding wet soil from the embankment structure is outlined in Section 303.04(h) of the 2007 Road and Bridge Specifications. Should it become necessary to utilize borrowed (off site) material to construct the embankment sections, such material should have engineering properties as good or better than the minimum design CBR of 6.4. It is estimated that bedrock will be a relatively small percentage of the overall excavation if encountered at all. Bedrock was neither encountered above subgrade in test borings

nor was it observed as outcrop in cut sections (See the ROCK DATA portion of this report for further explanation). **Based on test borings, field observations, and structural analysis, it is recommended that a 2:1 design be utilized for all embankment slopes and cut slopes throughout the project.** Top rounding of cut slopes is recommended to facilitate maintenance and minimize erosional energy. It is further recommended that all cut and embankment slopes be seeded as soon as possible due to the susceptibility of native materials to erosion. The aforementioned slope designs should offer optimum stability in soil, for cut and embankment sections. It should be noted that all embankment structures proposed should be continuously benched against the existing man-made and natural slopes in accordance with Section 303.04(h) of the 2007 Road and Bridge Specifications.

UNSUITABLE MATERIAL / SUBGRADE STABILIZATION

Test borings revealed the foundation soil at subgrade in the proposed cut sections and beneath the existing road to be wet (more than 30% over optimum moisture) at various locations. Soil sampled from cut sections and existing subgrade contained up to 48.0% moisture, with optimum moisture in CBR samples ranging between 15.7% and 29.6%. Due to the variability of composite soil beneath the road from the development and commercialization of this area and the overall wet nature of the natural soil, it is recommended that the pavement for entire project be stabilized in both cut and fill sections. In areas where the existing pavement will be utilized (overlaid), subgrade stabilization should be utilized from the outside edge of the existing pavement to the outside edge of the proposed pavement. The following recommendations should be utilized to stabilize subgrade for the entire project:

1. Where proposed subgrade encounters existing subgrade, undercut existing subgrade 200mm deep for the entire width of the proposed pavement structure and for the widening areas where existing pavement will be utilized, and remove unsuitable material. Should the excavated material be more than 30% over optimum moisture, it should be dried prior to placement elsewhere in an embankment or wasted.
2. Construct proposed subgrade to 200mm below proposed elevation where no existing material exists.
3. Construct the top 200mm of subgrade with Number 1 Open Graded Aggregate over newly constructed embankment sections and as backfill in undercut areas. The depth of No. 1 Aggregate backfill should be approximately 200mm, depending on the amount of material that subsides into the yielding soil. The No.1 Aggregate should produce higher and uniform

bearing values for the pavement structure while facilitating lateral drainage.

4. Place aggregate base and pavement on top of No. 1 Aggregate as outlined in the PAVEMENT DESIGN portion of this report.

NOTE: This recommendation for subgrade stabilization is for the entire width and length of the proposed mainline pavement (excluding areas where existing pavement will be utilized) and should be included in the pavement typical section. Designer please place a quantity of No.1 aggregate denoted as ***Subgrade Stabilization*** on the plans.

EMBANKMENT FOUNDATIONS

Field observation and test borings revealed two areas of unsuitable embankment foundation material within the project. The first area of unsuitable embankment foundation is on the left side of Peppers Ferry Road between stations 4+60 and 5+10. Multiple hand auger probes in the area revealed the foundation soil (clayey silt) to be wet to very wet and very soft. In order to construct a stable embankment in this area the following recommendations should be utilized:

1. Leave topsoil in place on original ground.
2. Place an 450mm thick layer of Number 1 Open Graded Aggregate as the bottom layer of the embankment (See Attachment A for rock layer surface area). The layer of rock should be exposed at the toe of the proposed embankment structure where possible. Exposing the rock at the toe should allow water to drain from beneath the embankment structure. Some subduction of the stabilization stone into the yielding foundation soil should be expected.
3. Place a layer of Geotextile Drainage Fabric on top of the entire layer of stabilization stone (Section 245.03(c) of the 2007 Road and Bridge Specifications). The fabric should prevent downward migration of embankment soil into the stabilization rock layer.
4. Place and compact embankment soil directly on top of Geotextile Drainage Fabric, constructing embankment utilizing standard methods.

The second area of unsuitable foundation is on the left side of Peppers Ferry Road between stations 16+75 and 16+95 (access road to SWMB #2). Multiple hand auger probes in this area revealed the foundation soil (clayey, sandy silt) to be wet and very soft. In order to construct a stable embankment in this area the following recommendations should be utilized:

1. Remove brush, fence, and debris in the denoted area, leave topsoil in place on original ground.
2. Place an 450mm thick layer of Number 1 Open Graded Aggregate as the bottom layer of the embankment (See Attachment B for rock layer surface area). The layer of

rock should be exposed at the toe of the proposed embankment structure where possible. Exposing the rock at the toe should allow water to drain from beneath the embankment structure. Some subduction of the stabilization stone into the yielding foundation soil should be expected.

3. Place a layer of Geotextile Drainage Fabric on top of the entire layer of stabilization stone (Section 245.03(c) of the 2007 Road and Bridge Specifications). The fabric should prevent downward migration of embankment soil into the stabilization rock layer.
4. Place and compact embankment soil directly on top of Geotextile Drainage Fabric, constructing embankment utilizing standard methods.

The current plans and cross sections reveal proposed major and sliver fills of existing embankment structures on this project. It should be noted that all embankment structures proposed should be continuously benched against the existing man-made and natural slopes in accordance with Section 303.04(h) of the 2007 Road and Bridge Specifications. Areas where continuous benching will be required include (but are not limited to):

1. On the right side of Peppers Ferry Road between stations 9+20 and 10+40.
2. On the left side of Peppers Ferry Road between stations 16+20 and 17+60.

UNDERDRAINS

To prevent water degradation of subgrade and pavement, it is recommended that a UD-4 for curb and gutter be installed on both sides of Route 114. Additionally, a CD-1 or CD-2 is recommended at each cut/fill interface.

ROCK DATA

From literature it was determined that bedrock within the project area will consist of shaley dolostone of the Elbrook Formation. Bedrock was neither exposed in any existing mainline cut section nor encountered above subgrade in any test boring for this soil survey. Although bedrock was not detected in soil survey borings, it may be encountered elsewhere within the project area as ledges or pinnacles (which is characteristic of karstic landforms). Based on the relatively inconsistent weathering properties of carbonate bedrock, some or most of this rock may not be rippable. As such, blasting may be required to excavate bedrock and controlled blasting techniques should be utilized should bedrock be encountered. Bedrock may be excavated via mechanical methods (ram hoe, etc.) in lieu of blasting. Note that there are private dwellings and businesses adjacent to the project area which could be damaged by

construction activities, i.e. ground vibration and air blast. In order to alleviate the Department from liability, water sources should be documented and structures which could be damaged by construction activities (ground vibration, etc.) should be inspected and documented prior to excavation of bedrock. Considering the limitations of practical investigation processes and the irregular weathering properties of carbonate bedrock, quantity and condition of bedrock in cut sections are difficult to accurately predict. It is roughly estimated that bedrock composes approximately 1% or less of the total excavation, producing roughly 22% shrinkage correction for the project.

DEMOLITION / REMOVAL of PAVEMENT

The average depths and widths of the existing pavement and aggregate for the mainline and connectors are as follows:

Peppers Ferry Road (sta. 3+00 to sta. 8+00 - 4 depth checks)
width variable and dependant on existing pavement utilized
225mm Asphalt Concrete
290mm Aggregate Base

Peppers Ferry Road (sta. 8+00 to sta. 18+30 - 6 depth checks)
9.2M average width
170mm Asphalt Concrete
220mm Aggregate Base

Ramp B (1 depth check)
6.5M width
320mm Asphalt Concrete
150mm Aggregate Base

Mall Entrances (2 depth checks)
3.5M average width
215mm Asphalt Concrete
300mm Aggregate Base

Marshall Drive (1 depth check)
8.6M width
120mm Asphalt Concrete
210mm Aggregate Base

Patriot Way (1 depth check)
8.6M width
120mm Asphalt Concrete
300mm Aggregate Base

Somerset Street (1 depth check)

9.1M	width
100mm	Asphalt Concrete
150mm	Aggregate Base

Majestic Drive (1 depth check)

7.4M	width
140mm	Asphalt Concrete
100mm	Aggregate Base

Stafford Drive (1 depth check)

7.5M	width
150mm	Asphalt Concrete
150mm	Aggregate Base

pH WATER

Surface water (of any kind) was not observed within the project limits at the time of this investigation. Inspection of the existing (metal) drainage structures did not reveal substantial acidic water degradation. It can be assumed from field observation that surface water pH should be neutral to slightly acidic for this project.

MATERIALS UNIT WEIGHTS

Asphalt Concrete:

Surface Asphalt - approximately 2456.2 kg./M^3.
Intermediate Asphalt - approximately 2456.2 kg./M^3.
Base Asphalt - approximately 2392.1 kg./M^3.

Crushed Aggregate:

No. 21-B Aggregate - approximately 2478.1 kg./M^3.
No. 1 Aggregate - approximately 1601.8 kg./M^3.

SUBSURFACE INFORMATION

This subsurface information in the soil survey report was obtained with reasonable care and recorded in good faith solely for use by the Department in establishing design controls for the project. The Department has no reason to suspect that such information is not reasonably accurate as an approximate indication of the subsurface conditions at the sites where the borings were taken. The Department does not in any way warrant or guarantee that such data can be projected as indicative beyond the limits of the borings; and any such projections by bidders are purely interpretive and altogether speculative. Further, the Department does not in any way guarantee, either expressly or by implication, the sufficiency of the information for bid purposes.

The information is available to bidders (upon request) in order that they may have access to subsurface data identical to that which is possessed by the Department, and are not intended as a substitute for personal investigation, interpretation, and judgment by the bidders.

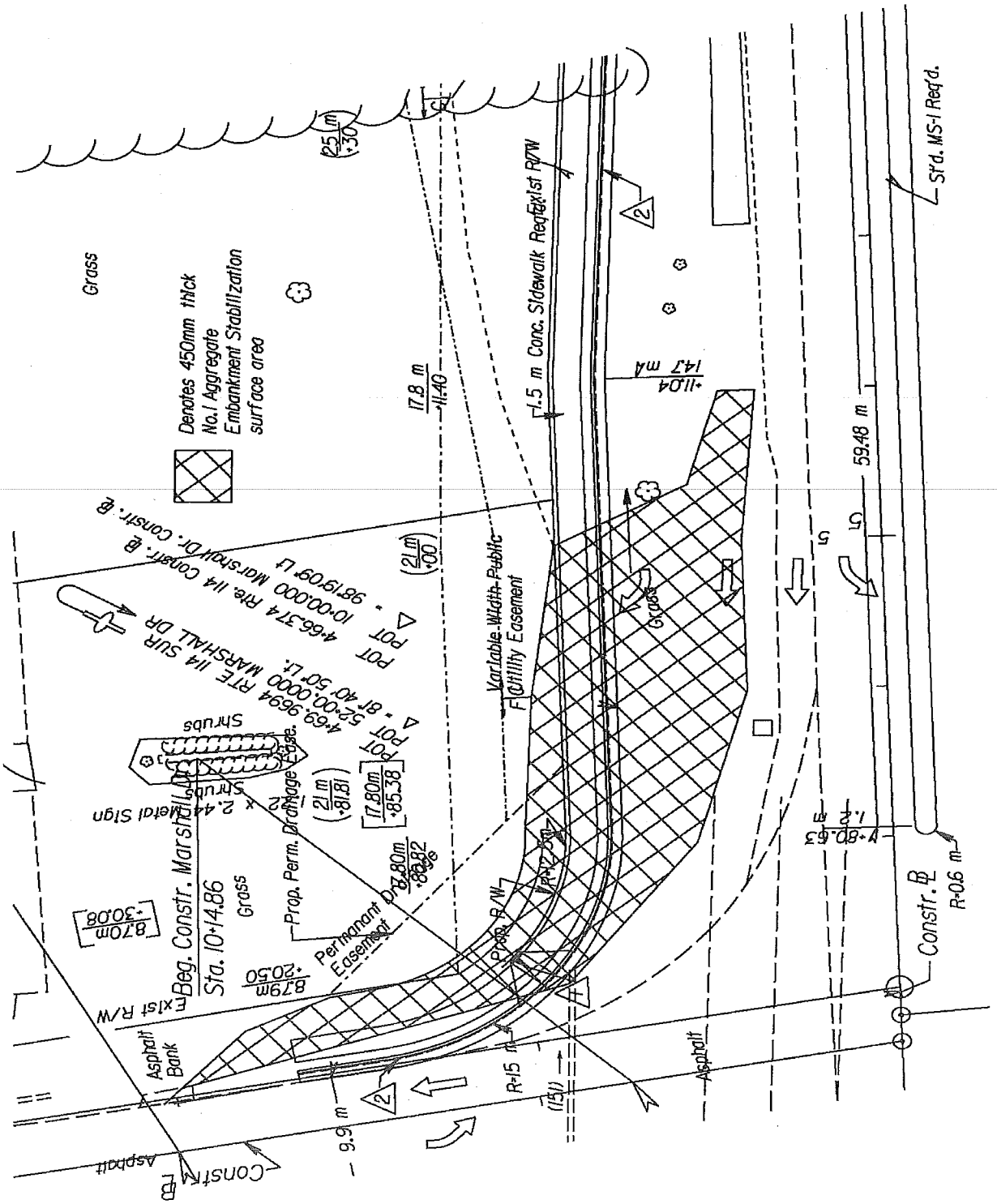
David T. Lee, PE
District Materials Engineer

Wade H. Pence, PG
District Engineering Geologist

SAC/WHP
cy: Mr. R. P. Williams, PE
Mr. T. M. Dowdy
Mr. J. Crumpacker, PE
Project File

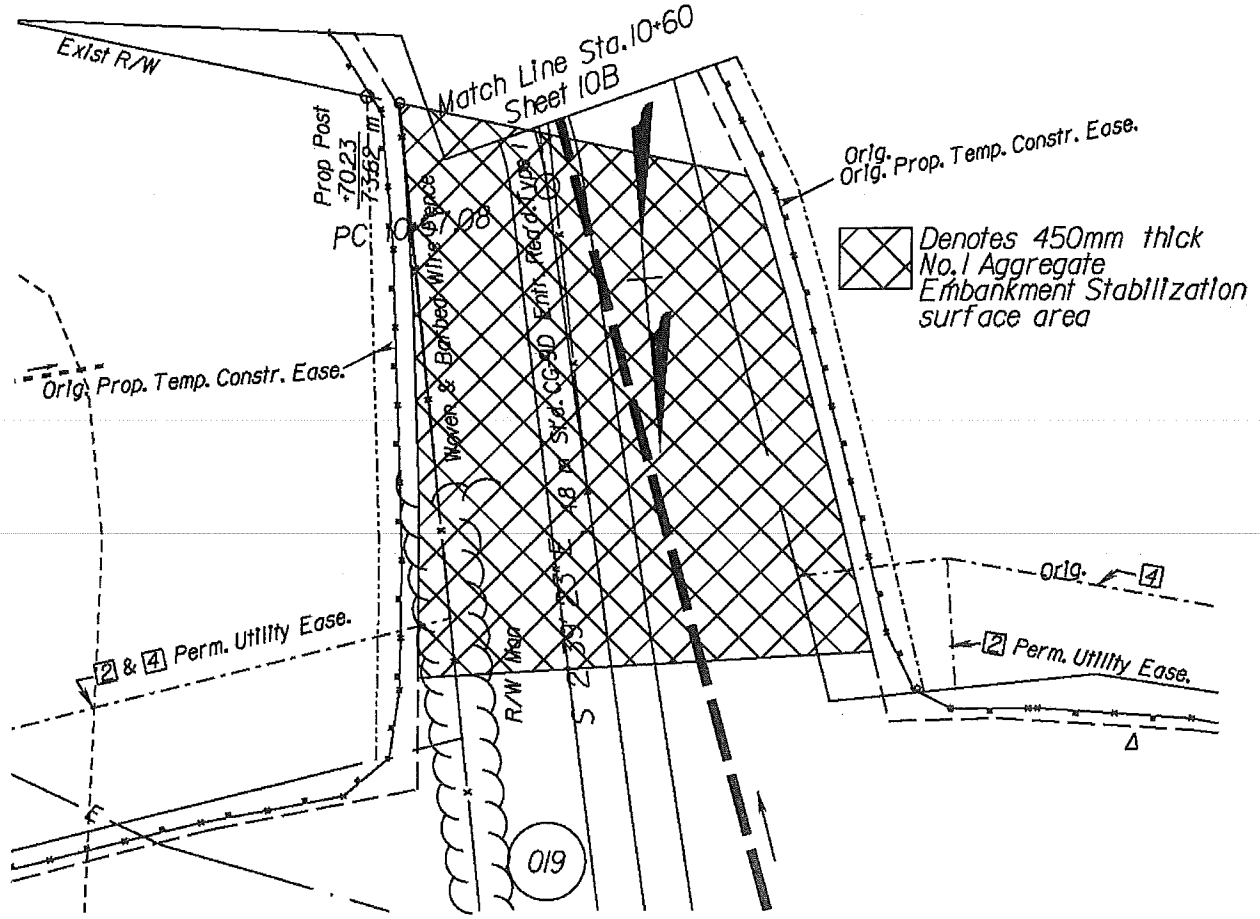
Attachment A

EMBANKMENT FOUNDATION DETAIL
(Sta. 4+60 to Sta. 5+10)



Attachment B

EMBANKMENT FOUNDATION DETAIL
(Left of Sta. 16+75 to Sta. 16+95)



PAVEMENT DESIGN CALCULATIONS

1993 AASHTO Pavement Design

DARWin™ Pavement Design System

A Proprietary AASHTOWARE™

Computer Software Product

VDOT

Flexible Structural Design Module

UPC 8746 (0114-154-101)
Montgomery County / Town of Christiansburg
Route 114

Flexible Structural Design Module Data

18-kip ESALs Over Initial Period:	2,303,068
Initial Serviceability:	4.2
Terminal Serviceability:	2.9
Reliability Level (%):	90
Overall Standard Deviation:	0.49
Roadbed Soil Resilient Modulus (PSI):	8,300
Stage Construction:	1
Calculated Design Structural Number (SN):	***4.18***

Specified Layer Design

Layer	Material	Str. Coeff.	Dra. Coeff.	Thickness	Application:	Calc. SN
1	SM-9.5 mm	0.44	1	37.5mm	90 kg/m^2	0.66
2	IM-19.0 mm	0.44	1	50mm	120 kg/m^2	0.88
3	BM-25.0 mm	0.40	1	125mm	-	2.00
4	Cement Treated Agg.	0.12	1	200mm	-	0.96
TOTAL	-	-	-	412.5mm	-	4.50

Simple ESAL Calculation

Performance Period (years):	30
Two-Way Daily Traffic (AADT):	16,000
Heavy Vehicle % (FHWA Class 5 or greater:	3
Number of Lanes in Design Direction:	2
Percent of Trucks in Design Direction:	59
Percent of Trucks in Design Lane:	90
Avg. Initial Truck Factor (ESALs/Heavy Veh):	0.657
Annual Traffic Growth Rate (%):	1.52
Total Calculated Cumulative ESALs:	***2,303,068***

Form TL-32MC

VDOT

VIRGINIA DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION
REPORT ON SAMPLE OF SOIL

AAP AASHTO R18

Report No.:	52-8041	Salem, VA	Date:	09/20/2010
Project:	0114-154-101, P101		Route No.:	114
County:	Town of Christiansburg		Sample No.:	1
Subm. By:	SAC		PPMS	8746 / 714
Date Sampled:	08/25/2010		Date Received:	08/26/2010
Location:	22.5m Lt. Sta. 4+20			
Field Description:	Tan-ornage fat Clay w/ silt, trace sand, moist to wet		Depth:	0.0m - 3.0m

ASTM Description: **Sandy fat CLAY (CH)**

Particle Size Analysis, VTM-25

Sieve	*% Passing*
1 1/2"	100.0
1"	100.0
3/4"	100.0
3/8"	100.0
No. 4	99.3
No. 10	98.7
No. 20	96.7
No. 40	91.1
No. 60	82.3
No. 80	73.7
No. 100	69.0
No. 200	56.7

Optimum Moisture, AASHTO T 99

Total Soil	%
-4 Portion	**25.2%**
Natural Moisture	34.5%

Max Dry Density, AASHTO T 99

Total Soil	lbs/ft^3
-4 Portion	**95.5** lbs/ft^3

Atterberg Limits, AASHTO T 89, T 90

Liquid Limit	73.9
Plastic Limit	24.6
Plasticity Index	49.3

Soil Classification :

AASHTO M 145	**A-7-6(25)**
ASTM D 2487	**CH**

CBR Data, AASHTO T 193

	Unsoaked	Before Soaking	After Soaking
CBR Value			**10.7**
% Moisture		25.2	28.7
% Density		101.4	99.4
Unit Weight (lbs/ft^3)		96.8	94.9
% Swell			**0.5**
% Moisture Top Inch			28.8

Remarks: From Sta. 3+00 To Sta. 7+90

Reported by: DCL

David T. Lee, P.E.
District Materials Engineer

Form TL-32MC

VDOT

VIRGINIA DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION
REPORT ON SAMPLE OF SOIL

AAPR AASHTO R18

Report No.:	52-8042	Salem, VA	Date:	09/20/2010	
Project:	0114-154-101, P101		Route No.:	114	
County:	Town of Christiansburg		Sample No.:	2	
Subm. By:	SAC		PPMS	8746 / 714	
Date Sampled:	08/30/2010		Date Received:	08/30/2010	
Location:	14m Rt. Sta. 8+20				
Field Description:	Tan-brown fat Clay, trace silt, sand, & gravel		Depth:	0.0m - 3.0m	

ASTM Description: **Clayey SAND (SC)**

Particle Size Analysis, VTM-25

Sieve	*% Passing*
1 1/2"	100.0
1"	100.0
3/4"	100.0
3/8"	100.0
No. 4	99.8
No. 10	98.6
No. 20	91.5
No. 40	77.7
No. 60	64.4
No. 80	55.1
No. 100	50.4
No. 200	38.8

Optimum Moisture, AASHTO T 99

Total Soil	%
-4 Portion	**26.0%**
Natural Moisture	38.3%

Max Dry Density, AASHTO T 99

Total Soil	lbs/ft^3
-4 Portion	**93.6** lbs/ft^3

Atterberg Limits, AASHTO T 89, T 90

Liquid Limit	74.3
Plastic Limit	23.3
Plasticity Index	51.0

Soil Classification :

AASHTO M 145	**A-7-6(11)**
ASTM D 2487	**SC**

CBR Data, AASHTO T 193

	Unsoaked	Before Soaking	After Soaking
CBR Value			**7.4**
% Moisture		26.1	28.8
% Density		99.5	98.5
Unit Weight (lbs/ft^3)		93.1	92.2
% Swell			**1.5**
% Moisture Top Inch			32.6

Remarks: From Sta. 7+90 To Sta. 10+50
0
0
0
0

Reported by: DCL

David T. Lee, P.E.
District Materials Engineer

Form TL-32MC

VDOT

VIRGINIA DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION
REPORT ON SAMPLE OF SOIL

AAP AASHTO R18

Report No.:	52-8043	Salem, VA	Date:	09/28/2010	
Project:	0114-154-101, P101		Route No.:	114	
County:	Town of Christiansburg		Sample No.:	3	
Subm. By:	SAC		PPMS	8746 / 714	
Date Sampled:	08/30/2010		Date Received:	08/30/2010	
Location:	10m Rt. Sta. 11+40				
Field Description:	Tan-orange-red fat Clay, trace silt		Depth:	0.0m - 5.5m	

ASTM Description: **Clayey SAND (SC)**

Particle Size Analysis, VTM-25

Sieve	*% Passing*
1 1/2"	100.0
1"	100.0
3/4"	100.0
3/8"	100.0
No. 4	99.8
No. 10	96.6
No. 20	83.6
No. 40	68.2
No. 60	56.6
No. 80	49.4
No. 100	45.9
No. 200	37.9

Optimum Moisture, AASHTO T 99

Total Soil	%
-4 Portion	**29.6%**
Natural Moisture	43.9%

Max Dry Density, AASHTO T 99

Total Soil	lbs/ft^3
-4 Portion	**88.7** lbs/ft^3

Atterberg Limits, AASHTO T 89, T 90

Liquid Limit	80.8
Plastic Limit	25.8
Plasticity Index	55.0

Soil Classification :

AASHTO M 145	**A-7-6(12)**
ASTM D 2487	**SC**

CBR Data, AASHTO T 193

	Unsoaked	Before Soaking	After Soaking
CBR Value			**11.4**
% Moisture		30.4	34.2
% Density		101.5	99.0
Unit Weight (lbs/ft^3)		90.0	87.8
% Swell			**0.9**
% Moisture Top Inch			33.0

Remarks: From Sta. 10+50 To Sta. 13+40

Reported by: DCL

David T. Lee, P.E.
District Materials Engineer

Form TL-32MC

VDOT

VIRGINIA DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION
REPORT ON SAMPLE OF SOIL

AAR AASHTO R18

Report No.:	52-8045	Salem, VA	Date:	09/28/2010	
Project:	0114-154-101, P101		Route No.:	114	
County:	Town of Christiansburg		Sample No.:	4	
Subm. By:	SAC		PPMS	8746 / 714	
Date Sampled:	09/02/2010		Date Received:	09/02/2010	
Location:	4.0m Lt. Sta. 15+35				
Field Description:	Tan-gray-yellow clayey Silt w/ sand, trace gravel		Depth:	0.0m - 2.5m	

ASTM Description: **Clayey SAND (SC)**

Particle Size Analysis, VTM-25

Sieve	*% Passing*
1 1/2"	100.0
1"	100.0
3/4"	100.0
3/8"	98.1
No. 4	91.9
No. 10	72.4
No. 20	57.2
No. 40	48.4
No. 60	43.3
No. 80	40.5
No. 100	39.1
No. 200	34.8

Optimum Moisture, AASHTO T 99

Total Soil	%
-4 Portion	**15.7%**
Natural Moisture	21.0%

Max Dry Density, AASHTO T 99

Total Soil	lbs/ft^3
-4 Portion	**110.6** lbs/ft^3

Atterberg Limits, AASHTO T 89, T 90

Liquid Limit	43.9
Plastic Limit	18.8
Plasticity Index	25.1

Soil Classification :

AASHTO M 145	**A-2-7(3)**
ASTM D 2487	**SC**

CBR Data, AASHTO T 193

	Unsoaked	Before Soaking	After Soaking
CBR Value			**9.5**
% Moisture		16.1	20.9
% Density		101.5	99.5
Unit Weight (lbs/ft^3)		112.3	110.0
% Swell			**0.6**
% Moisture Top Inch			20.2

Remarks: From Sta. 13+40 To Sta. 18+30

Reported by: DCL

David T. Lee, P.E.
District Materials Engineer