



October 28, 2014

Ms. Ginny England, P.E.
Johnson, Mirmiran & Thompson, Inc.
9201 Arboretum Parkway, Suite 310
Richmond, Virginia 23236

Subject: Addendum No. 1, Geotechnical Engineering Study, New Carter Gallier Boulevard, Powhatan County, Virginia, VDOT Project No. 1343-072-144, UPC 8216 (Schnabel Project No. 13613130)

Dear Ms. England:

SCHNABEL ENGINEERING CONSULTANTS, INC. (Schnabel) is pleased to submit Addendum No. 1 to our geotechnical engineering report dated July 16, 2014 (report). The purpose of this addendum is to expand on the previous recommendations regarding our identification of potentially unsuitable materials and their potential reuse on this project.

BACKGROUND

The recommendations contained in our report for unsuitable materials include materials considered for use:

- As embankment fill,
- Within 3 ft below the pavement or fill subgrade level,
- Within 2 ft below the bedding material of minor structures,
- Laterally within 2 ft of the outside edge of the pavement shoulders,
- Laterally within 2 ft of the limits of bedding material of minor structures.

Unsuitable materials are materials within the areas described above that:

- Classify as CH, MH, OH or OL in accordance with the Unified Soil Classification System (USCS),
- Contain more than 5 percent by weight organic matter,
- Exhibit a swell value greater than 5 percent as determined from the California Bearing Ratio (CBR) test using VTM-8,
- Materials within 3 ft of the pavement subgrade that exhibit a CBR value of less than 5.
- Saturated or very dry and/or loose or very soft soils that exhibit excessive pumping or rutting under the weight of construction equipment. If these near-surface materials can be moisture conditioned (mechanically or chemically) to an acceptable moisture content that allows adequate

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Carter-Gallier Boulevard, Powhatan County, VA**

compaction to meet project specifications, and classification testing indicates they are not otherwise unsuitable.

- Topsoil, peat, coal and carbonaceous shale.
- Are denoted in the Contract Documents as unsuitable.

A summary of the estimated undercuts included in our report are provided as Table 7-1. In areas to be filled, the estimated undercut depths shown in Table 7-1 are referenced from the existing ground surface (i.e. these depths include the topsoil thickness measured in the borings). In cut areas, the undercut depths in Table 7-1 are referenced from the proposed final subgrade elevation. The fourth column from the left in Table 7-1 denotes areas of cuts and fills at the boring locations.

Table 7-1: Estimated Undercut Summary

Boring Number	Approx. Carter Gallier Station Start	Approx. Carter Gallier Station End	Approx. Planned Cut (C) or Fill (F) Depth (ft)	Estimated Undercut Depth (ft)	Reason for Undercut
14BH-004	102+00	104+00	C8	3	Low CBR
14BH-005	104+00	106+00	C15	2	High moisture
14BH-006	106+00	108+00	C12	2	High moisture
14BH-007	108+00	110+00	F12	2	Low N value
14BH-008	110+00	112+00	F12	2	Low N value
14BH-012	118+00	120+00	F9	2	Low N value
14BH-015	124+30	126+30	F1	2	High moisture
14BH-017	127+80	128+75	C2	2	High moisture
14BH-022	35+50 (Rt 60)	38+50 (Rt 60)	C1	2	High moisture

ADDITIONAL RECOMMENDATIONS

High Moisture Content Soils

The primary reason the soils in cut areas included in Table 7-1 are unsuitable is high moisture content. We anticipate the contractor will scarify and dry these soils for use as fill when and where possible but some of the soils might be difficult to dry during cooler, wetter times of the year.

Lime modification could be used as an alternative to dry these soils so they could be used as fill. A VDOT Special Provision for Lime Modification is included as an attachment to this addendum. Lime modification means mixing a small amount (approximately 3% by weight) of hydrated lime or quick lime into the soils to dry them for use as embankment fill. Per the special provision, lime modification should be used for soils at least 30% above optimum moisture; this includes many of the unsuitable material encountered in the cut areas shown in Table 7-1.

Soft or Loose Fill Subgrade Soils

Table 7-1 indicates potential undercut in the deep fill area between approximate Stations 108+00 and 112+00 due to the presence of soils with low N values (i.e. low strength) at the fill subgrade level. The

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depth of ground water in this area is also shallow which would make undercutting and replacing these soils difficult without dewatering.

As an alternative to undercutting these soils, we recommend bridging over these unsuitable materials with crushed stone and stabilization geotextile. The crushed stone should meet the requirements of VDOT No. 57 or No. 3 crushed stone and this layer should be at least 18 inches thick. The stabilization geotextile should meet the requirements of the VDOT Road and Bridge Specifications Section 245.03 (d)(1) for *Subgrade Stabilization Fabric*.

LIMITATIONS

Except as noted above, the recommendations in our report remain unchanged. Please refer to our report dated July 16, 2014 for additional information.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or other instrument of service.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

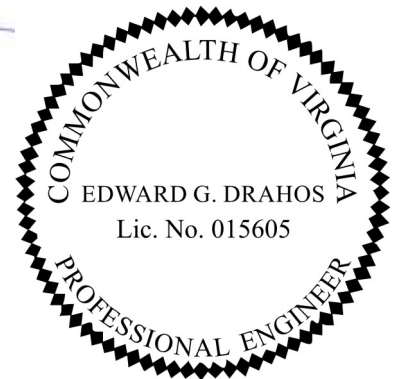
Sincerely,
SCHNABEL ENGINEERING CONSULTANTS, INC.



Paul T. Johnston, EIT
Senior Staff Engineer



Edward G. Drahos, PE
Senior Reviewer



PTJ:EGD:ms

Attachment: VDOT Special Provision for Lime Modification of Soils (March 12, 2007)

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
LIME MODIFICATION OF SOILS

March 12, 2007

I. DESCRIPTION

This work shall consist of modifying embankment material using a mixture of available soils and pelletized quick lime for the purpose of drying the soils to aid in achieving compaction.

II. MATERIAL

Lime shall conform to the requirements of Section 240 of the Specifications.

Water shall conform to the requirements of Section 216 of the Specifications.

III. PROCEDURES

Lime modification of soils shall be performed when the moisture content of the soils for use in embankments is at least 30 percent above optimum moisture as determined by VTM-1. Lime modification will not be permitted on frozen soils or when the ambient temperature is below 40 degrees F. Once delivered to the project, pelletized quick lime shall be adequately protected to prevent hydration of the quick lime.

The embankment soils to be modified shall be spread across the entire width of the embankment in lifts not to exceed 8 inches. For successive lifts, the surface of the previous lift shall be scarified to a depth of approximately 2 inches to permit "bonding" of successive lifts. The soils shall be partially pulverized to allow for greater surface area and lime shall be applied within 4 hours of soil placement at a rate of approximately 3 percent by weight of the soil to be modified (approximately 20lbs/sy for 8-inch depth).

Spreading equipment shall uniformly distribute the lime without excessive loss. Any procedure, which results in excessive loss or displacement of the lime, shall be immediately discontinued. No traffic will be allowed to pass over the spread lime until after completion of mixing.

The lime shall be mixed throughout the scarified material as thoroughly as practical. The mixer shall make continuous passes until it has produced a homogeneous mixture of soil and lime. The soil-lime mixture shall be free from streaks or pockets of unmixed lime. The mixing operation shall not penetrate more than 4 inches into the previously modified layer.

The treated material shall be acceptable for compaction when all of the applied lime has hydrated and the moisture content is within 20 percent of the optimum moisture content and 90 percent of the material passes the ¾ inch sieve. Additional water may need to be added to ensure complete hydration. The cost for additional water for hydration or dust control shall be included in the price for pelletized quick lime. The material shall then be compacted to 95 percent of the maximum dry density and within optimum moisture up to 20 percent of optimum moisture. Final compaction of subgrade shall be in accordance with Section 305 of the Specifications.

Dust control shall be in accordance with Section 511 except that all costs shall be included in the bid price for pelletized quick lime. The Contractor is responsible for compliance with all OSHA regulations governing the use of quick lime. Lime modification within 300 feet of a habitable structure shall be performed with a quick lime slurry in accordance with Section 306.03 (c) of the Specifications.

IV. MEASUREMENT AND PAYMENT

Lime will be measured in tons of pelletized quick lime, complete-in-place, and will be paid for at the contract unit price per ton of lime. Price shall include the cost of dust control. Manipulation will be measured in cubic yards of material, complete in-place and will be paid at the contract unit price per cubic yard. No payment will be made for pelletized quick lime which becomes hydrated or partially hydrated due to improper storage.

Manipulation will be measured in cubic yards and paid for at the contract bid price per cubic yard. Price shall include preparing the embankment material, scarifying, pulverizing, mixing, adding water and compacting the lime modified soils.

Weighing shall be performed in accordance with the requirements of Section 109.01 except that transporting vehicles shall be tared prior to each load.

Payment will be made under:

Pay Item	Pay Unit
Pelletized quick lime	Ton
Manipulation	Cubic Yards