


Geotechnical Challenges in Roadway Design and Construction
 Michelle E. Bolding, PE / August 22, 2019

Photos provided by VDOT

What Geotechnical Information Do I Need?

- What is the bearing capacity/pile length?
- What is the time for settlement/consolidation?
- Do I need a liner/underdrain?
- What is the volume of undercut/borrow?
- Is rock rippable?
- How thick is the pavement section?




Geotechnical Considerations


- Desk study – site conditions
- Planned Work - scope
 - Structures
 - Stormwater
 - Grading
 - Construction Sequencing
- Environmental Considerations
- Geotechnical Investigation
- Geotechnical Recommendations



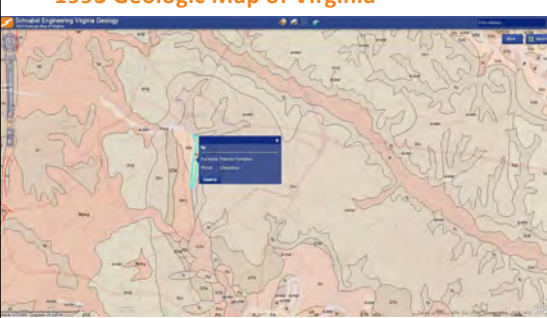
DESK STUDY




Geology Maps
 USDA Maps
 Available Geotechnical Data

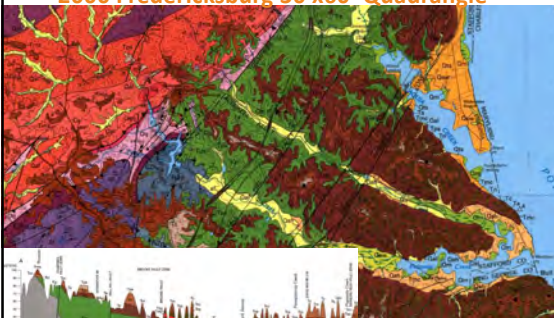



1993 Geologic Map of Virginia

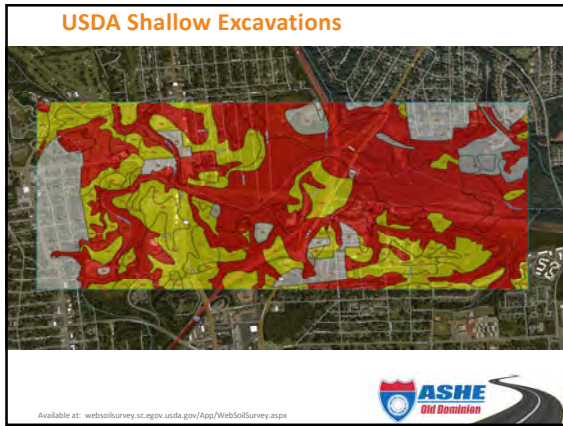




2000 Fredericksburg 30'x60' Quadrangle

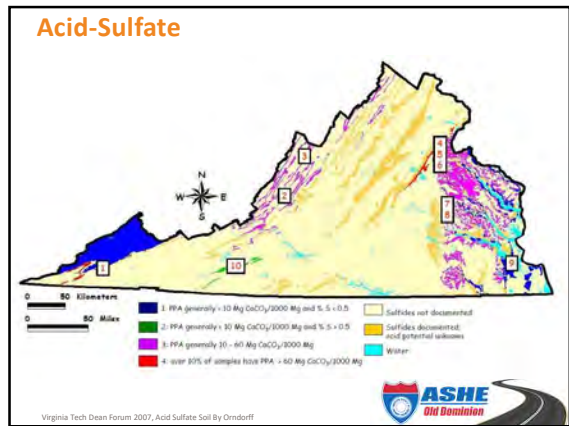
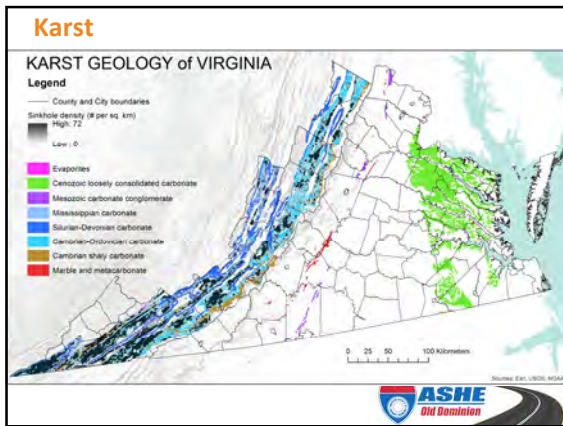






SPECIAL CONSIDERATION SOILS

Karst
Acid-sulfate
Shrink-Swell
Over-consolidated Clays
Organic/soft Clays
Rock Excavation



Structures

- Bridges
- Retaining Walls
- Noise Barriers
- Large Signs & Signals

Photos courtesy of VDOT

Structures - Bridges

- Foundation type
 - Shallow/Deep
- Scour Considerations
- Corrosion
- Foundation loads
- Means/methods
- Future Loading
 - Widening
 - Embankment settlement
- Schedule




Photo courtesy of VDOT

Structures – Retaining Walls

- Wall type
 - Gravity, MSE, Modular
 - Permanent tie-back/anchor
- External Stability
 - Sliding, overturning, bearing
- Global Stability
- External Forces
 - Subject to Impact
 - On a slope
- Schedule






Photo courtesy of VDOT

Structures – Noise Barriers, Signs, and Signals

- Usually not certain early
- Usually designed by the specialty contractor
- Geotech data helpful for obtaining realistic pricing




Photo courtesy of VDOT

Stormwater Facilities

- Stormwater Basins
- Bioretention Basins
- Water Quality Swales
- Culverts & Pipes





Photos courtesy of VDOT

Stormwater Facilities – Basins

- Depth to groundwater
- Permeability of soil
- Slope stability of basin embankments







Photo courtesy of VDOT

Stormwater Facilities – Culverts and Pipes

- Culverts
 - Scour
 - Corrosion
 - Subgrades
- Pipes
 - Tunneled/Bored
 - >36 inches diameter

Photos courtesy of VDOT

Grading

- Cuts/Fills
- Existing Structures
- Rock Excavation
- Slopes and walls







Grading

- On-site soil reuse
 - Suitable or unsuitable
 - Moisture Conditioned
 - Chemically stabilized
- Consolidation Settlement
 - During/post construction
 - Impact on existing structures
- Material Selection
 - Approved for use
- Rock Excavation
 - Rippable or blast



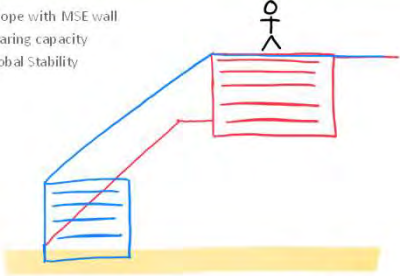


Grading - Slopes

- Height and purpose
 - >10 ft. or >25 ft.
 - Impounds water
 - Support structure
 - Failure damage property, \$\$\$
- Factors of Safety
 - 1.3 for non-critical w/ lab data
 - 1.5 without lab data
 - 1.5 for critical slopes
- Cuts –
 - Potomac Formation (OC)
 - Highly plastic soils

Grading – Walls on Slopes

- Fill slope with MSE wall
 - Bearing capacity
 - Global Stability

Construction Sequencing

- Schedule
- Time of Installation
- Schedule
- Impact on Adjacent Structures
- Schedule






Photo courtesy of VDOT

Construction Sequencing

- Cost of time
- Critical path
- Foundation Installation
 - Testing procedures
- Consolidation Settlements
 - Accelerated
- Means and methods
- Remediation, remove, and replace







Photo courtesy of VDOT

Completed:
Basic Site Geology
Project Scope

Next:
Planning the Field Work



Planning the Geotechnical Investigation

- Environmental Issues
 - Permitting
 - Wetlands
 - Time of Year Restrictions (TOYR)
- Previous Site Use
 - Cultural Resources
 - Potential Contamination








Photo by Kentucky Department of Fish and Wildlife.




Planning the Geotechnical Investigation

- Site Access
 - Allowable work hours
 - Weather Impacts
 - Adjacent Projects (LCAMs)
 - Utilities
 - Property Owner Notifications
 - Physical Access






Photos courtesy of VDOT and Schnabel Engineering.



Planning the Geotechnical Investigation

- Planning the Field Exploration
 - Boring locations & depths
 - Sample locations
 - Bulk,
 - Shelby tubes,
 - Rock cores
 - CPT, DMT, and Seismic Cones
 - Groundwater observation wells
 - In-situ permeability tests





2019 ASHE Old Dominion Scholarship Golf Tournament Engineering Scholarship Details




Two **\$2,000** scholarships for tuition, books, and fees!

<p>Eligibility criteria for John Tyler Community College include:</p> <ul style="list-style-type: none"> • Completion of scholarship application form • Must have at least a 2.5 GPA • Must be enrolled full-time at John Tyler • Must demonstrate financial need • Must be enrolled in the Engineering Degree program • Must have completed at least 30 credits toward degree 	<p>Eligibility criteria for J. Sargeant Reynolds Community College include:</p> <ul style="list-style-type: none"> • Completion of scholarship application form • Must have at least a 2.5 GPA • Must be enrolled full-time at J. Sargeant Reynolds • Must be enrolled in the Civil Engineering Technology track • Must have completed at least 12 credits toward degree
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10th Annual Scholarship Golf Tournament

October 17, 2019

<p>Gold Sponsor \$500 Includes hole sponsorship & 4 golf registrations</p>	<p>Beverage Cart Sponsor \$250</p>
<p>Silver Sponsor \$300 Includes hole sponsorship & 2 golf registrations</p>	<p>Hole Sponsor \$150 Companies may set up display spaces at the hole.</p>

\$100 per player includes:
18 holes of golf, cart, lunch, sit-down dinner, drink tickets, & more!
Awards dinner immediately follows golf.
Sponsorships available – see below!

Birkdale Golf Club
Captain's Choice Format
4-person teams

11:00 AM Check-in / Range Balls
12:00 PM Shotgun Start



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