What’s New with the NCDOT GEU?

- Geosynthetic Reinforced Soil (GRS)–Integrated Bridge System (IBS)
  - FHWA EDC-3 Innovation
- Geocells for Slope Erosion Control
  - Issues with establishing vegetation on steep RSS
- Compaction Grouting for Bridge Approach Slabs
  - Issues with repeatedly slab jacking settling bridge approach slabs
The NCDOT GRS–IBS

- Segmental Retaining Wall (SRW Units) instead of Concrete Masonry Units (CMU)
- Geogrids instead of geotextiles
- Cast-in-Place (CIP) footing instead of precast or no footing
- Bridge approach slab instead of paved asphalt approach
- Expecting significantly accelerated construction but maybe not substantially reduced construction costs

NCDOT GRS–IBS Pilot Project

- Anson County Bridge No. 201 on Rocky Mountain Church Road over Big Branch Creek
- Little Scour – shallow rock approx. 2 ft below stream bed
- Very Low Risk – 90° skew, April letting, 100 yr storm 2 ft below low chord, single span cored slab, no MOA required, minimal design rework, etc.
- Received a $400,000 grant from FHWA
Anson County Bridge No. 201

GRS Details

GRS Retaining Wall with SPM Units - Typical Section
Future Plans

- GRS abutment fails in connection per AASHTO MSE wall design
- GRS wall can be designed as an MSE wall per AASHTO without the bridge surcharge loads
  - Minimal connection needed with geogrid reinforcement at every layer
- Allows for standard MSE wall design with different combinations of SRW units, geogrids and backfills
- Revise MSE wall policy to be in line with standard GRS wall – ✔ Done, effective 1/5/15

Permanent Soil Reinforcement Mat, i.e., Turf Reinforcement Mat (TRM)
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Cellular Confinement Systems, i.e., “Geocells”
NC 33 over Norfolk Southern RR in Chocowinity, NC

NC 33 over Norfolk Southern RR in Chocowinity, NC
NC 33 over Norfolk Southern RR in Chocowinity, NC

NC 33 over Norfolk Southern RR in Chocowinity, NC
Future Plans

<table>
<thead>
<tr>
<th>EROSION CONTROL PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>Typical Application</td>
</tr>
<tr>
<td>Typical Material</td>
</tr>
<tr>
<td>Typical Longevity</td>
</tr>
</tbody>
</table>

Approach Slab Settlement
Slab Jacking

Dual Bridges on Cary Parkway over Norfolk Southern RR
Dual Bridges on Cary Parkway over Norfolk Southern RR

Compaction Grouting
Future Plans

• Division 5 is looking at using Bridge Maintenance funds for permanent fix

• Applying for $100,000 grant from FHWA for an Accelerating Innovation Development (AID) Demonstration Project to partially cover costs

• Implement new grout types with approved product list (APL) for prepackaged grout – ✔ Done, effective March 2015 Letting

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Updated Section 1003
Grout Production and Delivery

TABLE 1003-2

<table>
<thead>
<tr>
<th>Type of Grout</th>
<th>Minimum Compressive Strength at Height Change at 28 days</th>
<th>FlowA/SlumpB</th>
<th>Minimum Durability Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,000 psi – – 10</td>
<td>–3 0 sec –</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>T a b l e 1C Fluid ConsistencyC – 35,000 psi – 0</td>
<td>–0 . 2 % Per Accepted Grout Mix Design/Approved Packaged Grout 80</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>4D 600 psi 1,500 psi – 10</td>
<td>–2 6 sec –</td>
<td>80</td>
</tr>
<tr>
<td>4*</td>
<td>5 – 500 psi – 1</td>
<td>–3 “ –</td>
<td>–</td>
</tr>
<tr>
<td>5</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

A. Applicable to Type 1 through 4 grouts.
B. Applicable to Type 5 grout.
C. ASTM C1107.
D. Use Type 4 grout with proportions by volume of 1 part cement and 3 parts fly ash.

Type 5 Grout for Compaction Grouting