GEOTECHNICAL CONSTRUCTION OVERVIEW

• Earthwork Technical Process Reviews
• Sulfate Content Testing Comparison
• New Supplement 1122 for TEX-145

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Earthwork Technical Process Reviews

• 10 Specification Items
• 15 Projects
• 10 Districts
• 12 Contractors
Item 203 – Roadway Excavation And Embankment

- 3 Projects – 2 Interstates & 1 slide repair
Item 206 – Chemically Stabilized Subgrade

• 6 Interstate reconstruction projects
• Good compliance with specification
• Concerns
  – Curing coat application
  – Stabilization at phase interface
  – Subgrade sampling
Chemically Stabilized Subgrade

- CURING COAT APPLICATION
  - Uniform
  - Spotty
  - Not evident
Chemically Stabilized Subgrade

- **TREATMENT AT PHASE LINE**
  - Stabilizer cannot get all the way to the edge of existing pavement
  - If space permits, overlapping can be provided
Chemically Stabilized Subgrade

• Treatment at phase line
  – Cement spread to existing pavement edge
  – Grader or dozer digs out material along edge
  – Stabilizer blends as close as possible
  – Return blended material back, and compact
• **SUBGRADE SAMPLING**

  - Random sampling of subgrade for mix design
  - Biased sampling - where easiest to obtain
    – From median, only below shoulder, ignore phasing

• S 1120 revised January 2015

When this supplement is used during construction for stabilizing subgrade (Item 206), collect samples of in-place soil at the proposed subgrade elevation. ... For in-place soil samples, collect the samples from locations distributed across the treated area. For phased construction, collect in-place soil samples from locations distributed across the treated area of each phase at the frequency given above. Obtain the Department’s approval before collecting samples from outside the treated area.
Chemically Stabilized Subgrade

• Subgrade consisted of Fine Sand
• Treatment 16-in deep with 6.5% cement
• Grading equipment could not get smooth surface on the day of treatment
• Allowed to set for a day, then performed grading & cure coat
Item 507 – Bearing Piles

- Railroad Underpass – HP 14x73, 75-80 ft long

- Bedrock refusal required due to a confined aquifer
- Not carried to plans
- Plan Note allowed 1.5×UBV
- Piles had to be installed in 70-foot prebored holes
Item 840 – Mechanically Stabilized Earth Wall

• 3 Projects - different systems & contractors
• Panel & joint alignment common issues
Mechanically Stabilized Earth Wall

• Bolts inserted from top
  – Can’t see nut
  – Connection must be bolted not pinned
• No washer below bolt
  – Protects galvanization from tools
Mechanically Stabilized Earth Wall

• Temporary steel reinforcements crossing permanent geosynthetic straps
  – Potential for damage to permanent wall
• Shop drawings submitted separately and only showed one wall system
Mechanically Stabilized Earth Wall

• Backfill placement behind facing panel
  — Extend horizontally to back of panel
  — Space provided only at lowest row to prevent kick-out of bottom panel
Mechanically Stabilized Earth Wall

- Geotextile power-nailed to panel

- For this system, backfill to panel once reinforcement has been covered to free end
Mechanically Stabilized Earth Wall

- Temporary welded wire-faced walls
- Overlap of facing panels

✗ No overlap ⇒ Bulging
✓ Correct Overlap
Item 863 - Reinforced Soil Slope

- Project – Interchange reconstruction with limited R.O.W. (VECP replaced an MSE wall)

- Trucks driving on geogrid

- Geogrid folded & wrinkled
Sulfate Content Testing Comparison

• Cem-Base recruited several geotechnical laboratories for a review of the testing procedure in TEX 145-E.
  – Cem-Base, Inc.
  – Construction Consulting and Testing
  – CTL Engineering
  – Resource International
  – Soil and Material Engineers

• 18 subgrade soil samples from NW Ohio
• Blended, split samples given to each lab
• Lab Manager went to each lab to observe and document the lab’s procedure
TEX-145 Procedure

1. Dry sample & split to get a representative 100 g sample
2. Pulverize to pass No. 40 Sieve
3. Soak 20 g soil in 200 mL water for at least 12 hours to dissolve the soluble sulfate in the soil sample
4. Filter the solution and collect filtrate (1:20 dilution ratio)
5. Fill a sampling vial with filtrate
6. Use the vial to ‘zero’ the colorimeter
7. Add barium chloride reagent to the vial to form barium sulfate which clouds the water
8. Place the vial in the colorimeter to measure the turbidity
9. Repeat as necessary by diluting the filtrate to get a reading
10. Sulfate Content = Colorimeter Reading x Dilution Ratio
Variable Steps Identified

- Sample Drying: Oven 104°F (2), <140°F (2) or Air (1)
- Crushing Sieve: No. 40 (5)
- Replicate Testing Samples:
  - Three 20 g samples & ran entire test on all 3 samples (2)
  - One 20 g sample, made 1 filtrate & tested 3 filtrate samples (3)
- Soaking Time: 16 hours (2) or 24 hours (3)
- Filtering Method: Gravimetric (2) or Vacuum Pump (3)
- Filter Pore Size, μm: 0.25, 0.45, 2.5 (2), or 20
- Dilution Ratios: 1:20, 1:40, 1:80
Variable Steps Identified

• Colorimeter Manufacturers:
  – Chemtron (1) used by ODOT
  – La Motte (1)
  – Orion Aquafast (3) used by TXDOT

• Colorimeter Zero Calibration:
  – Distilled water blank (1)
  – Filtrate at test dilution ratio (4)

• Reagent: Barium Chloride (5)

• Sulfate Content Calculation (5)
  – Colorimeter Reading x Dilution Ratio = Sulfate Content, ppm
Soaking Time Period: 24 Hours vs. 16 Hours

Sulfate (ppm)

Sample No.

24-Hr Soak

16-Hr Soak
Replicate Samples: 3 Soil Samples vs. 3 Samples Filtrate

- **Sulfate (ppm)**
  - **Average**
  - **Soil Replicates**
  - **Filtrate Samples**
  - **Lab A**
  - **Lab B**
  - **Lab C**
  - **Lab D**
  - **Lab E**

**Sample No.**
- 1
- 13
- 17
- 16
- 7
- 9
- 5
Filter Media Pore Size

- 0.25 micron
- 0.45 micron
- 2.5 micron
- 20 micron

Sulfate (ppm)

Sample No.

1 13 17 16 7 9 5
The image displays a bar chart titled "Colorimeter". The chart represents sulfate concentrations (in ppm) across different samples, with each lab designated by a different color:

- Lab A - Chemtron: Green bars
- Lab B - Orion Aquafast: Brown bars
- Lab C - Orion Aquafast: Orange bars
- Lab D - Orion Aquafast: Green bars
- Lab E - La Motte: Blue bars

The y-axis represents the sulfate concentration (ppm), while the x-axis represents the sample numbers from 1 to 9. The chart provides a visual comparison of sulfate levels across different laboratories.
## Maximum Sulfate Content for Stabilization

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<th>Sample No.</th>
<th>Lab A</th>
<th>Lab B</th>
<th>Lab C</th>
<th>Lab D</th>
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Conclusions

• No two labs did the procedure the same way, or the way ODOT does it.

• General levels of sulfate content were determined by the labs.

• None of the identified variables appeared to significantly affect the test result.

• Keep the procedure simply.
  – No need to overcomplicate it.
  – Exact value not needed.
Supplement 1122
Determining Sulfate Content in Soils

• Replaces references to TEX-145 method in Geotechnical Bulletin 1 and Supplement 1120
• Uses same procedures
• Clarifies ambiguous steps
• Includes ODOT practice
• Effective July 17, 2015
Supplement 1122 Clarifications

• Make and test three soil replicates per sample
• Soaking the soil samples for 16 to 24 hours
• Filtration system:
  – Gravimetric with 2.5 – 1.0 μm filter paper
  – Vacuum filtration with 0.45 μm filter membrane
• Zero Colorimeter with either filtrate (turbid) or distilled water (nonturbid)
• Report sulfate content to 2 significant digits within the range of ‘<100 ppm’ to ‘>8000 ppm’
QUESTIONS

New Specifications Book in January 2016