2014 CONAWAY CONFERENCE

Earthwork Specification Update

Stephen Slomski, P. E.
Construction Geotechnical Engineer
Geotechnical Specification Update

• Specification Changes and Clarifications
  – Item 202
  – Supplemental Specification 840
  – Supplement 1121
  – Supplement 1015
  – Supplemental Specification 878
  – Item 611

• Intelligent Compaction Demonstrations
Item 202 Removal of Structures And Obstructions

• 202.02 General Construction Requirements
  – “Use removed or excavated materials in the Work when the material conforms to the specifications; if not, then recycle or dispose of the material according to 105.16 and 105.17.”
  – Removed redundancy. The two GP address the potential final disposition of these materials:
    • Wasted on-site or off-site
    • Reused or recycled
    • Used to construct legitimate fill
    • Placed in a landfill
Supplemental Specification 840
Mechanically Stabilized Earth Walls

• 840.02.F. & 840.03.B.9. Accredited MSE Walls
  – Added the Sanders MSE Wall System that uses steel strips with vertical punched tabs for frictional resistance and is fabricated by Sanders Precast Concrete Systems

• 840.04.A.1. Design Requirements
  – “Only use an accredited MSE wall system. Use only one soil reinforcement system for the entire length of the retaining wall.”
Supplemental Specification 840

• 840.04.B. Submittal of Shop Drawings & Calculations

• Revised requirements for Professional Engineer’s oversight of shop drawing submittals
  – Only one P. E. required to seal the submittal
  – Designers and checkers:
    • Do not have to be P.E.’s, but
    • Must be competent individuals and professionally knowledgeable of AASHTO specifications and Item 840
Supplement 1121  Certification of Nuclear Density Gauges and Operators

- Initially issued October 2013
- Describes the processes and requirements for certification of nuclear density/moisture gauges and gauge operators for inspection, testing, and/or documentation.
Supplement 1121

• Operator Requirements
  – Have current certification from an accepted outside organization, either NETTCP or NICET
  – Pass written test of ODOT practices

• Gauge Requirement – Pass an accuracy test

• Technicians and Gauges are qualified separately.

• Operator prequalification is effective for three calendar years.
Supplement 1121

- April 2014 Revision
- Reconciled administration of the certification of gauge operators with the Office of Consultant Services’ prequalification procedure for consultant Construction Inspection/Administration
- Gauge operator testing will be at District Offices on an needed basis
- Gauge validation will be by OMM
Supplement 1015 Compaction Testing of Unbound Materials

• 1015.01 General – Added the following:
  “Perform compaction testing with nuclear density/moisture gauges and gauge operators meeting the requirements of Supplement 1121.”
Supplemental Specification 878
Inspection And Compaction Testing of Unbound Materials

• 878.02 Qualifications
  – Removed the listing of the requirements for technicians and the lead technician to be certified by an outside organization.
  – Added that the technicians and the lead technician shall meet the requirements of Supplement 1121.
Item 611 Pipe Culverts, Sewers, Drains, And Drainage Structures

- 611.06 Bedding and Backfill states:
  “Ensure compaction density complies with the installation plan by performing compaction testing according to Supplement 1015 and the manufacturer’s recommendation.”

- The compaction testing inspector must be an ODOT Prequalified Nuclear Gauge Operator
  – Same requirements for all ODOT testing
Intelligent Compaction Demonstrations

• What is Intelligent Compaction (IC)
  – Instrumented roller systems with feedback control to evaluate material compaction in-progress
  – Measures material stiffness or rolling resistance instead of density
  – Continuous recording of material response and roller location
  – Applicable to both earthwork and pavements
Intelligent Compaction System

- GPS Receiver to Map Roller Location
- Display Panel to Show Information to Operator
- Instrumentation to Measure Compaction Progress
IC Benefits

- Visually shows improvement with successive passes & shows soft or unimproved areas
- Measurements analyzes entire compacted area vs. spot checking
- Shows operator completeness of roller coverage & progress in compacting lift
IC Roller Measurement Systems

- **Accelerometer Based**
  - Mounted on drum
  - Monitors applied effort and response from compacted material

- **Energy Based**
  - Pressure sensors measure effort to drive the roller
  - Lower rolling resistance relates to more compaction
IC Equipment Type

- Both Footed Rollers & Smooth Drum Rollers
- Vibratory mode required for accelerometer based systems
- Machine drive system works in both static and vibratory modes
Earthwork IC Demonstrations

- FHWA Every Day Counts Implementation Initiative
- Contractor: The Beaver Excavating Company
- IC Roller Provided by Ohio CAT & Caterpillar, Inc.
- Hosted by District 1 and District 11

ALL-75 in Lima

BEL-70 in St. Clairsville
<table>
<thead>
<tr>
<th>Lift</th>
<th>Roller Direction</th>
<th>Vibration Mode</th>
<th>Average MDP</th>
<th>Standard Deviation</th>
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<td>Forward</td>
<td>Static</td>
<td>131</td>
<td>7.3</td>
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<tr>
<td>2</td>
<td>Forward</td>
<td>On</td>
<td>116</td>
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<tr>
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<td>Static</td>
<td>92</td>
<td>5.7</td>
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<tr>
<td>2</td>
<td>Reverse</td>
<td>On</td>
<td>80</td>
<td>6.4</td>
</tr>
</tbody>
</table>

- Reverse MDP values are 30% lower than Forward MDP values
- Vibration mode reduces MDP values by 12% from Static mode values
Alternative Compaction Test Methods

- **Nuclear Density Gauge (NGD)**
  - Counts detections of nuclear particles
  - Correlated to wet density and moisture content

- **Lightweight Deflectometer (LWD)**
  - Measures deflection of soil due to falling weight
  - Correlated to the dynamic modulus of elasticity for the soil

- **Dynamic Cone Penetrometer (DCP)**
  - Measures penetration of conical tip due to falling weight
  - Correlated to CBR or bearing value
Test Method Results for ALL-75
Testing by Resource International, Inc.
Summary

• Current state of the technology would not allow ODOT to utilize IC for acceptance of earthwork compaction.
• Most suitable as a quality control tool for contractors.
• The LWD and DCP results did not show strong correlation to the IC measurements.
• LWD is more portable than the DCP.