Compaction & Permeability of Dense-Graded Asphalt Surface Mixes - Fall Status

Kevin McGhee, PE
VAA Fall Conference – Richmond, 2016
• Objective:
  – Critical review of VDOT’s acceptance procedures for plant mix density

• Scope:
  – Dense-graded surface mixes - 2016
  – Statewide resurfacing schedules
  – Statewide “quality incentive” projects

• Key Assumption (for now):
  – Existing density requirements are being met.
Important Context – 2016 Plant Mix

• Substantial revisions to dense-grade mix design requirements to include:
  – 50 gyration lab compaction for design (reduced from 65)
  – Revisions to gradation requirements (No. 4 and No. 30 sieves)
  – Minimum liquid AC requirements (5.5% on SM-9.5 and 5.3% on SM-12.5)
  – Statewide “quality incentive” pilots
Methodology

• Field Testing
  – Visit 1 “regular schedule” and 1 “incentive pilot” per district
  – Perform “shadow” density acceptance testing (coring) for one lot (5000’) of typical paving

• Analysis
  – Compare non-destructive density measurements (Nuke) to “ground truth”
  – Compare “reg. sched.” to “incentive” work
  – Relate field permeability to core density
  – Explore other variables that impact density and/or permeability
Field Testing Matrix – Regular Scheds.

- Nuke Gauge Footprint (Contractor QC) - SR
- 6” Core for Dens./Perm. (VTRC/VDOT) – SR & match with nuke footprint
- 4” Core for Bond (VTRC/VDOT) - R

5,000 feet (VTRC Field – Reg. Schedule)

1,000 feet (typ.)
Field Testing Matrix - Incentive Pilots

(VTRC Field – Incent. Pilot)

1,000 feet
(typ.)

- Nuke Gauge Footprint (Contractor QC) - SR
- 6” Core for Dens./Perm. (VTRC/VDOT) - SR
- 4” Core for Bond (VTRC/VDOT) - R
- 4” Plug for Dens. (Contractor/VDOT) - SR
## 2016 Testing – Sampled to Date

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>Contractor</th>
<th>District</th>
<th>Location/Route</th>
<th>Mix Type</th>
<th>Application (psy)</th>
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<tbody>
<tr>
<td>6/9/2016</td>
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</table>

Note: shaded blue projects were “quality incentive” pilots.
Baseline (Sort of) – 2015 “50 Gyration Trials”

- 10 Trial mixes (50 gyr)
- 10 “Control” mixes (65 gyr)

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</table>
Sample Legend – 2015/2016

• 50 Gyration Trials (2015):
  – 65 gyration control mixes (65 Gyr-2015)
  – 50 gyration trial mixes (50 Gyr-2015)

• Regular Schedule and Incentive Pilots (2016):
  – 50 gyration regular production (Prod-2016)
  – 50 gyration Incentive pilots (Incent-2016)
2015/16 – Pilots and Production

Minimum Control Strip

%G

2016 – Production & Incentive Pilots

[Graph showing data trends and labels for various categories such as 50 Gyr-2015, 65 Gyr-2015, Prod-2016, Incen-2016, with annotations for minimum control strip (92.2 to 92.5) and theoretically acceptable outside control strip with nuclear.]

10/6/2016
Field Permeability – 2016

The diagram shows a correlation between density (% MTD) and permeability (x10^-5 cm/s). Points on the graph are categorized as 'Bad' or 'Good', with 'High Permeability' and 'Low Density' also indicated. The data points suggest a decrease in permeability as density increases.
Field Permeability - Meeting Design

* Design requires $150 \times 10^{-5}$ cm/sec
Moving Forward

- Finish sampling 2016 – NOVA, Richmond, Salem, and Hampton Roads
- Compile relevant density, etc., testing results from Districts
- Parametric analysis:
  - Mix characteristics
  - Project characteristics
  - Paving practices
  - Etc.
Possible Outcome

• Density Acceptance?:
  – Current procedures (accept by nuke)
  – Plugs/cores
  – Continued Incentives
  – Quality monitoring/control

• Permeability?:
  – Compared to in-place voids
  – Relating field to production to design
  – Mix dependence?
Questions?