Construction of Overlays on US 58: Research and Materials Testing

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Outline

• VCTIR Research Plan
• End Result Specifications (ERS)
  – shadow implementation
• Long term performance evaluation
VCTIR Research Plan

• To evaluate both bonded and unbonded concrete overlays to determine if they are a cost effective and practical solution for extending the service life of existing CRCP
VCTIR Research Plan

• Collect information on existing pavement condition
• Monitor the construction of the overlays
• Determine the properties of the concrete
• Shadow implement ERS
• Evaluate the initial condition of overlays up to 2 years.
• Make plans to evaluate condition after 2 years.
Long Term Performance Evaluation Plan

• From Maintenance Division gather data:
  – IRI
  – Distress survey (video imaging)
• From Materials Division obtain FWD data for structural integrity
• From the District obtain visual surveys.
Pavement Condition

- Distress Survey
  - Video imaging
  - Visual survey
- IRI values
- FWD deflection data
Video Imaging
Visual Survey

- GPS coordinates
- Observed cracks, spalls, and patches.
Along the longitudinal edge of the pavement higher IRI is observed.
IRI After Construction

Unbonded Section After Construction

- Lane 2 - Inside (Left):
  - SD 18: 62
  - SD 19: 56

- Lane 1 - Outside (Right):
  - SD 18: 59
  - SD 20: 71

Average IRI (in/ mile)

Lane 2- Inside (Left)  Lane 1- Outside (Right)

- Left Wheel Path
- Right Wheel Path
FWD Data

- Before and after (completion of project)
- For unbonded section recent data
- For bonded section 2 year old data
Construction of the Unbonded Overlay

- Workability of the mixture
- Concrete in front of the paver
- Tie bar insertion
- Curing
- Loss of air and slump from plant to jobsite
Workability of the Mixture

• High slumps make edge difficult to form. The insertion of the tie bars also affects the edge.
Concrete in Front of the Paver
Tie Bar Insertion

Middle

Edge
Tie Bar at Edge
Air and Slump Loss

Slump loss of 1 to 1.5 in.

From plant to jobsite

In the wheelbarrow
ERS - Goals

• To have long lasting concrete structures
• Provide innovation
• Ensure consistent uniform concrete
• Pay based on the quality of concrete
ERS

Includes

• Prequalification
• QC Plan by the Contractor applicable to preconstruction and during construction
• Mix design approval
• Acceptance
## Differences in Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Current</th>
<th>ERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Design</td>
<td>Prescriptive</td>
<td>Performance Measures</td>
</tr>
<tr>
<td>Testing</td>
<td>VDOT</td>
<td>Contractor and VDOT</td>
</tr>
<tr>
<td>Basis of Pay</td>
<td>Minimum</td>
<td>PWL</td>
</tr>
</tbody>
</table>
ERS

• Used in pilot bridge structures
• Design portion being incorporated into VDOT specifications as an option
• Pay factor portion is still under discussion
ERS Sampling

- Lots and sublots. Initially (first night of placement) concrete was tested in the field: 0.2 mile one sublot. There were 6 sublots.
- Then tested at the plant due to convenience and safety: 30 truckloads one sublot. Each truck 10 yd\(^3\).
- One sample from each sublot was selected randomly.
ERS tests

• Screening tests at the fresh state:
  – Air content (6±2%)
  – Slump (0-3 in)
  – Density
  – Concrete temperature (95 °F)
ERS Tests

- Acceptance tests at the hardened state
  - Strength
  - Permeability

- Also testing for drying shrinkage for MEPDG
Mixture

- 596 lb/yd$^3$ cementitious material
- 25% Class F fly ash
- w/cm: 0.43, 0.45
- #57 coarse aggregate
- Natural sand
## Test Results

<table>
<thead>
<tr>
<th>Batch</th>
<th>Strength (psi)</th>
<th>Permeability (coul)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Avg</td>
</tr>
<tr>
<td>1-6 (Jobsite)</td>
<td>6</td>
<td>5158</td>
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<tr>
<td>7-26 (Plant)</td>
<td>13</td>
<td>5025</td>
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<tr>
<td>1-26</td>
<td>19</td>
<td>5067</td>
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</tbody>
</table>
Conclusions

- Construction was successfully executed on time.
- Concrete was of high quality (good strength, low permeability).
- Ride quality is good (IRI = 56 to 71 in/mile).
Thank you.