CEMENT TREATMENT
(ROAD-MIXED)

TxDOT Specification Item 275
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TTI

2018 TxDOT Short Course
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Basics of Full Depth Reclamation Process

- Assembling Background Information
- NDT Evaluation and Section Breakdown
  - GPR
  - FWD
- Verifying Pavement Structure and Sampling
  - Auger
  - Verification of problem location
  - DCP on shoulder for widening
- Laboratory Mix Design
  - Guidelines on selecting stabilizer type and amount
  - RAP content max 50%
- Pavement Design
  - Special Considerations
    - Need to Establish Foundation layer
    - Handling Variability
    - How to handle traffic
    - Need for widening
    - Avoid cutting into subgrade (add rock requirement)
  - FPS + Triaxial Design
- Special Considerations
  - Ensuring Surface bonding
  - Microcracking
- Construction Quality Assurance
  - Distribution of stabilizers
  - Immediate strength testing
  - Final Quality Assurance testing
- TxDOT Item 275, “Cement Treatment (Road-Mixed)"
  - Mix and compact cement, water, and subgrade or base (with or without asphalt concrete pavement) in the roadway.
  - Materials
    - Cement
    - Existing
      - Subgrade
      - Pavement
        » Maximum of 50% RAP
    - Flexible Base (furnish new base)
    - Water
    - Asphalt (may be permitted for curing purposes)
Mix Design

– Tex-120-E
  • Compressive Strength Test
  • 6x8 in mold
  • Tex-113-E to determine Optimum moisture and density

– Reference - TxDOT research 0-6271
  • Investigating small sample 2x4in
  • Moisture susceptibility test
TxDOT Specification, Item 275, “Cement Treatment – Road Mixed”

- **Equipment**
  - Cement distribution
    - Slurry equipment
    - Dry distribution equipment
  - Pulverization Equipment
  - Compaction Equipment
  - Finishing Equipment
    - Motor Grader
Microcracking

- TxDOT research project 0-4502
  - Minimum 12 ton vibratory roller
    - Typically the same roller used in compaction
  - Usual timing to perform microcracking 2-3 days after compacting
    - unless the average ambient temperature is <60°F, then increase to 4 days
  - 2 mph
  - 2 – 4 passes (down and back)
    - Can test with FWD before and after.
      Look for 50% reduction in
      Backcalculated modulus before stop rolling

Curing – 3 days

- Moist cure
- Asphalt cure
- Additional 2 days, after microcracking
Basic Steps – Preparing the Area
Basic Steps – Spreading Cement
Basic Steps – Adding Moisture
Basic Steps - Mixing
Basic Steps – Mixing and Compacting
Basic Steps - Compacting
Basic Steps – Compacting and Finishing
Basic Steps – Testing for Density
Original failure very wet subgrade
Lab design recommended 3% cement
FDR recycling top 14 1/2 inches
Microcracking between 1 and 3 days after treating
Seal Coat & 2 1/2 inch HMA surface
No cracks after 18 months
Minor Longitudinal

Condition 2006

No transverse Cracking
Northbound IRI – SH 47

Average IRI - Northbound

<table>
<thead>
<tr>
<th>Year</th>
<th>Average IRI</th>
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</thead>
<tbody>
<tr>
<td>2001</td>
<td>108</td>
</tr>
<tr>
<td>2004</td>
<td>56</td>
</tr>
<tr>
<td>2006</td>
<td>61</td>
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</table>
Many patches
New Failures
Poor Drainage
Existing HMA 2 – 4 inches
Existing Base 4 to 8 inches (low quality PI 15 to 18)
Moderate PI soils (23 to 33)
Low traffic
- Proposed to add 4 inches new base prior to FDR, either
  - Crushed Concrete, or
  - Grade 2 base
- Design based on blend 50% RAP + 50% new base
- Standard Lab Tests
  - 7 day Strength
  - Seismic Modulus
  - TST
  - Retained strength

### 7 day UCS and retained strength

<table>
<thead>
<tr>
<th></th>
<th>2%</th>
<th>3%</th>
<th>4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>271 (139%)</td>
<td>305 (183%)</td>
<td>427 (149%)</td>
</tr>
<tr>
<td>GR2</td>
<td>394 (141%)</td>
<td>429 (160%)</td>
<td>556 (183%)</td>
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</tbody>
</table>
SH 288 Pavement Design

Table A1 - Design Method A

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Usual Input FPS19w</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to 1st Overlay (years)</td>
<td>3.8 - 4.0</td>
<td>3.8</td>
<td>may be lower for maintenance projects</td>
</tr>
<tr>
<td>Initial Serviceability Index (SI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future Overlay – Initial SI</td>
<td>4.2 - 4.5</td>
<td>4.2</td>
<td>Future Overlays are not anticipated therefore use the conservative value</td>
</tr>
<tr>
<td>Minimum SI</td>
<td>2.0 - 2.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Design Confidence Level</td>
<td>A (65%) – B (90%)</td>
<td>B (90%)</td>
<td>Use default value in FPS program.</td>
</tr>
<tr>
<td>District Temperature Constant</td>
<td>30 - 31</td>
<td>30 - 31</td>
<td>Use default value in FPS program.</td>
</tr>
<tr>
<td>Swelling Potential, PVR swelling rate</td>
<td>0% - 100%</td>
<td>0%</td>
<td>Do not use swelling potential as an input to FPS.</td>
</tr>
<tr>
<td>Detour (Road User Cost)</td>
<td>Posted speed and expected speed during overlay</td>
<td>Use same speed for all traffic speed entries and detour Model 3</td>
<td>Does not affect the pavement structure. Eliminates user costs associated with traffic delays for future overlays.</td>
</tr>
<tr>
<td>Material Cost per Cy</td>
<td>Use District Specific costs.</td>
<td>Monitor Bid Tabs and adjust accordingly</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Modulus Value</th>
<th>Poison’s Ratio</th>
<th>Cohesion Value for MT check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Material (including Subgrade)</td>
<td>Modulus Back-calculated from FWD data</td>
<td>0.35</td>
<td>na</td>
</tr>
<tr>
<td>Existing Pavement – Scarified, Reshaped and Compacted</td>
<td>Approximately 3 times the subgrade modulus</td>
<td>0.35</td>
<td>na</td>
</tr>
<tr>
<td>Stabilize Exist Pav/Subgrade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) mostly granular base (75% or more base)</td>
<td>(100 ksi)</td>
<td>a) 0.3</td>
<td>a) 800</td>
</tr>
<tr>
<td>b) blend subgrade &amp; base (50% to 75% base)</td>
<td>65 ksi</td>
<td>b) 0.3</td>
<td>b) 650</td>
</tr>
<tr>
<td>c) mostly subgrade (&lt;50% base)</td>
<td>35 ksi</td>
<td>c) 0.35</td>
<td>c) 300</td>
</tr>
<tr>
<td>New Flexible Base</td>
<td>GR 2 = 50 ksi</td>
<td>0.25</td>
<td>1000</td>
</tr>
<tr>
<td>Cement Treated Base</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UCS&gt;210, with 85% retained strength</td>
<td></td>
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Construction of SH 288 FR
Completed highway 2010

10/07/2010
Project Description:

- ~ 5” existing ACP blended w/ 5” existing base
- ACP pulverized w/milling machine then blended w/base by rotomill in October 2008
- Cement slurry application (4%) initiated in November 2008
Field Construction
Application of Cement Slurry

- Produced by concrete plant and hauled in concrete trucks.
- Each truck spread in two batches with a custom spreader box over a length of ~ 211’
- Concerns with uniformity of cement application rate across transverse profile
  - Field-molded samples from wheelpath and center for 7-day UCS
  - PFWD on 2-day old section along both transverse and longitudinal profiles
Conclusions from SH 327

- Auger samples used for lab mix design matched well with field construction.
- Cement slurry application, after “bugs” worked out, seemed to work reasonably well.
  - No evidence of greater variability across lane width as compared to variability with longitudinal distance.
- 3 passes with roller recommended for microcracking.