Overview

- Driving Factors of FDR Increase in South Carolina
  - SCDOT State of the Pavement
  - Long History with Cement Treated Bases
  - First FDR Project Successful

- Current FDR Program
  - FDR Candidate Selection Process
  - Average Weighted Cost
  - Lane Miles Reclaimed

- Improving the Program
  - Identifying Problems
  - Improving The Product
  - Additional Training
South Carolina System

2013 State of the Pavement

- Pavement System
  - 5th Largest in Country
  - 41,460 Centerline Miles
  - 90,384 lane miles

- Accelerated Deterioration
  - 10th Fastest Population Growth
  - Increased Truck Traffic

- Funding
  - Declining Level of Service
  - Net Loss of 71,656 lane mile years of service in 2013

Lane Mile Breakdown

- Interstate
- Primary
- Secondary
- Non FA
South Carolina System

Service Life Net Change

Source: 2013 State of the Pavement Report
South Carolina System

Pavement Condition by Route Type

Source: 2013 State of the Pavement Report
Background - History

- SCDOT’s Long History with Cement Treated Bases
  - 1930s - First Engineered Soil Cement Base Material
  - 1969 – Stabilizing Soils for Use as Base Material on Secondary Road Projects - Dr. Chu – USC / SCDOT

- Rehab Program
  - Pre 1995 – FDP / Overlay or Chip Seal
  - 1995 – SC Route 97
SC Route 97 (1994)
Current FDR Program
Current Program

• Districts Assess Current Pavement Condition
  • Pavement Structure Type
    • Surface Material and Depth
    • Base Material and Depth
  • Surface Condition
  • Determine the Percentage of FDP Required

• Collect Traffic Data
  • Functional Class
  • ADT
  • Growth Rate
Current Program

- Pavement Design Estimator Inputs
  - Pavement Information
  - Traffic Data
  - General Information
    - Project Location
    - Project Dimensions

- Pavement Design Estimator Outputs
  - Structural Number Estimations
  - 2 design Alternatives
    - Overlay
    - FDR
Current Program

- Weighted Average Program Costs (11/2013 – 11/2014)
  - Cement – $115.88 per ton ($3.47 psy)
  - FDR 8” – $ 5.00 +/- $0.87 per square yard
  - FDR 10” – $ 4.98 +/- $0.54 per square yard
  - FDP 8” – $42.99 +/- $25.23 per square yard
  - FDP 10” – $47.56 +/- $15.80 per square yard
Current Program

FDR Lane Miles

<table>
<thead>
<tr>
<th>Year</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>284</td>
</tr>
<tr>
<td>2011</td>
<td>131</td>
</tr>
<tr>
<td>2012</td>
<td>256</td>
</tr>
<tr>
<td>2013</td>
<td>284</td>
</tr>
<tr>
<td>2014</td>
<td>639</td>
</tr>
</tbody>
</table>
Moving Forward - Improving the Program
Moving Forward – Identify Improvement Areas

- Quality Improvement Committee for CTB Bases
  - Industry
  - Contractors
  - Field Personnel
  - Materials Personnel

- In-House Research Study – “An Examination of Current Cement Treated Base Practices”
  - Includes FDR
  - Expected Deliverable – Best Practices Guide
    - Literature Review
    - Survey of State DOTs
Moving Forward - Mixes

Fig. 31. Relationship between strength and durability.

PCA S-C Lab Handbook

Tube Suction Testing
## Moving Forward - Mixes

<table>
<thead>
<tr>
<th>Depth (in)</th>
<th>300 psi (3.7% - Cement)</th>
<th>400 psi (5.0% - Cement)</th>
<th>500 psi (6.6% - Cement)</th>
<th>600 psi (8.0% - Cement)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>26</td>
<td>35</td>
<td>46</td>
<td>56</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
<td>43</td>
<td>57</td>
<td>69</td>
</tr>
<tr>
<td>12</td>
<td>39</td>
<td>52</td>
<td>69</td>
<td>83</td>
</tr>
<tr>
<td>13</td>
<td>42</td>
<td>56</td>
<td>74</td>
<td>90</td>
</tr>
<tr>
<td>14</td>
<td>45</td>
<td>61</td>
<td>80</td>
<td>97</td>
</tr>
<tr>
<td>16</td>
<td>51</td>
<td>69</td>
<td>92</td>
<td>111</td>
</tr>
<tr>
<td>17</td>
<td>55</td>
<td>74</td>
<td>97</td>
<td>118</td>
</tr>
</tbody>
</table>
# Moving Forward - Design

<table>
<thead>
<tr>
<th>UCS</th>
<th>Mres</th>
<th>Mrup</th>
<th>Tensile Stress</th>
<th>Ratio</th>
<th>Depth</th>
<th>Rate (psy)</th>
<th>tons/mile</th>
<th>Cement Cost Per Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>774</td>
<td>155</td>
<td>74.37</td>
<td>0.480</td>
<td>8</td>
<td>56</td>
<td>197.12</td>
<td>$ 22,792</td>
</tr>
<tr>
<td>500</td>
<td>707</td>
<td>141</td>
<td>54.72</td>
<td>0.387</td>
<td>10</td>
<td>57</td>
<td>200.64</td>
<td>$ 23,200</td>
</tr>
<tr>
<td>400</td>
<td>632</td>
<td>126</td>
<td>36.92</td>
<td>0.292</td>
<td>13</td>
<td>56</td>
<td>197.12</td>
<td>$ 22,792</td>
</tr>
<tr>
<td>300</td>
<td>547</td>
<td>109</td>
<td>23.71</td>
<td>0.217</td>
<td>17</td>
<td>55</td>
<td>193.6</td>
<td>$ 22,385</td>
</tr>
<tr>
<td>300</td>
<td>547</td>
<td>109</td>
<td>49.67</td>
<td>0.454</td>
<td>10</td>
<td>32</td>
<td>112.64</td>
<td>$13, 024</td>
</tr>
</tbody>
</table>
Moving Forward – Field Control

- Development of a Technician Training Course
  - Earthworks
    - Expand CTB Discussion
    - Material Components
  - Best Practices
    - Inspection
    - Control
  - New Testing Procedures
Recap

- Driving Factors
- Current Program
  - Significant Increase in use of FDR Alternative
- Moving Forward
  - Identify Further Cost Savings
  - Evaluate Their Potential
Questions