Roller Compacted Concrete Experiences in Arkansas

The Hattieville Project

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RCC Construction Project

- Fayetteville Shale Play Area
- Cement-Treated Reconstructed Base (CTRB)
  - Full-Depth Reclamation
- Roller-Compacted Concrete (RCC)
  - Section 1 – 7” over CTRB
  - Section 2 – 8” overlay
Section 1

- Slow progress
- Marginal densities
- Low strengths
Changes for Section 2

- New plant
- New paver
- No fly ash in mix
- Higher water content
  - Because of changes in cementitious materials
## Compressive Strengths

<table>
<thead>
<tr>
<th>Location</th>
<th>1 day (psi)</th>
<th>3 day (psi)</th>
<th>7 day (psi)</th>
<th>14 day (psi)</th>
<th>28 day (psi)</th>
<th>28 day (psi)</th>
<th>90 day (psi)</th>
<th>Density (pcf)</th>
<th>Density (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 – WB</td>
<td>1418</td>
<td>2982</td>
<td>3395</td>
<td>3505</td>
<td>3661</td>
<td>2813</td>
<td>4545</td>
<td>148.8</td>
<td>144.8</td>
</tr>
<tr>
<td>S1 – EB</td>
<td>457</td>
<td>1837</td>
<td>2553</td>
<td>2897</td>
<td><strong>3328</strong></td>
<td>2175</td>
<td>4139</td>
<td>150.6</td>
<td>138.6</td>
</tr>
<tr>
<td>S2 – WB</td>
<td>2077</td>
<td>3873</td>
<td>4279</td>
<td>4726</td>
<td>4943</td>
<td>3337</td>
<td>5284</td>
<td>148.2</td>
<td>143.0</td>
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<tr>
<td>S2 – EB</td>
<td>4102</td>
<td>5307</td>
<td>6504</td>
<td>6016</td>
<td>6289</td>
<td>3938</td>
<td>6993</td>
<td>151.3</td>
<td>142.5</td>
</tr>
<tr>
<td>S1 – Reconst.</td>
<td>2096</td>
<td>4340</td>
<td>4837</td>
<td>5174</td>
<td>5722</td>
<td>4531</td>
<td>6212</td>
<td>149.8</td>
<td>141.1</td>
</tr>
</tbody>
</table>

*Cylinders  **Cores

Nighttime temperatures generally ranged from 25 to 45 F
Temperature and Fly Ash?

Temperature vs. Strength
Cylinders, 24 hr

Compressive Strength (psi) vs. Temperature, F

R² = 0.8042
R² = 0.8886

Section 1
Section 2

Temperature
Fly Ash

0 10 20 30 40 50 60 70
Smoothness and Skid Resistance

• Smoothness
  o Before Diamond Grinding
    • 250 in/mi
  o After Diamond Grinding
    • 69.5 in/mi – 76.0 in/mi
    • Almost 3 years

• Skid Resistance
  o Skid Number ~58
Cracking

1 crack
1st yr reconst. section
2 Years Later
Centerline Deterioration

After 1 year, 15% Affected Length
Transverse Joint Spalling

<5% defective
1st year
Cost

- $2,010,550 total project cost
- $484,444/l-m RCC (not counting transitions)
- Compare to ????
- 2” HMA overlay - $88,000/l-m
  - RCC is 5x more expensive?
- 8” HMA overlay - $415,017/l-m
  - 20-year design life
- Non-freeway reconstruction with minor widening
  - $1,500,000/l-m

**RCC saves over $1 million / lane-mile**
Lessons Learned

• Practice, practice, practice
• Great application – remember intent!
• Watch out for low temperatures
  o Increase minimum placement temperature to 50F?
• Fly ash in mix not recommended
  o Unless strength gain is compatible with temperature
• Plant must be capable of providing continuous production - speed and coordination critical
• Construction joints are difficult
• Thin overlay vs. diamond grinding?
After Two Years. . .
After Almost 3 Years
Recommendations

• Use RCC for:
  o Low to medium traffic volume roadways
  o Rural highways and city streets
  o As a base for medium to high traffic roadways

• Do not use RCC for:
  o Freeways and other high traffic volume highways
  o Urban areas and arterials
    • Unless detour options are available

• Allow RCC paving April – September
  o Do not pave at < 50 °F
  o Do not pave if nighttime low is expected to be < 40 °F
Thank You!

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