Interstate-59 Mainline Construction

Dekalb County, AL

Mr. Will Gray
Managing Partner | A.G. Peltz Group LLC | Birmingham, AL

Agenda

• History and Background
• Project Details
• Project Economics
• PCTB Construction
• PCC Pavement Construction
• Lessons Learned
Background

• In 1978, Approximately 42% of Alabama’s Interstate roadways were constructed with concrete. Most of the concrete roadways in service today have been in service for 40+ years.

• The two most recent concrete mainline construction projects were completed in 2011 and 2012. I-59 in Etowah County (2011) and I-65 in Jefferson County (2012)

• Recently, several concrete projects of different scope had been successfully completed prior to the current I-59 project.
  • Shoulder reconstruction with RCC on I-59.
  • Statewide intersection reconstruction program.

• Thank you for the opportunity ALDOT!

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Project Details - General

- Eight mile reconstruction of I-59 in Dekalb County, AL.
- 134,379 SY of 12” mainline and inside shoulder pavement.
- 46,354 SY of 8” outside shoulder pavement.
- 4” Permeable Cement Treated Base (PCTB) required under all travel lanes.
- Project constructed in two four mile phases and utilized contra-flow traffic control scheme.

Project Details – Typical Section
Project Details – PCCP Specifications

- ALDOT 450 specification requires the use of a non-skid aggregate in mainline pavements.
- ALDOT 450 specification requires thicknesses within 0.1" to receive full payment.
- ALDOT 450 specification requires IRI readings less than 65 in/mile to receive full payment.

![Table 1]

<table>
<thead>
<tr>
<th>Mean Roughness Index Inches/Mile/Section</th>
<th>Contract Price Adjustment Percent of Pavement Unit Bid Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 35 (Under 0.5)</td>
<td>1.05</td>
</tr>
<tr>
<td>35 to less than 45 (0.6 to less than 0.7)</td>
<td>(1.05 - MIR / 1.2)</td>
</tr>
<tr>
<td>45 to less than 65 (0.7 to less than 1.0)</td>
<td>1.00</td>
</tr>
<tr>
<td>65 thru 90 (1.0 thru 1.4)</td>
<td>100 + (MIR - 65) / 1.25</td>
</tr>
<tr>
<td>Over 90 (Over 1.4)</td>
<td>Unacceptable</td>
</tr>
</tbody>
</table>

Where diamond grinding is performed to bring the Mean Roughness Index to 65 inches per mile or less, payment for the test section will be a maximum of 100% of the contract price.

Project Details – PCTB Specifications

- ALDOT 333 specification requires the use of a single size (#57 or #67) aggregate and a minimum cementitious content (282 #/CY).
- A.G. Peltz Group proposed adopting the FAA specification to include some fines for mixture stability and a bracketed strength requirement.

333.02 Materials.

(a) Permeable Cement Treated Base Mix (PCTB).  
1. Mix Design.
   - PCTB shall be an open graded uniform mixture consisting of base aggregate, cement, and water meeting the following parameters:
     - Maximum water to cementitious materials ratio of 0.45.
     - Maximum slump shall not be measured.
     - Portland cement content of greater than or equal to 282 lb/ycf.
     - Compressive strength at 7 days of greater than or equal to 500 psi.
     - Type I, II, III, or IV cement shall be used.
     - Fly ash and ground granulated blast furnace slag shall not be used.
     - Coarse aggregate shall be #57 or #67 crushed stone meeting the requirements of Section 801.
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Project Economics - Competition

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost per Mile - Asphalt</th>
<th>% Increase from Previous Bid</th>
<th>Cost per Mile - Concrete</th>
<th>% Increase from Previous Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>$3,073,176.25</td>
<td></td>
<td>No Bid</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>$4,048,304.83</td>
<td>31.73%</td>
<td>No Bid</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>$5,863,142.91</td>
<td>44.83%</td>
<td>$5,068,060.55</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>$4,893,529.41</td>
<td>-16.54%</td>
<td>$5,785,269.12</td>
<td>14.15%</td>
</tr>
</tbody>
</table>
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PCTB Construction
PCTB Construction

- Guidelines from FAA PCTB specification were accepted by ALDOT for construction.
- Laboratory mixture designs were set up to achieve required strength and then specimens were made to confirm required permeability.

PCTB Construction

- PCTB material was mixed utilizing a volumetric pugmill at the project location.
- PCTB material was placed utilizing a high density paver for the full width of the interstate.
- This method required very little additional rolling to achieve the desired compaction results.
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PCC Construction – Mixture Design

• PCC mixture designs were developed utilizing the CP-Tech Center's Mixture Design Analysis and the tarantula curve.
• Initially, single mixture designs were developed for both the slipform and fixed form applications.
• This was a very bad decision. (More on that later.)
PCC Construction – Mixture Design

- Original mixture design utilized a 3 aggregate blend and 546 lbs. of cementitious materials.
- 70% of the coarse fraction of aggregates was non-skid as prescribed by the ALDOT 450 specification.
- Original mixture easily exceeded strength requirements.

PCC Construction – Mixing Plant

- Central mix batch plant, erected at the project location, is utilized to produce required pavement mixes.
- PCC material is hauled to the placement area in end dump trucks.
- Mixing plant can easily achieve target placement rate of 160 CY per hour.
PCC Construction – Paving Equipment

• Due to smoothness requirements, a full width placer/spreader is being utilized.
• Mainline pavements are placed at the full 24 foot width in a single pass.
• Curing and tining are performed by a full width texture cure machine.
• Stringless controls are utilized for the placer/spreader and slipform paver.
PCC Construction – Lessons Learned

“You Don’t Know What You Don’t Know”
Lessons Learned – PCC Mixture

• Mixture performance is critical to achieve smoothness.
• True performance cannot be evaluated until placement begins.
• Having the ability to make mixture adjustments is helpful.
• Evaluation of aggregate gradations during production is critical.

Lessons Learned – Electronics

• Stringless machine control reduces jobsite obstacles and assists in achieving smoothness goals.
• Real-Time smoothness indicator allows methodology and material changes to be evaluated for effectiveness.
Lessons Learned – Methodology

• Consistent and proper head of material is critical for smooth pavements.
• Lower vibration energy generally creates smoother pavements.
• Smooth track lines and flat paving pan increase smoothness.
• Elimination of stop-starts.
• Evaluation of stringless model prior to paving with ProVal.
• Everything needs to be perfect.

Conclusions

• Properly designed concrete pavements can be competitive in Alabama and do encourage competition.
• PCTB can be effectively utilized as a drainage layer under concrete roadways.
• Smooth concrete pavements can be constructed when proper material and construction methodologies are utilized.
• “You Know What You Know”