Project Background

- Unbonded overlay on the driving lanes of I-44
- Remove and replace existing unbonded overlay
- Perform the work as quickly as possible
- Minimize impact to traveling public
- Joplin Project office- Marvin Morris RE
Project Background

REMOVE & REPLACE DRIVING LANES WITH
9” UNBONDED CONCRETE ON GEOTEXTILE FABRIC (BONDBREAKER)
OR 10.5” JPCP ON 12” ROCK BASE
PAVEMENT REPAIR IN PASSING LANES
LENGTH = 4.450 MILES
Project Background
Why?

- Driving Lane had previously been ground
- Panels were faulting
- Faulting due to failure of previous bond breaker
Why?

- Driving Lane had previously been ground
- Panels were faulting
- Faulting due to failure of previous bond breaker
Why?

- Driving Lane had previously been ground
- Panels were faulting
- Faulting due to failure of previous bond breaker
What to do

- Remove the existing driving lane and previous bond breaker
- Leave shoulder intact
- Leave passing lane intact
- Install new bond breaker
- Pour back driving lane
Sounds simple

- Begin with full depth pavement repair
- Build crossovers
- Switch traffic head to head
- Begin removals
- Bond breaker
- Drill bars
- Baskets
- Pave
Unkowns

- How much pavement repair would there be in driving and passing lanes?
- Underlying damage to adjacent concrete
Removals

- Antigo performed breaking operations
- Existing bond breaker was no problem
- Had spalling due to expansion of broken concrete and existing slab conditions
Removals

- Antigo performed breaking operations
- Existing bond breaker was no problem
- Had spalling due to expansion of broken concrete and existing slab conditions
Removals

- Trackhoe to remove bulk of material
- Skidsteer provided clean up
- Material hauled back to plant location
Removals

- Had spalling problem on the first half
- Vibratory ripper was used to try and fix issues
- Spalling still occurred
Removals

- Had spalling problem on the first half
- Vibratory ripper was used to try and fix issues
- Spalling still occurred
Drilling

- Shoulder was drilled
- Tie-Bars were epoxied into place
- Dual five gang drills were used
Bond breaker

- Geotextile fabric used as bond breaker
- Rolled out very quickly
- Pinned baskets once down
10.5” Full Depth Replacement

- Under the overpasses MoDOT opted for full depth removal and replace
- Both driving and passing lanes were replaced
- We removed both lanes at once
10.5” Full Depth Replacement

- 12” of rock base was installed
- We paved the passing lane first
- This allowed us to pave through continuously in the driving lane
10.5” Full Depth Replacement

- 12” of rock base was installed
- We paved the passing lane first
- This allowed us to pave through continuously in the driving lane
$306,000 bonus was possible at $8,500 a day
75 days maximum days head to head
Completed head to head in 39 days
Reduce the time head to head made for a safer project
Constant Time Crunch

- Set forth certain criteria when bidding project
- Plan the work and work the plan
- Be prepared to adjust on the fly
- Learn from one side before moving to the other
Mix Design

- Optimize Mix Design
- 3 aggregate system
- Maximum amount of flyash used
- Minimum cementitious material content
- Aggregate proportions to give best paving mix possible
- Tarantula Curve, Percent Retained, Shilstone all weighed to blend aggs
Mix Design

<table>
<thead>
<tr>
<th>Mix Designs</th>
<th>Mix Type</th>
<th>MFP</th>
<th>Coarseness Factor</th>
<th>WF</th>
<th>CF</th>
<th>FAA Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate 1</td>
<td>Jasper Stone</td>
<td>1&quot; Max</td>
<td>51.00%</td>
<td>2.66</td>
<td>0.60%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Aggregate 2</td>
<td>River Valley</td>
<td>Class A</td>
<td>35.00%</td>
<td>2.62</td>
<td>0.20%</td>
<td>Target Workability</td>
</tr>
<tr>
<td>Aggregate 3</td>
<td>Mulberry Stone</td>
<td>Chip</td>
<td>14.00%</td>
<td>2.68</td>
<td>0.60%</td>
<td>Workability Difference</td>
</tr>
<tr>
<td>Ash Grove Chemult</td>
<td>Type V/II</td>
<td>75.00%</td>
<td>9.15</td>
<td></td>
<td></td>
<td>W/C Ratio</td>
</tr>
<tr>
<td>Boral Resources Springfield</td>
<td>Class C</td>
<td>25.00%</td>
<td>2.65</td>
<td></td>
<td></td>
<td>Design CF</td>
</tr>
<tr>
<td>Air (2-2oz. 100 wt. of cementitious)</td>
<td>Polychem SA</td>
<td>2-2oz. 100 wt. of cementitious</td>
<td></td>
<td></td>
<td></td>
<td>Air</td>
</tr>
<tr>
<td>Water Reducer (oz/100 wt.)</td>
<td>Polychem 400N</td>
<td>6.00%</td>
<td>5-5oz per 100 wt. of cementitious</td>
<td></td>
<td></td>
<td>slump</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Aggregate 1</th>
<th>Aggregate 2</th>
<th>Aggregate 3</th>
<th>Aggregate 4</th>
<th>Cum. % Retained</th>
<th>Gradation Envelope</th>
<th>Gradation Envelope</th>
<th>Cum % Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>3/4</td>
<td>0.22</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>1/2</td>
<td>28.6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>3/8</td>
<td>59.26</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 4</td>
<td>90.19</td>
<td>2.62</td>
<td>2.58</td>
<td>0</td>
<td>47</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 8</td>
<td>91</td>
<td>8.28</td>
<td>6.65</td>
<td>0</td>
<td>58</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 16</td>
<td>94.26</td>
<td>21.2</td>
<td>93.45</td>
<td>0</td>
<td>99</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 30</td>
<td>95.02</td>
<td>47.3</td>
<td>95.31</td>
<td>0</td>
<td>78</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 50</td>
<td>95.94</td>
<td>85.55</td>
<td>96.13</td>
<td>0</td>
<td>93</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 100</td>
<td>96.76</td>
<td>98.44</td>
<td>96.63</td>
<td>0</td>
<td>97</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
<tr>
<td>No 200</td>
<td>97.46</td>
<td>99.46</td>
<td>97.03</td>
<td>0</td>
<td>98</td>
<td>Upper</td>
<td>Upper</td>
<td>100</td>
</tr>
</tbody>
</table>

Coarse Sand % 8-30: 3% Yes
Fine Sand % 30-200: 29% Yes

Cementitious Volume: 2.7755 Cu. Ft.
Water Volume: 3.4252 Cu. Ft.
Air Volume: 1.62 Cu. Ft.
Total Volume: 7.8189 Cu. Ft.
Volume of 100 lb of Aggregate: 0.6057
Total Aggregate Per Yard: 3166.84

Cement: 590.75 Lbs
Flyash: 590.75 Lbs
Water: 313.62 Lbs
W/R: 5.751

Cost Analysis: 2.5

Batch Weights (LBS):
Cement: 590.75
Flyash: 590.75
Water: 313.62
W/R: 5.751

Mix Design

MA-3 Gradation Distribution Chart

% Retained Per Individual Sieve

Sieve Size

0 5 10 15 20 25

1.5 1 3/4 1/2 3/8 No 4 No 8 No 16 No 30 No 50 No 100 No 200
Mix Design

MA-5 Gradation Distribution Chart

- **Cumulative Percent Retained**
- **Sieve Size**: 1.5, 1, 3/4, 1/2, 3/8, No 4, No 8, No 16, No 30, No 50, No 100, No 200
Mix Design

Tarantula Gradation Distribution Chart

% Retained Per Individual Sieve

Sieve Size

No 200 No 100 No 50 No 30 No 16 No 8 No 4 3/8 1/2 3/4 1 1.5
Mix Design

Coarseness and Workability Chart

Coarseness Factor

Workability Factor
Game Plan

- Started on WB Lanes
- Started on East end of project
  continuous paving until we reached West end
- Switched crews every 12 hours
- Paver never stopped running
Paving

- Averaged roughly 190 yds an hour
- Yds/hr and pace was limited to paver speed
- New RexCon Mobile 12 Self-Erecting Batch Plant
Smoothness Challenges

- Smoothness testing
- Performed with High Speed Inertial Profilers
- JSP referred back to 610 without the 15 adjoining exception
- Ran profile before construction on shoulder and passing lane
- Gave idea of existing roadway
Left Wheel Path

![Bar chart showing distance (ft) vs. RL (in./min) with data before and after grinding. The chart displays fluctuations in RL along the distance axis, marked by orange and blue bars representing before and after grinding respectively.](image-url)
Right Wheel Path
Post Grind Left

[Bar chart with data]
Post Grind Right
WB Overlay Smoothness

- Pre-Grind Numbers
  - IRI combined average 67.49
  - Decent ride
  - Had ALR’s to address

- Post-Grind Numbers
  - IRI combined average 25.7
  - Very smooth and rides really well
Overlay Smoothness

- Post-Grind Numbers
- EB Driving Lane IRI Average 23.6
- WB Driving Lane IRI Average 25.7
- Project smoothness overall success
Results

- Strength Average was 6,828 PSI
- Standard Deviation was 621 PSI
- QL average on strength was 5.21
Going forward

- Stick to the plan and meet the schedule
- Be prepared for unknowns
- Entire contractor team has to be on-board a project like this
Questions?

- Contact Information
  Kyle Frye P.E.
  Quality Control Manager
  (816) 262-0170