Inbound & Outbound Peña Boulevard Reconstruction

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Engineer
February 5, 2015
Overview

- DIA Facts and Project Overview
- Peña Boulevard History with Alkali Silica Reactivity
- Removal vs. Rubbilization
- Drainable Base
- Safety and Shoulder Erosion Mitigation
- Review and Lessons Learned
DIA Facts

- Opening Date: February 28, 1995
- Location: 23 miles northeast of downtown Denver
- Elevation: 5,431 feet above sea level
- Size: 34,000 acres, 53 square miles
- Runways: Six runways; 4 north/south and 2 east/west
Project Overview

Source: Google Earth Maps
Project Overview

Phase One – IB Peña Reconstruction (2011)

Phase Two – OB Peña Reconstruction (2012)

Phase Three – IB/OB Peña Reconstruction (2014)

Source: Google Earth Maps
Project Overview
Alkali Silica Reactivity (ASR)

- Alkali Silica Reactivity (ASR) is the reaction between the cement paste and the aggregates that causes deterioration of concrete.
Alkali Silica Reactivity (ASR)

- Repairs
  - Patch Material is a high density rubber. Similar to the material that super balls are made of.
Alkali Silica Reactivity (ASR)

Continued deterioration due to ASR

2010 Spall Repair
Removal vs. Rubbilization

- What is Rubbilization?

- Sustainable Product?
  - Advantages
  - Cost Comparison
- **Multi-Head Breaker Method**
  - **Pavement Breaker.** Breaking of the concrete pavement shall be accomplished with a self-contained, self-propelled, unit with hammers mounted laterally in pairs with half the hammers in a forward row and the remainder diagonally offset in a rear row so that there is continuous breakage from side to side. The lift height of the hammers shall be independently adjustable. The equipment shall have the capability of rubblizing a 13 foot lane in a single pass.
  - **Steel Roller.** A steel vibratory roller fitted with a “Z” pattern grid on the drum face having a gross weight of not less than 10 tons, operated in vibratory mode, shall be used to settle and seat the rubblized pavement.
Removal vs. Rubbilization
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Removal vs. Rubbilization

Rubbilization Typical Profile
N.T.S.

Removal Typical Profile
N.T.S.
Removal vs. Rubbilization
Removal vs. Rubbilization
## Removal vs. Rubbilization

- Looking at the numbers for 100,000 square yards of PCCP.

<table>
<thead>
<tr>
<th>Removals</th>
<th>Unit</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of Concrete</td>
<td>SY</td>
<td>$3.60</td>
</tr>
<tr>
<td>4-inches ABC Class 6</td>
<td>TON</td>
<td>$14.50</td>
</tr>
<tr>
<td>Geotextile Class 1 Separator</td>
<td>SY</td>
<td>$3.00</td>
</tr>
</tbody>
</table>

| Total                           |      | $949,275.00 |

<table>
<thead>
<tr>
<th>Rubbilization</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inches ABC Class 6</td>
<td>TON</td>
<td>$14.50</td>
</tr>
<tr>
<td>Rubbilization</td>
<td>SY</td>
<td>$3.00</td>
</tr>
</tbody>
</table>

| Total                           |      | $444,637.50 |

- Risk???

<table>
<thead>
<tr>
<th>Removals</th>
<th>Rubbilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather (Soft Spots)</td>
<td>Minimal Soft Spots</td>
</tr>
<tr>
<td>Cost (e.g. Trucking, Materials)</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
</tr>
</tbody>
</table>
Drainable Base
- The need for drainable base?
Drainable Base
Drainable Base
Safety and Shoulder Erosion
Safety and Shoulder Erosion
Safety and Shoulder Erosion
Review and Lessons Learned

- Rubbilization
  - Install edge drains prior to rubbilization.
    - Eliminates difficulty of installation and provides a better product.
  - The rubbilized material along the edge of roadway will not meet the specification requirements due to the un-confined space.
  - Perform test pits up front to evaluate the gradation and to provide a set process or procedure for meeting the specification requirements.
  - Identify soft spots and stabilize as necessary with the rubbilized concrete.
Review and Lessons Learned

- Removal of Concrete (Seating)
  - Break concrete into 2-foot minus nominal dimension.
    - Smaller dimension preferred.
  - Account for 20-25% overrun of ABC Class 6 to fill the voids.
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