Virginia Concrete Conference
March 4-5, 2009

Route 5 - Chickahominy River Bridge

VDOT End Result Specification (ERS)
Pilot Project
The Good

- CHARLES CITY/JAMES CITY – The Virginia Department of Transportation (VDOT) will open the new Route 5 Judith Stewart Dresser Memorial Bridge over the Chickahominy River to vehicle traffic Saturday, Jan. 24—approximately seven months ahead of schedule. The structure replaces the aging 70 year old swing span bridge.
The Good

- Producers are able to . . .
  - use aggregates that by today’s specifications would not have been acceptable for use by VDOT.
  - use already proven mix designs with statistical data for VDOT projects.
  - generate our own performance based mix design based on our materials, not only VDOT approved materials.
  - The use of HRWR’s in the design allows for more versatility in the mix.
The Good

- Because of the plant's proximity to the job site, (1 mile from job) we were able to set up all the testing at the concrete plant.
- Based on all the fresh concrete properties, there were a very small percentage of loads that were not accepted for the project.
- The average slump for the project was 7 ¼”.
- Design 5 to 9 inches.
- The average air content was 6.6%
- Design 5.0 to 9.0%
- The average unit weight was 141.57 pcf.
- The theoretical unit weight is 140.54 pcf.
- Permeability results were fabulous! 433 coulombs.
  - (St. Dev. 161)
The Bridge is closed temporality due to malfunctions, causing unnecessary delays.
The Bad

- We must look at the current +/- 2 requirement of the on the job specifications.
- The top end of the air content with HRWR is increased by 1%! Why? The additional air will only decrease the overall strength of the concrete.
The Bad

- Waste! A lot of concrete was thrown away, because the initial specifications called for testing every load.

SCREENING TESTS

- Once consistent data is received, (meet spec) changes could be made to minimize testing. First three loads, and every so many loads (or even random testing every so many yards).
Average A-4 General strength on the Project

4900 psi
Average A-4 General Slump on the Project

7 ½”  8”  8”
7 ¼”  7 ½”  7 ¼”
7 ¼”  7”  6 ¾”  6 ¼”
7 ¼”  7 ½”  7 ¼”
8”  7 ¼”  5”  7 ½”
7 ½”  7 ¾”  7 ¾”  7 ½”
Average A-4 General Air Content on the Project

<table>
<thead>
<tr>
<th>Average Air Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2%</td>
</tr>
<tr>
<td>6.6%</td>
</tr>
<tr>
<td>6.8%</td>
</tr>
<tr>
<td>7.4%</td>
</tr>
<tr>
<td>6.7%</td>
</tr>
<tr>
<td>6.4%</td>
</tr>
<tr>
<td>7.0%</td>
</tr>
<tr>
<td>6.6%</td>
</tr>
<tr>
<td>6.6%</td>
</tr>
<tr>
<td>6.6%</td>
</tr>
<tr>
<td>6.6%</td>
</tr>
<tr>
<td>7.1%</td>
</tr>
<tr>
<td>6.5%</td>
</tr>
<tr>
<td>6.1%</td>
</tr>
<tr>
<td>6.8%</td>
</tr>
<tr>
<td>6.1%</td>
</tr>
</tbody>
</table>
Average A-4 General Permeability on the Project

433 coulombs
The Ugly

- Under current specifications, very few loads would have been penalized.
- Under the ERS, this data shows that penalties would have been applied to ten of the seventeen lots tested.
The Ugly

- To avoid penalties, a ready mix producer will have to go against initial thought.

- Instead of the 4000 design, to meet the average 4500 psi requirement, you would have to design the mix design around 5000 psi to minimize your chances of penalties.

- This would be an increase in the cost to the contractor, ultimately the owner.
What could / should we do?

- Invest in highly sophisticated concrete plant, that would have to batch more slowly, and weigh materials more accurately (batching).
- Assess every position in the batch process. Drivers, batch personnel, loader operator, Q. A. people, to focus on consistency!
- Assess your fleet of trucks, less variability is better.
- A variety of mix designs may be necessary for year round construction.
- Entertain the idea of non air-entrained mix designs for areas not susceptible to freeze thaw.
The Good, The Bad and The Ugly
End Result Specification