Project Alluvion Updates

Better Concrete Conference
November 10, 2016
Project Alluvion Updates

Project Background

Microsoft Alluvion

Phase 1: 35,000sf Administration Building (AB1), 285,000sf of server space (AS1-AZ), 31,000sf connector buildings (CN)
Phases 2-4: addition of 4 server buildings each phase - 285,000sf each phase
Iowa State University Updates

- What Do We Know Now?
Air and Durability

Super Air Meter

Rapid Air Test

Image: Gudimettla
Air and Durability

Results

• Air content—good
  • 5.6-8.2% in front of paver (conventional—higher)
  • All cores: 5.8% and up

• SAM/spacing factor
Air and Durability

• Freeze/thaw resistance (ASTM C666)
  • Durability factor – all above 75% indicating a good F/T resistance
  • Correlate with air structure
Resistance to Chemical De-Icers

Soak tests

- 56 day cure
- Soak in 4% MgCl₂ at 40°F
Permeability

Resistivity Test

Results

• 7 & 28 days
  • Similar results for M-QMC and reg. QMC

• 56 & 91 days
  • M-QMC showing continuous improvement, higher resistivity than reg. QMC

• Significant improvement over C4

Image: Proceq
Resistivity of Core Samples:

Higher resistivity = less permeable, greater durability

### Permeability Class

<table>
<thead>
<tr>
<th>Permeability Class</th>
<th>Chloride Permeability Charge Passed (coulombs)</th>
<th>28-Day Surface Resistivity (kΩ-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>&gt;4000</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Moderate</td>
<td>2000-4000</td>
<td>12-21</td>
</tr>
<tr>
<td>Low</td>
<td>1000-2000</td>
<td>21-37</td>
</tr>
<tr>
<td>Very low</td>
<td>100-1000</td>
<td>37-254</td>
</tr>
<tr>
<td>Negligible</td>
<td>&lt;100</td>
<td>&gt;254</td>
</tr>
</tbody>
</table>
Alluvion Conclusions

Workability and finishing

• Mix is paving and finishing nicely
• Watch how curbs are standing up

Chemical resistance and permeability

• Benefits of fly ash may become apparent in long-term test results

Expansion tests indicate improved resistance to salts
Concrete Mix Updates

What are We Going to Do Now

▪ Concrete Mix on Other Projects
Concrete Mix Updates

- What is Different
  - Coarse Aggregate
  - Fine Aggregate
  - Intermediate Aggregate
  - Fly Ash Type
  - 400 lbs Cement Minimum
  - Test Section
Concrete Mix Updates

Tarantula (2015)

Tarantula (2016)
Concrete Mix Updates

Construction

- Adjustments made first day
- Actual workability
- Air loss
- Water
- W/C discussion
QUESTIONS
FROM THE AUDIENCE
Ask away…