Project Alluvion

Municipal Streets Seminar

November 18, 2015
Project Alluvion

Introductions

- Andy Denker – CTI
- Jeremy Huntsman – HR Green
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Project Background

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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
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Project Challenges
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Project Participants / Consultants

- City of West Des Moines
- CTI
- Elder Corp
- J&K Construction
- Bolton & Menk
- McClure Engineering
- MSA
- Shive-Hattery
- HR Green
- Civil Design Advantage
- Iowa State University
- Purdue University
- Oregon State University
- Louisiana Transportation Research Center
- CP Tech Center
- Iowa Concrete Paving Association
- Minnesota Dept. of Transportation
- Iowa Dept. of Transportation
- Logan Contracting
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Timelines

- Pine Avenue – S. 8\textsuperscript{th} Street to Highway 28
- Water main Connections
- White Crane Road
- Pine Avenue – West of S. 8\textsuperscript{th} Street
- S. 8\textsuperscript{th} Street – Pine Avenue to County Line Road
- S. 8\textsuperscript{th} Street – Pine Avenue to Army Post Road
- Maffitt Lake Road – Veteran’s Parkway to S. 8\textsuperscript{th} Street
- Fiber Optic Connections
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Why This Project is a Test Section?

- Mix of new pavement and existing pavement
- Similar traffic volumes for all streets
- Large enough to get good dataset
- Need to start sometime
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Current Concrete Issues

- Saturation/Freezing and Thawing
- Chemical Attack
- Incremental Cracking
- Others
What are We Going to Do

- Sealant
- Subdrain
- Subbase / Subgrade
- Concrete mix
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Sealant

- Pavix
  - Existing Pine Avenue joints
  - Joints for 500’
  - Entire slab for 500’
  - Right after paving machine
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Subdrain

- Subdrain installed on all projects
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Subbase / Subgrade

- 12” Subgrade Prep
- 12” Subgrade Prep and 6” Subbase
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Concrete Mix

- Who is involved
  - City of West Des Moines
  - CP Tech Center
  - ICPA
  - HR Green
  - Iowa State
  - Purdue
  - Oregon State
  - Paving Contractors
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Concrete Mix

- Concrete Mix Timeline
  - Project was Ready to Go
  - City of West Des Moines Requested a Solution
  - Meeting with ICPA – John Cunningham
  - ICPA Brought in Dr. Weiss, CP Tech Center, Dr. Rupnow
  - Formulate the Specifications
  - Meeting with Paving Contractors
  - More Specification Changes
  - Testing
Concrete Mix

- Dr. Weiss – Calcium Oxychloride
  - Increase Fly Ash to 33%
  - Reduce Reaction of Salts with Calcium Hydroxide
What Causes the Calcium Oxychloride to Form

For each system the results are a little different but let’s focus on CaCl₂ as the salt: Reactions occur with C₃A and CH

- \( \text{CaCl}_2 + 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 12\text{H}_2\text{O} \rightarrow 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{CaCl}_2 \cdot 10\text{H}_2\text{O} \)
- Friedel’s salt

- \( \text{CaCl}_2 + 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{CaSO}_4 \cdot 12\text{H}_2\text{O} \rightarrow 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{CaCl}_2 \cdot 10\text{H}_2\text{O} + \text{CaSO}_4 \cdot 2\text{H}_2\text{O} \)
- Monosulfate (AF₃)
- Friedel’s salt
- Gypsum

- \( 0.5 \text{CaCl}_2 + 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{CaSO}_4 \cdot 12\text{H}_2\text{O} \rightarrow 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 0.5\text{CaSO}_4 \cdot 0.5\text{CaCl}_2 \cdot 11\text{H}_2\text{O} \)
- Monosulfate (AF₃)
- Kuzel’s salt
- Gypsum
- + 0.5 (CaSO₄·2H₂O)

- \( 3\text{Ca(OH)}_2 + \text{CaCl}_2 + 12\text{H}_2\text{O} \rightarrow \text{CaCl}_2 \cdot 3\text{Ca(OH)}_2 \cdot 12\text{H}_2\text{O} \)
- Calcium Oxychloride

The hypothesis is that without C₃A and CH these reactions should not occur.
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Concrete Mix

- Minnesota Spec and Modifications to Spec
  - Air – Minimum of 6% Behind Paver
  - W/C ratio – 0.40 Target, 0.42 Maximum
  - 400 lbs Cement Minimum
  - Testing – ISU Testing Results to Date
  - Test Section
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Construction

- Collaboration
- Issues before paving
- Aggregates
- Pricing
- Previous experience
- Test section
- Fly ash
  - Availability
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Construction

- Adjustments made first day
- Actual workability
- Air loss
- Water
- W/C discussion
- Power settings
- Temperamental mix
QUESTIONS FROM THE AUDIENCE
Ask away...