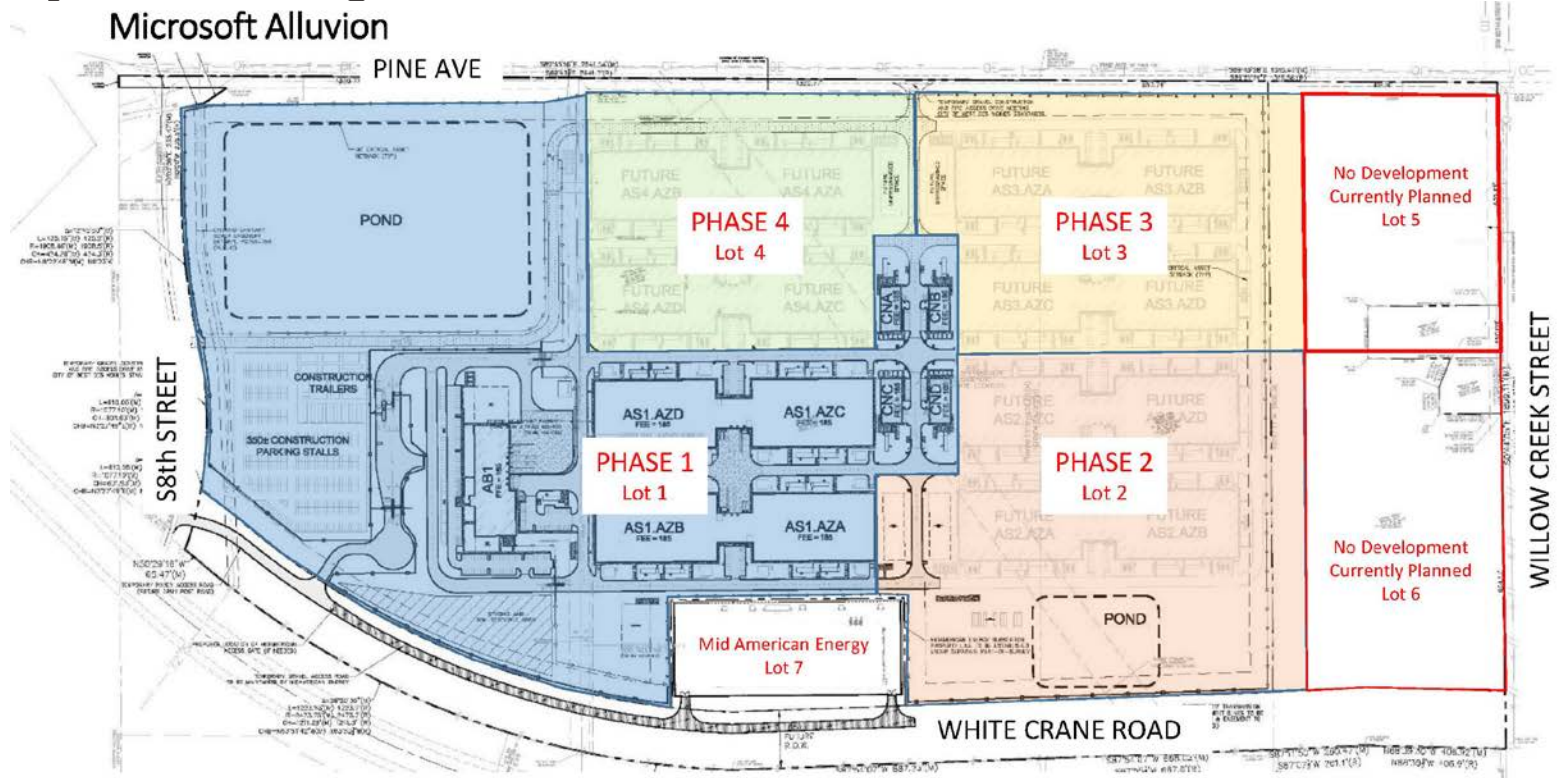


Project Alluvion Updates

Better Concrete Conference
November 10, 2016

Project Alluvion Updates

Project Background



Microsoft DSM06-Alluvion.

Phase 1: 35,000sf Administration Building (AB1), 285,000sf of server space (AS1-AZ), 31,000sf connector buildings (CN)

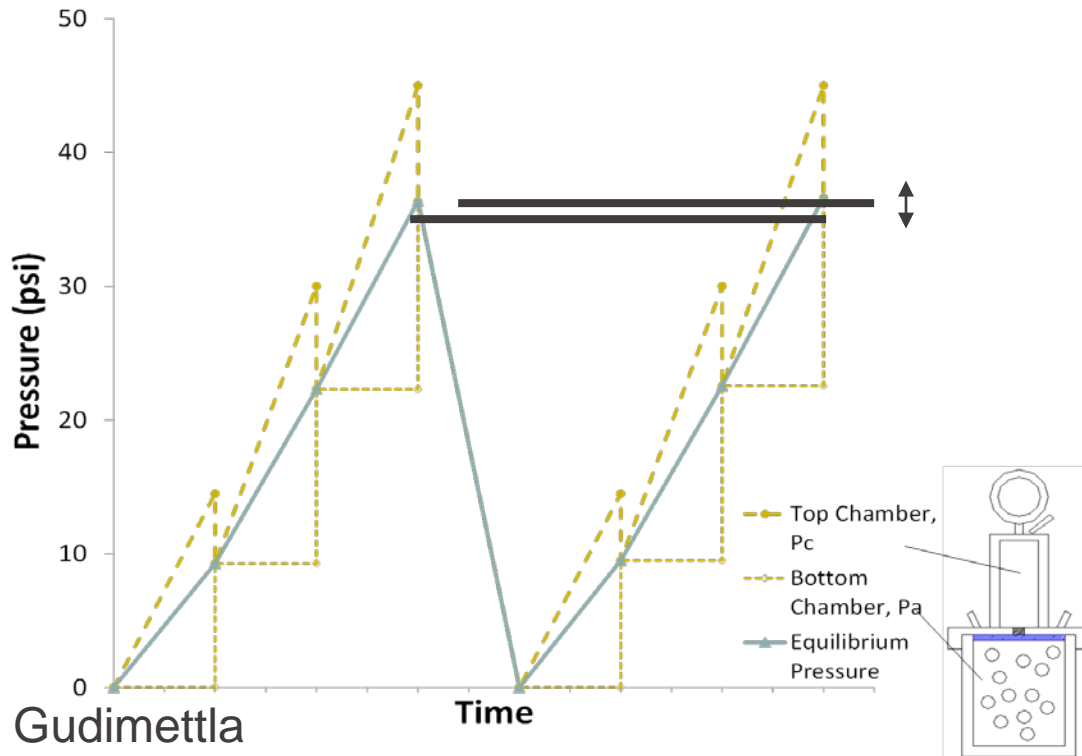
Phases 2-4: addition of 4 server buildings each phase - 285,000sf each phase

Iowa State University Updates

- What Do We Know Now?

Air and Durability

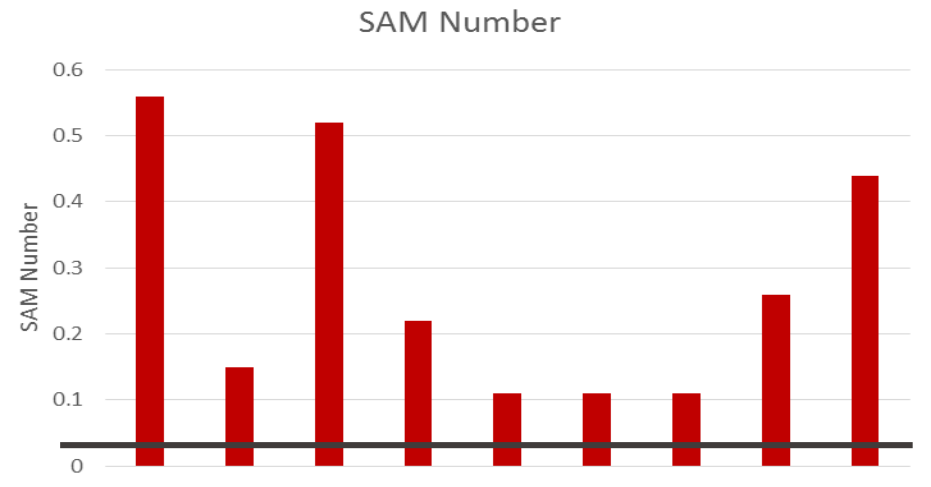
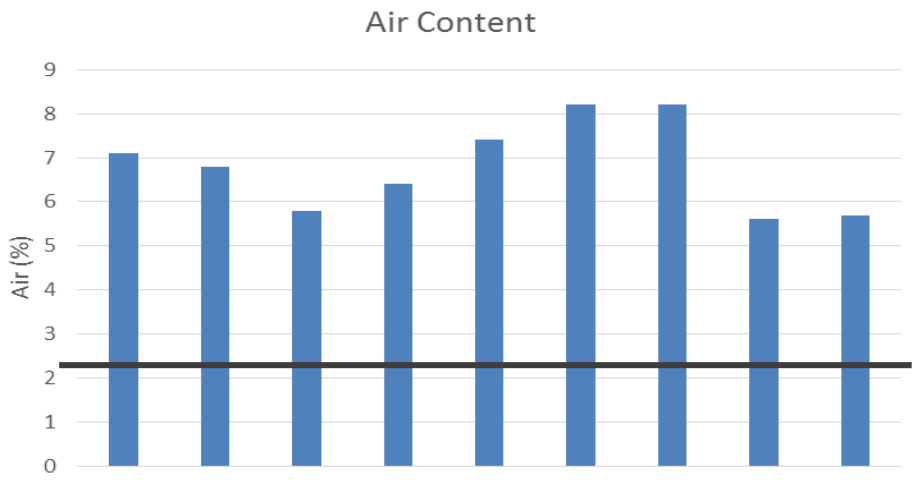
Super Air Meter Rapid Air Test



Air and Durability

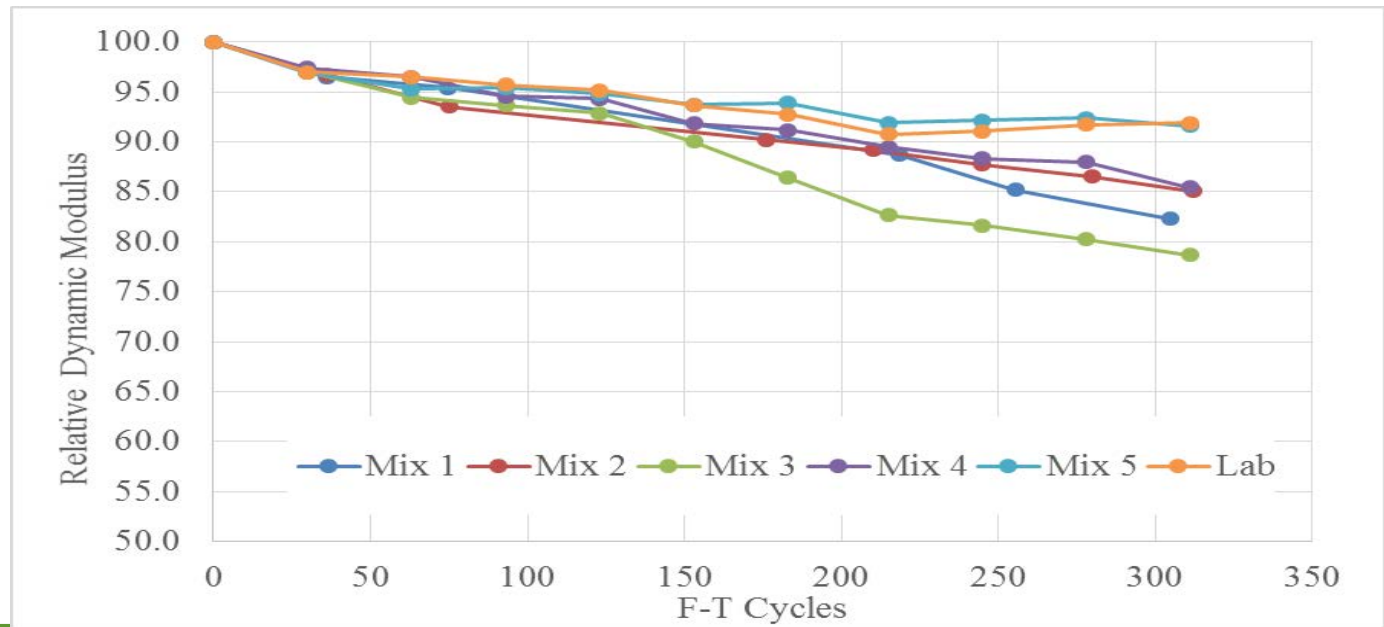
Results

- 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

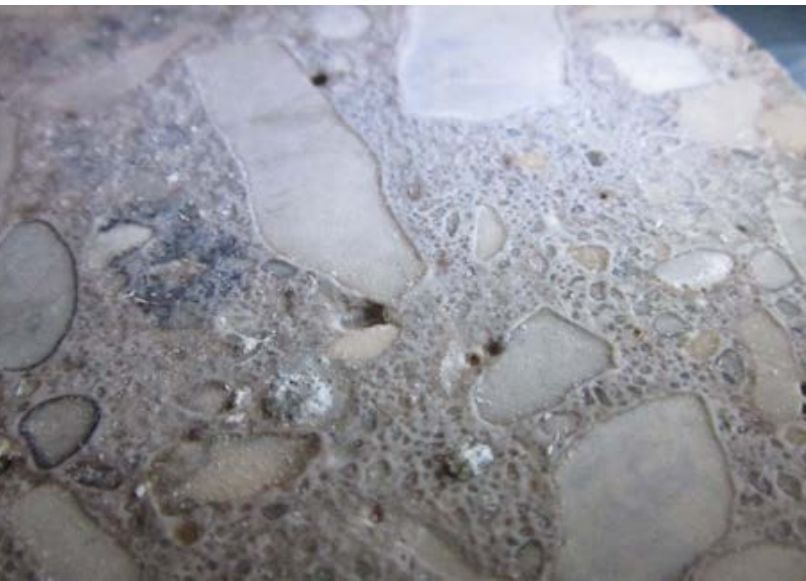
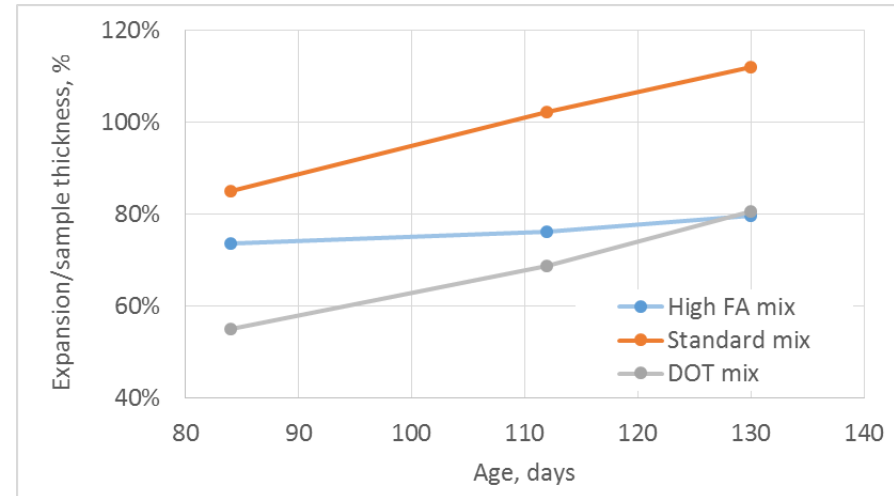
- Freeze/thaw resistance (ASTM C666)
 - Durability factor – all above 75% indicating a good F/T resistance
 - Correlate with air structure



Resistance to Chemical De-Icers

Soak tests

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



Permeability

Resistivity Test Results

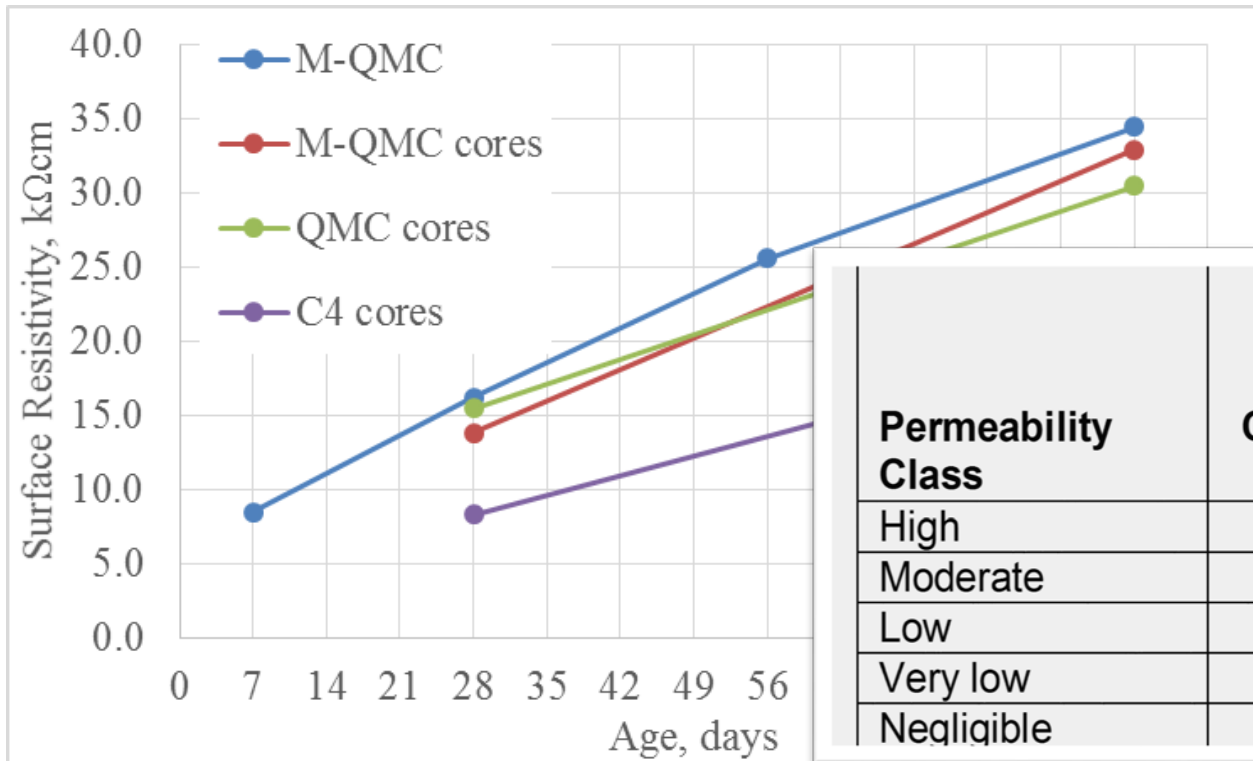
- 7 & 28 days
 - Similar results for M-QMC and reg. QMC
- 56 & 91 days
 - M-QMC showing continuous improvement, higher resistivity than reg. QMC
- Significant improvement over C4



Image: Proceq

Permeability

Resistivity of Core Samples:



Higher resistivity = less permeable, greater durability

Permeability Class	Chloride Permeability Charge Passed (coulombs)	28-Day Surface Resistivity (kΩ-cm)
High	>4000	<12
Moderate	2000-4000	12-21
Low	1000-2000	21-37
Very low	100-1000	37-254
Neqliqible	<100	>254

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

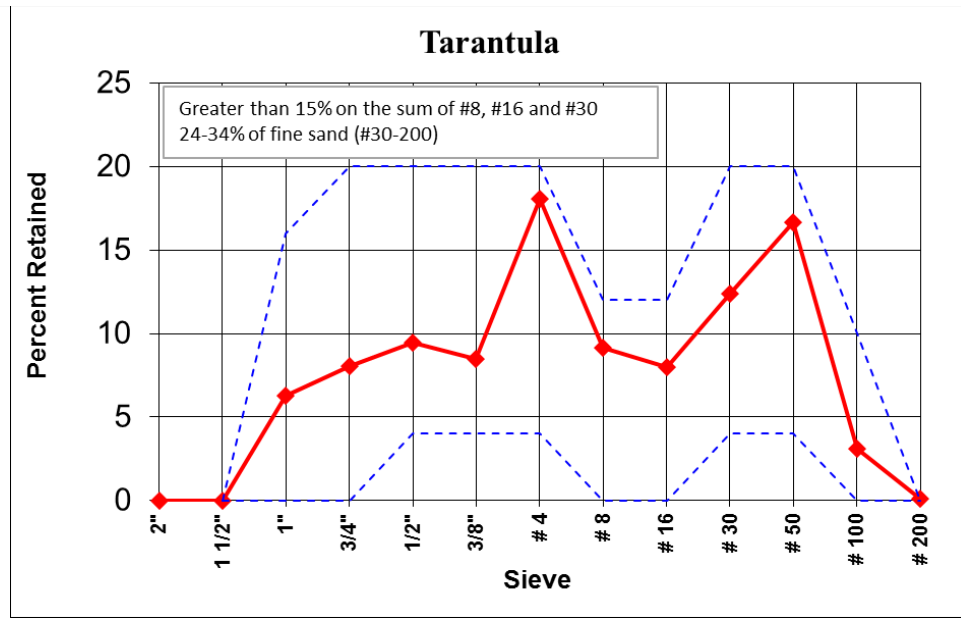
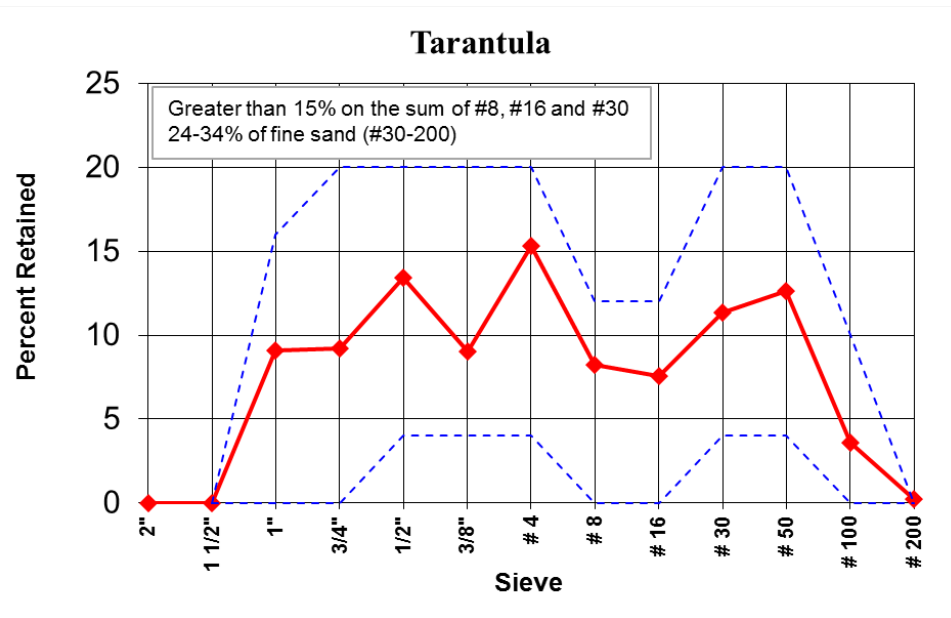
Concrete Mix Updates

- 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...