

# ***Michigan Rapid Set Pavement Repairs***

***National Concrete Consortium  
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# ***Accelerated Opening-to-Traffic Pavement***

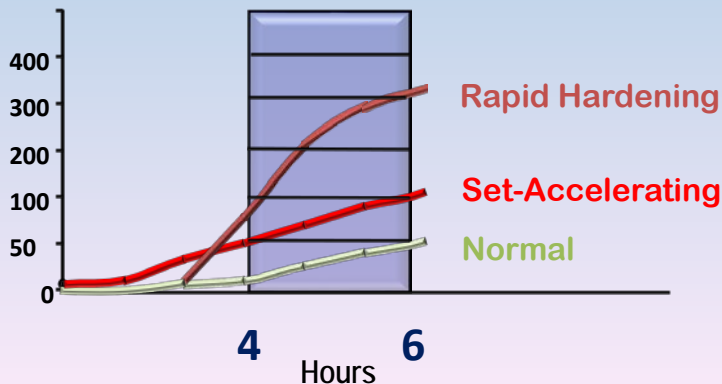
## ***In General,***

- ***MDOT Fast Set Mixtures (obsolete)***
  - *High cement content*
  - *Calcium chloride set accelerator*
  - *300 psi within 8 hour at opening to traffic*
  - *Moderate cost*
  - *Little work time*
  - *5-7 years service life*
- ***MDOT Moderate Set Mixtures (obsolete)***
  - *High cement content*
  - *Calcium chloride set accelerator*
  - *500 psi within 24 hours at opening to traffic*
  - *Moderate cost*
  - *Little work time*
  - *Approximately 10 years service life*
- ***MDOT Current Durable Patching Mixture***
  - *Moderate cement content*
  - *Minimal non-chloride set accelerator*
  - *300 psi within 72 hours at opening to traffic*
  - *Moderate cost*
  - *Estimated 15 years service life*
- ***Several Proprietary Products on the Market***
  - *\$\$\$\$*
  - *Very limited application*



# *What are we Striving to Achieve Now?*

- *Cast-in-Place Rapid Setting Concrete Mixtures that are...*
  - *Cost-effective*
  - *User-friendly*
  - *Timely – mobility*
  - *“Durable”*



# Current Plan

- *Research Team*
  - *MDOT Materials*
  - *University of Michigan – Will Hansen*
- *Defined suite of materials*
- *Designed the mixture criteria*
- *Special provision written*
- *Current field trials (3<sup>rd</sup> year)*
- *Refining,*
  - *Placability / finishability*
  - *Targeting 1 hour work time with minimal slump loss*
  - *Opening to traffic 4-6 hours*



# *Rapid Set Mixture Details*

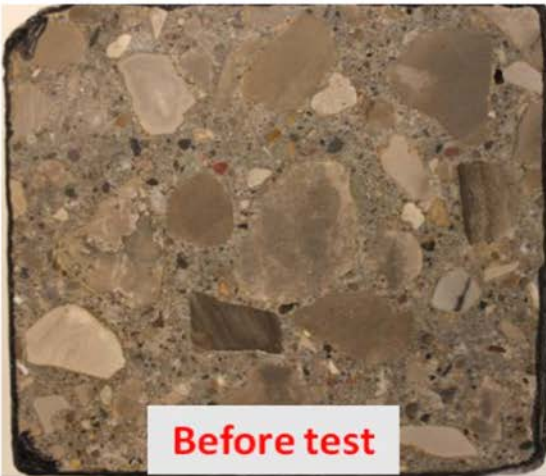
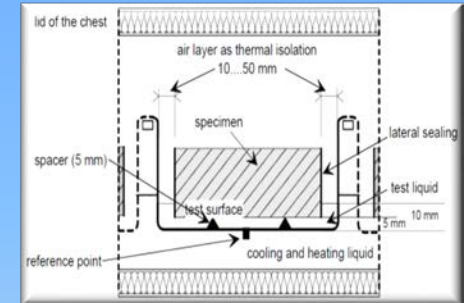
- *Mixture constituents:*
  - *Coarse aggregate - Clean, low absorption, high crushed content*
  - *Fine Aggregate – 2NS*
  - *658 lbs/cyd Type I*
    - *Holcim-St Gen, or*
    - *St Mary's*
  - *25 oz/cwt "SikaSet" non-chloride accelerator*
  - *25 oz/cwt "Rapid 1" Hardening admixture*
  - *8 oz/cwt of "Viscocrete 2100" HRWR*
  - *AEA of their choice*
  - *w/cm: 0.31 - 0.32*
- *Field trials – 300 psi flex. at approx. 6 hours from batching to OTT*



# Lab Durability Testing – Typical Concrete Mix



**UM Modified RILEM Test**



**Before test**



**After test**

**Typical concrete scaled surface profile after 80 F-T cycles**

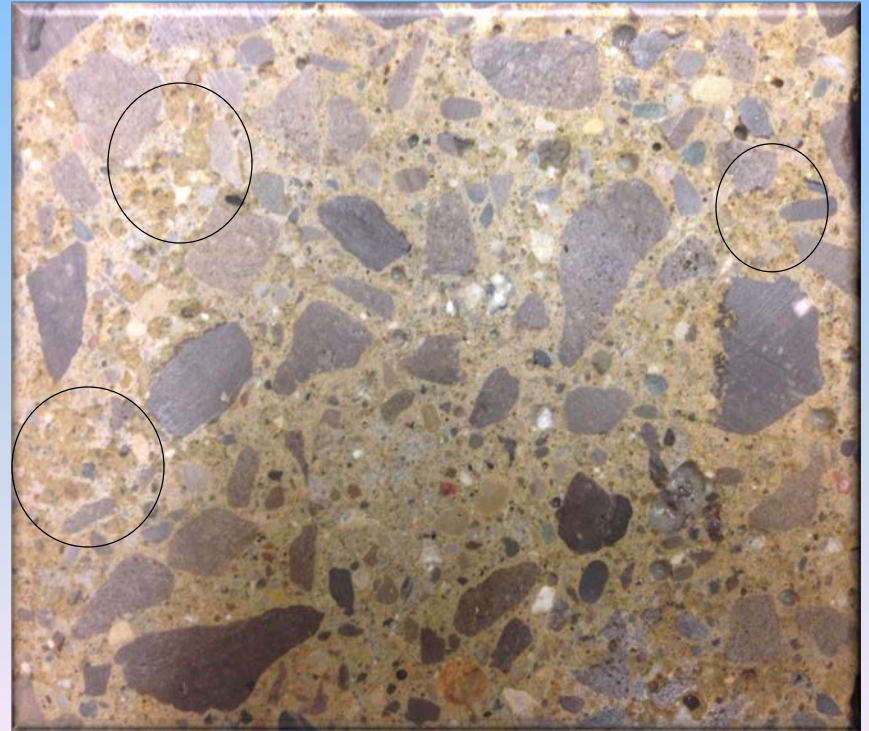
# *Rapid Set Field Trial*

## *Modified RILEM Test*

*Before 56 cycles*

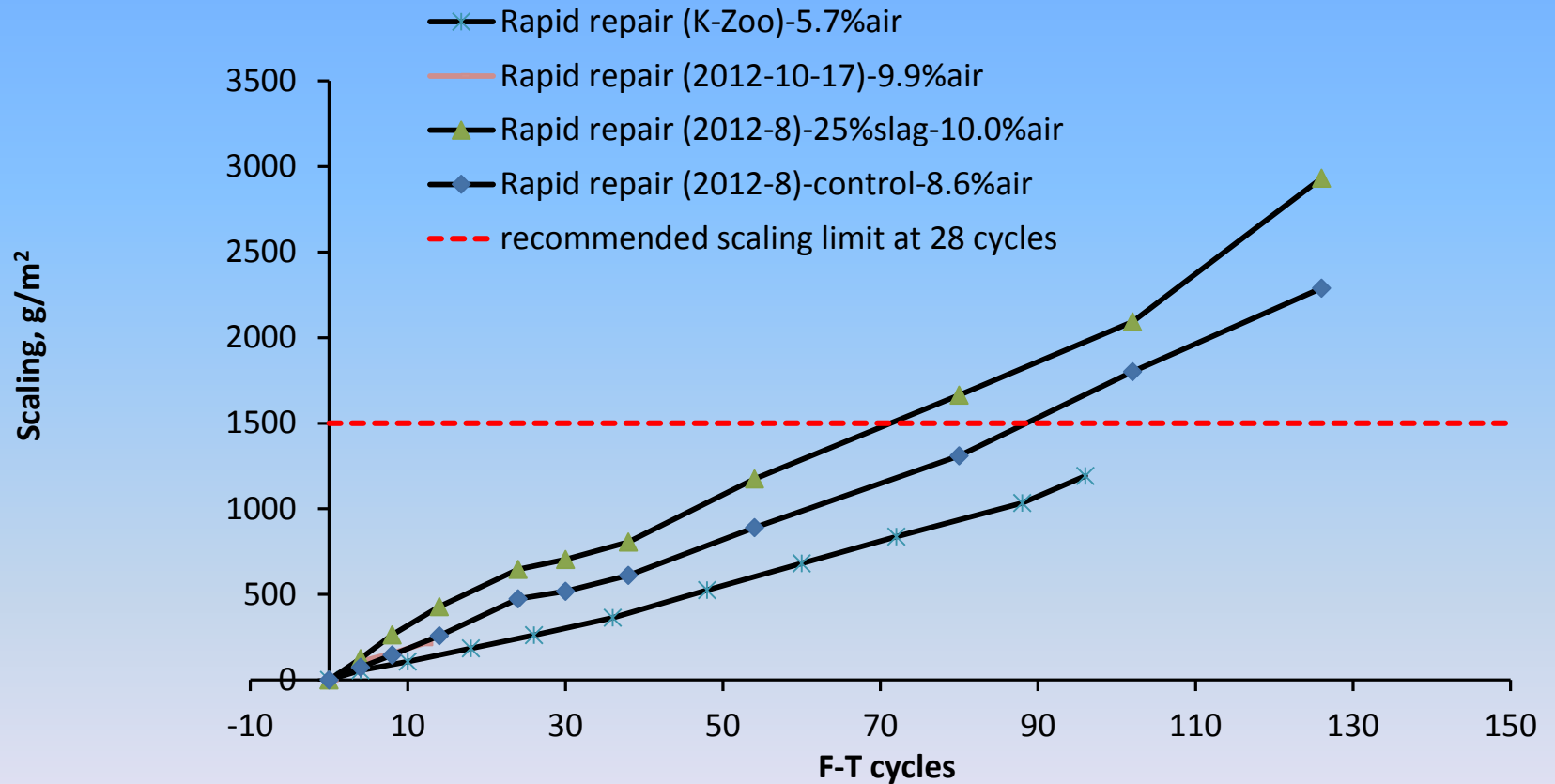


*After 56 cycles*



# Lab Testing: Durability Testing

## Modified RILEM Test





# *Lab Shrinkage Testing*

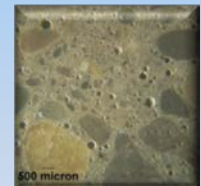
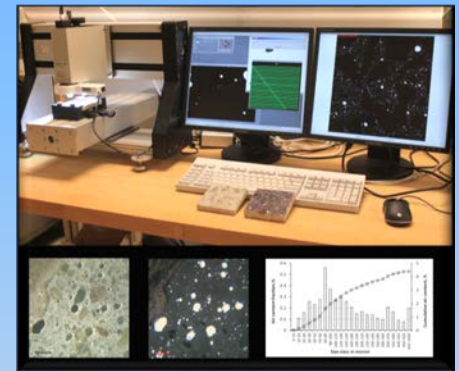


# *What We Know So Far:*

- *Aggregate Qualities*
  - *Clean, low absorption, high crushed content, SSD at batching*
- *Construction Process – Most practices do not change*
  - *Haul Time – 60 minutes pot life*
  - *Blankets (2 layers of R7)*
  - *Tooled joints – no realistic sawing window*
  - *Curing samples – move beams onto slab 2.5 hrs after batching*
- *Temperature Limitations*
  - *Tested in 50's, 60's, and 80's*
- *Admixture Combinations*
  - *Specific combination required*
- *Not all patches on a job require the Rapid Set mixture*

# *In the Works*

- *Laboratory evaluations at UM*
  - *Durability testing*
  - *High resolution petrographic evaluations*
- *In the Field*
  - *Continued trials with experts engaged*
  - *Sampling of in-service concrete for lab analysis*
  - *Validation of long-term durability prospects*
    - *Oldest field trial, to date – completed third winter in-service*
- *Currently underway*
  - *Monitor mainstream implementation*
  - *Trial using internal curing*
  - *Continue to monitor long-term performance*
- *Keep in mind,*
  - *15 year anticipated service life*
  - *Mobility emphasis*



# *Precast Pavement Repairs 2013-14*

- *I-94 in Southwest Michigan*
- *Mainline PCC pavement under bridge overpasses*
- *Lots of random cracking after installation*
- *Investigation currently underway*





# Questions?



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