Damaging Interactions Among Concrete Materials

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U.S. Army Corps of Engineers

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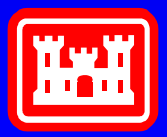

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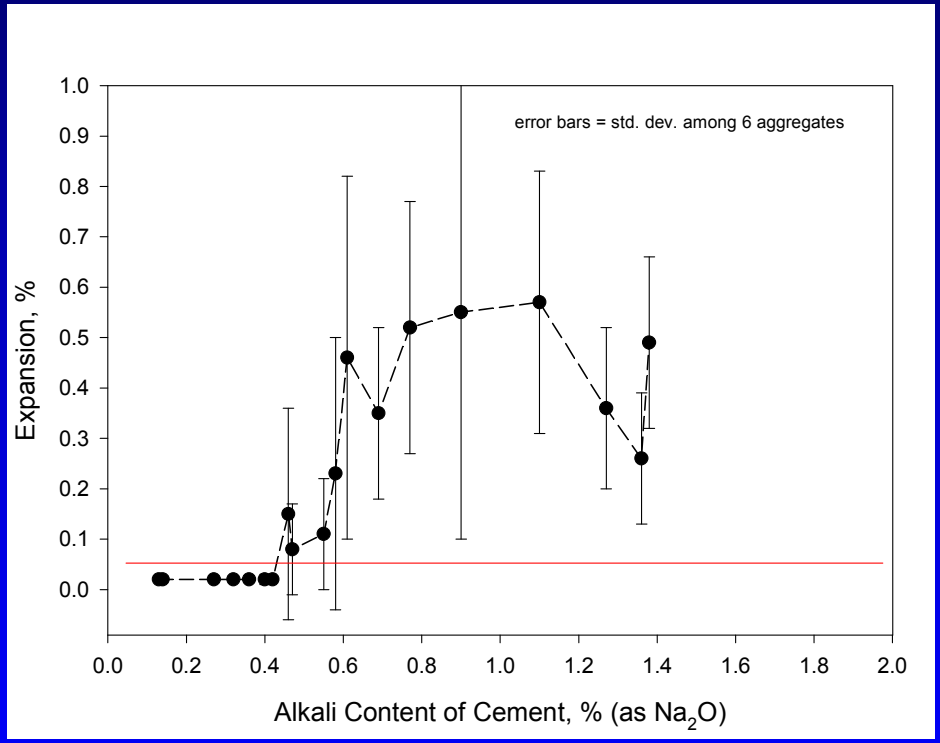
Interactive Effect

- Ad hoc definition: Effect of two or more materials acting on each other in unexpected ways.
- Focus on the negative
- Usually are problematic because of lack of understanding of mechanism
- Tend to defy specifications

AAR: One of the Older Ones

AAR

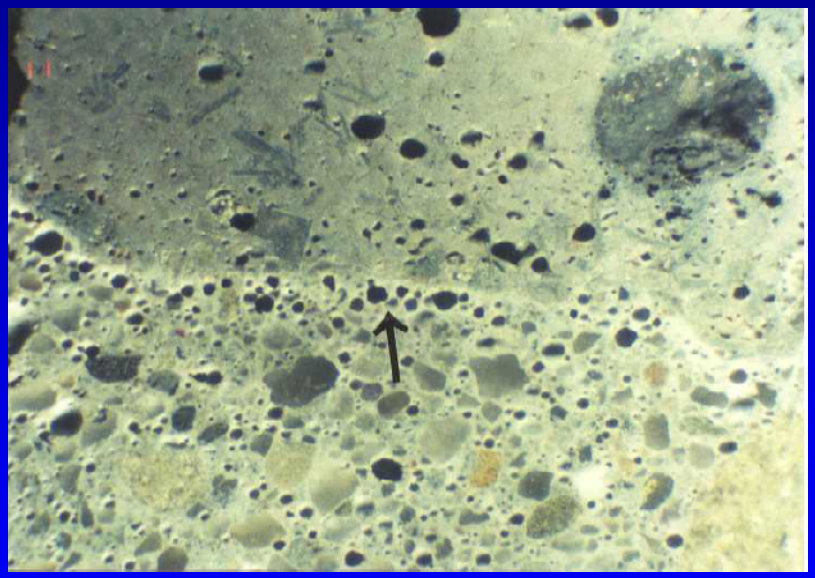
- Cement alkalis
  - Solution: Total alkalis < 0.60%
- Reactive Constituents



Low Alkali Didn’t Work!

Cement – Air Entraining Admixture (relatively new)

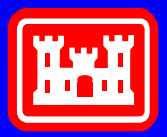
- Some AEA's?
- Some concrete materials?
- Some conditions?
- Air voids collapse around aggregate



Failure of Air Void Systems

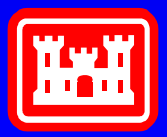
Early Stiffening Reactions

- Portland Cement –WRA Reactions
- Portland Cement – Fly Ash Reactions
- Vary from mild to severe
  - Mild – nuisance
  - Intermediate – often most problem
  - Severe – total show stopper!

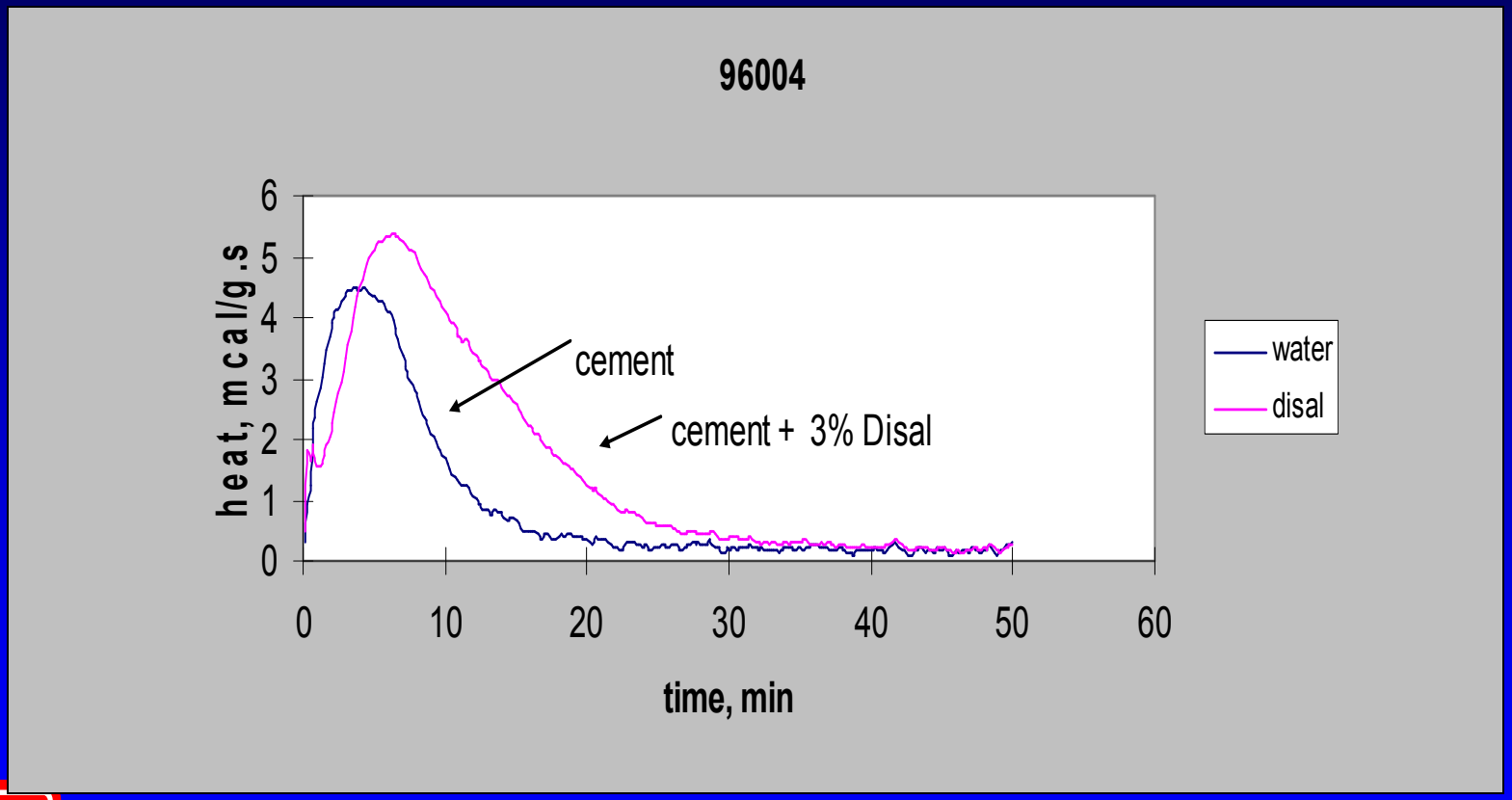


Flash Setting vs False Setting

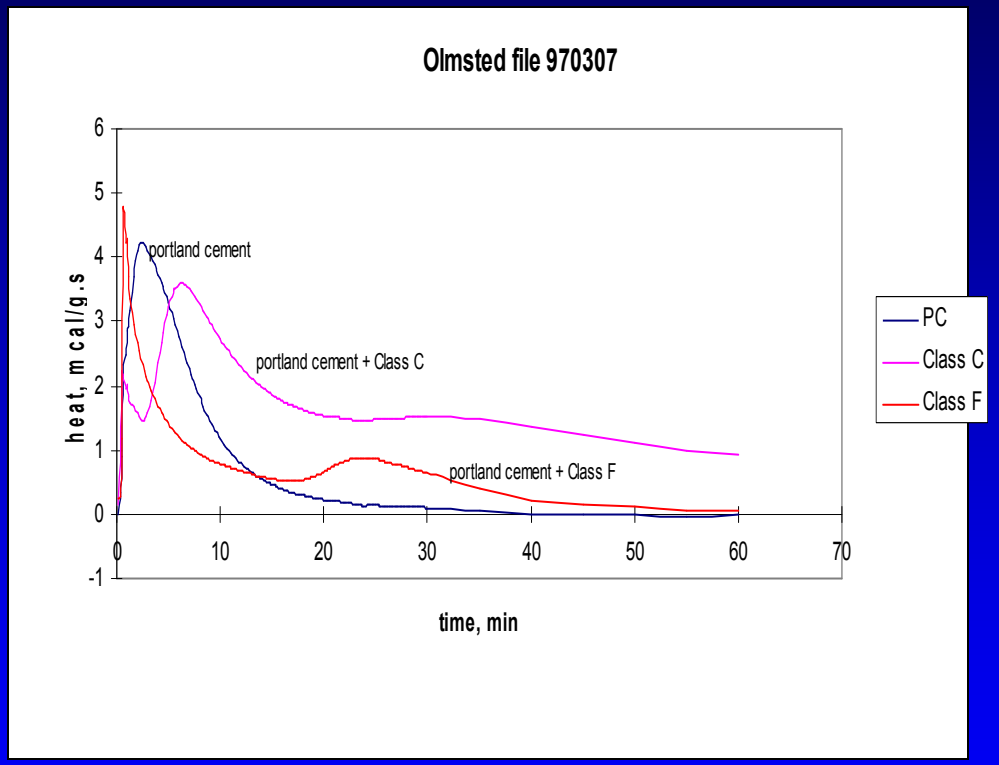
- Flash setting – doesn't disappear on extended mixing – usually caused by accelerated cement hydration
- False setting – disappears with extended mixing – caused by plaster in cement

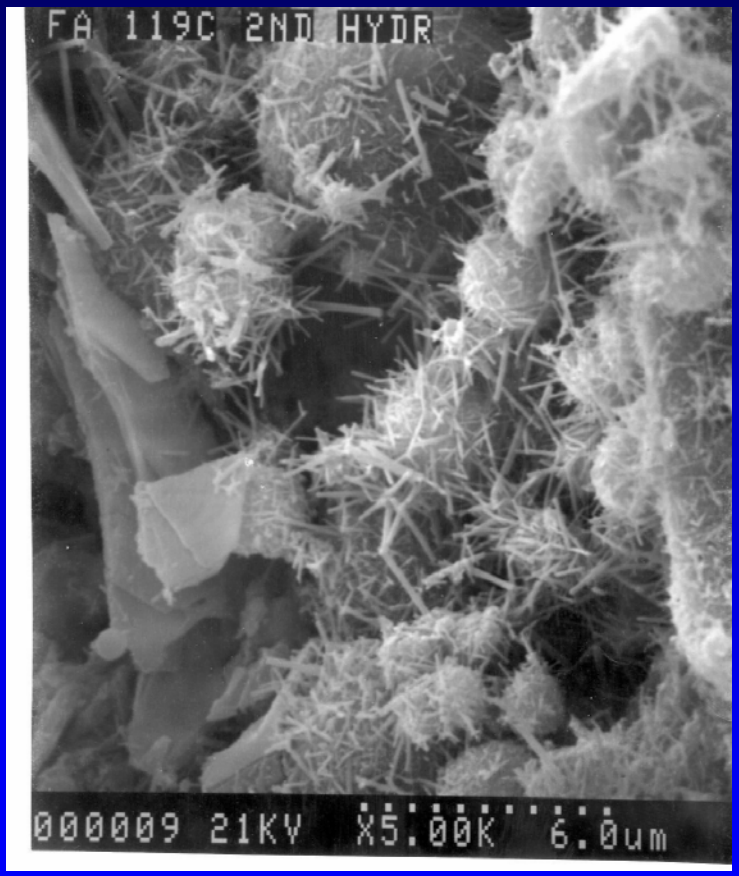


Cement – WRA: Flash Setting



Cement – Fly Ash Reaction





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Damage Factors

- Poor compaction
- Temptation to add water
- Economic - Lost productivity

Poor Compaction

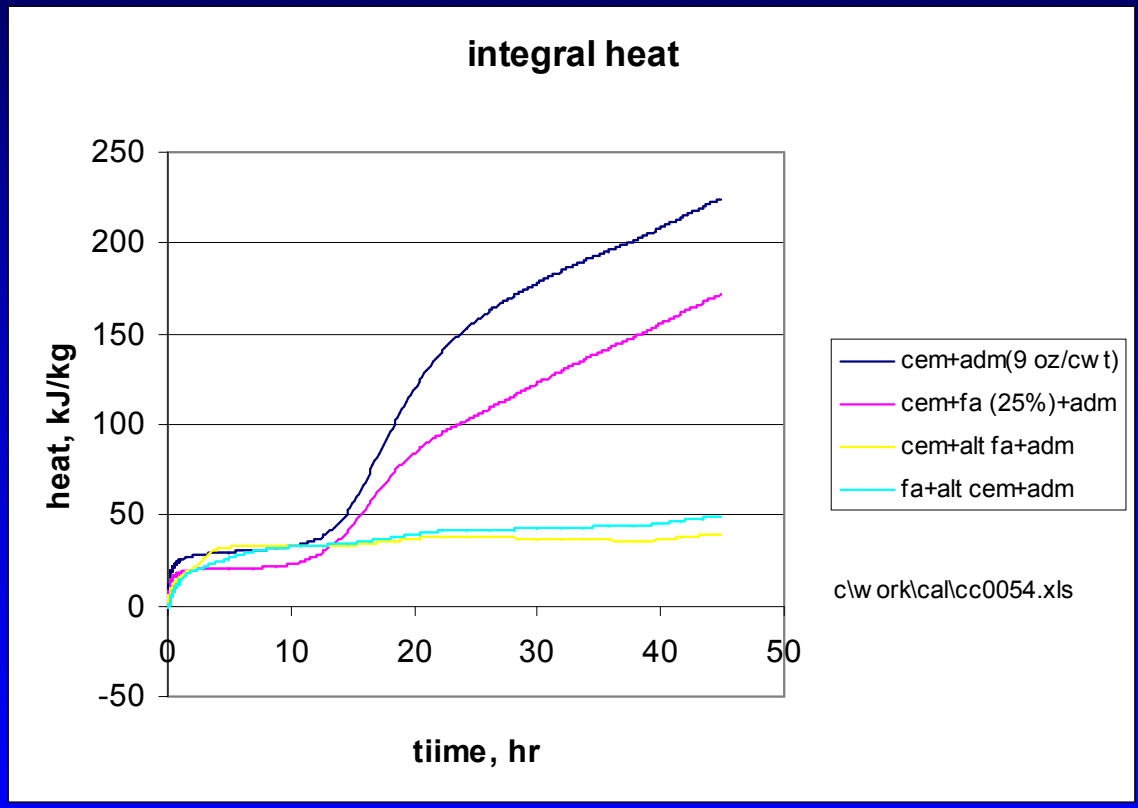
Extra Water

Lost Productivity

Extreme Retardation

- Cement – WRA Reactions
- Cement – Fly Ash – WRA Reactions

Inhibition of C_3S Hydration

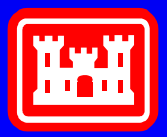


Damage Factors

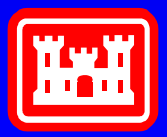
- Plastic Shrinkage Cracking
- Economic – Lost Productivity

ASTM Task Group on Interactions

- Developing test methods
  - Early stiffening
  - Delayed setting
- No specification activity
  - Plausible with fly ashes
  - No clear responsibility tag with admixtures



The End



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