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Durability of Concrete Made with Alternative Supplementary Cementitious Materials

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POWERING THE NEW ENGINEER TO TRANSFORM THE FUTURE

Outline

- Phase I – Baseline Investigation (Complete)
  - Initial Material Characterization/Feasibility
  - Volumetric Stability
  - Alkali-Silica Reactivity – Accelerated
  - Electrical Resistivity
- Phase II – Transport Properties (In Progress)
  - Rapid Chloride Penetration
  - Mercury Intrusion Porosimetry
  - Water Permeability
- Phase III – Long-Term Exposure (In Progress)
  - Alkali Silica Reactivity
  - Sulfate
  - Field Exposure
- Conclusions

Phase I – Baseline Investigation: Feasibility

- Motivation

Application:	General Prescribed Dosages of Supplementary Cementitious Material in Florida (FDOT, 2014)			
	Fly Ash	Blast Furnace Slag	Metakaolin	Silica Fume
Mass Concrete	18-50%	50-70%	8-12%	7-9%
Drilled Shafts	33-37%	58-62%		
Precast Concrete	25% max.	70% max.		
Other Concrete	18-30%	25-70%		

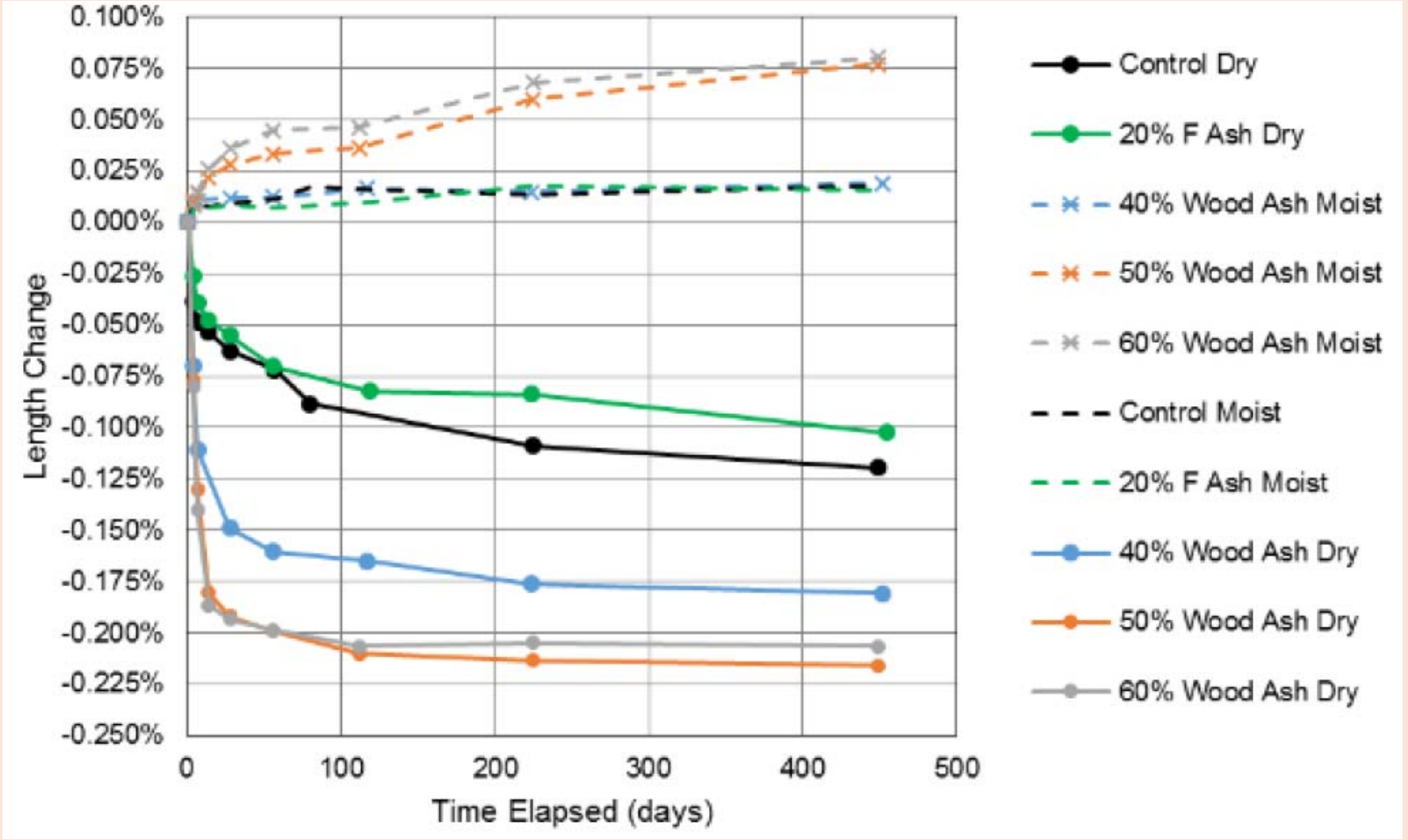
Standard Specification for Road and Bridge Construction, Section 346, 2018.

Phase I – Baseline Investigation: Feasibility

- Materials Acquisition
  - Sugarcane Bagasse Ash
  - Rice Husk Ash
  - Class C Fly Ash
  - Ground Waste Glass
  - Equilibrium Catalyst
  - Wood Ash

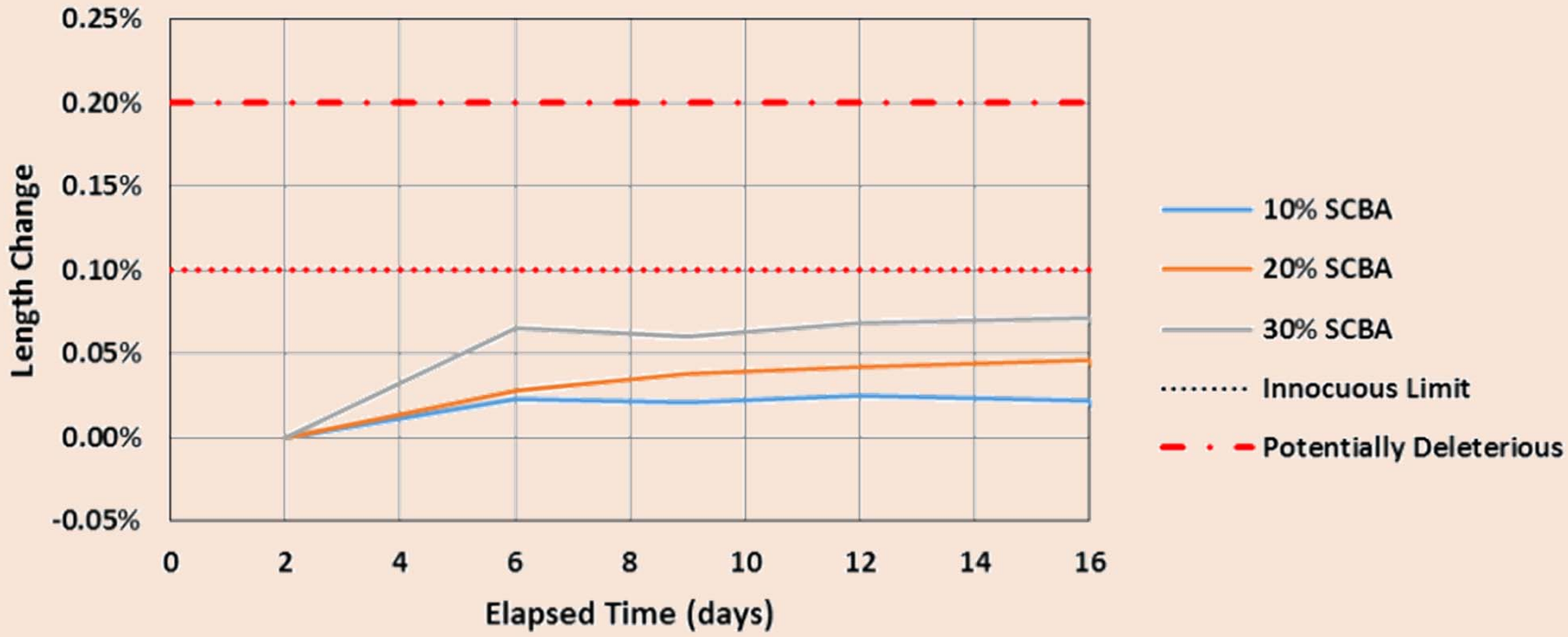
Phase I – Baseline Investigation: Dimensional Stability

- ASTM C157 – Length Change



Phase I – Baseline Investigation: Dimensional Stability

- ASTM C1567 – Accelerated Length Change



Phase I – Baseline Investigation: Dimensional Stability

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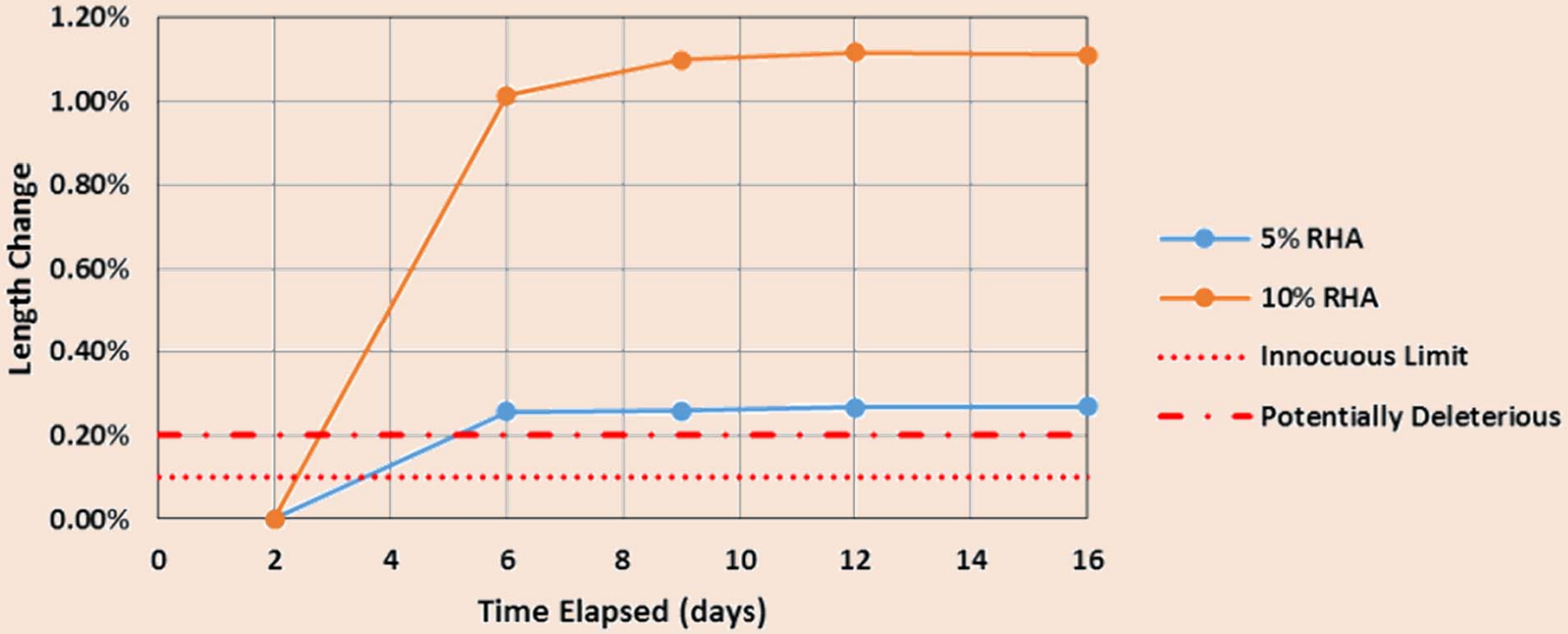
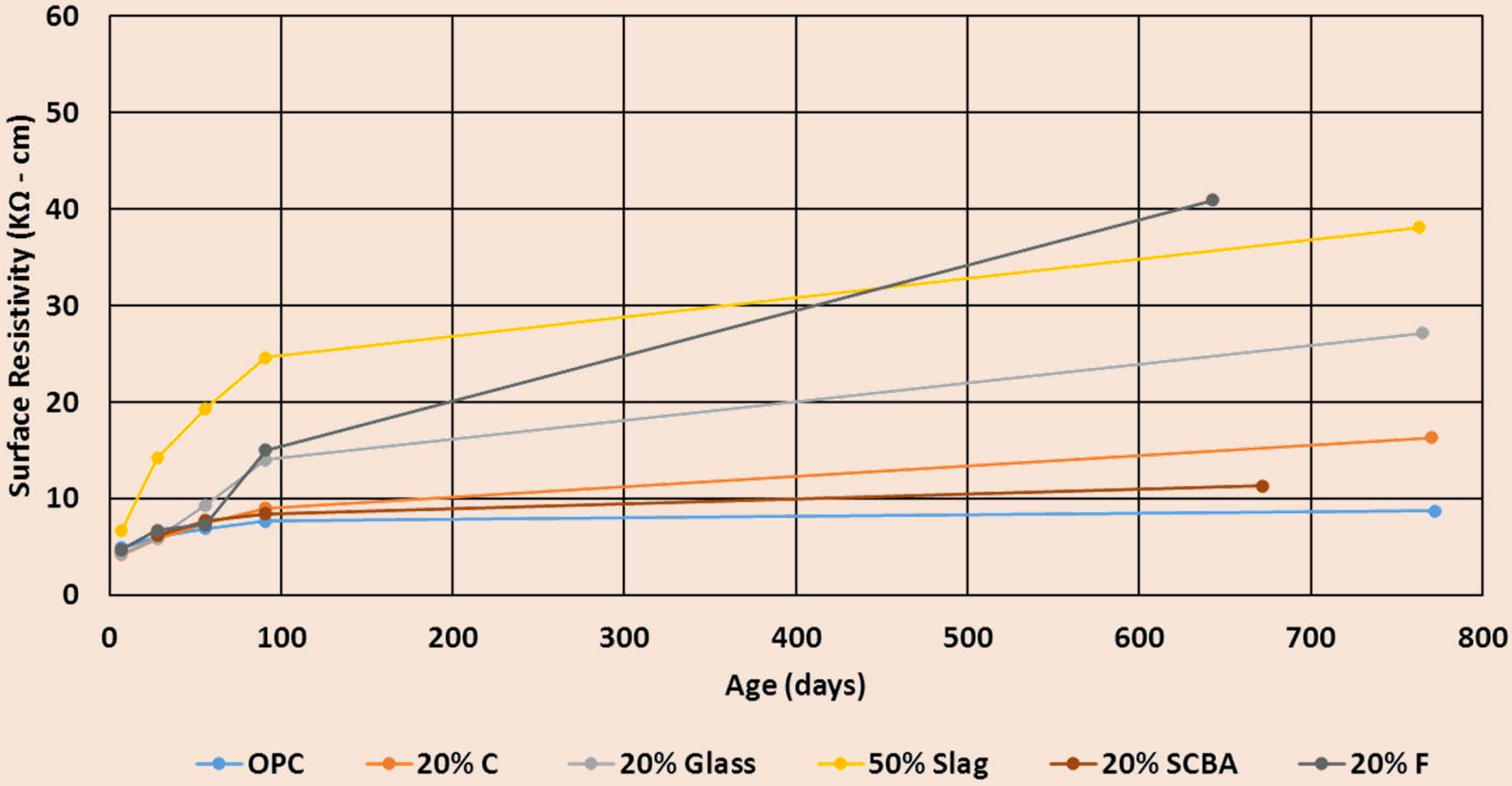


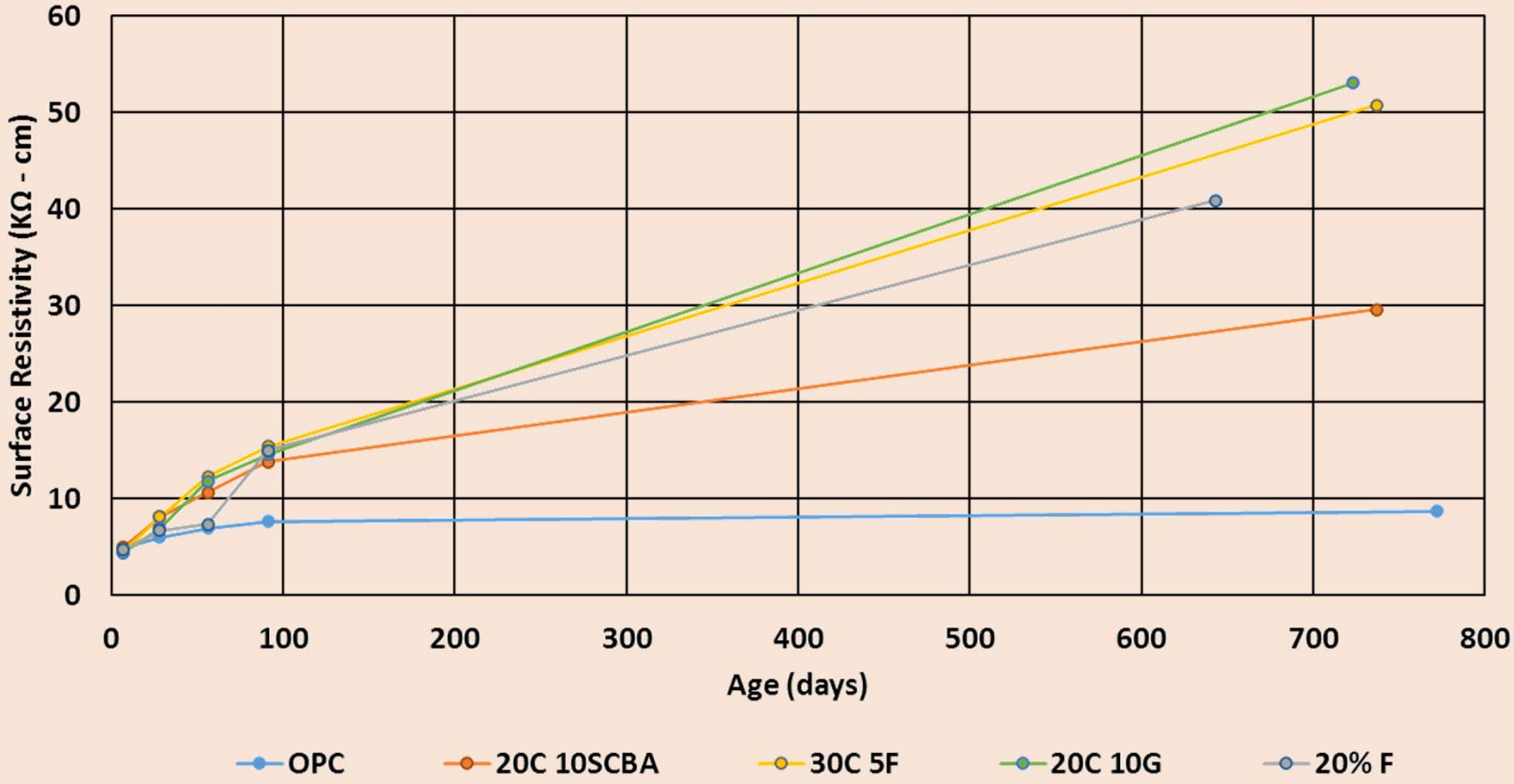
Phase I – Baseline Investigation: Electrical Resistivity

- Binary Mixtures



Phase I – Baseline Investigation: Electrical Resistivity

- Ternary Mixtures



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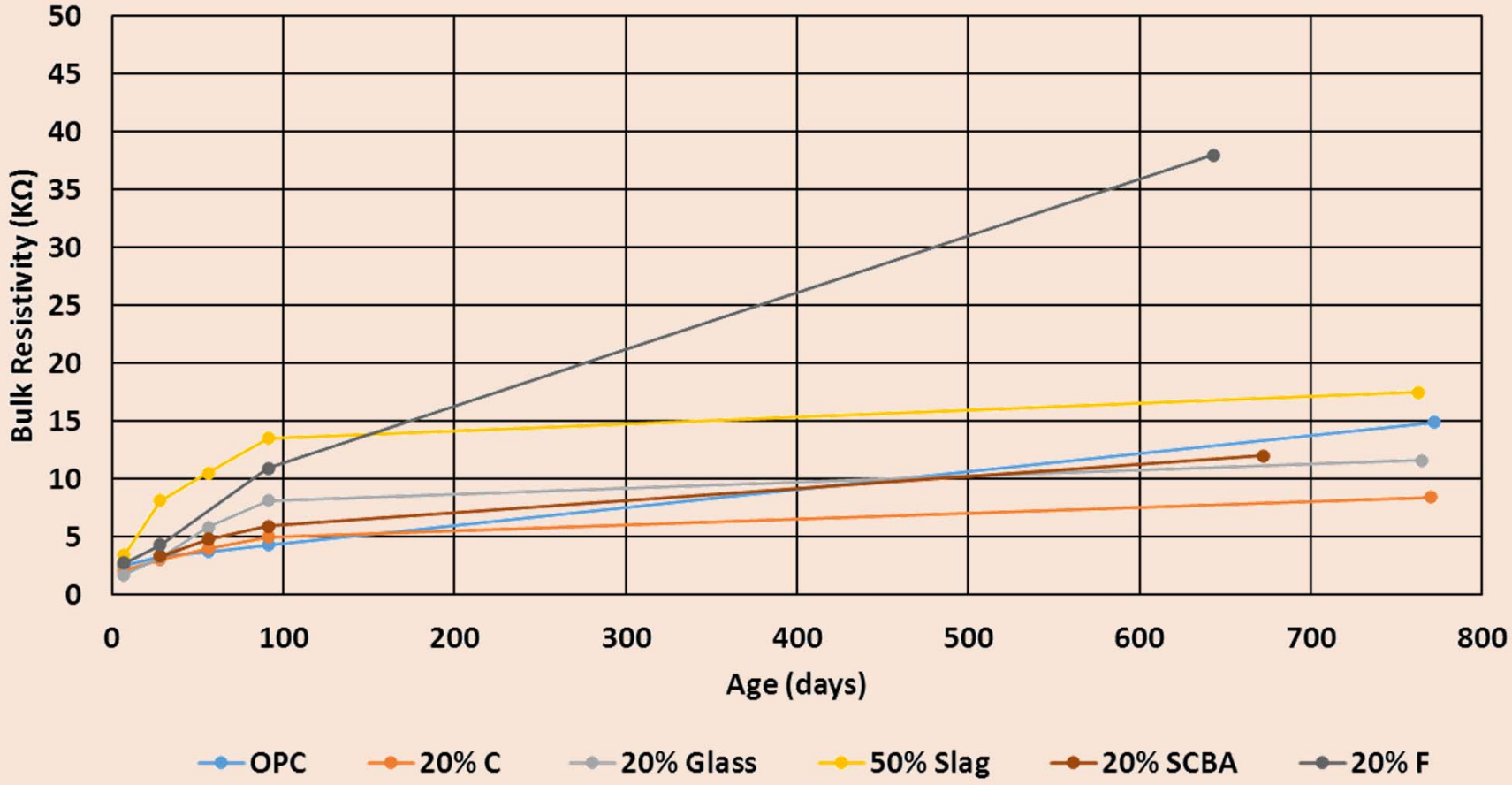

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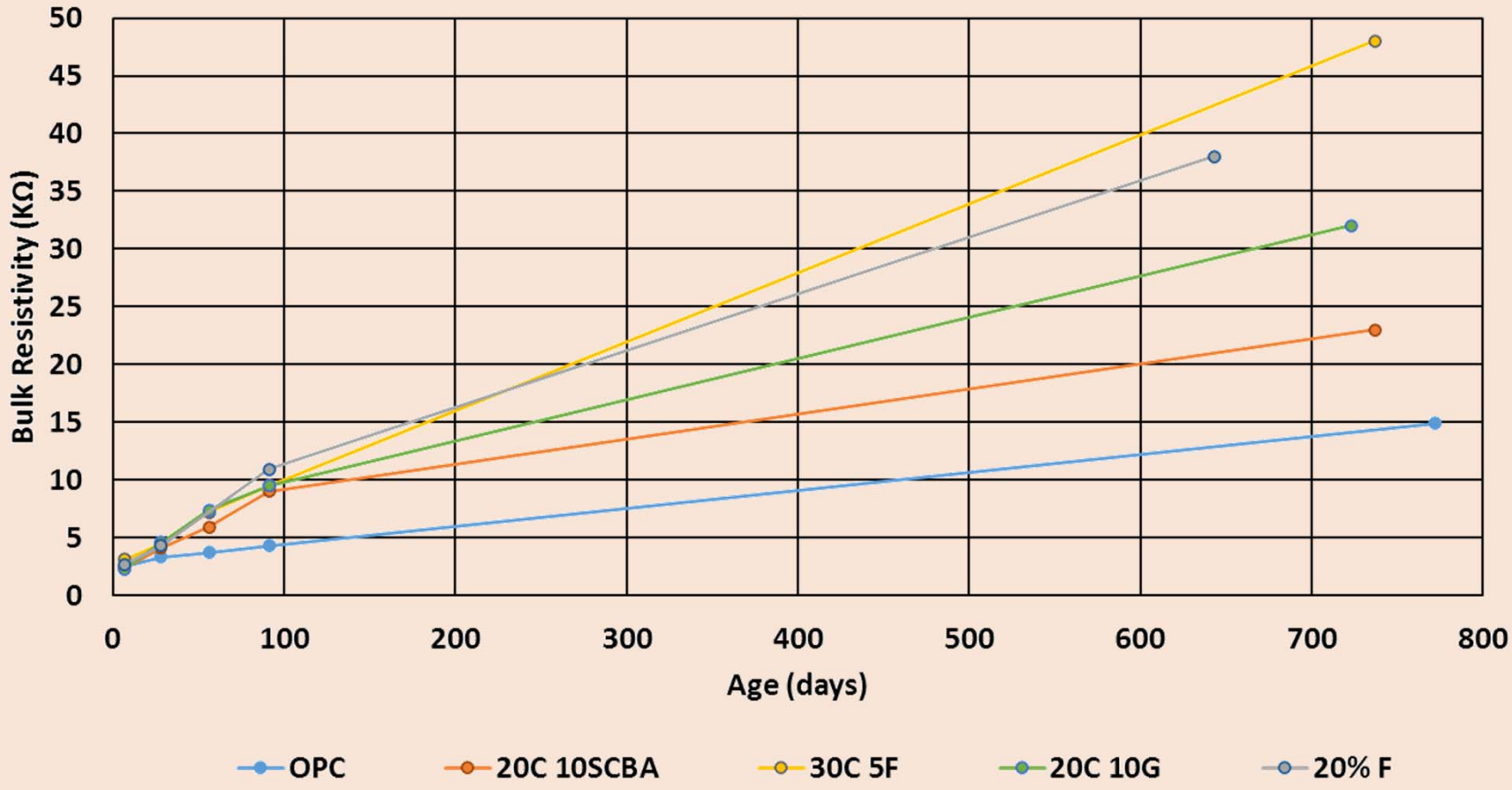
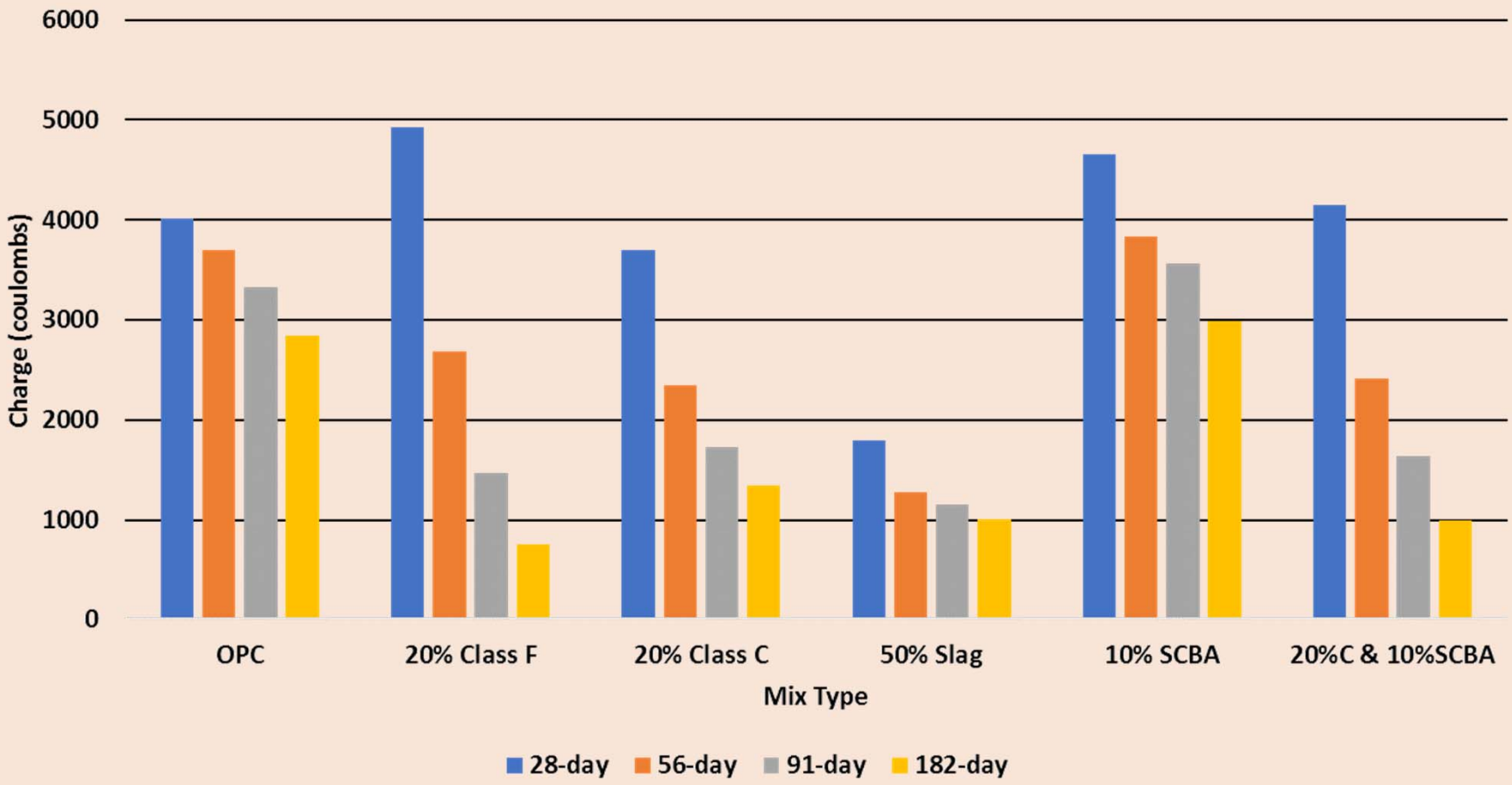
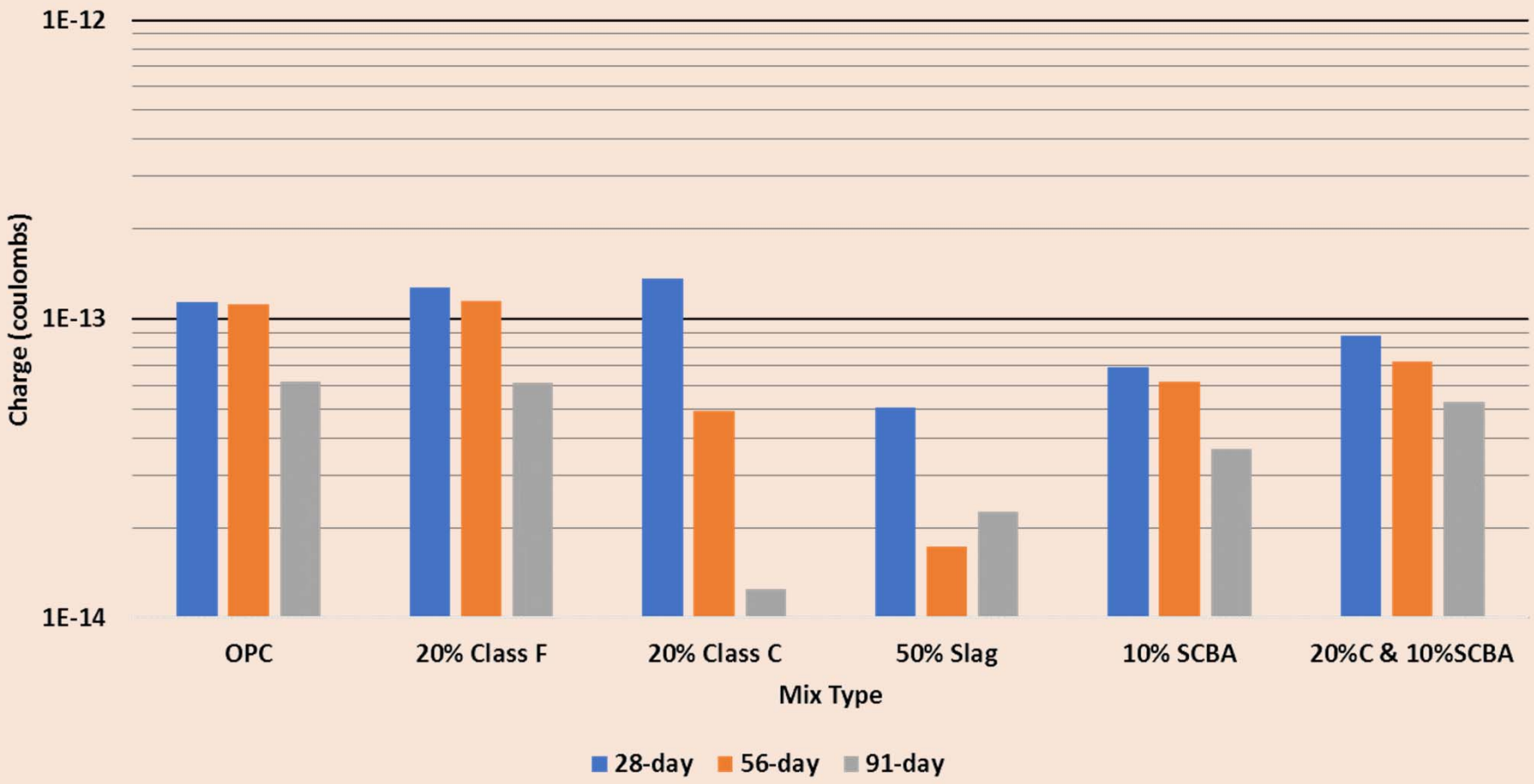


Phase II – Transport Properties: RCP



Phase II – Transport Properties: Water Permeability



Phase III – Long-Term Exposure: Field Exposure

UF Research Building

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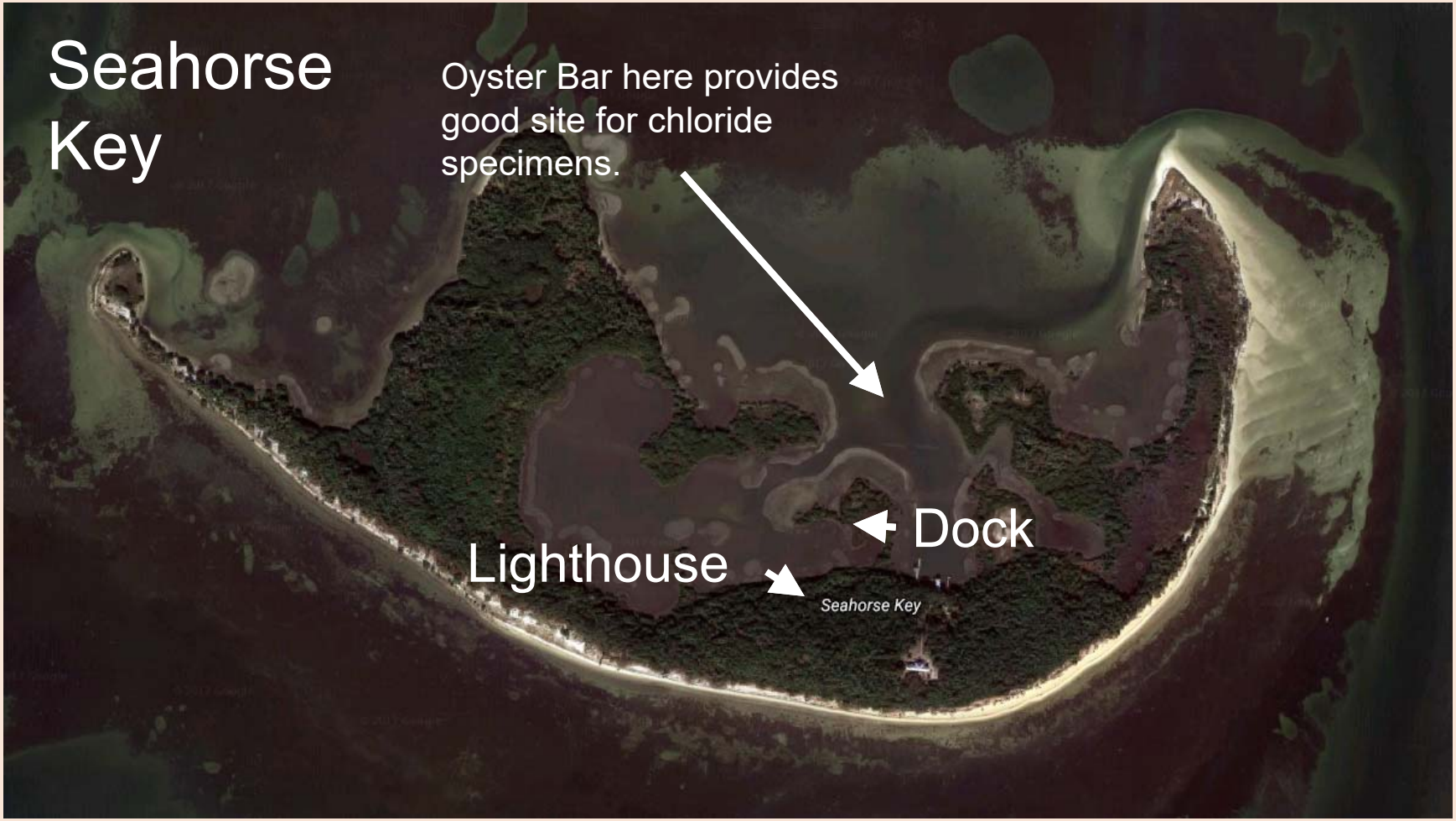

Tentative Conclusions

- Glass powder performance in binary mixes perform better than control, but not as well as common pozzolans
- Ternary mixes incorporating either glass or sugarcane bagasse ash with class C fly ash can perform comparably or better than 20% class F ash mixes
- More long term exposure required (and planned)

Thank you.
Questions?