Assessment of Sand Quality on Concrete Performance: Examination of Acidic and Sulfate/Sulfide-Bearing Sands

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Project Description
The goal of this project is to assess the impact of sulfide-/sulfate-bearing sands on early-age behavior (setting, hydration kinetic), mechanical properties (compressive strength, stiffness), and durability (impact on corrosion of reinforced concrete, expansion due to DEF or sulfide oxidation) of concrete and mortar mixtures.

Methodology

3 different sands are analyzed
- GDOT-approved sand (CONTROL)
- Sulfate-bearing sand 1 (SITE D)
- Sulfate-bearing sand 2 (SITE H)

Concrete Mixture Design
- w/c = 0.43
- Normal coarse aggregate
- AE admixture (0.7 fl oz/cwt)

Mortar Mixture Design
- w/c = 0.5

ASTM C1202: CI Penetrability
ASTM C215: Dynamic Elastic Modulus
ASTM C1038: Mortar Bars Expansion
FM 5-522: Corrosion Test

Preliminary Results
Reduction of pH
Site H and Site D sands exhibited an important drop of pH in aqueous environment.

Calorimetry:
delay of cement hydration and setting.

Compressive strength: 1, 3, 7, 28, 56, and 90 days.

Dynamic Elastic Modulus.
- @28 days
  - Control Sand: 5,200 ksi
  - Site H Sand: 5,505 ksi
  - Site D Sand: 5,386 ksi
- @90 days
  - Control Sand: 5,331 ksi
  - Site H Sand: 5,761 ksi
  - Site D Sand: 5,531 ksi

Expansion of Mortar Bars: 25 °C and 70 °C

Rapid Chloride Permeability Test (RCPT).
- Charge (C) Penetrability
  - Control Sand: 3.975 Moderate
  - Site H Sand: 3.260 Moderate
  - Site D Sand: 3.064 Moderate

Accelerated Corrosion Testing of Reinforced Concrete Using Impressed Current.

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