

High Performance Concrete and Drilled Shaft Construction

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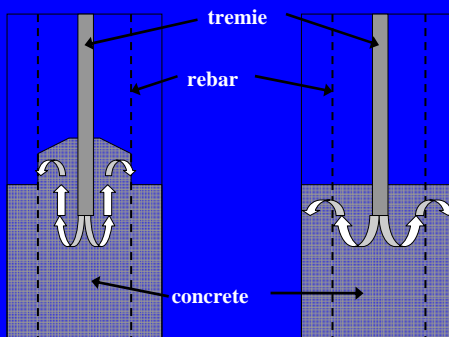
A Proposal for High Performance Concrete

- Similar concept as used for current high performance concrete, *but*
- Performance characteristics for fresh concrete properties (rather than hardened)

Why?



Workability and Passing Ability



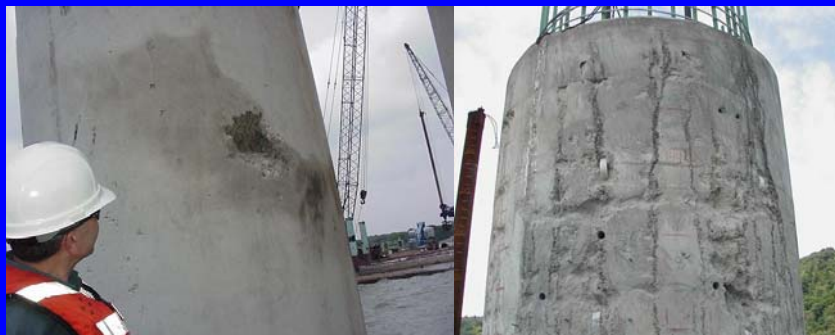
Concrete with inadequate workability

Concrete with good workability and filling ability

Congested Rebar Cage



Exposure of Trapped Laitance Attributed to Inadequate Workability



Congested Rebar Cage



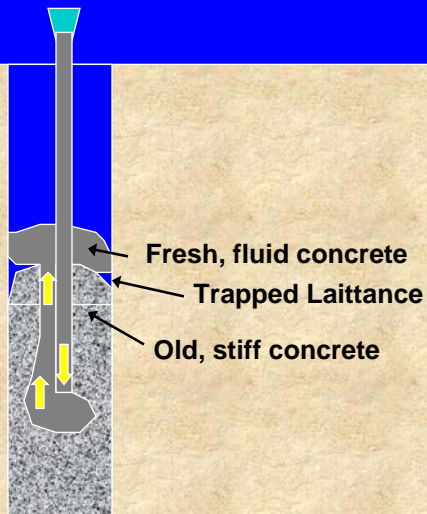
SCC Mix

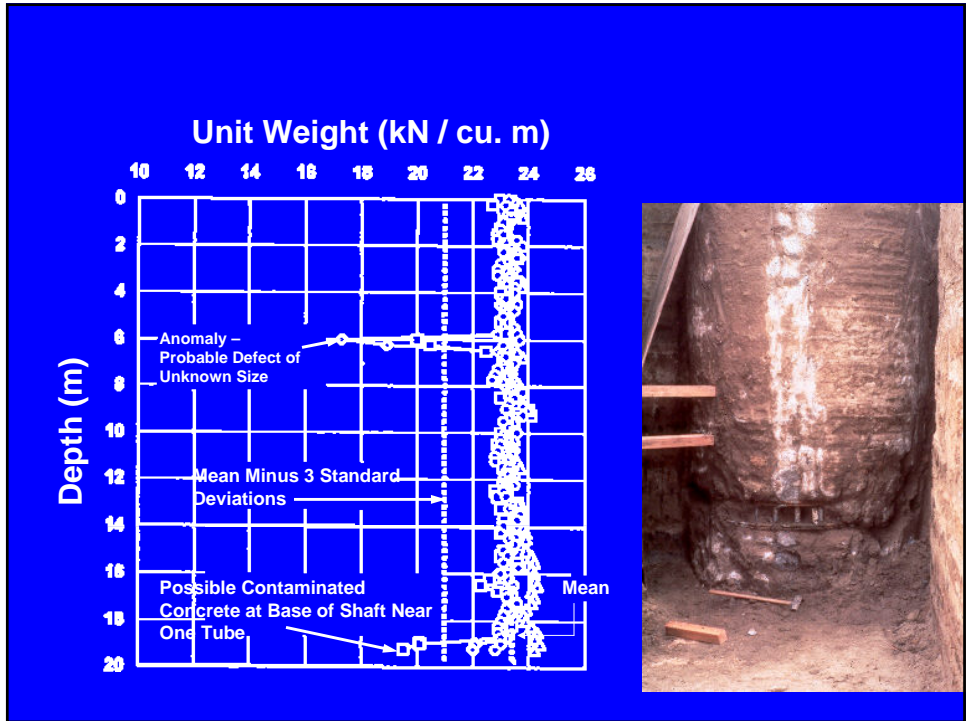
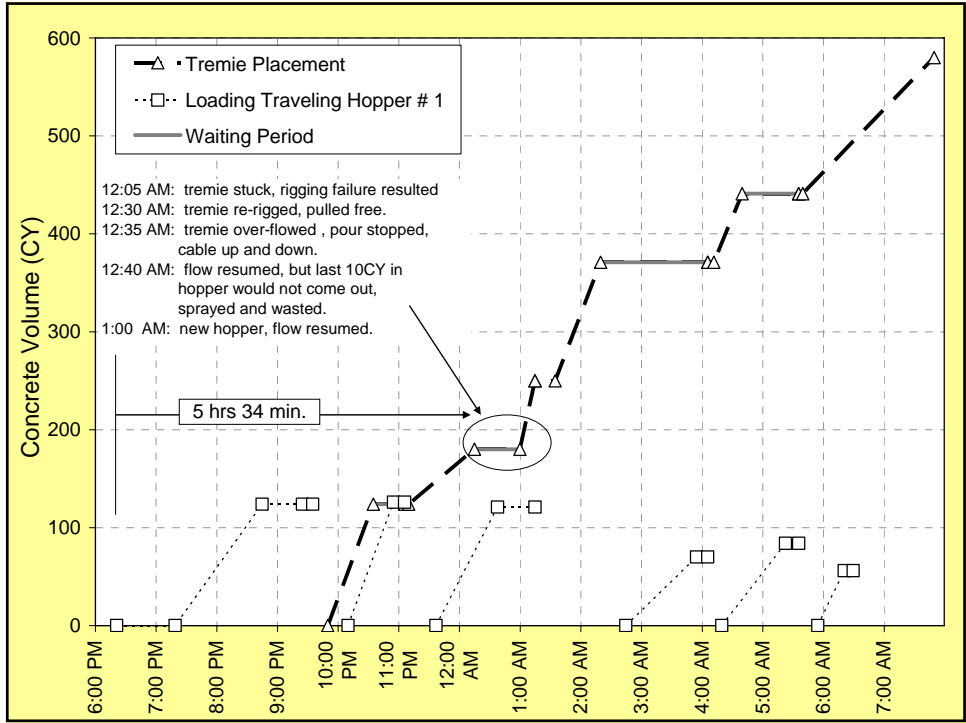


Conventional Concrete



Workability Retention

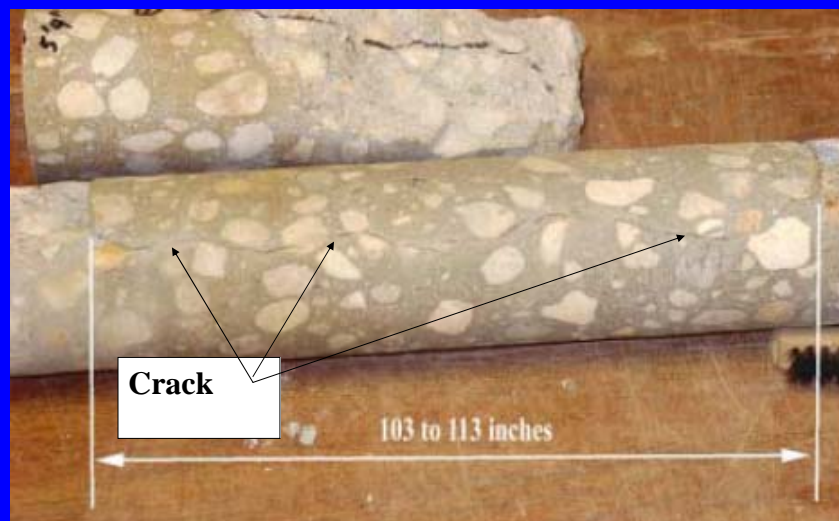




Bleeding



Bleeding



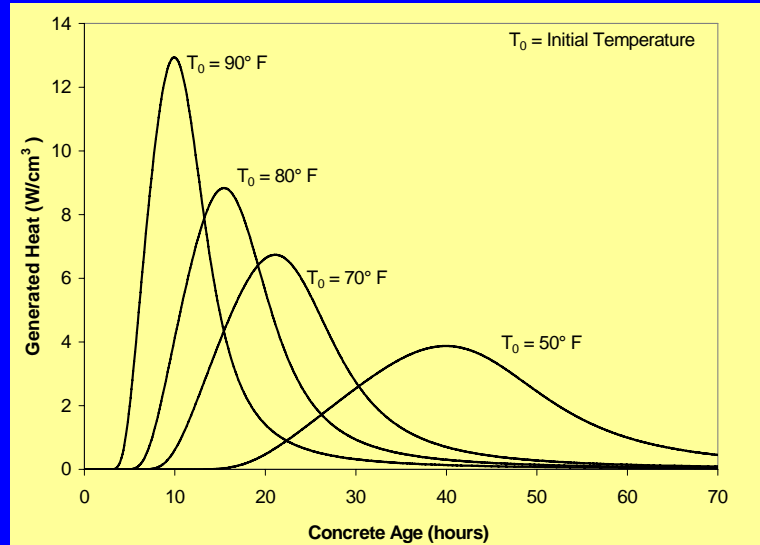
Bleeding



Bleeding



Temperature



High Performance Drilled Shaft Concrete

- We need to define a “high performance concrete” based on fresh properties:
 - Workability
 - Passing ability (tight rebar cages)
 - Retarded set time
 - Avoid segregation & bleeding (need cohesive paste); will need fines & proper aggregate gradation
 - Control of hydration temperature

Strategies for Drilled Shaft Concrete Mix Design

- Aggregates:
 - Use rounded gravel aggregates rather than crushed stone
 - Use No. 67 or 78 aggregate gradation rather than No. 57
 - Use sand to total aggregate ratio in the range of 0.44 to 0.50

Strategies for Drilled Shaft Concrete Mix Design

- Admixtures:
 - water reducing & hydration control admixtures
 - viscosity modifying admixtures (VMA) as needed to help control bleeding
 - fly ash and/or slag to increase cementitious content & reduce the portland cement content
 - Use 56 day or 90 day strength specifications with high dosage of fly ash or GGBF slag

Strategies for Drilled Shaft Concrete Mix Design

- Temperature:
 - temperature affects admixture dosages!
 - use adiabatic or semi-adiabatic curing of specimens
 - Control the fresh concrete placement temperature to less than 80°F (75°F)
 - Utilize Type II cement + fly ash or slag to control heat of hydration & reduce DEF potential

Strategies for Drilled Shaft Concrete Mix Design

- Most Important:
 - Develop project-specific mix design
 - Fresh concrete performance requirements should be specific to application

Thanks for Listening!

