Use of SCC for the Repair of Bridge Substructures

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Outline

SCC applications

• New construction
  – arch bridge, bridge beams, drilled shafts
  – Normal weight and lightweight

• Substructure repairs
  – Pile
  – Column
  – Cap
SCC Arch Bridge in Fredericksburg, VA 2001

- Arch length of 45 ft
- 5,000 psi
- Low permeability
SCC Arch Bridge – 2001
Smooth surface finish

Wing wall from the arch bridge
SCC Beams – Rte 33 (2005)

Project planned 8 SCC beams; however, producer used SCC in 32 more beams

Over Pamunkey River

- 8,000 psi
- Low permeability
Drilled Shaft – Route 28 (2007)

Placement of concrete and removal of casing were easy.

Lack of consolidation is a problem with conventional concrete.
Lightweight SCC - 2012

- Two 128 ft spans
- 4 beams per span, one test for each beam (8 tests)
- Average compressive strength: 10,724 psi, 5 out of 8 batches had over 11,000 psi.
- Low permeability (< 1,000 coulombs)
FHWA Pile Repair - 2009

At Colonial Parkway a pile was hit by a barge.
Colonial Parkway

Concrete pumped from bottom up. Drum to catch the overflow.
Colonial Parkway

Repaired pile
VDOT Lynchburg District
Substructure Repair, 2010

- Two bridge substructures at Altavista repaired with SCC
  - Route 699 bridge
  - Route 712 over Route 29 bypass

Route 699

Route 712
Route 699 - Backwall

Bucket is used to place SCC in the backwall.
Route 699

Backwall construction
Route 699

Smooth SCC finish on the support buttress

Finished backwall
Route 712 – Column and Pier Cap

Removal of deteriorated concrete
Evaluating anodes: sections had anodes with and without embedment mortar
Route 712

Foam to close gaps

Formwork
Route 712

SCC delivery through funnel and flexible tube

Strength 4,880 psi,
Permeability 1,347 coulombs
Route 712

Shoring up the bulged formwork
Route 712

Using buckets to place SCC is not a good method!
Route 712

Void at the bottom due to stiffening mixture, shy cover, and congested reinforcement
Route 712

Completed SCC repair.
Lynchburg, 2013

Encasing columns

Column 2 ft 8 in increased to 3 ft 8 in
NOVA Bridge - 2011

Repair of a new pier cap that had consolidation problem
Pier Cap Soffit Repaired with SCC

Interface between SCC and existing concrete
NOVA, I-95 over Furnace Road

SCC pumped

Increase in size of an existing column
NOVA, I-95 over Furnace Road

Completed pier cap
Staunton, I-81 (2011)

SCC pumped

Strength 5,310 psi,
Permeability 1,503 coulombs
I-81

Small pump is sufficient for SCC repairs
Staunton, I-81 (2011)
Shotcrete

Adjacent pier caps repaired by shotcrete
Shotcrete - concrete pneumatically projected at high velocity onto a surface.
SCC and Shotcrete @ I-81

Rough surface

Smooth surface
SCC Consolidation @ I-81

Loss of workability necessitated internal vibration
Conclusions

• SCC with high workability, proper strength and durability can be produced using locally available materials.

• Attention must be paid to the mixture and the placement procedures.
Thank you.

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