



Virginia Center *for* Transportation
INNOVATION
& **RESEARCH**



We bring innovation to transportation.

USING SELF-CONSOLIDATING CONCRETE FOR CONCRETE REPAIRS

Gail M. Moruza, Graduate Research Assistant, UVA, CEE Dept.

H. Celik Ozyildirim, Ph.D., P.E., Principal Research Scientist

Outline

- Benefits and concerns of SCC
- FHWA Colonial Parkway
- Recent VDOT repair projects
 - Lynchburg
 - Altavista: Rte 699 & Rte 712
 - NOVA
 - Staunton
 - I-81
 - Alma: Rte 340
- Recommendations



Benefits of SCC

- High workability and no consolidation concerns
- Faster construction
- Reduced noise and increased safety because vibrators are not used
- Less labor required
- Smoother surface finish



Conventional concrete slump test



SCC slump flow



Concerns of SCC

- Uniformity
- Loss of stability, segregation
- Air-void system
- Increased shrinkage
- Formwork pressure and tightness
- Placement methods and rates



FHWA Pile Repair with SCC

- Colonial Parkway, Jamestown
- October 2009
- Barge damaged a pile
- Repaired with SCC



FHWA Pile Repair - 2009



At Colonial Parkway a pile was hit by a barge.



Colonial Parkway



Broken concrete removed and reinforcement added.



Colonial Parkway



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



Colonial Parkway



Repaired pile



Substructure Repair, 2010

- Two bridge substructures at Altavista repaired with SCC
- Route 699 bridge backwalls
- Route 712 over Route 29 bypass
- Columns and pier caps repaired using SCC instead of shotcrete



Lynchburg District, Route 699



Route 699



Bucket is used to place SCC in the backwall.



Route 699



Completed backwall
curing



Route 699



Smooth SCC finish on
the support buttress



Lynchburg District Route 712 over Route 29 Bypass



Altavista (2010)

Route 712 Bridge Repairs



Exposed reinforcement
after deteriorated
concrete was removed.



Route712



Installation of anodes



Route 712



Formwork

Foam to close gaps



Route 712



SCC delivery through
funnel and tube



Route 712



Shoring up the bulged formwork



Route 712

- Delays caused stiffening of the mixture requiring vibration



Route 712



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



Route 712



Using buckets to place SCC is not a good method!



Route 712



Completed SCC
repair.



NOVA, B619 SCC Repair - 2011



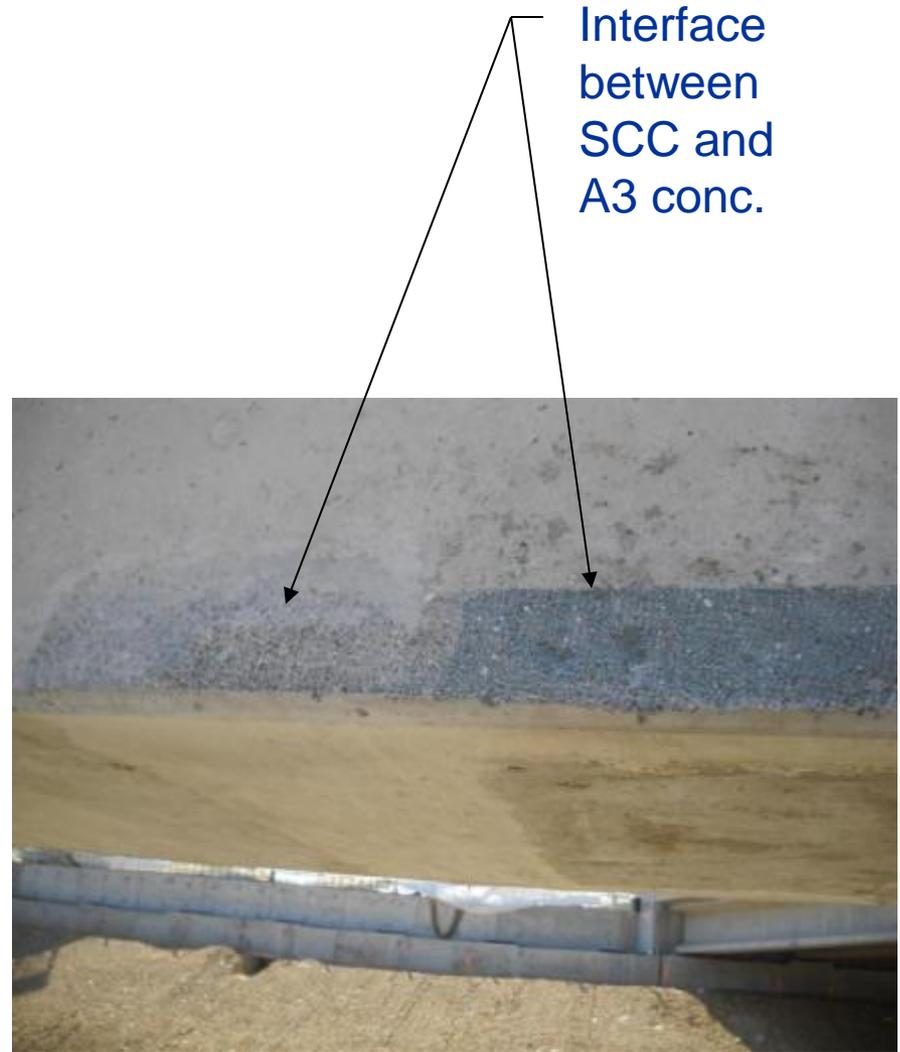
Repair of a new pier cap that had consolidation problem



NOVA



Pier Cap Soffit
Repaired with
SCC



Interface
between
SCC and
A3 conc.



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 District, I-81



Deteriorated pier cap



Staunton, I-81



Shadow Vehicle on the Shoulder

Both lanes open to traffic



Staunton, I-81 (2011)



SCC placement using
small pump



I-81



Small pump is sufficient for SCC repairs



Staunton, SCC



08/26/2011







Staunton, SCC



08/29/2011



Shotcrete, I-81

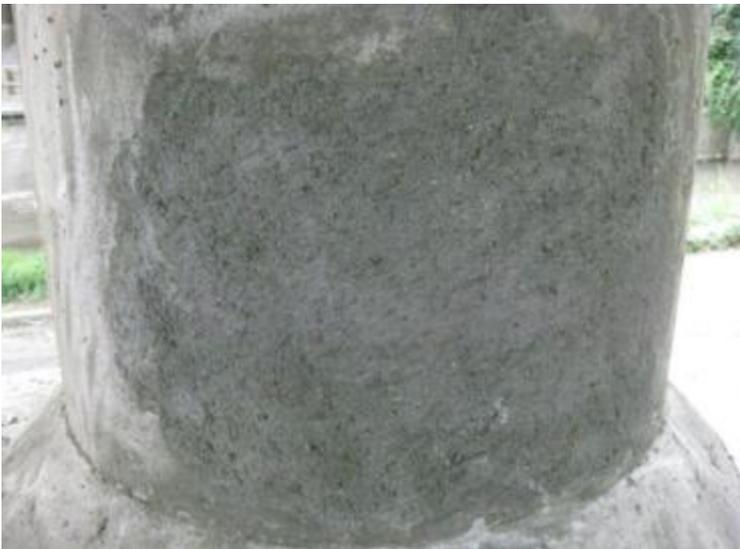


Adjacent pier caps repaired by shotcrete

Shotcrete - concrete pneumatically projected at high velocity onto a surface.



Staunton, Shotcrete



SCC and Shotcrete @ I-81



Smooth surface

Formwork provides good curing

Rough surface



Alma (2013)

Route 340 Bridge Repairs



Deteriorated area marked for repair.



SCC – Route 340



Anodes placed



Alma (2013)

Route 340 Bridge Repairs



Bulging formwork and bucket placement.



Alma (2013)

Route 340 Bridge Repairs

- Concretes were tested at the beginning and also at the end to ensure they were SCC during placement.



Alma (2013)

Route 340 Bridge Repairs



Formwork on left, repaired area on right.



Summary

Mixture:

- Stable
- Proper air void system
- Workability during placement
- Acceptable shrinkage



Summary

Placement:

- Form pressure and tightness
- Head: pump or height
- Continuous flow



Conclusions

- SCC with high workability, proper strength, and adequate durability can be produced using locally available materials.
- Attention must be paid to the mixture and the placement procedures.





Virginia Center *for* Transportation
INNOVATION
& **RESEARCH**

We bring innovation to transportation.

Thank you.