Repairs of Concrete Structures Using Self-Consolidating Concrete

Celik Ozyildirim, Ph. D., P.E.

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Outline

• Self-consolidating concrete (SCC)
• VDOT SCC applications
• SCC Repairs
  – FHWA Colonial Parkway
  – Lynchburg
  – NOVA
  – Staunton
SCC: Concrete with High Workability

Conventional

SCC
SCC Applications in Bridge Structures

Precast concrete:
- Arch Bridge, 2001
- Test Beams, 2003
- Rte 33 Beams, 2005

Cast-in-place concrete:
- Drilled shafts
- Repairs
SCC Arch Bridge – 2001

- First SCC application
- Arch length of 45 ft

- 5,000 psi
- 2500 coulombs
SCC Arch Bridge (2001)
SCC Beams – Rte 33 (2005)

Over Pamunkey River

8,000 psi
1,500 coulombs
Drilled Shaft – Route 28 (2007)
Pile Repair with SCC

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

Pile damaged by barge
Colonial Parkway

Broken concrete removed and reinforcement added.
Colonial Parkway

Concrete pumped from bottom up. Drum to catch the overflow.
Lynchburg District
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
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
Route 712

Removal of deteriorated concrete from column and pier cap
Installation of anodes
Route 712

Foam to close gaps

Formwork
Route 712

SCC delivery through funnel and tube
Route 712

Shoring up the bulged formwork
Route 712

Void at the bottom due to stiffening mixture, shy cover, and congested reinforcement
Using buckets to place SCC is not a good method!
Route 712

Completed SCC repair.
Repair of a new pier cap that had consolidation problem.

07/05/11
NOVA – B619

Interface between SCC and A3 conc.

Pier Cap Soffit Repaired with SCC
I-95 over Furnace Road

SCC pumped

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

Completed pier cap
Staunton District, I-81

Deteriorated pier cap
Ready mixed concrete truck and the pump on the shoulder
I-81

Small pump is sufficient for SCC repairs
SCC placement using pump
I-81

Completed SCC repair
Adjacent pier caps repaired by shotcrete
SCC versus Shotcrete
Summary

Mixture:
- Stable
- Proper air void system
- High flow rate
- Acceptable shrinkage
Summary

- SCC loses slump flow with time
- Consider haul and construction time
- Develop mixtures with extended setting time and reduced slump flow loss
- Use vibrators if mixture stiffens
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.
Thank you.

Celik Ozyildirim, Ph. D., P.E.