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# Repairs of Concrete Structures Using Self-Consolidating Concrete

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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



- 5,000 psi
- 2500 coulombs

- First SCC application
- Arch length of 45 ft



# 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.



# Colonial Parkway



Repaired pile



# 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



# Route 699



Bucket is used to place SCC in the backwall.



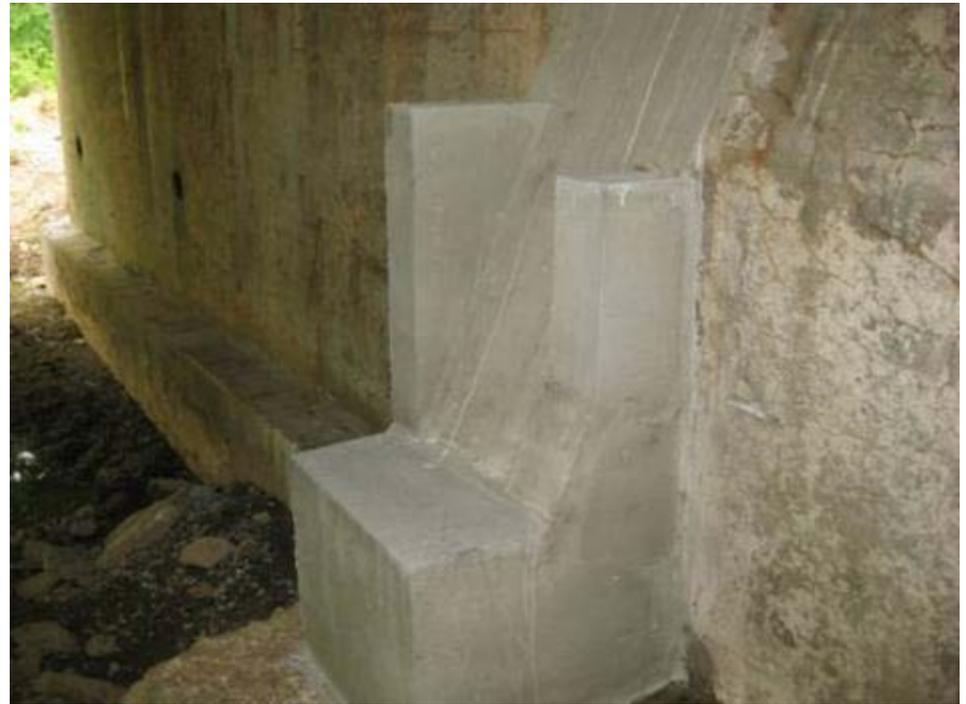
# Route 699



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



# 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



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



Repair of a new pier cap that had consolidation problem.

07/05/11



# NOVA – B619



Pier Cap  
Soffit  
Repaired  
with SCC

Interface  
between  
SCC  
and A3  
conc.



# 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



# I-81



Ready mixed concrete truck and the pump on the shoulder



# I-81



Small pump is sufficient for SCC repairs



# I-81



SCC placement using pump



# I-81



Completed SCC repair



# Route 81 - Shotcrete



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.





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**Thank you.**

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