I-85/I-95 PCC Rehabilitation Projects

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I-85 Anderson County

• Constructed 1963
  – 9 inches Jointed Plain Concrete
  – 25 foot joint spacing w/o load transfer
  – Asphalt shoulders

• First rehabilitation 1978
  – Patching
  – Unsuccessful pressure grouting
I-85 Anderson County

- Second rehabilitation 1991
  - Patching
  - Resealing
  - Grinding
  - Edge drains added
- By 1996, distress was at very high levels
  - High percentage broken slabs
  - Severe faulting
I-85 Anderson County

- 1998 - Funding shortage, decided to rubblize northbound lane only
  - 2004 ADT = 53,000, 35% trucks
  - Assumed rubblized structural coefficient = 0.30
  - Overlay thickness = 8 inches
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• Staging plan:
  – Rubblize driving lane
  – Overlay driving lane with 200 psy AC Binder
  – Rubblize passing lane
  – Overlay passing lane with 200 psy AC Binder
  – Alternate overlays until 600 psy AC Binder and 200 psy AC Surface
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• Staging plan (continued):
  – Maximum elevation difference between lanes not to exceed 2 inches
  – Pave only during weekdays, not at night or weekend
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• Staging plan (continued):
  – Big question - How long can traffic run on first lift of asphalt?
    • Pavement Design recommendation - 48 hours
    • FHWA recommendation - 24 hours
    • Staging plan - 10 days
  – Actual single lift life
    • 8 hours
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• Massive problems:
  – No traffic without two lifts on rubblized PCC
  – Extended lane closures
  – Post-rubblized deflections in excess of 100 mils
  – Overlay increased from 8 to 12 inches
  – Reconstruction between bridges
  – 6 mile traffic jams, numerous complaints
  – Chain collision accident with multiple fatalities
I-85 Anderson County

• Outcome:
  – SCDOT changed rehabilitation policy
  – No daytime lane closures when volume exceeds 800 vph (later modified to 1200 vph)
  • Typical closure restrictions: No closures between 6 AM and 8 PM
  • Creates severe difficulties for concrete pavement rehabilitation projects
I-85 Anderson County

- What to do for the southbound lane?
  - Condition was also very poor
  - No suitable detour available
  - Nighttime patching estimated to take over 2 years
  - Uncomfortable with structural capacity of rubblized section
I-85 Anderson County

• What to do for the southbound lane?
  – Traffic volumes justified widening from four to six lanes
  – Decided to do unbonded overlay
I-85 Anderson County

- Project let February 13, 2001
- A+B bid prices
- Low bidder – Lane Construction
  - A = $60,945,869.20
  - B = $4,117,500.00
  - Total = $65,063,369.20

(Bid tab online at www.dot.state.sc.us/doing/bidtabulations.html, 2/13/01 Letting, File 04.117B)
I-85 Anderson County

- Staging plan:
  - Very complex, required 27 pages to describe
  - First Step: Remove 10-foot asphalt shoulder and replace with 8 inches PCC at night.
  - No tie bars, dowels, or sealant. Joints matched to mainline.
I-85 Anderson County

Shoulder

<table>
<thead>
<tr>
<th>Passing Lane</th>
<th>Driving Lane</th>
<th>Rebuilt Shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Aggregate Base</td>
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</tbody>
</table>
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• Staging plan:
  – Shift traffic right by 8 feet, place temporary barrier wall in original passing lane.
I-85 Anderson County

- Staging plan:
  - Construct pavement and base in median:
    - 12 inches Plain Jointed PCC
    - 2 inches Bituminous Permeable Base
    - 2 inches AC Surface
    - 8 inches Graded Aggregate Base
    - Edge drain
  - Construct new asphalt lane in northbound median and diversion lane across median.
I-85 Anderson County

- Driving Lane
- Passing Lane
- Aggregate Base
- Rebuilt Shoulder
- Shoulder
- 200 psy Bituminous Permeable Base
- 8 inches GAB
- 28 Feet
I-85 Anderson County

• Staging plan:
  – Move temporary barrier wall to center of old driving lane in southbound lane. Shift one lane of traffic to new pavement, one lane to northbound lane.
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- Aggregate Base: 8 inches GAB
- Passing Lane
- Driving Lane
- Rebuilt Shoulder
- Shoulder
- 200 psy Bituminous Permeable Base
- 16 Feet

SCDOT
I-85 Anderson County

- Construct new center lane over existing passing lane

200 psy Bituminous Permeable Base

8 inches GAB

16 Feet

Aggregate Base

Shoulder | Passing Lane | Center Lane | Passing Lane | Driving Lane | Rebuilt Shoulder
I-85 Anderson County

- Move single lane from old pavement to new pavement

200 psy Bituminous Permeable Base

8 inches GAB

Aggregate Base

200 psy Bituminous

Shoulder | Passing Lane | Center Lane
--- | --- | ---
Passing Lane | Driving Lane | Rebuilt Shoulder
I-85 Anderson County

Construct remaining pavement
I-85 Anderson County

- Other pavement details
  - 15 foot joint spacing
  - 1.5 inch dowel bars
  - Full-depth tied concrete shoulder
  - Neoprene joints seals
I-85 Anderson County

• Other issues:
  – Had to jack overpasses to allow for 14-inch change in grade.
  – Had to close ramps at one interchange temporarily to reconstruct.
  – Ride met specifications, but was not satisfactorily smooth. Decided to diamond grind entire project.
  – Had to remove neoprene joints and reseal after grinding
I-85 Anderson County

• Other issues:
  – Pace of construction very hard on inspection personnel.
  • Resident Construction Engineer chose to retire during project.
  • Lead inspector got 2 months of compensatory time.
  – Cost of temporary barrier was over $6 million.
I-85 Anderson County

• Improvements over original design:
  – 12-inch versus 9-inch slab
  – 15-foot versus 25-foot slabs
  – Dowels versus aggregate interlock at joints
  – Tied PCC versus asphalt shoulders
  – Positive drainage versus bathtub with erodible base.
I-95 Florence County

- From I-20 to SC Route 327
- Approximately 13 miles
- Constructed 1964-1967
  - 10” Plain Jointed PCC
  - 5” Cement Stabilized Sand-Clay Base
  - 25’ Joint Spacing
  - No positive load transfer
I-95 Florence County

- 2004 ADT = 48,400 ADT, 20% trucks
- One previous CPR in 1984 with tied PCC shoulders.
- By 2001, was highly distressed with over 50% of slabs in northbound driving lane requiring repair.
- Severe faulting.
- Base erosion issues.
I-95 Florence County

• Originally planned to do widening and unbonded overlay in the same manner as I-85 Anderson.

• Geometric/ROW/Bridge issues would not allow major change in grade.

• Decision made to widen and reconstruct existing pavement.
I-95 Florence County

- Removed existing 10” PCC.
- Repaired base with new cement treatment where necessary.
- New pavement over existing base:
  - 11” Plain Jointed PCC (15’ joint spacing)
  - 2” Asphalt Surface
  - 8” Graded Aggregate Base (new lanes)
- Traffic control/staging similar to I-85.
I-95 Florence County

- Project let May 2002
  - Low Bid: $64,169,002.17
  - Awarded to Lane Construction Co.
  - 635,980 sy of PCC Pavement @ $30/sy
  - $3.7 million for barrier wall
  - $2.0 million for traffic control
- Work began July 8, 2002
- Project accepted May 5, 2004
I-95 Florence County

• New features:
  – PCC flexural strength requirement raised from 550 psi to 650 psi at 14 days to reduce pavement thickness by one inch.
  – Allowed the use of old PCC as coarse aggregate for new PCC.
  – Allowed the use of automatic dowel bar inserter in lieu of chairs.
  – Required diamond grinding of new surface for better rideability.
Phase I Concrete Breaks - I-95 Florence

Strength versus Time

Average = 670.4 psi
Std. Dev. = 16.7 psi
Minimum = 652 psi
Maximum = 682 psi
I-95 Flexural Breaks, Phases 2 and 3
Mixes using recycled coarse aggregate (Mixes 4R2, 4R3, and 4R4)

Average = 674 psi
Standard Deviation = 31 psi
Problems?

• Some contamination was encountered early from joint sealant, backer road, and wood
Problems?

• Motorists were crossing median from express lane to exit.
• Existing base was very saturated; more repairs required than estimated.
• One portion of median was constructed with muck from original project, had to be undercut more than expected.
• Mainline traffic flowed well, but some backups were encountered at interchanges.
Questions?