Bonded Concrete Overlays on Asphalt (BCOA)

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Why overlay with concrete?

• Concrete is the longer lasting pavement solution; can last 30 or more years with minimal maintenance.

• Concrete can be the cheaper solution when long-term maintenance and user costs are figured.

• Get in, get out, stay out...
What are the concrete options?

- Remove 5 to 12 inches of existing pavement and replace with concrete. (Unbonded Overlay)
- Remove 0 to 5 inches of existing pavement and overlay with concrete. (Bonded Overlay)
What’s the distinction between the options?

• An unbonded overlay with concrete is designed in a similar manner to a traditional pavement.
• It may depend on the material underneath for support, but does not depend on being bonded.
• However, bonding does improve performance.
Concrete pavement design principles

- PCC pavements are rigid
- Vehicle loads are distributed over large areas (beam strength) (15-20 ft)
- Minor deflections
- Low subgrade pressures
- Subgrade uniformity is more important than strength
Asphalt pavement design principles

- Asphalt pavements are flexible
- Distribution of loads depends largely on pavement thickness
- Load on subgrade is more concentrated
- Deflections are much higher
- Subgrade strength/stiffness is very important
Thin bonded overlay design principles

- Asphalt surface is unable to resist traffic braking or accelerating forces.
- Hybrid structure is sufficient to carry traffic loads.
Thin bonded overlay design principles

- Maintaining bond is critical to keeping the two layers acting as a single unit. If bond is lost, stresses in concrete layer will increase greatly.
Bonded versus unbonded behavior

**Bonded**
- Tension: 0
- Compression: NA

**Unbonded**
- Tension: 0
- Compression: NA
Suitable candidates for bonded overlay

• Stable support conditions (localized weak areas can be strengthened)
• Surface distresses
  - Rutting/shoving of surface layer (not deep)
  - Top down cracking (mostly age-related)
• Minimum of 3 inches of asphalt remaining after milling.
Poor candidates for bonded overlay

- Significant structural deterioration
  - High severity fatigue cracking
  - Rutting of base and subgrade
- Stripping of asphalt layers
- Poor drainage
- Inadequate or uneven support
- Inadequate base structure
Selection of bonded overlay thickness

- Several methodologies available
  - PavementDesigner.org
  - University of Pittsburg BCOA-ME
    FHWA Pooled Fund Study 5-165
Joint layout

• Avoid placing longitudinal joints in wheelpath.
• Smaller slab sizes (less than 6’ x 6’) sometimes (but not always) reduce overlay thickness.
• Need to balance reduction in thickness with increase in joint sawing and potential maintenance, if sealed.
Material considerations

Concrete
- May use high-early strength to facilitate construction.
- Consider using fibers in concrete when overlay thickness is 4 inches or less.
- Fiber type and quantity should be selected to achieve a minimum residual strength of 20%.
Construction considerations

- A milled surface enhances the bond, especially for overlays 4 inches or less.
- Milling depth should:
  - Remove surface distortions > 2 inches deep
  - Match curb or adjacent structure elevations
  - Account for changes in cross slope prior to placement of surface layer. (But, don’t mill too much!)
Construction considerations

• Ensure the milled surface is clean
  - Sweep the surface thoroughly
  - Remove dust with compressed air

• Mist the surface prior to concrete placement
  - Reduce surface temperatures
  - Reduce moisture absorption from concrete
  - No standing water
Construction considerations
Construction considerations
Construction considerations
Examples
US-82 and US-84, Waycross, GA

- Thin bonded overlay
- 4 inches thick
- Let July 2003
US-82 and US-84, Waycross, GA
US-82 and US-84, Waycross, GA
US-82 and US-84, Waycross, GA
SR-196/SR-119, Hinesville, GA
SR-25 at Brampton Rd, Garden City, GA
SR-25 at Brampton Rd, Garden City, GA
Blossom Street at Assembly, Columbia, SC
Blossom Street at Assembly, Columbia, SC
Harden Street at Gervais, Columbia, SC
Harden Street at Gervais, Columbia, SC
US 1/SR 4 Lyons, GA (Toombs County)
US 1/SR 4/ US 341 Baxley, GA (Appling County)
SR 19 @ SR 27 Hazlehurst (Jeff Davis County)
SR 4/US 82 in Waycross (Ware County)
SR 38/US 84 @ SR 32 Patterson (Pierce County)
SR 15/SR 121 @ SR 203 (Appling County)
For detailed information on concrete overlys, refer to the guide titled "Concrete Overlays: Sustainable Solutions for Resurfacing and Rehabilitating Existing Pavements". This third edition provides a practical approach to understanding and successfully using concrete overlays, from selection to opening.
The great author considers his response to the question.
Thank you!

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