CONCRETE OVERLAYS OF ASPHALT (WHITETOPPING): Current Practice, Expectations and Future Directions

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AGENDA

Concrete Overlays Overview

Design Issues
- Thickness
- Jointing
- Materials

Construction Issues, Costs & Performance
CONCRETE OVERLAYS HAVE THE SAME LONG-TERM DURABILITY AND COST ADVANTAGES OF TRADITIONAL CONCRETE PAVEMENTS

**Durability & Costs Advantages**

Add strength and durability to an existing pavement

Competitive on Initial & Life Cycle Cost
- A wide range of thicknesses can be used
- Can be designed to last from 10 to 40+ years

Can be placed on both concrete and asphalt pavements.
- Existing pavement does not have to be removed
- Few pre-overlay repairs are necessary.
- Use normal concrete pavement construction practices.

Have good safety and sustainability characteristics
- Reduced pavement removal / use existing structure
- Uses fewer virgin materials
- High skid resistance and non-rutting
- High reflectivity = greater visibility, lower surface temperature
- Stiff system = better fuel efficiency
- Fewer construction emissions

Improved design procedures & construction practices have increased the versatility of concrete overlays
MOST STATES HAVE SOME CONCRETE OVERLAY EXPERIENCE ...

The National Concrete Overlay Explorer

1147 items.

658 results out of 1147 cannot be plotted.

Iowa
- Over 500 different overlay projects
- First project in 1960
- Most projects on county road system

Missouri
- Using Alternate Bid/Alternate Designs (concrete vs Asphalt) for high volume highways
- Majority of overlay projects have gone concrete

Colorado
- Has pioneered the use of thin concrete overlays

Michigan
- Over 18 projects of 6 to 8 in. concrete overlays on interstate applications

Illinois
- Has constructed 81 overlays since 1974.
- 65 been over asphalt or composite pavement

States with Concrete Overlay Experience

http://overlays.acpa.org/webapps/overlayexplorer/index.html

1. Iowa Concrete Pavement Association
2. National Concrete Pavement Technology Center (CPTech Center)
... and its use as a percentage of concrete pavements being placed is growing.

On a National basis, concrete overlay are 16 to 17% of all concrete pavements placed.

1. Source: ACPA: data from states reported in ACPA’s Publication “pavement Market Quaterly” and data received from ACPA /Chapter State paving assns.

Date as of Nov 2015
WHILE OIL PRICES HAVE DROPPED, ASPHALT PRICES HAVE NOT

Effects of 10% Oil Price Changes on PPI

Source: Portland Cement Association
data thru Nov 2015
WHILE OIL PRICES HAVE DROPPED, ASPHALT PRICES HAVE NOT
Effects of 10% Oil Price Changes on PPI

Source: Portland Cement Association: data thru Nov 2015
FL Data: From Oman Bid Data.
MOST TECHNICAL ISSUES HAVE BEEN ADDRESSED BY THE CONCRETE INDUSTRY & RESEARCHERS

- Overlay types and uses
  - Six overlay summaries
- Evaluating existing pavement & overlay selection
- Design of concrete overlays
- Miscellaneous design details
  - Curbs & gutters, manholes, etc
  - Transitions
  - Widening & lane additions
- Concrete overlay materials
- Work zones under traffic
  - Staging scenarios
- Key points for overlay construction
  - Accelerated construction
- Specification considerations
- Repairs of overlays

http://www.cptechcenter.org/index.cfm
... LOTS OF OTHER GUIDANCE IS ALSO AVAILABLE
CONCRETE OVERLAYS OF ASPHALT HAVE UNTIL RECENTLY BEEN CALLED “WHITETOPPING OVERLAYS”

Bonded Concrete Resurfacing of Asphalt Pavements

- Small square panels reduce curling, warping, & shear stresses.
- Mill if necessary to correct crown, remove surface distresses, improve bonding. Need to leave 3” min. HMA after milling.
- HMA surface temperature below 120 F before paving.

Ultra-thin Whitetopping or UTW (2” – 4”). Not commonly used
Thin Whitetopping (4” – 8”). Use is increasing

Unbonded Concrete Overlay of Asphalt Pavements

- Unbonded resurfacing movement dominates underlying asphalt.
- Slightly smaller than normal joint spacing is common and depends on the thickness of the underlying pavement and the unbonded resurfacing.

Thin Whitetopping (4” – 8”). Use is increasing
Conventional Whitetopping (8” +)

The major difference between bonded and unbonded is how the interface is treated during the design process
THE CHOICE BETWEEN OVERLAY TYPE IS PRIMARILY BASED ON THE EXISTING PAVEMENT CONDITION

Pavement Deterioration Curve

<table>
<thead>
<tr>
<th>Structural/Functional Condition</th>
<th>Age or Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>3&quot;- 8&quot; AC Overlays</td>
</tr>
<tr>
<td>Bonded Overlays of Asphalt &amp; Composite</td>
<td>8&quot; &amp; Thicker AC Overlays</td>
</tr>
<tr>
<td>Good</td>
<td>3&quot;- 8&quot; AC Overlays</td>
</tr>
<tr>
<td>Patching/DG &amp; 2&quot;- 4&quot; AC Overlays</td>
<td>Reconstruction (AC or PCC)</td>
</tr>
<tr>
<td>Fair</td>
<td>8&quot; &amp; Thicker AC Overlays</td>
</tr>
<tr>
<td>Poor</td>
<td>Reconstruction (AC or PCC)</td>
</tr>
<tr>
<td>Deteriorated</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Deteriorated</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td></td>
</tr>
</tbody>
</table>

Other Issues that dictate viability of an overlay
- Roadway type (Interstate vs Arterial vs Collectors)
- Urban vs Rural
- Site specific considerations
  - shoulder, bridges, and other vertical clearance issues
- Traffic control options & Time to open
A BONDED OVERLAY CONCRETE OVER ASPHALT ARE OFTEN USED IN URBAN APPLICATIONS
Where elevations and vertical clearances are an issue

Used to carry traffic loadings typical of:
• low-volume roads
• city streets
• parking areas
• intersections
• bus pads
• etc.

Midland, Texas
Loop 250 Frontage Roads

Childress, Texas
US 287

Pennsylvania

Midland, Texas
Loop 250 Frontage Roads
THIN BONDED OVERLAYS ON ASPHALT ARE A COMPOSITE PAVEMENT
Both the asphalt and concrete carry part of the load

Concrete bonds to Asphalt

Milled surface creates bond between the new concrete to the existing asphalt
- Need at least 3” remaining asphalt after milling

Need to be able to characterize the Existing Asphalt Details
- Pavement thickness after preparation
- Asphalt pavement modulus

Lowers neutral axis & decreases concrete stresses

**Unbonded**
- \( L = 9,000 \text{ lbs} \)
- \( \sigma = 793 \text{ psi} \) (Compression)
- \( \sigma = 556 \text{ psi (Comp)} \) (Tension)

**Bonded**
- \( \sigma = 398 \text{ psi (Comp)} \) (Compression)
- \( \sigma = 556 \text{ psi (Comp)} \) (Tension)
Koke Mill Subdivision
Springfield, Illinois
24 Years and Running
UNBONDED CONCRETE OVERLAY OVER ASPHALT CAN BE PLACED ON EXISTING ASPHALT PAVEMENT IN BAD CONDITION.
Little or no pre-overlay repair needed

Used on applications where elevations is not an issue (low to high volumes), or milling of existing surface is required
  - City streets, Farm to Market (FM), County Roads
  - State Highways
  - Interstates

Avoid reconstruction problems.
  - Minimal rain delays.
  - Maintain traffic on existing surface.
UNBONDED CONCRETE OVERLAY OVER ASPHALT ARE BEING USED SUCCESSFULLY ON STREET APPLICATIONS
Illinois Examples

Marion Street, Oak park, Illinois

Western Ave, Chicago, IL

4-inch Steel Fiber Reinforced unbonded overlay
Joint Spacing = 6 ft.

4-inch Concrete Inlay/Overlay Joint Spacing = 3 ft.
In service for 12 years
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Concrete Overlays Overview

Design Issues

- Thickness
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Construction Issues, Costs & Performance
CONCRETE OVERLAY THICKNESS DESIGN PROCEDURES

Overlay Design Procedures

Unbonded Whitetopping
- Pavement-ME / MEPDG
- ACPA StreetPave Software
- 1993 AASHTO Guide for Design of Pavement Structures
  - ACPA WinPAS Design

Bonded Whitetopping
- ACPA BCOA Calculator
- Pavement-ME / MEPDG
- 1993 AASHTO

All procedures account for:
- Traffic
- Subgrade & Subbase Condition
- Asphalt Condition
- Load Transfer & Edge Support
- Concrete Materials / Strength
- Reliability
- Can use software or design charts

- Based AASHTO Road Test in Ottawa IL, 1958-60
- Intended for use on highway pavements
- Specifically designed for streets and local roads
- Intended for use on highway pavements
- ACPA Web Application (http://apps.acpa.org/apps)
- Intended for Highways, Streets and Local Roads
## Typical Concrete Thickness for Urban Applications

<table>
<thead>
<tr>
<th>Typical Concrete Thickness for Urban Applications</th>
<th>Typical Concrete Thickness for Rural Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate &amp; Expressways</td>
<td>Principal &amp; Minor Arterials</td>
</tr>
<tr>
<td>2-4”</td>
<td>2-4”</td>
</tr>
<tr>
<td>3-6”</td>
<td>3-6”</td>
</tr>
<tr>
<td>3-6”</td>
<td>3-6”</td>
</tr>
<tr>
<td>6-11”</td>
<td>5-6”</td>
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<tr>
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</tr>
</tbody>
</table>

### Interstate & Expressways
- 4 lane or more divided highways with limited access

### Arterials
- Moderate or high-capacity roadways which typically carry vehicles for longer trips (many rural state highways are included in this category)

### Collectors
- Collect & disperse traffic between arterials and local roads or from sections of neighborhoods (rural farm to market roads are included in this category)
**SHORT JOINT SPACING IMPROVES PERFORMANCE**
Reduces environmental loading (curling & warping) and stresses in the slab

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**Effect of Slab Length on Shrinkage Force**

Curling & warping is produced by the shrinkage force at the slab surface.

- Due to drying and thermal differential shrinkage on the surface of the concrete.

The magnitude of this force is dependent on the length of the surface.
- Shorter slabs have less length, which means that shorter slabs have reduced curling.

**Effect of Slab Length on Bending / Deflection**

All concrete slabs bend and deflect when loaded

Reducing slab length reduces changes the primary response from bending to deflection

- Shorter jointing means slabs deflect more
- Longer (standard) jointing means slabs bend more, which increases tension on the bottom of the slab

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For 3” to 6” concrete overlays, joint spacing plays a major role.
IT IS BEST TO KEEP JOINTS OUT OF THE WHEELEPATH

MnROAD Whitetopping Distress
(Mainline - Feb 2002)

<table>
<thead>
<tr>
<th>Cell Description</th>
<th>Panels Cracked (%)</th>
<th>Corner Cracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”-4’x4’ (93)</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3”-4’x4’ (94)</td>
<td>40</td>
<td>165</td>
</tr>
<tr>
<td>3”-5’x6”*(95)</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>6”-5’x6’ (96)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6”-10’x12’ (97U)</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>6”-10’x12’ (92D)</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

4” PCC with 5’x6’ Panels is the optimal design at MnROAD

4’x4’ Panels - Corner Breaks due to Wheel Loadings
### Desirable Characteristics

- Strength
- Durability (low Permeability)
- Workability (matched to how placed)
- Setting time can be decreased for early opening

### Concrete Mix

- Standard Concrete or Higher Early Strength
  - Depends on opening requirements
  - Minimize water/cementitious ratio (w/cm)
- Use Well Graded Mixes
  - Improve construction and performance, improves workability, increase concrete density, reduces water demand, & improves durability
- Minimize cementitious content & Use SCMs
- Check for incompatibility during the mix design

### Curing

- Critical to long term performance
  - Conventional Paving – 200 sq.ft./gal.
  - Thin Overlays – 100 sq.ft./gal

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- Gap-graded
- Well-graded
STRUCTURAL / SYNTHETIC FIBERS CAN IMPROVE PERFORMANCE
Most useful on Pavements less than 6 inches

Fibers do not increase the concrete’s strength
  • Increases toughness
  • Increases post-crack integrity / fatigue
  • Improve ductility

Helps control plastic/drying cracking
  • Does not reduce shrinkage
  • Does not change rules for joint spacing
  • Does not control of movement across random cracks

Typical Dosage Rates
  • Polypropylene ~ 3 lbs./CY
  • Steel ~ 40 to 60 lbs./CY
  • Synthetic ~ 3 to 5 lbs./CY
AGENDA

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Construction Issues, Costs & Performance
CONCRETE OVERLAYS USES THE SAME CONSTRUCTION PROCESS AS NEW CONCRETE PAVEMENTS

<table>
<thead>
<tr>
<th>Fixed Forms</th>
<th>Slip Form</th>
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<tbody>
<tr>
<td>• Used for smaller volume applications</td>
<td>• Used for higher volume projects</td>
</tr>
<tr>
<td>• Intersections</td>
<td>• Clearance can be an issue - Typical paver needs 4 ft on each side for track &amp; string line</td>
</tr>
<tr>
<td>• Parking lots</td>
<td>• Width can be reduced with good planning and zero clearance pavers</td>
</tr>
<tr>
<td>• bus pads</td>
<td>• Advantages</td>
</tr>
<tr>
<td>• Advantages</td>
<td>• Uses low-slump concrete</td>
</tr>
<tr>
<td>• Allows tight side clearances</td>
<td>• Allows high productivity</td>
</tr>
<tr>
<td>• Eases paving width changes</td>
<td>• Develops smooth surface</td>
</tr>
<tr>
<td>• Necessary for blockouts &amp; intersections</td>
<td></td>
</tr>
</tbody>
</table>

- Used for higher volume projects
- Clearance can be an issue - Typical paver needs 4 ft on each side for track & string line
- Width can be reduced with good planning and zero clearance pavers
- Advantages
  - Uses low-slump concrete
  - Allows high productivity
  - Develops smooth surface
CONSTRUCTION OF CONCRETE OVERLAYS OF ASPHALT

Main addition is “Milling & Cleaning” the surface
DRAINAGE AND ELEVATIONS ARE CAN BE ADDRESSED BY MILLING WITHIN THE GUTTERS OR ON THE GUTTER

Opt. 1 - Mill Required Depth at curb
Depth is Adequate for Light Traffic

Opt. 2 - Mill partial depth & bond to obstruction (Transition & truck areas)

Opt. 3 - Transition slab – Transition & truck areas
OTHER WAYS TO DEAL WITH EXISTING CURB & GUTTER
Bond a new curb & gutter to the existing

SH-83 in Aurora, CO
- 5" concrete overlay of asphalt
- Overlaying 6" vertical curb with a mountable curb.
- Placed 1997
- Traffic ~ 30,000 ADT.

Mike Miller Hyuandi, Peoria, IL
- 3” Bonded concrete overlay of asphalt
- Constructed in April 2011
OTHER WAYS TO DEAL WITH EXISTING CURB & GUTTER
SH-83 in Aurora, CO – 5-inch Concrete Overlay – 10 years later

Same Location as paver picture

SH-83 North of Belleview
SEVERAL OPTIONS FOR CONCRETE TO ASPHALT TRANSITIONS

**Detail A**
Thickened edge unbonded overlay (T>4 in)

10-15 ft (typical)

Saw cut face

5 ft (min.)

AC SURFACE

AC BASE

**Detail B**
Thickened edge for bonded overlay (T<4 in)

Saw cut face

T+3 in.

L = Standard length between joints (4-6 ft)

AC SURFACE

AC BASE

**Detail C**
Thickened edge for new pavement

Saw cut face

10-15 ft (typical)

5 ft (min.)

AC SURFACE

AC BASE

GRANULAR

**Detail D**
Impact slab for new pavement

12 in (min.)

15 ft. (typical)

2.0 in (min)

Dowel bars optional

40 mm

AC SURFACE

AC BASE

GRANULAR

T > 7 in
IOWA HAS 309 CONCRETE OVERLAYS OF ASPHALT
Average Concrete Overlay Cost between 2000-2010 = $17.77/SY

<table>
<thead>
<tr>
<th>Decade</th>
<th>No. of Projects</th>
<th>Avg Cost ($/SY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960-79</td>
<td>8 projects</td>
<td>-</td>
</tr>
<tr>
<td>1980-89</td>
<td>48 projects</td>
<td>-</td>
</tr>
<tr>
<td>1990-99</td>
<td>33 projects</td>
<td>-</td>
</tr>
<tr>
<td>2000-09</td>
<td>70 projects</td>
<td>-</td>
</tr>
<tr>
<td>2010-15</td>
<td>131 projects</td>
<td>-</td>
</tr>
</tbody>
</table>

Average concrete overlay thickness is 5.8 inches

Source: Iowa Concrete Pavement Association (Data thru 2015)
* How projects were bid changed in 2013. Cost data is being updated
COLORADO HAS 44 CONCRETE OVERLAYS OF ASPHALT
Since 2000, average concrete overlay cost has $27.59/SY (Wted Avg = $26.87/SY)

No. of Overlays
less than 6” = 24
less than 8” = 25

- SH-68 Harmony Rd, Fort Collins
- SH-83 Franktown
- SH 40 I70 to Hugo
- SH-287 Kiowa Cty Line – South
- SH-119 East of Longmont
- US-287 S. of Campo (Lone Mile)
- I-70 Eisenhower Tunnel Approaches
- US-287A Springfield North
- US-287B South of Eads – South
- US-287A Baca and Prowers
- SH-40 South of Kit Carson
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- SH-121 Wadsworth, C-470 to Parkhill
- SH-83 Quincy Ave & Parker Road
- Commerce City 56th and Hwy 85
- SH-83 Rice to Orchard
- SH-83 Arapahoe to Orchard
- US-287A Lamar South
- US-287A Lamar South
- US-26 Fleming to E. of Haxton
- SH-119 East of Longmont
- SH-83 Parker Rd - Pine Ln to Arapahoe
- SH-83 Quincy Ave & Parker Road
- US-40/287 East to Cheyenne Cty Line
- SH-83 Arapahoe to Orchard
- SH-40 South of Lamar
- SH-40 Rice to Orchard
- US-40/287 Lamar South
- I-70 Eisenhower Tunnel Approaches
- SH-83 Quincy Ave & Parker Road
- SH-83 Arapahoe to Orchard
- SH-40 Rice to Orchard
- US-40/287 Lamar South
- US-287A Springfield North
- US-287B South of Eads – South
- SH-83 Quincy Ave & Parker Road
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- US-287B South of Eads – South
- US-287 Springfield North
- US-287B South of Eads – South
- US-287A Springfield North
- SH-14 - Larimer and Weld Counties
- US-30 Cokeville
- I-70 - Kit Carson County (MP 411-418)
ILLINOIS HAS 65 CONCRETE OVERLAYS OF ASPHALT
Most have been experimental Ultra-thin concrete overlays

1970-89: 3 projects
1990-99: 17 projects
2000-09: 39 projects
2010-12: 12 projects
White-Topping Volusia

- **SR-5/US-1**
- **South of Edgewater**
- **Constructed in 1988 (28 years)**
- **MP 11.459 to MP 9.599 (1.9 miles)**
Existing Conditions Prior to Whitetopping
White-Topping Volusia

Southbound lanes
White-Topping Volusia

US 1 Project Layout

1" Asphalt Base
8 1/2" Limerock Subbase

DLD Joints: 12 Standard
2 x 3 Special

Jt. Spacing: 12', 14', 16' — t = 6"
14', 16', 18' — t = 7"
16', 18', 20' — t = 8"

Jt. Type: DLD - (STD. & SP.), UDLD.
White-Topping Volusia

Standard 12-dowel pattern and tie bars
White-Topping Volusia

PCS US 1 Concrete Pavement

- Cracking
- Ride

Year

PCS Rating
10 9 8 7 6 5 4 3 2 1 0
White-Topping Volusia

Transverse Cracks

Control Section

Special
(3 dowels/whp)

Standard
(12 dowels)

Special

Standard

Special

Standard

Percent Slabs

0 (14 ft.)

1 (12 ft.)

2 (14 ft.)

3 (16 ft.)

4 (12 ft.)

5 (14 ft.)

6 (16 ft.)

7 (14 ft.)

8 (16 ft.)

9 (18 ft.)

10 (14 ft.)

11 (16 ft.)

12 (18 ft.)

13 (16 ft.)

14 (18 ft.)

15 (20 ft.)

16 (16 ft.)

17 (18 ft.)

18 (20 ft.)

6 in

7 in

8 in
White-Topping Volusia

**Longitudinal Cracks**

- **6 in**: Special (3 dowels/whp), Standard (12 dowels)
- **7 in**: Special, Standard
- **8 in**: Special, Standard

Control Section:
- 0 (14 ft.)
- 1 (12 ft.)
- 2 (14 ft.)
- 3 (16 ft.)
- 4 (12 ft.)
- 5 (14 ft.)
- 6 (16 ft.)
- 7 (14 ft.)
- 8 (16 ft.)
- 9 (18 ft.)
- 10 (14 ft.)
- 11 (16 ft.)
- 12 (18 ft.)
- 13 (16 ft.)
- 14 (18 ft.)
- 15 (20 ft.)
- 16 (16 ft.)
- 17 (18 ft.)
- 18 (20 ft.)

**Percent Slabs**

- 0%
- 5%
- 10%
- 15%
- 20%
- 25%
- 30%
- 35%
- 40%
- 45%
- 50%

**Florida Department of Transportation**
White-Topping Volusia

Corner Cracks

- Control Section
  - 6 in: Special (3 dowels/whp)
  - Standard (12 dowels)
- 7 in: Special
- 8 in: Special

Percent Slabs

0 (14 ft) | 1 (12 ft) | 2 (14 ft) | 3 (16 ft) | 4 (12 ft) | 5 (14 ft) | 6 (16 ft) | 7 (14 ft) | 8 (16 ft) | 9 (18 ft) | 10 (14 ft) | 11 (16 ft) | 12 (18 ft) | 13 (16 ft) | 14 (18 ft) | 15 (20 ft) | 16 (16 ft) | 17 (18 ft) | 18 (20 ft)
White-Topping Volusia

Spalling

- Control Section (3 dowels/whp)
- Special (12 dowels)
- Standard
- Special (6 in)
- Standard (7 in)
- Special (8 in)
- Standard

Percent Slabs

<table>
<thead>
<tr>
<th>Section</th>
<th>Percent Slabs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (14ft.)</td>
<td>45</td>
</tr>
<tr>
<td>1 (12ft.)</td>
<td>40</td>
</tr>
<tr>
<td>2 (14ft.)</td>
<td>35</td>
</tr>
<tr>
<td>3 (16ft.)</td>
<td>30</td>
</tr>
<tr>
<td>4 (12ft.)</td>
<td>25</td>
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<tr>
<td>5 (14ft.)</td>
<td>20</td>
</tr>
<tr>
<td>6 (16ft.)</td>
<td>15</td>
</tr>
<tr>
<td>7 (14ft.)</td>
<td>10</td>
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<tr>
<td>8 (12ft.)</td>
<td>5</td>
</tr>
<tr>
<td>9 (18ft.)</td>
<td>0</td>
</tr>
<tr>
<td>10 (14ft.)</td>
<td>5</td>
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<tr>
<td>11 (16ft.)</td>
<td>10</td>
</tr>
<tr>
<td>12 (18ft.)</td>
<td>15</td>
</tr>
<tr>
<td>13 (16ft.)</td>
<td>20</td>
</tr>
<tr>
<td>14 (18ft.)</td>
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</tr>
<tr>
<td>15 (20ft.)</td>
<td>30</td>
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<tr>
<td>16 (16ft.)</td>
<td>35</td>
</tr>
<tr>
<td>17 (18ft.)</td>
<td>40</td>
</tr>
<tr>
<td>18 (20ft.)</td>
<td>45</td>
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</tbody>
</table>

Florida Department of Transportation
White-Topping Volusia

Ride Quality

MRI, in/mile

Control Section

Special (3 dowels/whp)

Standard (12 dowels)

Special

Standard

Special

Standard

6 in

7 in

8 in

0 (14ft.)

1 (12ft.)

2 (14ft.)

3 (16ft.)

4 (12ft.)

5 (14ft.)

6 (16ft.)

7 (14ft.)

8 (16ft.)

9 (18ft.)

10 (14ft.)

11 (16ft.)

12 (18ft.)

13 (16ft.)

14 (18ft.)

15 (20ft.)

16 (16ft.)

17 (18ft.)

18 (20ft.)
White-Topping Volusia

![Graph showing the average faulting in inches for different sections and dowel placements.]

- Control Section: Special (3 dowels/whp)
- Special Section (12 dowels): 6 in
- Standard Section (12 dowels): 7 in
- Special Section (12 dowels): 8 in

Average Faulting (in)

0 (0 ft.), 1 (12 ft.), 2 (14 ft.), 3 (16 ft.), 4 (15 ft.), 5 (14 ft.), 6 (16 ft.), 7 (14 ft.), 8 (16 ft.), 9 (18 ft.), 10 (14 ft.), 11 (16 ft.), 12 (18 ft.), 13 (16 ft.), 14 (18 ft.), 15 (20 ft.), 16 (16 ft.), 17 (18 ft.), 18 (20 ft.)
SUMMARY

1. Concrete Overlays have Long-term Durability and Cost Advantages
   • Add strength and durability to an existing pavement
   • Can be placed on existing asphalt pavements using a wide range of thicknesses
   • Existing pavement does not have to be removed and few pre-overlay repairs are necessary.

2. Concrete Overlays are Competitive on Initial & Life Cycle Cost
   • Concrete Overlays can be designed to last from 10 to 40+ years before most major repairs are needed

3. Concrete Overlays can be placed using normal concrete pavement construction practices or as a Roller Compacted Concrete pavement.

4. Concrete Overlays have good safety and sustainability characteristics
   • Fewer workzones
   • High skid resistance and non rutting
   • Improved fuel savings / Lower emissions
   • High Reflectivity / High albedo surfaces
Thank You
& Any Questions?

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Cell: 713-598-6669