Performance of Ultra Thin Bound Wear Course
Case Study Interstate 35 Southbound Mile Post 18 to 12
Field Review

November 13, 2008

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On November 13, 2008, I reviewed the section of Interstate 35 southbound just north of junction with Interstate 90. The reason for reviewing this section is the following excerpted from report “Field Observations of the Coring of I-35 Between Mile Post 18 and 16 Southbound” Jerry Geib and Thomas Wood September 27, 2005. (Appendix A) This review is on going research to determine how Bituminous over Concrete (BOC) pavements crack, and how to reduce or eliminate cracking of the Hot Mix Asphalt (HMA) overlay.

“The roadway was originally constructed in 1970. The pavement was nine inches of reinforced concrete pavement laid 24 feet wide with panel length of 27 feet with skewed joint with doweled reinforcement. The shoulders widths are three feet inside and ten feet outside shoulder paved with HMA. The concrete had deteriorated to the point that the District personnel recommend doing a HMA overlay. The recommend overlay was placed with two 1½ inch of HVNW37540E layers and 1½ inches of HVWE37540E wearing coarse. The binder used was a P.G. 64-28. The length of the overlay was approximately covered six miles. The Northern two miles and Southern two miles received a total overlay thickness of ± 4.5 inches of HMA. The Center two miles received ± 4.5 inches of HMA followed by ¾ to ⅝ inch of Ultra Thin Bonded Wearing Coarse (UTBWC). Observations in 2004, the two Sections that did not receive the U TBWC were cracked at a much greater rate then the Center Section that received the U TBWC.”

Weather conditions on November 13th where light rain which facilitated the seeing the cracks, pop outs, and surface defects. The following rating systems was used to rate each crack.

If the crack has been sealed and had no additional cracks are present and the sealant is tight and working proper this crack would receive a rating of one (1). If the crack had not been sealed but the crack where narrow enough that ¾ inch router would cut both sides of the crack then the crack would also receive a rating of one (1).

If the crack has been sealed but secondary cracks have formed with total length of the additional cracks greater then one foot this crack would receive a rating of two (2). If the crack had not been sealed and also have secondary cracks formed with total length greater then one foot then the crack received a rating to two (2). See picture #1 below.
If the crack has been sealed and the additional cracks have combined to form small potholes then the crack received a rating of three (3). If the crack has not been sealed and had small potholes caused by combination of the secondary cracks then the crack received a rating of three (3). The minimum size of the potholes had to be the size of a fist or bigger. Most of the damage was located along the center line of the roadway at the junction of the cold paving joint. See Picture #2 for example of rating #3.
Figure 1 and 2 are graphs of the length of transverse crack for each section. The following labeling method was used. North and South section which has 4.5 inches of superpave overlay. The center section labeled Ultra Thin Bonded Wearing Coarse (UTBWC) also received 4.5 inch super pave over lay followed by \( \frac{3}{8} \) to \( \frac{3}{4} \) inch of UTBWC overlay.
Figure 1 November 13, 2008 Transverse Crack Measurements.
Figure 2 November 13, 2008 Transverse Crack Measurements.
Field Observations of Coring of I-35 Between Mile Post 18 and 16 Southbound

September 27, 2005

By: Jerry Geib and Thomas Wood
On September 27, 2005, cores were taken from I-35 between milepost 18 to 16 from southbound right lane. This section of rural interstate highway received a Hot Mix Asphalt (HMA) overlay in the summer of 2001.

The roadway was originally constructed in 1970. The pavement was nine inches of reinforced concrete pavement laid 24 feet wide with panel length of 27 feet with skewed joint with doweled reinforcement. The shoulders widths are three feet inside and ten feet outside shoulder paved with HMA. The concrete had deteriorated to the point that the District personnel recommend doing a HMA overlay. The recommend overlay was placed with two 1½ inch of HVNW37540E layers and 1½ inches of HVWE37540E wearing course. The binder used was a P.G. 64-28. The length of the overlay was approximately covered six miles. The Northern two miles and Southern two miles received a total overlay thickness of ± 4.5 inches of HMA. The Center two miles received ± 4.5 inches of HMA followed by ¾ inch of Ultra Thin Bonded Wearing Coarse (UTBWC). Observations in 2004, the two Sections that did not receive the UTBWC were cracked at a much greater rate then the Center Section that received the UTBWC.

Cracking on I-35

<table>
<thead>
<tr>
<th>Section</th>
<th>Linear feet of cracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edgeline</td>
<td>9583</td>
</tr>
<tr>
<td>Centerline</td>
<td>10988</td>
</tr>
<tr>
<td>Transverse</td>
<td>3355</td>
</tr>
<tr>
<td>Total</td>
<td>23926</td>
</tr>
<tr>
<td>Northern Section Normal Overlay</td>
<td>8588</td>
</tr>
<tr>
<td>Southern Section Normal Overlay</td>
<td>5410</td>
</tr>
<tr>
<td>Center Section with UTBWC</td>
<td>604</td>
</tr>
</tbody>
</table>

Table 1, Linear feet of cracks by types and sections - 2004 data.
Figure 3, Regular HMA overlay—September 27, 2005
Figure 4, Ultra Thin Bonded Wearing Coarse-September 27, 2005
Our observations are the following.

The first core was part of the regular overlay at a crack that had not cracked all the way across the lane. It was taken six feet right of centerline just past the end of the visual crack. The core showed no sign of a crack. The depth of the HMA was five inches.

Figure 5, Core # 1-September 27, 2005
This second Core was taken on the same crack as Core one, but cored at ten feet right of the centerline. This core demonstrates that the crack is forming from the top down. The crack has migrated through the top two lifts of the HMA overlay. The crack in the HMA was also offset from the joint in the existing PCC, by approximately four inches to the downstream of concrete joint in the direction of normal traffic flow.

Figure 6, Core 2 Top View-September 27, 2005

Figure 7, Core 2 Side View-September 27, 2005
This third Core was also taken from the regular HMA overlay. It was taken 7.5 feet right of the centerline, from what appeared to be a more mature crack. This crack has migrated all the way thorough the HMA overlay across the lane. It also is off set by approximately four inches from the joint in the PCC toward the downstream side.

Figure 8, Location of core # 3-September 27, 2005

Figure 9, Core #3 Side View-September 27, 2005
Figure 10, Core #3 Location of joint in PCC-September 27, 2005

Figure 11, Looking down core hole for core #3.-September 27, 2005
The forth Core was obtained from the center section of the project that receive UTBWC in addition to the regular overlay. It was taken 5.5 feet right of centerline. On the surface of the core it appears like there was a crack but the side view of the showed no sign of any cracking. The joint in the PCC was also offset approximately four inches from where the surface crack appeared to be.

![Figure 12, Core #4 surface before coring-September 27, 2005](image)

![Figure 13, Core #4 No crack visible-September 27, 2005](image)
The fifth and final Core sampled was also taken in the Center section that receive the UTBWC in addition to the regular HMA overlay. It was located 9.5 feet right of centerline. There as a crack visible on the surface of the pavement in the location that the core was taken. The core showed no sign of the crack under the surface. The joint in the PCC was also offset by approximately four inches from the surface crack.

Figure 14, Surface crack at the location that core #5 was taken.-September 27, 2005

Figure 15, Surface of Core #5
Figure 16, Side view of core #5-September 27, 2005

Figure 17, Joint sealant from PCC joint on Core # 5.-September 27, 2005
The three main observations are.

1. The sections that only received the HMA overlay have cracked at a much greater rate at this time. The 2004 crack data showed that HMA had cracked at a rate five times greater than the section utilizing UTBWC.

2. All the joints in PCC were offset by approximately four inches as compare to the location of the surface cracks.

3. Some of the cracks in the UTBWC seem only to be on the surface.

I would recommend continued documentation of development of cracks in all of these sections to determine if the reduction of cracking in UTBWC is only a temporary delay benefit. Other bituminous over concrete pavements should be cored to determine if the offset of the cracks in the overlay versus the joint in concrete is a normal occurrence.