I-70 Extended Life Pavement Performance

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IDOT - Bureau of Research
I-70 Project Location

District 7 Clark County (Constructed by District 5)
I-70 Clark County
Average Daily Truck Traffic

Source: FHWA 2011
Why Use Extended Life Pavement Design?

- Warranty demonstration project mandated by Illinois FIRST legislation in 1999
  - "The Department shall implement a demonstration project, under which 20 of the contracts ... for fiscal years 2000 through 2004 shall have a performance-based warranty of at least 5 years…"

- Also required extended life designs
  - “10 of those contracts shall be designed for a 30-year life cycle.”

- Asphalt industry wished to compete on “30-year life cycle” warranty projects
What Is An Extended Life HMA Design?

- Built to last longer than the standard 20-year design
- Will not require major rehabilitation or patching
- Surface is sacrificial and is replaced at some frequency
I-70 Project Details

- IL 1 to Indiana Border – Contract 70044
  - Unbonded CRCP Overlay (2002)
- Martinsville to IL 1 – Contract 70059
- 5-year warranties on both projects (pavement and bridges)
- 20-year warranties were considered (at IAPA’s request)
Alternate bidding was considered
Zero blanking band used for surface testing of pavement
Bridge decks constructed 1/4 inch high and diamond ground for smoothness
Unbonded CRCP Overlay – Design Details

- Existing 8-in. CRCP (1969) with D-cracking susceptible aggregates and 2 prior asphalt overlays
- 30-year (extended life) design period
- 12.0-in. unbonded CRCP overlay of existing (after mill to profile)
UBOL Construction Sequence

12" PCC SHOULDERS

12" UNBONDED CRCP OVERLAY

MILL OR OVERLAY TO GRADE LINE

HMA OVERLAY

HMA OVERLAY

HMA SHOULDER

8" CRCP

4" BAM BASE

12 ft.

24 ft.

6 ft.
- Existing 8-in. CRCP (1971) with D-cracking susceptible aggregates and 2 prior asphalt overlays
- 30-year (extended life) design period
- 17.5-in. HMA on rubblized CRCP
- 5.25-in. overlay of existing CRCP (control)
Design Curve Used in 2001

HMA Overlay Thickness
for Rubblized Pavements

Traffic Factor

HMA Overlay Thickness, Inches

- Districts 1, 2
- Districts 7, 8, 9
Limiting Strain Criterion (Maximum) Thickness – 11.50 inches
Rubb. Construction Sequence

- Existing HMA Overlay
- Existing 8” CRCP
- 17.5” New HMA

Rubb. Construction Sequence

12 ft. 24 ft. 6 ft.

New HMA Shoulder

Existing HMA Shoulder

17.5” New HMA

4” BAM Base

Existing 8” ARCP
Extended Life HMA Elements

- Steel slag SMA surface
- Polymer used in all lifts
- 1.0% hydrated lime (dry) anti-strip in all lifts
- Polymer tack coat between lifts
- Extra tack coat on longitudinal joints
- Material transfer device on all lifts
- Did not use rich bottom base layer
Rubblization and HMA Construction
Multi-Head Breaker
Broken Pavement Behind Multi-Head Breaker
Z-Grid Roller
Rubblized Pavement Ready for HMA Overlay
## HMA Lifts

<table>
<thead>
<tr>
<th>Lift Thickness (in)</th>
<th>Mix Information</th>
<th>Binder Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00</td>
<td>N80 SMA 12.5 Surface Course</td>
<td>SBS PG 76-28</td>
</tr>
<tr>
<td>2.50</td>
<td>N105 19.0 Binder Course</td>
<td>SBS PG 76-28</td>
</tr>
<tr>
<td>3.00</td>
<td>N105 19.0 Binder Course</td>
<td>SBS PG 76-28</td>
</tr>
<tr>
<td>10.00 (2 lifts)</td>
<td>N90 19.0 Binder Course</td>
<td>SBS PG 70-22</td>
</tr>
</tbody>
</table>
I-70 HMA Core
I-70 HMA Core
Open House
Project Monitoring

- Traffic
- Data collection vehicles
  - Digital imagery
  - International Roughness Index (IRI)
  - Rutting
- Distress surveys
- Falling weight deflectometer testing
Percent Consumed

<table>
<thead>
<tr>
<th></th>
<th>HMA/Rubblized</th>
<th>CRCP UBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years (Years)</td>
<td>52</td>
<td>55</td>
</tr>
<tr>
<td>Design ESALs (Years)</td>
<td>39</td>
<td>43</td>
</tr>
</tbody>
</table>
Condition Rating Survey (CRS)

- CRS 9.0 – 7.6 = Excellent
- CRS 7.5 – 6.1 = Good
- CRS 6.0 – 4.6 = Fair
- CRS 4.5 – 1.0 = Poor
Unbonded CRCP Overlay – Performance

- 2018 CRS=7.7, IRI=75
- Centerline deterioration (low level)
- **Edge punchouts** (around 3 per mile) with (temporary) spray injection patching
- Permanent patching (very little)
- Some warranty repairs
Edge Punchout
HMA / Rubblized CRCP – Performance

- 2018 CRS=8.0, IRI=48
- Rutting=0.11 in.
- Centerline deterioration is only recorded CRS distress
- No warranty repairs on pavement (some bridge deck repairs)
Mechanical Damage
Car Fire Damage
Down Image (3D)

- Centerline Cracking
- Mid-Lane Longitudinal Cracking
Mill and Overlay
Reflective D-Cracking
2018 IRI by 0.1-mile (HMA)

IRI (in/mi) vs. Mileage

Mill and 5.25" HMA

Rubbilization and 17.5" HMA

EB

WB

MAP-21 Good
2018 IRI by 0.1-mile (CRCP)

IRI (in/mi)

EB  WB  MAP-21 Good
2018 Rutting by 0.1-mile

- Mill and 5.25" HMA
- Rubblization and 17.5" HMA

Rutting (in)

- EB
- WB
- MAP-21 Good
# Warranted Distresses (5-yr.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Extent</th>
<th>Severity</th>
<th>Warranty Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue Cracking</td>
<td>50 sq. ft.</td>
<td>Moderate</td>
<td>Patch 150% of Distressed Area</td>
</tr>
<tr>
<td></td>
<td>Any within section</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Block Cracking</td>
<td>100 sq. ft.</td>
<td>Moderate</td>
<td>Mill &amp; Replace</td>
</tr>
<tr>
<td></td>
<td>Any within section</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Transverse Cracking</td>
<td>10 lin. ft.</td>
<td>Moderate</td>
<td>Seal</td>
</tr>
<tr>
<td></td>
<td>Any within section</td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
# Warranted Distresses (5-yr.)

*Longitudinal Cracking*

<table>
<thead>
<tr>
<th>Location</th>
<th>Extent</th>
<th>Severity</th>
<th>Warranty Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within the Lane</td>
<td>10 lin. ft.</td>
<td>Moderate</td>
<td>Seal</td>
</tr>
<tr>
<td>Any within section</td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Centerline Deterioration</td>
<td>10 lin. ft.</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Edgeline</td>
<td>10 lin. ft.</td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
# Warranted Distresses (5-yr.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Extent</th>
<th>Severity</th>
<th>Warranty Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRI</td>
<td>Within Section</td>
<td>Avg. 110 in./mi.</td>
<td>Mill &amp; Replace</td>
</tr>
<tr>
<td>Potholes &amp; Shoving</td>
<td>Any within section</td>
<td>All severity levels</td>
<td>Patch 150% of Distressed Area</td>
</tr>
<tr>
<td>Bleeding, Flushing, &amp; Raveling</td>
<td>500 sq. ft.</td>
<td>Moderate High</td>
<td>Mill &amp; Replace</td>
</tr>
<tr>
<td></td>
<td>Any within section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rut Depth</td>
<td>Any within section</td>
<td>0.30 in.</td>
<td>Mill &amp; Replace</td>
</tr>
</tbody>
</table>
Performance Summary

- Overall performance has been excellent on both projects
- CRCP UBOL has experienced edge punchouts that have required maintenance
- SMA surface has been maintenance free for 15+ years with minimal rutting
Performance Summary (cont.)

- IRI values on HMA/Rubb. have been consistently lower than those on CRCP UBOL
- Rubblized section performed much better than the mill and overlay control section
Acknowledgements

- David Lippert, IDOT (retired)
- Steve Robinson, IDOT District 5
- Tom Zehr, Central Bureau of Materials
- Marshall Thompson, Univ. of Illinois
Questions?

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