2003–2006 MnROAD Mainline Maintenance Observations and Test Track Lessons Learned

Prepared for
AFD40
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Outline:
- MnROAD Facility
- Test Sections Pre-Existing Condition
- 2003 Maintenance Activities
- Maintenance Observations
- APT Facility Maintenance Lessons Learned
A long-term pavement testing facility that gives researchers a unique, real-life laboratory to study and evaluate the performance of materials used in roadway construction.

**MnROAD Facility – Test Sections**

**History**
- Original Construction (92-93)
- Open to Traffic (94)

**Layout/Current Designs**
- Mainline / Low Volume Road
- Asphalt and Concrete Surfaces
- 3, 5, 10 Year Designs
- Each test cell 500 feet long

2003 Maintenance performed on Mainline HMA
- Four 5-year HMA test cells (cells 1-4)
- Ten 10-year HMA test cells (cells 14-23)
MnROAD Facility - Mainline Traffic

**Mainline Traffic**

I-94 West Bound Interstate Traffic

18,900 (1994) : 26,400 (2001)

AADT 12.5% (1994) : 14% (2001) HCAADT

HMA = 6 Million ESALS (Dec 2005)

MnROAD Facility - Research Resources

**Onsite Technical Staff**

**Safe/Accessible Work Zone**

**Sensor Data**

- Data Collection Network
- 4,600+ Sensors Installed
- Static and Dynamic Data
- Weather Data
- Traffic Data

**Detailed Lab Testing**

**Detailed Performance Monitoring**

**Oracle Database**
MnROAD Facility - HMA Mainline Maintenance

Maintenance Activities before 2003

- **1998**: Rout & Seal crack sealing in cells 1 & 16
- **1999**: Micro-surfacing applied to cells 20 & 23
- **2000**: Blow & Go crack sealing in 12 of the 14 HMA cells, only control cells 3 & 17 left unsealed

MnROAD Mainline Pre-Existing Condition

Top Down Cracking

Transverse Cracking

Rutting

Less Rutting in Passing Lane

Goals of Maintenance Plan

- Conditions varied - Some maybe too far gone for treatments
- Restore Ride to Acceptable Levels
- Reduce Rutting in Driving Lanes
- Add Surface Texture to HMA Cells
**Maintenance Plan**

**Plan**
- Apply maintenance activities, alone or in combination, to improve cell's ride
- Two control cells, 3 & 17, no maintenance applied
- All previously sealed cracks will be re-sealed
- Some cells will have transverse cracks leveled
- Some cells will receive a slurry or micro-surfacing thin maintenance surface

**Maintenance Plan - Study Matrix**

<table>
<thead>
<tr>
<th>Cell</th>
<th>Reseal Cracks</th>
<th>Transverse Crack Repair</th>
<th>MiniMac Slurry Seal / Microsurfacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>Crack Seal Only</td>
<td>Micro(1)</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
<td>MiniMac (1)</td>
<td>MiniMac (2)</td>
</tr>
<tr>
<td>3</td>
<td>NO</td>
<td>Control Cell - No Maintenance Performed</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
<td>Mastic</td>
<td>Micro (2)</td>
</tr>
<tr>
<td>14</td>
<td>Yes</td>
<td>Mastic</td>
<td>MiniMac(2)</td>
</tr>
<tr>
<td>15</td>
<td>Yes</td>
<td>MiniMac</td>
<td>Micro(1) over MiniMac(1)</td>
</tr>
<tr>
<td>16</td>
<td>Yes</td>
<td>Mastic</td>
<td>Nothing</td>
</tr>
<tr>
<td>17</td>
<td>NO</td>
<td>Control Cell - No Maintenance Performed</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Yes</td>
<td>Mastic</td>
<td>Micro(1)</td>
</tr>
<tr>
<td>19</td>
<td>Yes</td>
<td>Mastic</td>
<td>Micro(1)</td>
</tr>
<tr>
<td>20*</td>
<td>Yes</td>
<td>Mastic</td>
<td>Micro(1)</td>
</tr>
<tr>
<td>21</td>
<td>Yes</td>
<td>Micro(1)</td>
<td>Micro(2)</td>
</tr>
<tr>
<td>22</td>
<td>Yes</td>
<td>Micro(1)</td>
<td>Micro(1)</td>
</tr>
<tr>
<td>23*</td>
<td>Yes</td>
<td>Crack Seal only</td>
<td></td>
</tr>
</tbody>
</table>

* 1999 Microsurfacing done on these cells
**Maintenance Plan - Crack Sealing**

May 2003

Re-Sealed transverse (thermal) cracks with crumb rubber sealant using the blow & go method of crack sealing.

All Cells but 3 and 17 (controls)

**Maintenance Plan - Transverse Mastics**

June 2003

Leveled transverse (thermal) cracks with two mastic materials

Cells 4, 14, 16 & 18
Maintenance Plan – Transverse Slurry

July 2003

Leveled transverse (thermal) cracks with slurry in cell 15.

Maintenance Plan – Mini-Mac Slurry

July 2003

Applied full width slurry on cells using the Mini-Mac Machine (6 foot passes)

Cells 2, 14 & 15
Maintenance Plan – Micro-Surfacing Slurry

August 2003

Applied full lane width micro-surfacing in one or two lifts

Cells 4, 15, 18, 19, 20, 21, & 22

Observations – Cell 14 Example

Cell 14 (Mini-Mac 2 lifts)

2004 – One Winter

2005 – Two Winters
**Observations - Cell 4 Example**

Cell 4 (MicroSurfacing 2 lifts)

- 2004 – One Winter
- 2005 – Two Winters

**Observations - Rutting**

- Note cell 20 (1999) & Cell 2 (2003) both performed well
- 2 lifts are better than 1 lift
- 1 lift is better than nothing
- Both MiniMac and Microsurfacing performed similar
Observations - Top Down Cracking

- First winter Top down cracks reflected through
- The single slurry with transverse crack repair and the double slurry treatments did the best job of reducing reflective top down cracking initially after three years.
- Today a majority of the cracks are back to their pre-maintenance conditions

Observations - Ride

- Crack seal have been getting progressively worse over time
- Single and double slurry treatments with transverse crack repair (Mastics and MiniMac applications) are performing best
- 2004 Cells 14, 15, 16 required repairs due to reflective cracking and poor ride
- Control cells showed virtually no change
Observations - Transverse Cracking

- Mastic treatments did not prevent the cracks from returning.
- Majority of the cracks reflected though after one year.
- Double slurry seal without crack repair was performing the best after 3 years.
- Control cells (1, 3, 17, 23) maintained their severity levels.
- Both slurries do show a greater increase in medium severity cracking ("V") from single crack causing a wider surface crack.

APT Facility Lessons Learned

- MnROAD, with its isolated Low Volume Road and the ability to switch traffic on and off the Mainline, allows for detailed measurement to be taken in a safe, consistent manner by its highly trained staff.

- 500-ft cell is representative of a larger pavement section
  - Quality construction is possible in a short cell
  - Significant differences in cell performance have been observed

- Maintenance treatments have allowed MnROAD to delay before its next reconstruction in a positive manner while allowing valuable short-term research to be conducted.
APT Facility Lessons Learned

- MnROAD strikes an appropriate balance between the environmental and traffic loading factors that affect maintenance treatment performance.
- The MnROAD database is able to store data regarding pavement materials, traffic, and the environment to support both current research projects and those anticipated in the future.
- Test cells/studies are not lost from researcher to researcher over time.

Conclusions

- MnROAD as an APT has yielded detailed valuable results for the maintenance treatments tested.
- Slurry seals have performed quite well in terms of restoring ride quality and filling in ruts.
- None of the maintenance treatments studied was successful in preventing reflective cracking from underlying transverse or top down cracks.
- Under appropriate conditions slurry seals can be used for an effective maintenance treatment.
- Mn/DOT will continue to monitor the performance of the maintenance activities placed in 2003.