Cost Effective Pothole Patching
Patching Materials

- Hot Mix Asphalt
- Cold mix
  - Locally available
  - High-Performance, proprietary
Cincinnati’s Pothole Repair Procedure Using HMA

CLASS I REPAIR
- Cut area around with a jackhammer
- Clean hole with a brush/broom
- Apply tack
- Place HMA
- Compact using vibratory plate
- Seal edges
- Approx. time for 2-person crew = 30 minutes

CLASS II REPAIR
- This step not performed
- Clean hole with a brush/broom
- Apply tack
- Place HMA
- Compact using vibratory plate
- Seal edges
- Approx. time for 2-person crew = 15 minutes
City’s Winter Pothole Repair Program

- Emulsion based high-performance material
- Throw (dump) and tamp
- 10 minutes for 2-person crew
- Repairs treated temporary and replaced in Spring
Study Objectives

- Compare the performance of HMA patching to high-performance cold mix patching
- Verify the assumption that cold mix patching is a temporary solution.
Tasks

- Review published studies
- Survey local agencies
- Conduct field experiment

Prepare recommendations
Previous Studies

- SHRP
- ODOT
- NSF
- AASHTO
- DOTs
SHRP Research

- SHRP H-106, 1991
- 1200 test repairs in US and Canada
- Materials:
  - UPM
  - Perma-Patch
  - QPR2000
  - PennDOT486
  - HFMS-2
Quality of repair materials used, not the repair method, is important

Throw-and-roll method or the spray-injection method produce repairs as durable as those using the more costly and time-consuming semi-permanent method

Annual savings could range between $24 million and $89 million, depending on the rate of adoption.
Other Studies

- ODOT research
  - Nine asphalt-cement-based materials were tried in field experiments.
  - Two mixes - HPM cold mix and PennDOT 485 cold mix showed satisfactory performance. The HPM cold mix, in particular, performed well under all installation conditions for both rigid and flexible surfaces.
- NSF Study – UPM performed well
- AASHTO Survey:
  - 19 agencies use UPM, reported satisfactory performance
Telephone survey of 10 cities
- Grand Rapids, Traverse City, Evansville, Louisville, Bloomington, Denver using UPM for 10+ years
## Use of High-Performance Cold Mix in Ohio

<table>
<thead>
<tr>
<th>City</th>
<th>Mix Type</th>
<th>How long</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akron</td>
<td>UPM</td>
<td>10 years</td>
<td>Winter installation; dump and go</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>UPM/QPR2000</td>
<td>20 years</td>
<td>Winter installation; dump and go/tamp</td>
</tr>
<tr>
<td>Cleveland</td>
<td>UPM</td>
<td>30 years</td>
<td>Temporary patch</td>
</tr>
<tr>
<td>Dayton</td>
<td>UPM</td>
<td>30 years</td>
<td>Hand tamped; 2-3 years life</td>
</tr>
<tr>
<td>Toledo</td>
<td>UPM</td>
<td>20 years</td>
<td>Dump and temp/roll; 75% last a long time</td>
</tr>
</tbody>
</table>
What is UPM?
Permanent Pavement Repairs Easily in any Weather

- UPM's super high-performance will save you time and money patching potholes - or your money back!

- Over 90% of all UPM patches outlast the surrounding pavement. Unique has been making UPM for almost 30 years - and we are not afraid to guarantee it.

For more information, call (800) 441-4821.

On-site demonstrations throughout North America.
30 installations

Compare performance of Cincinnati’s Class I repairs with UPM
Repair type: Class I
Traffic: Moderate
Pavement surface: Asphalt
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Concrete
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Asphalt
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Concrete
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Concrete
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Asphalt
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Asphalt
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Asphalt
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Asphalt
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Concrete
Condition after 3 years
Repair type: Class I
Traffic: Heavy
Pavement surface: Concrete
Condition after 3 years
Repair type: Class I
Traffic: Moderate
Pavement surface: Asphalt
Condition after 3 years
HMA Class I repairs
- Some distress was noticed in all repairs within 7 to 10 months after repair
- Severity of distress increased with time

UPM repairs
- Minimal to no distress after three years
## Cost Analysis

<table>
<thead>
<tr>
<th>Material cost</th>
<th>HMA ($0.62 @ $25/ton)</th>
<th>UPM ($1.50 @ $60/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor cost</td>
<td>$20.00 (30 minutes)</td>
<td>$6.67 (10 minutes)</td>
</tr>
<tr>
<td>Equipment cost</td>
<td>$0.38</td>
<td>$0.38</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$21.00</td>
<td>$8.55</td>
</tr>
<tr>
<td>Input</td>
<td>Example Number</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Material Type</td>
<td>Local</td>
<td>UPM</td>
</tr>
<tr>
<td>Material Cost ($/ton)</td>
<td>20</td>
<td>85</td>
</tr>
<tr>
<td>Wages for Repair Crew ($/day)</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Wages for Traffic Control ($/day)</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Equipment Cost for Repair Crew ($/day)</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Equipment Cost for Traffic Control ($/day)</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Productivity (tons/day)</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Initial Need (tons)</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>User Delay Costs ($/day)</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Estimated Repair Life (months)</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Estimated 5 year Cost ($, without user delay)</td>
<td>710,000</td>
<td>138,570</td>
</tr>
<tr>
<td>Estimated 5 year Cost ($, with user delay)</td>
<td>1,710,000</td>
<td>281,430</td>
</tr>
<tr>
<td>Cost-effectiveness ($/ft² of initial need—without user delay)</td>
<td>44.38</td>
<td>8.66</td>
</tr>
<tr>
<td>Cost-effectiveness ($/ft² of initial need—with user delay)</td>
<td>106.88</td>
<td>17.59</td>
</tr>
</tbody>
</table>

Note: This chart is a duplication of Table 21, Summary of inputs for cost-effectiveness examples, found on page 76 of SHRP-96-353, INNOVATIVE MATERIALS DEVELOPMENT AND TESTING VOLUME 2: PAVEMENT REPAIR (1991).
Conclusions

- UPM (high-performance cold mix) performed than conventional HMA patching material
- Present study reinforces findings from past research
- High-performance cold mix repairs should not be viewed as temporary repairs
Thank you