NCAT Pavement Test Track

Mix Performance Optimization (BMD), Friction, Preservation, Cold Recycle Mix
Accelerated Pavement Testing (APT)

MnROAD

MnROAD
Illinois in the 2018 Research Cycle

- Mix performance testing (CG)
- Benefits of preservation (PG)
- Northern climate focus (MnROAD)

Why Performance Optimization?

- Optimized use of available virgin, recycle materials
- Volumetrics don’t necessarily relate to mix quality
- Rutting, cracking, durability, friction assurance
- Recycling agents (rejuvenators versus softeners)
- Numerous experiments on the 2015, 2018 Tracks
- Both “volumetrics plus” & “performance modified”
- Low & high RAP, with and without recycling agents
- Some 2018 mixes produced with lower air voids.
Cracking Group (CG) Experiment

<table>
<thead>
<tr>
<th>Design &gt; 40</th>
<th>Produce &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% RAP Ctrl.</td>
<td>High Dens. Ctrl.</td>
</tr>
<tr>
<td>Low Dens./ AC Ctrl</td>
<td>Ctrl + 5% RAS</td>
</tr>
<tr>
<td>Ctrl + 35% RAP PG 58-28</td>
<td>Ctrl + HIMA</td>
</tr>
<tr>
<td>AZ Rubber</td>
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<table>
<thead>
<tr>
<th>RH PMLC</th>
<th>STOA LMLC</th>
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<tr>
<td>26.2</td>
<td>30.2</td>
</tr>
<tr>
<td>13.2</td>
<td>13.9</td>
</tr>
<tr>
<td>23.8</td>
<td>33.2</td>
</tr>
<tr>
<td>6.7</td>
<td>10.9</td>
</tr>
<tr>
<td>32.4</td>
<td>41.6</td>
</tr>
<tr>
<td>32.9</td>
<td>80.8</td>
</tr>
<tr>
<td>208.1</td>
<td>133.1</td>
</tr>
</tbody>
</table>

Construction Testing

77°F 122°F
2/17/2020 Track Maintenance

IL Flexibility Index Test (I-FIT)
Example Data from 2018 Track Build

1. Between-lab Variability
2. Binder Source
3. Mix Production
4. Critical Aging

What About Friction?
Dynamic Friction Tester

Stationary Dynamic Friction Testing
DFT versus KJ Law Trailer

Scatterplot of DFT20, DFT40, DFT60 vs SN64R

Does BMD Work for Preservation?
Pavement Preservation

- Key to perpetual pavement philosophy
- Advantage of flexible over rigid pavements
- MAP-21 for cracking, rutting, & roughness
- Distinction between good, fair, & poor surfaces
- Data driven preservation alternative selection
- Benefits as function of pretreatment condition.

Selection by Life Cycle Performance

Section 19: Virgin thinlay with PG67-22

MAP-21 Cracking
Green = "Good" (<5%)
Yellow = "Fair" (5% ≤ 20%)
Red = "Poor" (>20%)

% Cracking

0   1   2   3   4   5   6   7
0    10  20  30  40  50  60  70

Good - Treated
Fair - Treated
Poor - Treated

Good - Untreated
Fair - Untreated
Poor - Untreated
Thinlay

Section 19: Virgin thinlay with PG67-22

MAP-21 Cracking
Green = "Good" (<5%)
Yellow = "Fair" (5% ≤ 20%)
Red = "Poor" (>20%)

- Good - Treated
- Fair - Treated
- Poor - Treated
- Good - Untreated
- Fair - Untreated
- Poor - Untreated

↓ ≈ 40%
↓ ≈ 70%

Thinlay with 54% RAP Binder

Section 23: 50% RAP thinlay

MAP-21 Cracking
Green = "Good" (<5%)
Yellow = "Fair" (5% ≤ 20%)
Red = "Poor" (>20%)

- Good - Treated
- Fair - Treated
- Poor - Treated
- Good - Untreated
- Fair - Untreated
- Poor - Untreated

↓ ≈ 30%
↓ ≈ 60%
Thinlay with 19% PC-RAS Binder

Need for performance optimized construction/design!

MAP-21 Cracking
Green = "Good" (<5%)
Yellow = "Fair" (5% ≤ 20%)
Red = "Poor" (>20%)

% Cracking
0 10 20 30 40 50 60 70 80 90 100

Age, Years
0 1 2 3 4 5 6 7

≈30%
≈45%

Implementation (Reduced Cracks Year 5)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
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<tbody>
<tr>
<td>Single Micro</td>
<td>16</td>
<td>14</td>
<td>8</td>
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<tr>
<td>Double Micro</td>
<td>84</td>
<td>39</td>
<td>28</td>
</tr>
<tr>
<td>Single Chip + CS</td>
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<td>25</td>
<td>28</td>
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<tr>
<td>Double Chip</td>
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<td>Triple Chip</td>
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<tr>
<td>Fiber Chip</td>
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<td>32</td>
<td>27</td>
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<tr>
<td>Virgin Thinlay</td>
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<td>40</td>
<td>34</td>
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<tr>
<td>50% RAP Thinlay</td>
<td>71</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>5% RAS Thinlay</td>
<td>66</td>
<td>33</td>
<td>23</td>
</tr>
</tbody>
</table>
What About 100% RAP Cold Recycle Mix?

Cold Recycle Base from a Hot-Mix Plant
Cold Recycle Base from a Hot-Mix Plant

Cold Recycle Base from a Hot-Mix Plant
End-of-Cycle Conference for the 2018 NCAT Pavement Test Track and the MnROAD Pavement Research Partnership

April 20-22, 2021
Auburn, AL