Results of MTO’s 2011 Asphalt Cement Initiatives

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Alexander W. (Sandy) Brown, P.Eng.
Ontario Hot Mix Producers Association - Technical Director
Background

- MTO and Industry collaborated over the last 8 years on 2 new test procedures – ExBBR and DENT.
- A mutually acceptable test protocol and acceptance limits were developed by the MTO-OHMPA Binder Task Group.
- Total of 30 (38) trial projects paved between 2011 and 2015.
- 16 have reached the end of the warranty period with no contract disputes and so the projects are considered closed.
- Data from these 16 projects was shared with Industry and analysed for this presentation.
Background

- All testing on new asphalt cement from QA samples and was tested by MTO QA laboratories
- Testing included: Standard (M320) 1 hr BBR test; LTLG and Grade Loss from the Extended (72 hr) BBR test; Ash test; CTOD from the DENT test (Ontario procedure); and MSCR % Recovery
- Crack monitoring was carried out by MTO at 3 years using their new ARAN
- These results are preliminary in nature
- This is Industry’s analysis of the results
Correlation between Construction Type and Cracking
Results of MTO ARAN Cracking Measurement at 3 years

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Total Cracking (m/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overlay</td>
<td>~1000 ft/mile</td>
</tr>
<tr>
<td>Pulverize</td>
<td></td>
</tr>
<tr>
<td>Mill</td>
<td></td>
</tr>
<tr>
<td>FDR</td>
<td></td>
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<tr>
<td>CIREAM</td>
<td></td>
</tr>
</tbody>
</table>

Filled symbols indicate LTPP grade is 6C lower than specified grade.
Poor Correlation (trending correctly)
Results of MTO ARAN Cracking Measurement at 3 years

- Overlay
- Pulverize
- Mill
- FDR
- CIREAM

1, 2, 3 - HMA lifts
Filled symbols indicate LTPP grade is 6°C lower than specified grade

\[ y = 19.5x + 197.01 \]
\[ R^2 = 0.2232 \]

72 hr ExBBR Specified Low Temperature Limiting Grade Difference (°C)
measured by MTO QA testing
Moderate Correlation (trending correctly)
Results of MTO ARAN Cracking Measurement at 3 years

y = 38.378x + 350.69
R² = 0.4888

Filled symbols indicate LTPP grade is 6°C lower than specified grade
No Correlation (no trend)
Results of MTO ARAN Cracking Measurement at 3 years

![Graph showing correlation between total cracking and difference from specified value.](image)

- **LTLG - 72 hr ExBBR**
  - Equation: $y = 2.0989x + 241.97$
  - $R^2 = 0.0003$

- **M320 - 1 hr BBR**
  - Equation: $y = -6.6745x + 245.3$
  - $R^2 = 0.0068$

Oct 21, 2015
No Correlation (trending incorrectly)
Results of MTO ARAN Cracking Measurement at 3 years
Total Cracking with Proper LTPPBind Grade

![Graph showing correlation between Total Cracking (m/km) and Difference from Specified Value (°C) measured by MTO QA testing.](image)

- **LTLG - 72 hr ExBBR**
  - Linear equation: $y = -20.82x + 156.94$
  - $R^2 = 0.0269$
- **M320 - 1 hr BBR**
  - Linear equation: $y = -21.256x + 248.09$
  - $R^2 = 0.0653$

Oct 21, 2015
No Correlation (trending incorrectly)
Results of MTO ARAN Cracking Measurement at 3 years

Total Cracking (m/km)

- Overlay
- Pulverize
- Mill
- FDR
- CIREAM

1, 2, 3 - HMA lifts
Filled symbols indicate LTPP grade is 6C lower than specified grade

\[
y = 304.37e^{0.0964x}
\]
\[
R^2 = 0.0425
\]

72 hr ExBBR Loss (°C)
measured by MTO QA testing
No Correlation (trending incorrectly)
Results of MTO ARAN Cracking Measurement at 3 years

Fillcd symbols indicate LTTP grade is 6C lower than specified grade

\[ y = 324.91e^{-2.135x} \]
\[ R^2 = 0.2337 \]
Poor Correlation (trending correctly)

Results of MTO ARAN Cracking Measurement at 3 years

- Overlay
- Pulverize
- Mill
- FDR
- CIREAM

1, 2, 3 - HMA lifts

Filled symbols indicate LTPP grade is 6C lower than specified grade

\[ y = 285.22e^{-0.013x} \]

\[ R^2 = 0.1332 \]
No Correlation (trending incorrectly)

Results of MTO ARAN Cracking Measurement at 3 years

Total Cracking (m/km)

DENT CTOD Difference from Specification (mm)

measured by MTO QA Testing

Filled symbols indicate LTPP grade is 6C lower than specified grade

\[ y = 204.96e^{0.503x} \]

\[ R^2 = 0.1683 \]
Summary of the cracking at 3 years based on MTO monitoring and testing

- Industry’s analysis of preliminary data
- On Mill and Pave with 2 lifts
  - The standard 1 hr BBR test shows better correlation than 72 hr Extended BBR test
  - Loss doesn’t correlate – engineering control
    - Asking for DENT or MSCR seemed to control Loss
  - Ash (REOB?) doesn’t correlate – engineering control
  - MSCR has poor correlation (trends correctly)
  - DENT doesn’t correlate (trends incorrectly)
- These charts will change – it has only been three years
Discussion