Potholes, Potholes, Potholes!!
and Asphalt Cement

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Press Coverage

- This year, there seems to be no end to the press coverage on potholes
  - Started in mid January and has continued

- What does it all mean??

- What causes potholes?
Potholes

- Potholes are the result of freeze-thaw action on water that has been allowed to penetrate the pavement structure.

- This was an unusual winter:
  - Polar vortex
  - Flash freeze warning
  - Thunder snow and its less well known sibling thunder sleet
Quality of the asphalt cement

- More stuff in the press
  - Garbage asphalt??
  - We have a spec and suppliers meet the spec
- Why do we modify anyway?
  - All asphalt has a useful temperature index (UTI)
  - Typically less than 92°C, then we need modification
  - For our typical roads in southern Ontario (PG 58-28) modification is not required
  - Temperature bumping requires modification
How do we modify?

- We use different methods to meet the specifications
  - PPA (polyphosphoric acid)
  - Polymers – Elastomers and Plastomers
  - Softeners – mid-level distillates, RHVDO

- In Ontario, we do not specify modification method
RHVDO Residue

- Waste engine oil in asphalt?

- What is it?
  - Re-refined Heavy Vacuum Distillate Oil residue

- Not the stuff they drain from your car at the local garage
  - This is the residue from a refinery process to make recycled engine oil
MTO-Industry Partnering

- MTO-OHMPA Binder Task Group
- Successfully tackled several issues
  - PPA – developed specification language
  - RHVDO residue – Ash Test
- Doing and experiment with acceptance to look at test methods
  - 33 contracts will be studied for about 8 years
  - MTO RoadTalk Winter 2014 – article by Pamela Marks
New Specification

- Why do we need one?
- Fatigue cracking is becoming an issue
- We need to have a specification that measures the degree of elastomeric modification
- Test developed in the US over the last 7 years
- Has been balloted and accepted in the US and will be adopted by about 2/3s of the states in the next 18 months
Draft Contract Language for

MATERIAL SPECIFICATION FOR MSCR GRADED ASPHALT CEMENT

Intended to replace OPSS.MUNI 1101 dated November 2013

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1101.01 SCOPE
This specification covers the requirements for the properties and use of MSCR (Multiple Stress Creep Recovery) graded asphalt cements. It is intended to replace OPSS.MUNI 1101 dated November 2013.

1101.01.01 Specification Significance and Use
This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

1101.01.02 Appendices Significance and Use
Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.
# Table 1—MSCR Graded Asphalt Binder Specification

<table>
<thead>
<tr>
<th>MSCR Grade</th>
<th>52</th>
<th>58</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-34</td>
<td>-40</td>
</tr>
<tr>
<td><strong>Original Binder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash point, T 48: temp, min °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity, T 316: test temp, °C (max 3 Pa-s)</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>Dynamic shear, T 315: @ 10 rad/s, test temp °C (G*/sinδ, min 1.00 kPa)</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td><strong>Rolling Thin-Film Oven Residue (T 240)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass change: max, percent</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>MSCR, TP 70: test temp for MG xxS-yy, °C (J_{nu3.2}, max 4.5 kPa^{-1}; J_{nudft}, max 75%)</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>MSCR, TP 70: test temp for MG xxH-yy, °C (J_{nu3.2}, max 2.0 kPa^{-1}; J_{nudft}, max 75%)</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>MSCR, TP 70: test temp for MG xxV-yy, °C (J_{nu3.2}, max 1.0 kPa^{-1}; J_{nudft}, max 75%)</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>MSCR, TP 70: test temp for MG xxE-yy, °C (J_{nu3.2}, max 0.5 kPa^{-1}; J_{nudft}, max 75%)</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td><strong>Pressurized Aging Vessel Residue (R 28)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAV: aging temp, °C</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Dynamic shear, T 315: @ 10 rad/s, test temp for MG xxS-yy, °C (G* sinδ c, max 5000 kPa)</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Dynamic shear, T 315: @ 10 rad/s, test temp for MG xxH-yy, xxV-yy and xxE-yy, °C (G* sinδ c, max 6000 kPa)</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Creep stiffness, T 313: test temp @ 60 s, °C (S, max 300 MPa; m-value, min 0.300)</td>
<td>-24</td>
<td>-34</td>
</tr>
</tbody>
</table>

**Notes:**

a. This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

b. For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of G*/sinδ at test temperatures where the asphalt is a Newtonian fluid.

c. G*/sinδ = high temperature stiffness and G* sinδ = intermediate temperature stiffness.

d. The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.
MSCR Acceptance Limits

- MSCR Recovery @ 3.2 kPa (%)
- Acceptable
- Rejectable

Graph showing acceptance limits for MSCR recovery at 3.2 kPa.
Table A-1
Grade Selection for Ontario MGAC Zones

<table>
<thead>
<tr>
<th>MGAC Zone (Note 1)</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA with up to 20% RAP</td>
<td>MG 52L - 34</td>
<td>MG 58L - 34</td>
<td>MG 58L - 28</td>
</tr>
<tr>
<td>HMA with 21 to 40% RAP</td>
<td>MG 52L - 40</td>
<td>MG 52L - 40</td>
<td>MG 52L - 34</td>
</tr>
</tbody>
</table>

Notes:
1. Zones are defined in Appendix A.
2. In the above table, the value for "L" represents the letter designation given in Table A-2.
3. MG xx5-yy refers to Standard Traffic
4. MG xxH-yy refers to Heavy Traffic
5. MG xxV-yy refers to Very Heavy Traffic
6. MG xxE-yy refers to Extremely Heavy Traffic
7. The adjusted letter grade ("L") remains unchanged for higher RAP substitution (i.e. in Zone 1 where MG 52H-34 is specified according to Table A-2, the grade shall be change to MG 52H-40 if more than 20% RAP is used in the mix).

Table A-2
OPSS.MUNI 1101 - Guidelines for the Adjustment of MGAC Traffic

<table>
<thead>
<tr>
<th>Based on Roadway Classification and Traffic Conditions Highway Type</th>
<th>Increase from Standard MG xx5-yy</th>
<th>Optional Additional Grade Increase (Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Heavy Traffic (Note 3)</td>
<td>Upgrade to MG xxE-yy</td>
<td>N/A</td>
</tr>
<tr>
<td>Urban Freeway</td>
<td>Upgrade to MG xxV-yy</td>
<td>N/A</td>
</tr>
<tr>
<td>Rural Freeway</td>
<td>Upgrade to MG xxH-yy</td>
<td>Upgrade to MG xxV-yy</td>
</tr>
<tr>
<td>Urban Arterial</td>
<td>Consider increasing to MG xxH-yy if heavy truck traffic is greater than 20% of AADT</td>
<td>Upgrade to MG xxV-yy</td>
</tr>
<tr>
<td>Rural Arterial Urban Collector</td>
<td>Zone 1: MG 52S-34</td>
<td>Upgrade to MG xxH-yy or MG xxV-yy</td>
</tr>
<tr>
<td>Rural Collector</td>
<td>Zone 2: MG 58S-34</td>
<td></td>
</tr>
<tr>
<td>Rural Local</td>
<td>Zone 3: MG 58S-28</td>
<td></td>
</tr>
<tr>
<td>Urban/Suburban Collector</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Upgrading is recommended for use in both surface and top binder courses (i.e., top 80 to 100 mm of hot mix).
2. Consideration should be given to an increase in grade for roadways which experience a high percentage of heavy truck or bus traffic at slow operating speeds, frequent stops and starts, and historical concerns with instability rutting (i.e. truck climbing lanes, etc.).
3. Extreme Heavy Traffic typically refers to airports, dedicated transitways or truck marshalling yards.