Is It Time to Revise the Precision and Bias Sections in T313, T315 and T316?

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Precision Estimates for AASHTO Test Method T308 and the Test Methods for Performance-Graded Asphalt Binder in AASHTO Specification M320

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Summary of the Study

• The study used the AMRL Proficiency Sample results for the PG Graded Asphalt Binder.
• The sample sets were from 181 – 196.
• Covering the years 2000 – 2004.
• They further tightened the data than what was in the AMRL reports and it became the Precision and Bias for several AASHTO standards.
The Report for T315 PAV Residue

3.2.7.3 PAV Residue: \( G^* \sin \delta \)

Results from analyzing the data for the DSR testing on PAV residue can be found in Appendix Q. One pair of modified binders, sample numbers 187 and 188, was used in the analysis.

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Sample Numbers</th>
<th>No. of Labs</th>
<th>PG Grade</th>
<th>AC Grade</th>
<th>Average Results</th>
<th>Repeatability</th>
<th>Reproducibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGB</td>
<td>181 &amp; 182</td>
<td>181</td>
<td>PG 64-16</td>
<td>AC 10</td>
<td>4557</td>
<td>249</td>
<td>695</td>
</tr>
<tr>
<td>PGB</td>
<td>183 &amp; 184</td>
<td>178</td>
<td>PG 70-22</td>
<td>--</td>
<td>2310</td>
<td>117</td>
<td>293</td>
</tr>
<tr>
<td>PGB</td>
<td>185 &amp; 186</td>
<td>178</td>
<td>PG 64-22</td>
<td>AC 20</td>
<td>3830</td>
<td>223</td>
<td>526</td>
</tr>
<tr>
<td>PGB</td>
<td>187 &amp; 188</td>
<td>185</td>
<td>PG 76-22</td>
<td>--</td>
<td>1100</td>
<td>61</td>
<td>167</td>
</tr>
<tr>
<td>PGB</td>
<td>189 &amp; 190</td>
<td>182</td>
<td>PG 64-22</td>
<td>AC 30</td>
<td>4335</td>
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<td>597</td>
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<td>PGB</td>
<td>191 &amp; 192</td>
<td>185</td>
<td>PG 52-34</td>
<td>AC 10</td>
<td>3640</td>
<td>171</td>
<td>660</td>
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<tr>
<td>PGB</td>
<td>193 &amp; 194</td>
<td>188</td>
<td>PG 64-22</td>
<td>AC 20</td>
<td>2922</td>
<td>137</td>
<td>364</td>
</tr>
<tr>
<td>PGB</td>
<td>195 &amp; 196</td>
<td>199</td>
<td>PG 70-22</td>
<td>--</td>
<td>3163</td>
<td>137</td>
<td>432</td>
</tr>
</tbody>
</table>

Table 14 - Summary Table for T315, PAV \( G^* \sin \delta \)

A review of the data shown in Table 14 indicated that the form of the precision estimates should be based on the coefficient of variation (CV%). The average repeatability coefficient of variation for the eight pairs of samples analyzed was determined to be 4.9 percent. The corresponding average reproducibility coefficient of variation was determined to be 14.2 percent. In each case, the average coefficient of variation was determined by calculating the “simple arithmetic average” as described in Section 8.4.2 of ASTM C802-96 [15].
DSR T315-12 (2016) PAV Residue

• Precision and Bias, Section 14
• Single Operator $1s\% = 4.9$, $d2s\% = 13.8$
• Multi-laboratory $1s\% = 14.2$, $d2s\% = 40.2$
Review of AMRL’s Average and Standard Deviation

- The Average and Standard Deviation for the PG Asphalt Binder Proficiency Samples were compiled from 2000 – 2016.
- The 1s% (%COV) was calculated and plotted.
T315 DSR, Original, RTFO, PAV

AMRL DSR T315 Proficiency Samples % COV

Test % COV

PG Binder Sample Number

Orig DSR G*/sin d
RTFO DSR G*/sin d
PAV DSR G*sin d
PAV Residue, T315 DSR, T313 BBR

AMRL PAV Aged Binder T315, T313 Proficiency Samples %COV

Sample Number

PAV DSR G*sin d  BBR Creep Stiff  BBR M value
T316 Rotational Viscosity

AMRL Rotational Viscometer T316 Proficiency Sample % COV

Sample Number

% COV

0.000 1.000 2.000 3.000 4.000 5.000 6.000 7.000 8.000 9.000 10.000

175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250

2000 - 2006
Multi-Lab d2s% Using Newer AMRL

- The 2005 report tightened up the AMRL data lowering the 1s% by 10-15% in most cases.
- The AASHTO P&B is compared to the average 1s% of the AMRL data from 2006-2016.

<table>
<thead>
<tr>
<th>Multi-Lab</th>
<th>AASHTO</th>
<th>AMRL 2006-16</th>
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</thead>
<tbody>
<tr>
<td>Std #</td>
<td>Test</td>
<td>d2s%</td>
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<tr>
<td>T315</td>
<td>O DSR</td>
<td>17.0</td>
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<tr>
<td>T315</td>
<td>R DSR</td>
<td>22.2</td>
</tr>
<tr>
<td>T315</td>
<td>P DSR</td>
<td>40.2</td>
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<tr>
<td>T313</td>
<td>Crp Stf</td>
<td>17.8</td>
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<tr>
<td>T313</td>
<td>M</td>
<td>6.8</td>
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<tr>
<td>T316</td>
<td>Rot Visc</td>
<td>12.1</td>
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</tbody>
</table>
Conclusion

• It is time to do another study using the AMRL proficiency sample data from the last decade to update the precision & bias in AASHTO.

• The most dramatic effect will be with the DSR test (T315). The improvement probably reflects the labs retiring the circulating water systems and switching to Peltier units.