Proposal of additional test campaign

IWG WGWT
3 December 2021

JAPAN AUTOMOBILE STANDARDS INTERNATIONALIZATION CENTER
1. JASIC findings - Water depth (WD) vs SRTT Average μpeak

(Shown at the IWG WGWT on 29 July)

\[ \mu_{\text{peak}} \] of SRTT worn spread about twice as wide as that of SRTT new regardless the influence of water depth

Variation of SRTT must be reduced.

*Data includes results of screening and analytical tests. Trailer method (Sequence A & B)
There are **78%** (53/68) cases that the WWGI difference between laboratories exceeds 0.1*. This level of precision also must be reduced.

* Threshold difference in R117.
Factors which may cause the variability of the $\mu$peak value of worn tyres:

- Use of buffed SRTTworn as reference tyre
- Water depth
- Road surface roughness
- Test speed
- Accuracy of tread depth measurement
- Tyre surface roughness

→ JASIC proposes to assess testable variation factors from above.

Purpose of the assessment
To improve precision of formulas, JASIC would like to
- Re-conduct test campaign
- Eliminating the influence of buffing process by assuming the use of Molded SRTTworn
Factors which may cause the variability of the \( \mu \)peak value of worn tyres:

- Use of \textit{Molded SRTT\textit{worn}} as reference tyre
- Water depth
- Road surface roughness
- Test speed
- Accuracy of tread depth measurement
- Tyre surface roughness

■ Goal of the assessment

To identify the factors which should be controlled, in order to have the new formula measuring \textit{Molded SRTT\textit{worn}} and \textit{Candidate} tyres with sufficient precision for the introduction of the regulation.
2. Concept of Additional Assessment

- Tyres and items for evaluation
  - Buff SRTTworn, Molded SRTTworn, SRTTnew, Candidate tyres

- Test precision
  - ✓ Intra-test center variability
  - ✓ Inter-test center variability
3. Evaluation Factors

- Molded SRTTworn: Evaluate its performance.

- Water depth / road surface roughness: Evaluate the relationship between water depth and road surface roughness (MTD).
  
  ✓ Water depth/water flow volume: Evaluate the sensitivity to μ at 4 levels (0.5 mm, 1.0 mm, 1.5 mm, 2.0 mm)

  ✓ MTD: Evaluate the difference in μpeak between test centers at wider range of MTD (Select test centers to cover wide MTD range)

- Tyre surface roughness: Assessment results already available.
  From μpeak vs. number of uses, determine the maximum number of uses for Molded SRTTworn.
4. Test Plan

■ Test tyres:
Molded SRTTworn
  Provided from Michelin to each test center.

Buffed SRTTworn *¹
  Using existing products already distributed to each test center.

Candidate tyre
  Category: Normal and 3PMSF *²
  Using existing products already distributed to each test center.

*¹ May need to prepare extra Buffed SRTTworn, as tread depth of existing Buffed SRTTworn may reach 1.6 mm.

*² In the first test campaign, we did not have enough M+S tyres to calculate the equations. For this reason, in order to conduct a minimum volume of necessary assessments, M+S tyres are not included in the Candidate for this plan.

■ Participants:
  1) Assess day to day variation of Molded SRTTworn and equations of calculations
     All test centers

  2) Water depth / road surface roughness
     Test center which performed water depth evaluation of analytical plan
1) Assess day to day variation of Molded SRTTworn and equations of calculations

- Candidate tyres: All Normal and 3PMSF tyres provided to test centers in the first test campaign.

<table>
<thead>
<tr>
<th>Normal</th>
<th>M+S</th>
<th>3 PMSF/ICE</th>
</tr>
</thead>
</table>

M+S tyres are excluded from 2nd test campaign.

- Participants: All Test centers.

- Test sequence:

**Basic sequence**
- Molded SRTTw – Buffed SRTTw – Candidate 1 – Candidate 2 – Molded SRTTw – SRTTn – Candidate 3 – Candidate 4 – Molded SRTTw

To assess day to day variation, the Normal tyre and the 3PMSF tyre with the lowest $\mu_{peak}$ value among each category in the first test campaign are tested for 4 consecutive days.

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Molded SRTTw – Candidate Normal (lowest $\mu_{peak}$) – Candidate 3PMSF (lowest $\mu_{peak}$) – Molded SRTTw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 2</td>
<td>Molded SRTTw – Candidate Normal (lowest $\mu_{peak}$) – Candidate 3PMSF (lowest $\mu_{peak}$) – Molded SRTTw</td>
</tr>
<tr>
<td>Day 3</td>
<td>Molded SRTTw – Candidate Normal (lowest $\mu_{peak}$) – Candidate 3PMSF (lowest $\mu_{peak}$) – Molded SRTTw</td>
</tr>
<tr>
<td>Day 4</td>
<td>Molded SRTTw – Candidate Normal (lowest $\mu_{peak}$) – Candidate 3PMSF (lowest $\mu_{peak}$) – Molded SRTTw</td>
</tr>
</tbody>
</table>
4. Test Plan

2) Water depth / road surface roughness

Participants : Test center which performed water depth evaluation of analytical plan

Test sequence :
Day 1  Water depth 0.5mm
Molded SRTTw – Buffed SRTTw – Candidate A – Candidate B – Molded SRTTw – SRTTn-Candidate C – Molded SRTTw

Day 2  Water depth 1.0mm
Molded SRTTw – Buffed SRTTw – Candidate A – Candidate B – Molded SRTTw – SRTTn-Candidate C – Molded SRTTw

Day 3  Water depth 1.5mm
Molded SRTTw – Buffed SRTTw – Candidate A – Candidate B – Molded SRTTw – SRTTn-Candidate C – Molded SRTTw

Day 4  Water depth 2.0mm
Molded SRTTw – Buffed SRTTw – Candidate A – Candidate B – Molded SRTTw – SRTTn-Candidate C – Molded SRTTw
JASIC recommend to produce Molded SRTT worn: **146 tyres**

1.5 time number of 1\textsuperscript{st} test campaign*  
+ additional spare (1 set/lab) for emergency purpose

* In the first test campaign, 50% of the sequences were performed on Buffed SRTT worn reference and 50% on SRTT new reference. Since the additional test campaign JASIC proposes is only for the Molded SRTT worn reference, the number of Molded SRTT worn runs is 1.5 times the number of Buffed SRTT worn runs in the first test campaign. Therefore, the number of Molded SRTT worn needs to be 1.5 times the number of Buffed SRTT worn used in the first test campaign.

<table>
<thead>
<tr>
<th></th>
<th>Trailer method</th>
<th>Vehicle method</th>
<th>Sub total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participated test center</td>
<td>9</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Number of 1\textsuperscript{st} test campaign</td>
<td>18</td>
<td>57</td>
<td>-</td>
</tr>
<tr>
<td>Necessary quantity for additional test campaign</td>
<td>27</td>
<td>90</td>
<td>117</td>
</tr>
<tr>
<td>Spare (1 set per lab)</td>
<td>9</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td><strong>146</strong></td>
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</tbody>
</table>