Status report to the 187\textsuperscript{th} session of WP.29 (June 2022)

Informal Working Group on Measurement Uncertainty (IWG MU)
Scope on UN Regulations No. 51 & 117

• develop harmonized technical requirements for these UN Regulations of GRBP with consideration to their test protocols.
• develop a practice guide for compensation and/or correction factors.

Roles
- Chair: Norway
- Secretariat: OICA
- CPs: China, EC, France, Germany, India, Italy, Japan, Netherlands, Russian Federation, Spain, UK

Targets
- compensate systematic errors if possible
- evaluate the influence of random errors (remaining quantities)

General Approach
- possible to improve test procedures for UN Regulations not only in GRBP but also for all other GRs
- documented in Consolidated Resolution on Construction of Vehicles (R.E.3) or as a Document for Reference.

Time
- established 2019
- extended mandate until September 2023

IWG Measurement Uncertainties

Facts and Figures

homepage
https://wiki.unece.org/pages/viewpage.action?pageId=92012814
IWG Measurement Uncertainties

Main Results and Output by June 2022

UN Regulation No. 51
- Development of uncertainty budget
- Preparation of vehicle and tyres
- Temperature correction of tyres
- Test track compensation 90%

UN Regulation No. 117
- Preliminary considerations and examinations 25%

Documents for Reference
- Working Document: General Approach to Estimate Measurement Uncertainties
- Informal Document: How to handle Measurement Uncertainties due to its Regulatory Impact? 75%

Deliverables by June 2022

- UN Regulation 51.03 Amendment 7
  - ECE-TRANS-WP29-2022-84e

Document for Reference
- ECE-TRANS-WP29-GRBP-2022-9e-rev1
## Uncertainty Evaluation of UN Regulation No. 51

### Uncertainty Evaluation

- A table of the contribution of each of the quantities to the overall measurement uncertainties has been established.
- The quantities have been grouped into categories:
  - Run-to-run
  - Day-to-day
  - Site-to-site
  - Vehicle-to-vehicle
- For each of these groups, the impact on the overall pass-by noise level ($L_{urban}$) has been established (based on experience & measurements or theoretical calculations).
- The combined uncertainty is calculated for each category separately, and an "uncertainty budget" is shown for each of these categories:
  - Type-Approval,
  - COP and
  - Field Tests (vehicles in use)

### Uncertainty Budgets

<table>
<thead>
<tr>
<th>Input Quantity</th>
<th>Estimated deviation of the meas. result (peak-peak)</th>
<th>Probability Distribution</th>
<th>Share [%]</th>
<th>Combined Standard Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro climate wind effect</td>
<td>0.40</td>
<td>gaussian</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Driver: Deviation from centered driving</td>
<td>0.50</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Driver: Start of acceleration</td>
<td>0.50</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Speed variations of +/- 1 km/h</td>
<td>0.30</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Driver: Load variations during cruising</td>
<td>0.00</td>
<td>gaussian</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Varying background noise</td>
<td>0.10</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Varying background noise during measurement</td>
<td>0.10</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Barometric pressure deviation of +/- 30 hPa</td>
<td>0.60</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Air temperature effect on tyre noise 5-10°C</td>
<td>1.00</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Air temperature effect on tyre noise 0-40°C</td>
<td>1.00</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
<tr>
<td>Varying background noise during measurement</td>
<td>0.60</td>
<td>rectangular</td>
<td>0.02</td>
<td>0.144</td>
</tr>
</tbody>
</table>

### Uncertainty Evaluation

- **Coverage Factor**
  - **k=2** (95%)

<table>
<thead>
<tr>
<th>Type Approval</th>
<th>COP</th>
<th>Field Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>1.55</td>
<td>1.60</td>
</tr>
<tr>
<td>1.7</td>
<td>3.8</td>
<td>6.6</td>
</tr>
</tbody>
</table>

### Notes

- Variations expected within the same test facility and slight variations in ambient conditions found within a single test series.
- Variations expected within the same test facility but with variations in ambient conditions and equipment properties that can normally be expected during the year.
- Variations between test locations where, apart from ambient conditions, equipment, staff and road surface conditions are different.
- Variations of vehicle mass.
IWG Measurement Uncertainties

*Status and Next Steps*

**01 Results of Investigations**

IWG MU has worked on the measurement uncertainties of UN Reg. No. 51 and will continue to do so for No. 117 (tyre rolling sound).

**02 General Approach**

IWG MU has developed the Document for Reference (DfR): A general approach how to handle measurement uncertainties.

**03 Implementation of Results**

IWG MU presented an Informal Document on "How to handle Measurement Uncertainties due to their regulatory impact" (GRBP-75-08). The main topic of this paper was to notify the missing link between the DfR and its implications for UN Regulations.

**04 Amendment of Procedure**

IWG MU will amend the Document for Reference (DfR) with the Implementation Procedure to UN Regulations *in the 76th GRBP (Sept. 2022)* and *189th WP.29 (Mar. 2023)*.
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PROPOSED Implementation Procedure

Investigation of Measurement Uncertainties

Direct Implementation to Regulations

Recommended Procedure

• Table of uncertainties should be attached as an annex to every regulation that deals with measurements.

• Everytime a regulation will be amended according to the test methods the “Annex of Measurement Uncertainties” should be updated, too.

• If there is up to now no “Annex of Measurement Uncertainties” available, this should be added within the next amendment of this regulation.
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Conclusion & Discussion

✔ This procedure was endorsed by GRBP in 75th session.

✓ Presentation to 187th session of WP.29 was recommended:
   “Potential to overtake this approach to other GRs?”

❓ Ask for comments and feedback of WP.29.

“Thank you for your attention!”