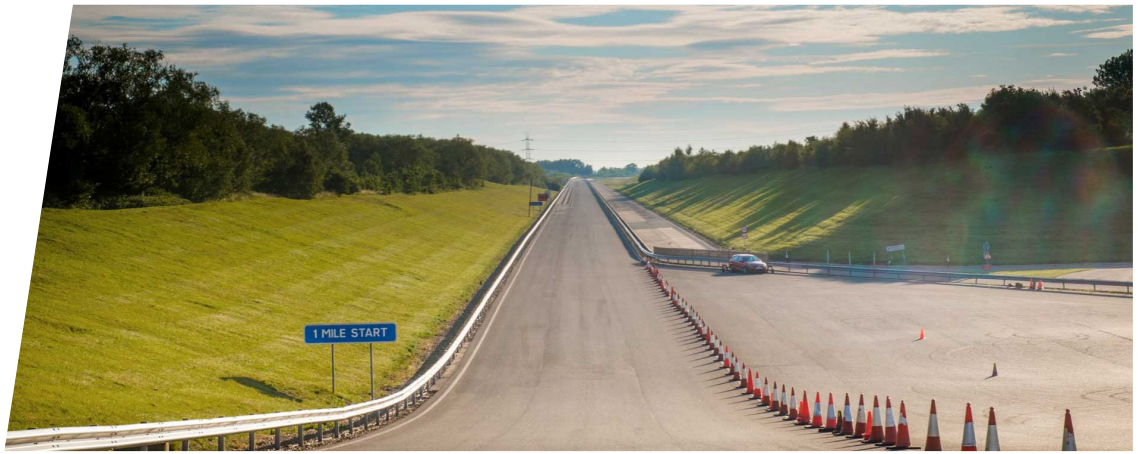
Submitted by the experts of OICA

Informal Document **GRBP-79-45**
79th GRBP, 6-9 February 2024
Agenda Item 3.

ASEP / RD-ASEP Study

Study performed by UTAC on behalf of ACEA / OICA



ASEP / RD-ASEP Study
OICA-ACEA

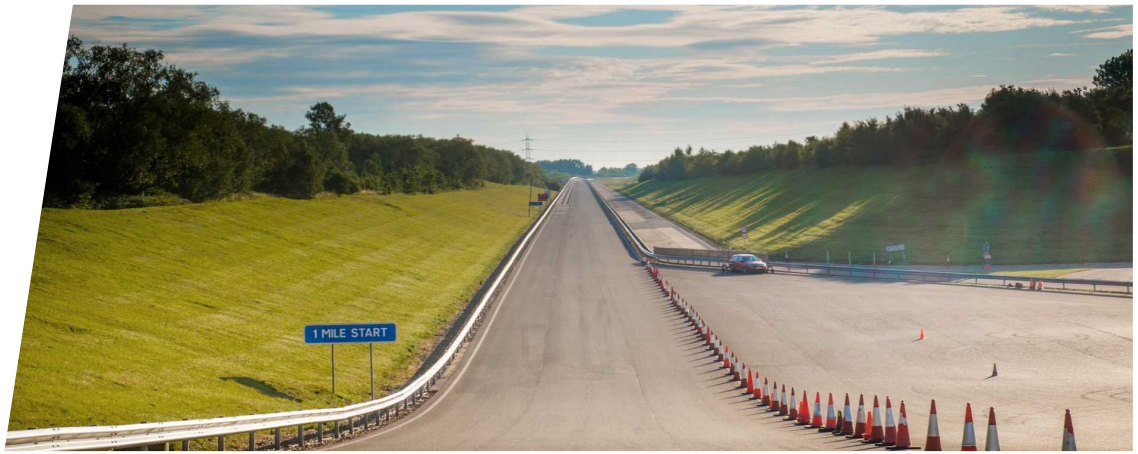
Interim Report to 79th GRBP
February 2024

Study on ASEP and RD-ASEP Monitoring - outlines

- UTAC was initially tasked by ACEA/OICA to perform a study on ASEP and RD-ASEP implementation.
  - Work Package 1: implementation of ASEP
    - Literature review on ASEP ☑
      the reasons of ASEP implementation and to identify the changes since the ASEP introduction.
    - Recognition and implementation of the ASEP ☑
      Questionnaires send to CPs and OEM on ASEP implementation
    - ASEP Impact ☐
      Outdoor test campaign on 8 vehicles (4 veh. before 2016 (UNR51.02) and successors).
  - Work Package 2: RD-ASEP monitoring (July 2023 to June 2024)
    - RD-ASEP implementation ☐
      Questionnaire included in RD-ASEP monitoring datasheet:
      - to qualify the RD ASEP process,
      - to identify potential difficulties encountered
      - to highlight the ways of improvement.
    - Database analysis ☐
      statistical analysis, impact of the RD ASEP (correlation, trends, ways of improvement…)
- Joint study of CPs and Automotive Industry
  - France, Germany, Japan, The Netherlands, OICA (ACEA)

*Previous study's presentation, questionnaires details: GRBP-78-34
RD-ASEP Monitoring Data Delivery Document: GRBP-77-15-Rev.3

WP1.1. Literature review



Literature review : ASEP during development (2005-2009)

Model-based approach

OICA proposal

- Detecting **non-linearities**, cycle-beating, cheating.
- **Engineering** method based on a linear **regression** determined individually per vehicle.
- **Engine speed** based.

F/D proposal

- Based on **linear sound behaviour.**
- Establishing **limit curves** based on fixed slopes.

Slope-Assessment

- Combination of F/D and OICA proposals.
- Critics/limitations:
- The engine speed, as only explicative variable, limits the gear ratios to $k \leq i$ (for limiting the influence of the rolling noise).
- No Not-to-exceed limit (No worst-case).
- Slope-Assessment could allow noisier vehicles than R51.02.

Not-To-Exceed approach

Netherlands proposal

- Establishing **limit curves**.
- Method not based on a physical noise model but geometrically built from both the **anchor** point and a **N-T-E** point at the **maximum** engine speed.
- Dealing with the worst-case, but the slope could be artificially flat, especially for vehicles with high rated engine speed.

Ref. Sound Assessment

- Preserving the **benefits** of **R51.02**.
- Operating conditions close to 61 km/h and 1.9 m/s².

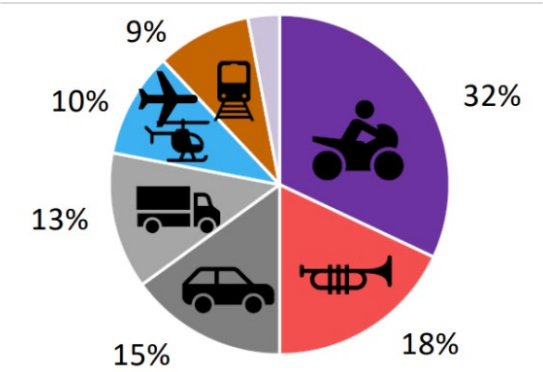
L_{urban}-Assessment

- Defining a **vehicle of concern** using **L_{urban}** as **metric**.
- **Classifying** method **empirically** established from dataset.
- The assumptions make difficult to understand the physical noise behaviour of the vehicles.

Literature review : Vehicle annoyance versus ASEP

Administration's view: citizens' complaints (from environment groups)

- The sound emitted by M1 cars is perceived as **annoyance** but less important compared to other sources.



Administration's action: noise abatement

- Installation of automated noise camera to **monitor sound** from passing vehicles
- Such monitoring can be used to gain an overview about **nature, number and timing of any kind of noise events** (sirens, horns, street sweepers, garbage trucks, modified vehicles, reckless driving, buses, trucks and more).

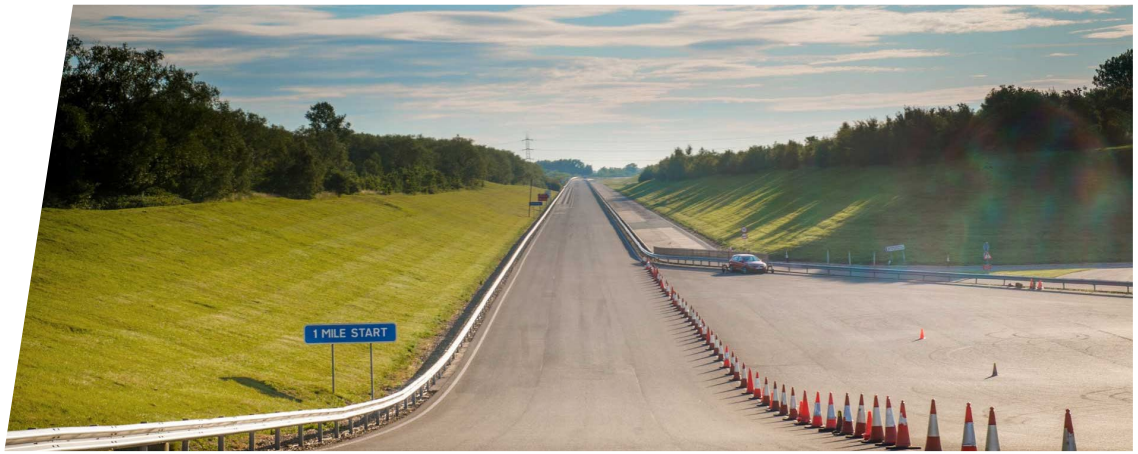
Manufacturer view: sound enthusiast customers (from press releases)

- The sound's character of cars is often perceived as **pleasantness.**
- The ASEP provisions triggered a thorough **redesign of the powertrain**.

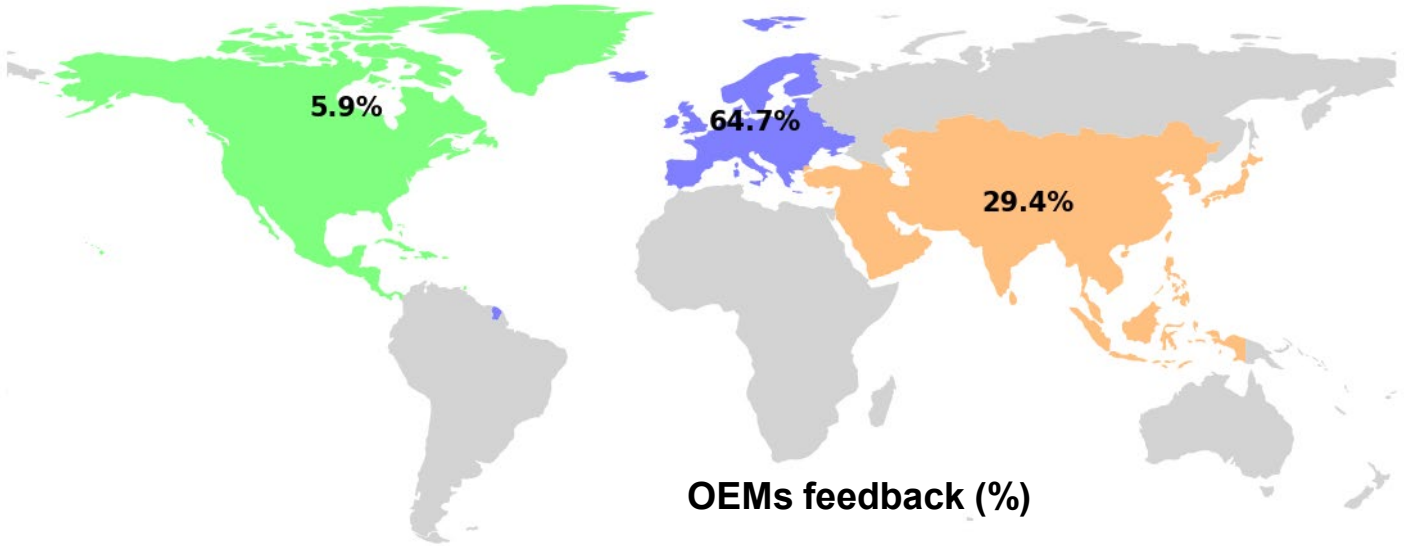
Press' observation

- The sound of newer car models seem to be **less emotional**.
- Customers report that new cars were "**disappointing** compared to previous models".

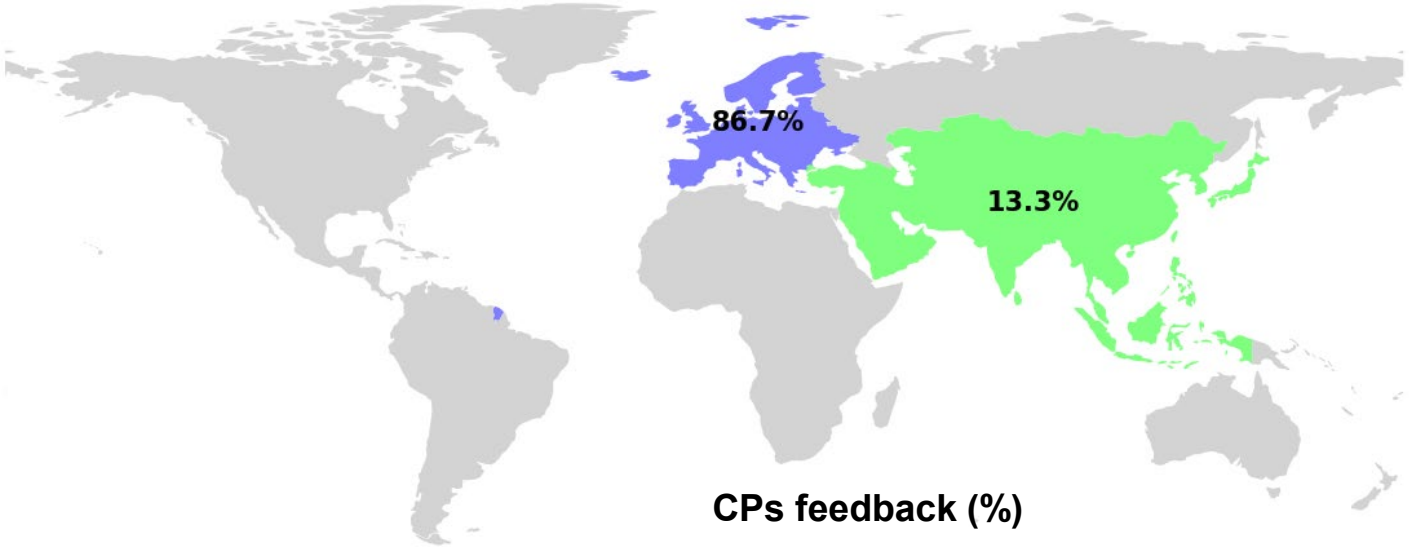
WP1.2. Recognition and implementation of ASEP



Questionnaire survey



OEMs feedback (%)



CPs feedback (%)

We crafted two distinct questionnaires, specifically designed for OEMs and CPs.

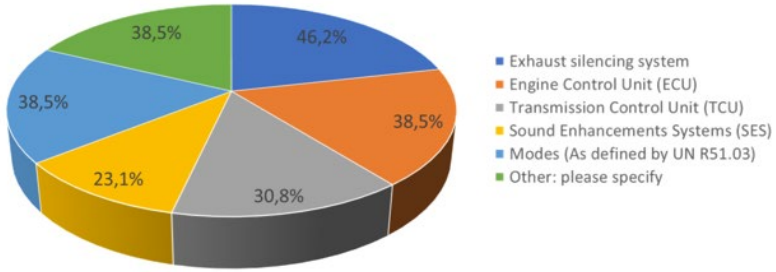
We collected feedback from a total of 17 OEMs and 15 CPs.

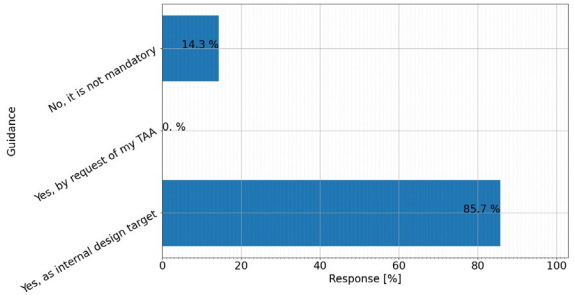
Geographic distribution of OEMs (top) and CPs (bottom), categorized by their respective regions.

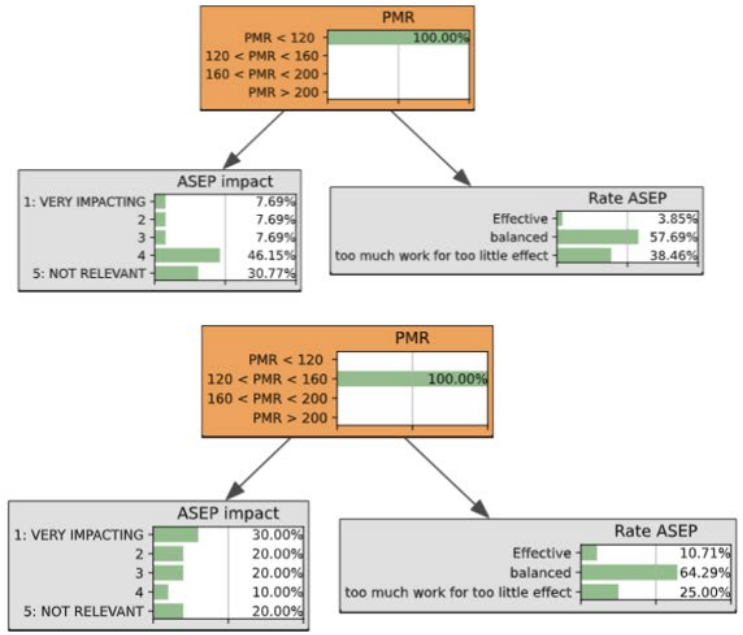
Good representativity, particularly in the European region.

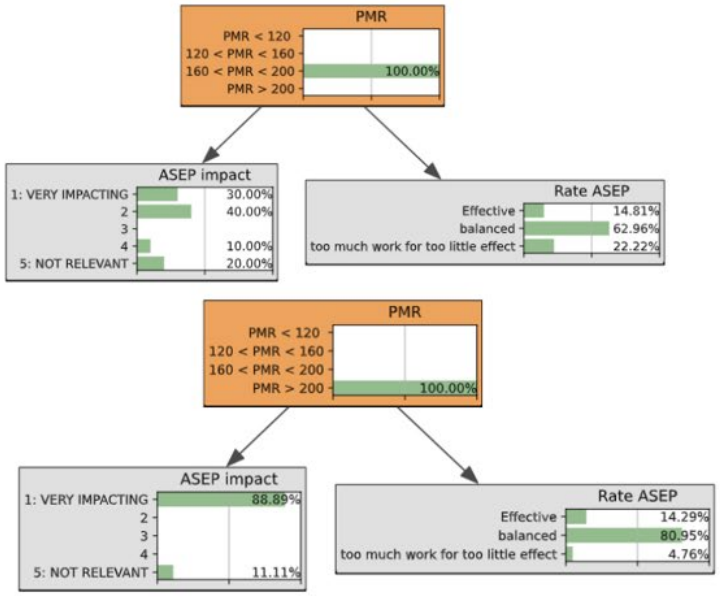
Key findings from OEMs questionnaire

1. Most manufacturers apply the guidance of the GRB-68-03 voluntarily.
2. Correlation between the PMR and the impact of the ASEP.
3. Most manufacturers of vehicles with low PMR are little impacted by ASEP.
4. Most manufacturers of low PMR vehicles consider ASEP too time-consuming with minimal impact.
5. Most manufacturers of high PMR vehicles rate ASEP as being balanced.
6. ASEP has an impact, especially on exhaust system, ECU and TCU.









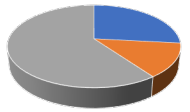
Key findings from CPs questionnaire

1. The trend of citizens' complaints increases could be linked to more awareness of environmental noise issues (after Covid 19, with home office, …).
2. The Market Surveillance is not systematically applied (only half of CPs answering to the questionnaire applies MaS for noise).
3. ASEP is rarely tested
4. Low assessment or information regarding the ASEP effectiveness in reducing single vehicle noise.

Conclusions:

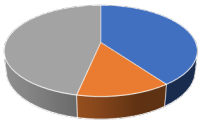
- At least, the EU system allows enough enforcement for noise abatement
- Recommendation to
  - Systematically use the MaS
  - Reinforce in-use controls and PTI

In your opinion, has ASEP contributed to making noisy single vehicles quieter?

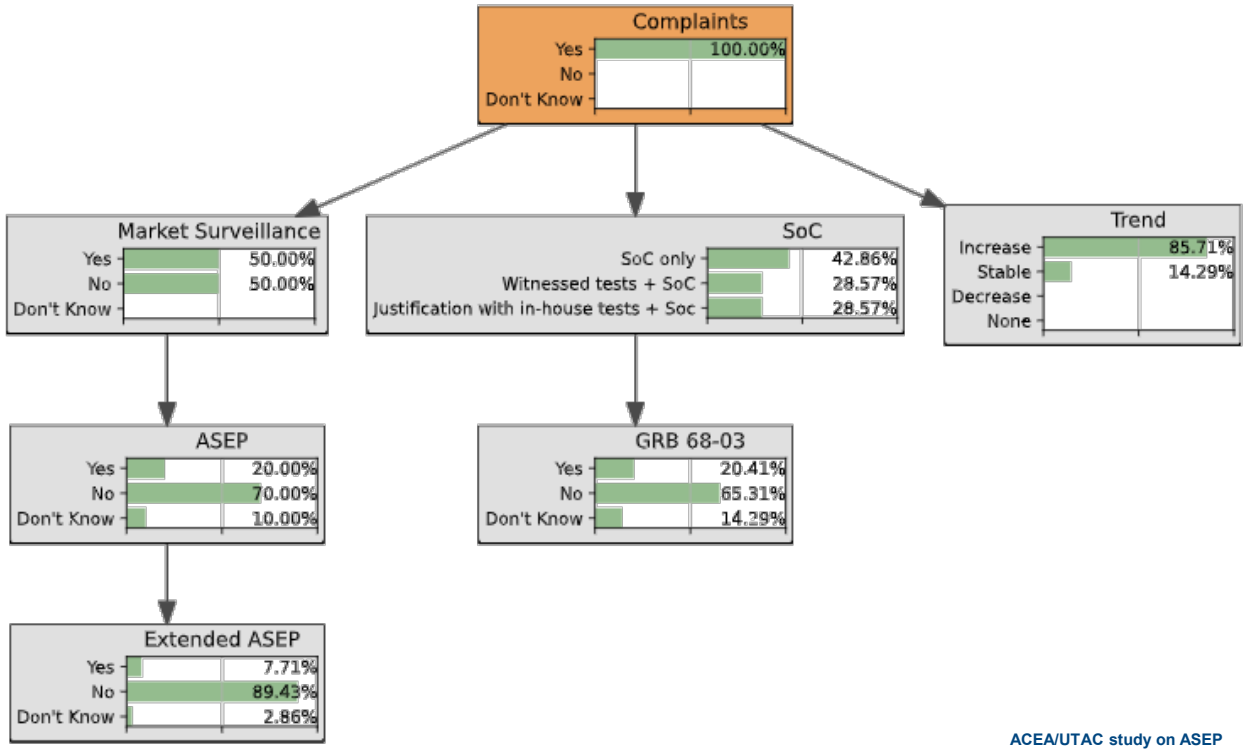


YES NO DON'T KNOW

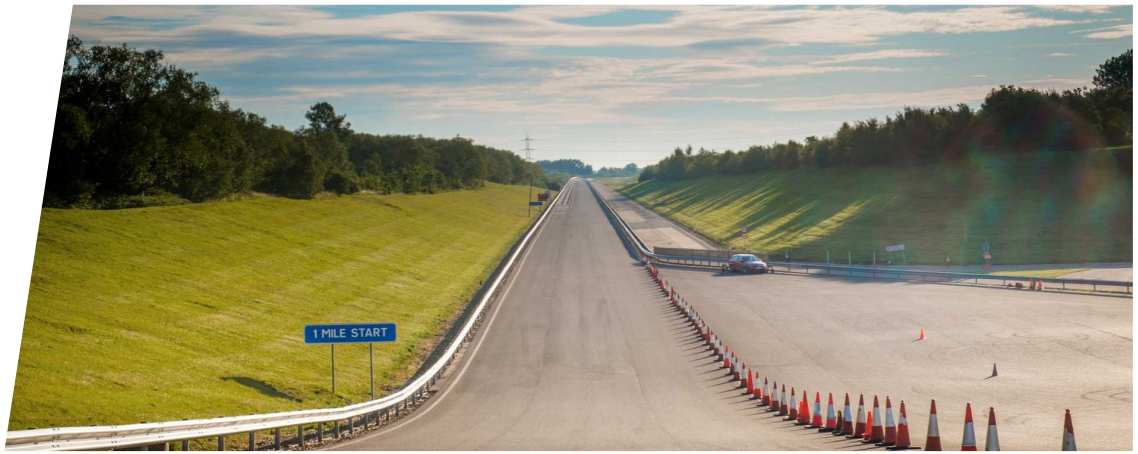
Is ASEP an important tool for single vehicle noise abatement ?



YES NO DON'T KNOW



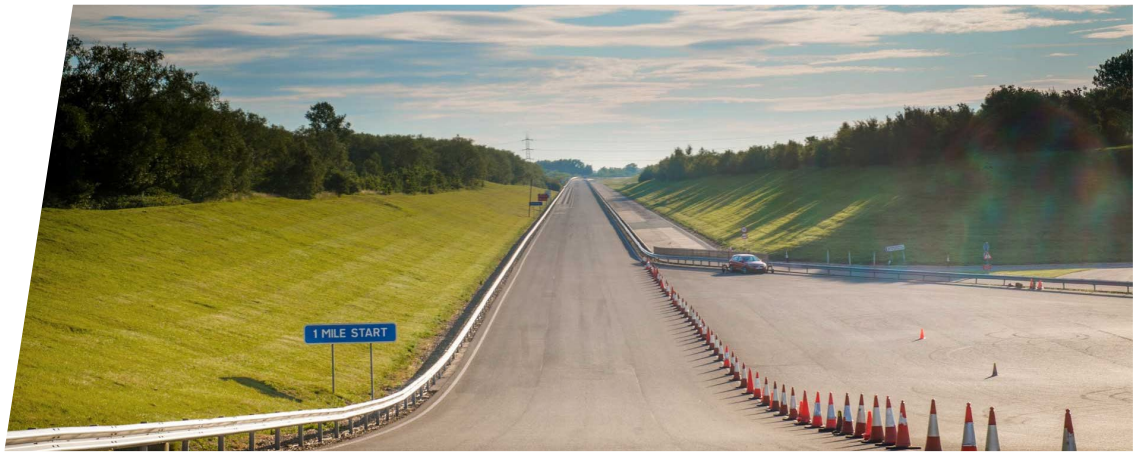
WP1.3. Test campaign



Next steps

- Tests according to
  - UNR51.03
    and
  - ASEP based on the test program outlined by the IWG RD-ASEP in 2017/2018
    - except stationary sound measurement
      and
    - adding tyre rolling noise
- 8 vehicles targeted of which 4 tests are in the pipe.
  - When possible, twin pairs of vehicles
    - one approved acc. to UNR51.02
    - its successor under UNR51.03
  - Single vehicles might be tested as well, if they are interesting.
  - Vehicles selection is based on press reports and outcome of questionnaires.
- Target to complete all tests by end of June 2024
- Presentation to be done at next GRBP session (Sept 2024)

WP2. RD-ASEP Monitoring



RD-ASEP monitoring: database

- UTAC made a data-exchange platform available
  - For TAAs and for OEMs (on voluntary base)
  - For mandatory data (type approval) and for other sets of data or for other kinds of vehicles (PEV, …)
  - Other data than TA data can be updated (even “FAIL” one)
    → identify it in the file name and in the sheet “(0) data tracking”

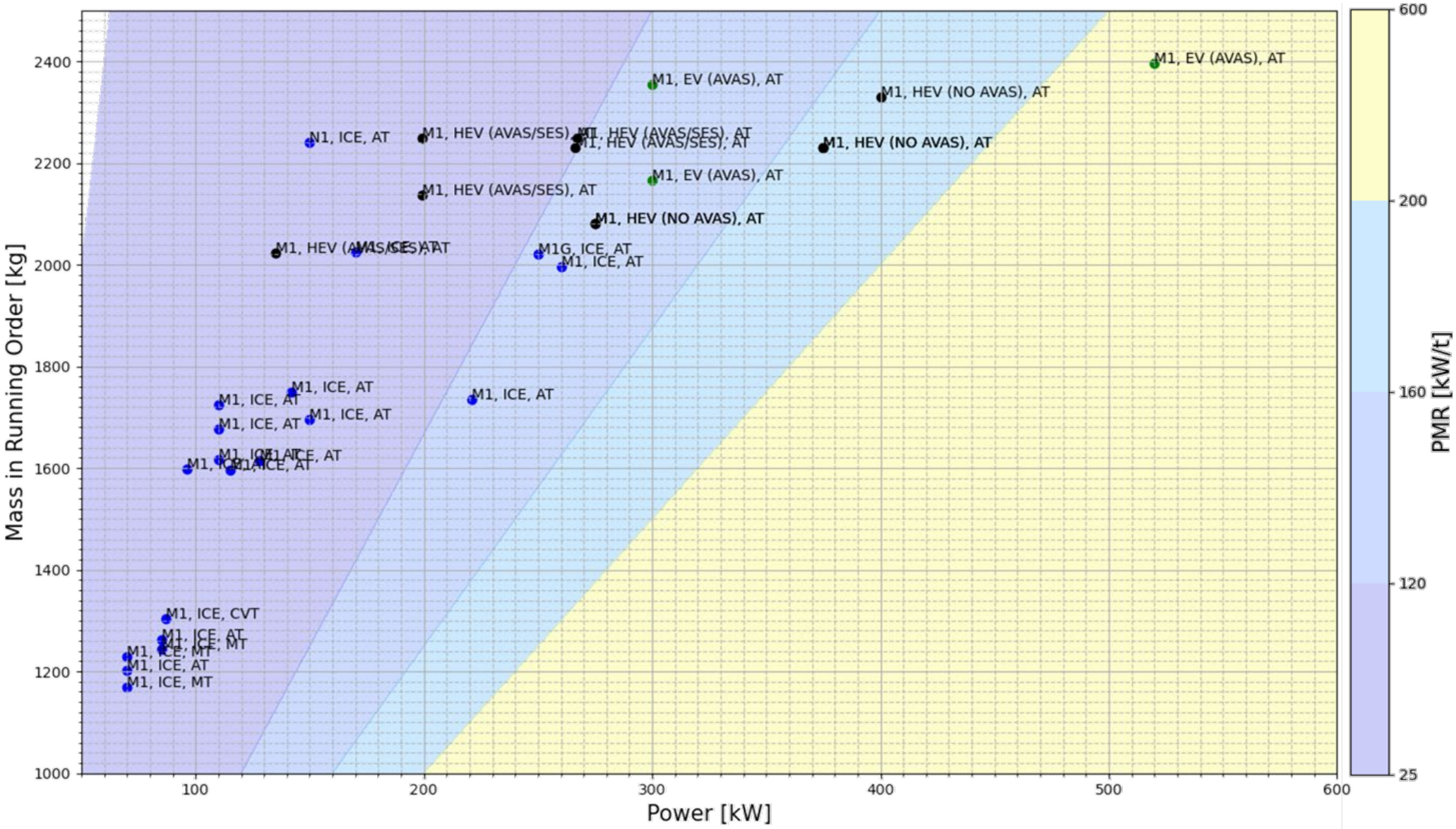
- Process of access to the platform
  - Confirmation of email address of the person(s) in charge to send data for RD- ASEP (email exchange with UTAC)
  - Registration code given to upload data to server/registration form
  - Upload of data in confidentiality per TAAs and per OEMs

- RD-ASEP Monitoring Data Delivery Document
  - Documents for reference only | UNECE: GRBP-77-15-Rev.4
  - This document was updated since last GRBP
    → ensure you’re using the latest version
    → do not modify it
  - Includes also a short survey to TAAs on the RD-ASEP implementation
    → ensure you have filled it
  - ONLY the datasheet to upload (not the pdf file)

RD-ASEP monitoring: first data

- RD-ASEP monitoring according to UNR51.03:
  - Numbers of registered CPs: 8 (7 TAAs, one with 2 TS)
  - Number of data set received: 18
- Request from some OEMs to submit data on voluntary base
  - Numbers of registered OEMs: 2
  - Number of data set received: 0
- Post processing of data will be done separately
  - To be included in the RD-ASEP data evaluation
  - TA-data will also be assessed independently

RD-ASEP monitoring: vehicles characteristics



Legend and Abbreviations:

- Vehicle Category M1-a
- Vehicle Category M1-b
- Vehicle Category M1-c
- Vehicle Category M1-d

- HEV: Hybrid Electric Vehicle
- AVAS: Acoustical Vehicle Alerting System
- SES: Sound Enhancement System (supplement to AVAS)
- ICE: Internal Combustion Engine
- AT: Automatic Transmission
- CVT: Continuous Variable Transmission
- EV: (Pure) Electric Vehicle

Next steps

- Contribution to IWG RD-ASEP
- Interim presentation to be done at next GRBP session (Sept 2024)
- Final presentation of the data analysis at GRBP session (Feb 2025)

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