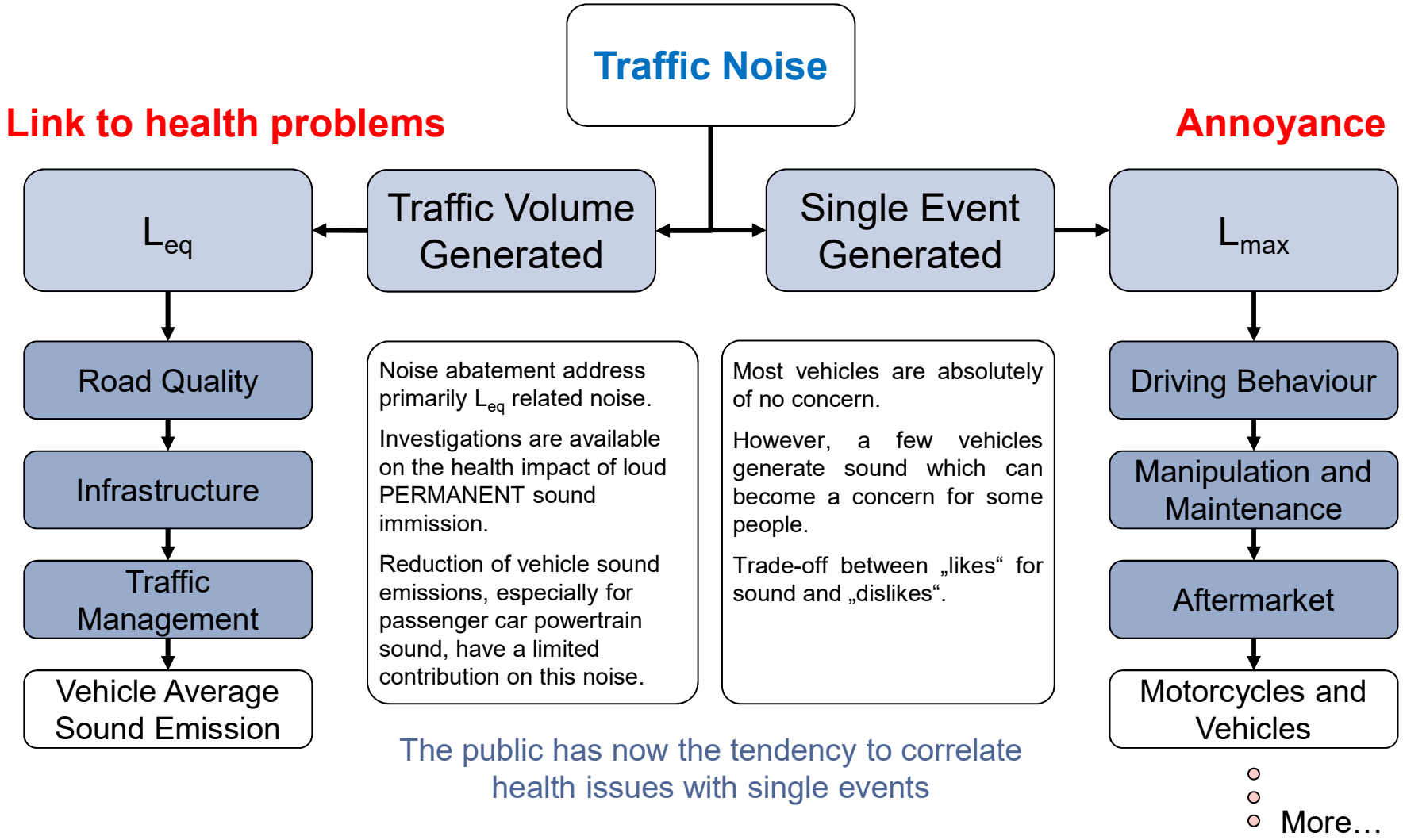
13 February 2017

P R E S E N T A T I O N O F

INTERNATIONAL ORGANIZATION OF MOTOR VEHICLE MANUFACTURERS

Revision of ASEP

Considerations for Future Steps
Enhancement of the presentation from Germany


Traffic Noise
Link to health problems
Annoyance
L_{eq}
Traffic Volume Generated
Single Event Generated
L_{max}
Road Quality
Infrastructure
Traffic Management
Vehicle Average Sound Emission
Noise abatement address primarily L_{eq} related noise.
Investigations are available on the health impact of loud PERMANENT sound immission.
Reduction of vehicle sound emissions, especially for passenger car powertrain sound, have a limited contribution on this noise.
Most vehicles are absolutely of no concern.
However, a few vehicles generate sound which can become a concern for some people.
Trade-off between „likes“ for sound and „dislikes“.
Driving Behaviour
Manipulation and Maintenance
Aftermarket
Motorcycles and Vehicles
More…
The public has now the tendency to correlate health issues with single events

Situation on Single Events

- Most passenger vehicles are designed to meet comfort expectations, therefore the vehicle manufacturer and customer have the same interest as the noise legislation goals – be as quiet as possible. These vehicles are not capable of annoyance, except when driven recklessly.
- However, a significant part of the driving society enjoy sound feedback from their vehicles. Electronic sound production devices are now available at mass market cost to enhance the natural sound of vehicles.
- This technology was originally very expensive, because the technical realization was **difficult** and the necessary electronic equipment added **high costs**. But, what was available for few exclusive products, is now emerging to the whole market.
- **For customers who value expressive sound, the original sound idea "feedback on driving" turned to customer expectation for a "loud sound whenever feasible"**.
- It is necessary to consider how the new Regulations UN R51.03 and R59.02, including ASEP, are able to control this technology. If necessary, additional requirements need to be introduced.

The Market of Sound for Single Events

Original Equipment

OR…

UN R51.02 / UN R51.03 APPROVALS

Aftermarket

Ab sofort ab Lager lieferbar:

Hersteller	Modell
Audi	A4
Audi	A5
Audi	Q7
BMW	3er
BMW	5er
BMW	X3
Ford	Mustang
Mercedes	C-Klasse
VW	Golf 6
VW	Golf 7
VW	Passat

OR…

Maxhaust Soundbooster Porsche Macan S Diesel mit Sportabgasanlage inkl. App-Steuerung

E-Mail an einen Freund

Schreiben Sie die erste Kundenmeinung

Lieferzeit: auf Lager

499,00 €

inkl. 19% MwSt. zzgl. Versandkosten

APPROVAL IS UNCLEAR

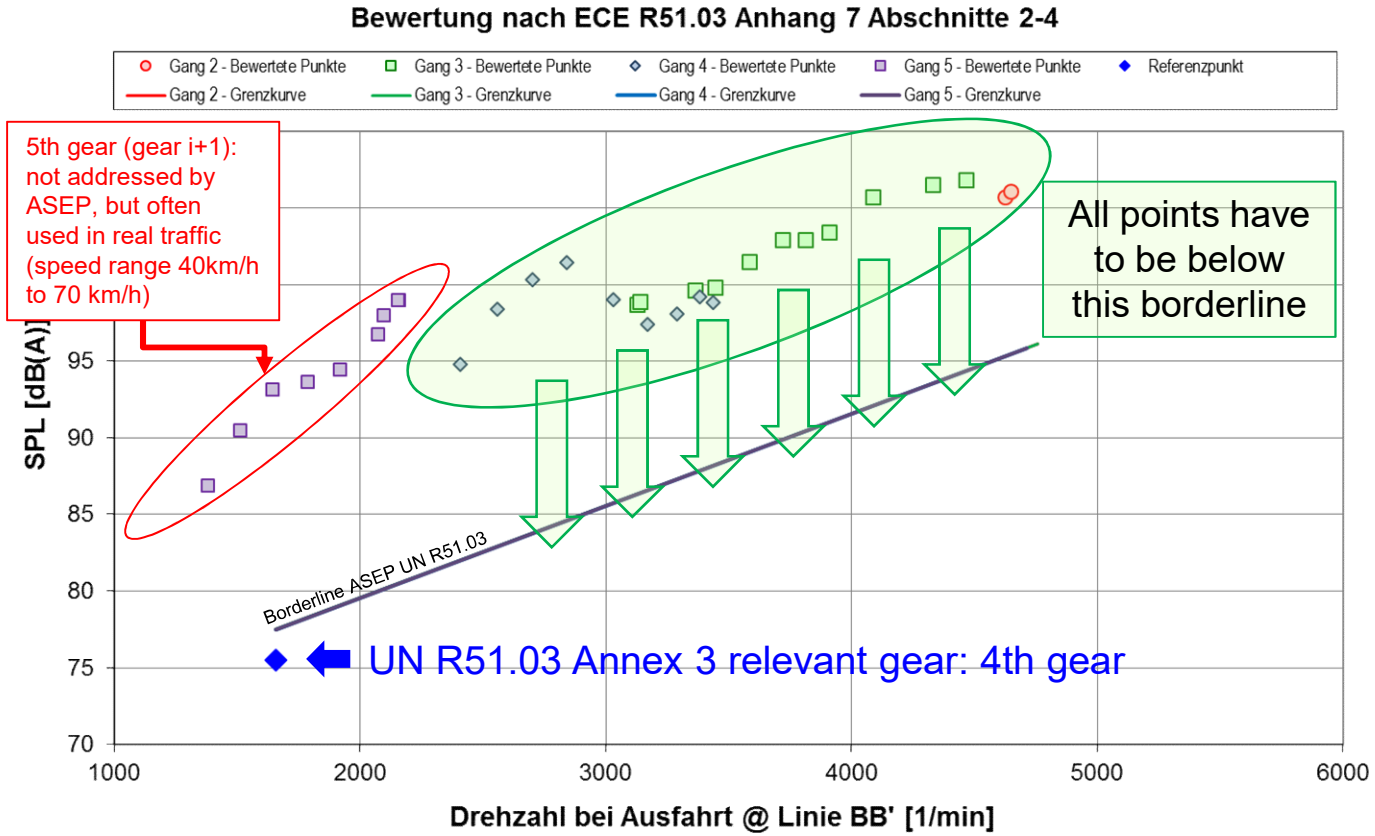
Manipulation

OR…

ILLEGAL

Extreme Sound Tackled By UN R51.03

Example for a WOT sound emission of an extreme vehicle, **approved under R51.02**, tested under the ASEP conditions of UN R51.03



What was legal under UN R 51.02 will no longer be approved under R51.03

Environmental Complaints

- In prior years, people did not complain about loud vehicles; instead, people complained about extreme driving styles.
- **This was because a high sound output was only possible, when the driver was choosing unnecessary high engine speeds and loads.**
- Today, vehicles can be extremely loud, even when following the normal traffic flow.
- **Consequently, people start to complain about products and not as much the driving style.**

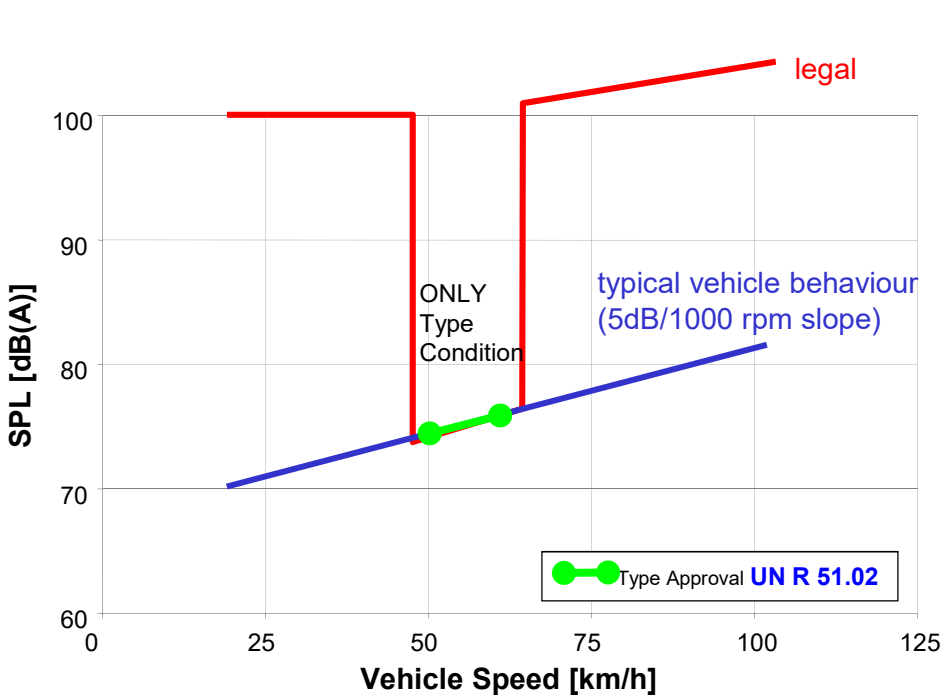
http://www.swr.de/landesschau-aktuell/bw/mannheim/auto-poser-in-mannheim-polizei-greift-hart-durch/-/id=1582/did=18022870/nid=1582/vttjbe/index.html

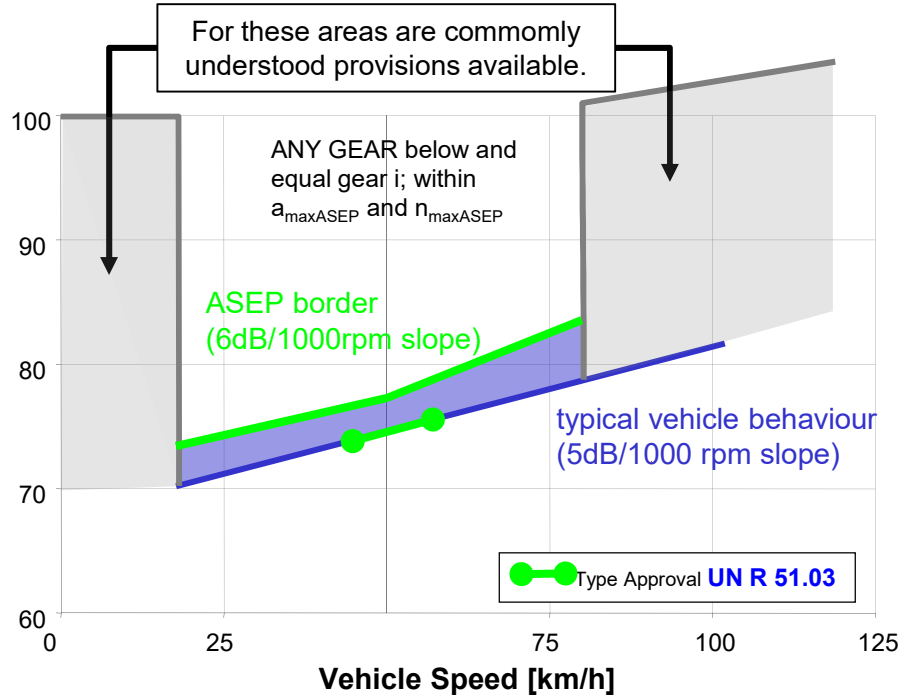
Public Reaction

- The emissions scandals have resulted in new approaches in the field of environmental legislation.
  - In Europe, RDE – Real Driving Emissions – will be introduced to overcome differences in emissions on a test bench compared to real life driving.
  - Many people request that this kind of concept should be extended to the field of sound emission.
  - The EU announced, that RDN – Real Driving Noise – will be considered, after RDE is fully established.
- However, with R51.03:
  - the sound ***is*** controlled in an extended area, targeting urban and suburban driving, including aggressive driving behavior.
  - exterior sound emission ***is*** measured under real environmental conditions.

? Isn't ASEP already a kind of RDN

UN R51.03 ASEP – Already a Big Improvement





- UN R51.03 ASEP is already a big improvement compared to UN Regulation R51.02, but:
  - The UN Regulation R51.03 has just started; thus products approved according to R51.03 have not yet arrived to the market on a large scale.
  - Many manufacturers, and especially aftermarket, will use the old R51.02 approvals up to the maximum possible application date in 2022.

ASEP– Current Situation

- **ASEP is already a big improvement compared to UN Regulation R51.02**, *but;*

- ASEP is not yet fully developed for a market, where competition and customer expectations drive OE and aftermarket manufacturer to more and more extreme solutions.
- ASEP should be revised with a concept, where the sound output is linked to the driving performance. This would follow the physical principles and meet fair customer expectations.

"Slope-Assessment" – Current Situation

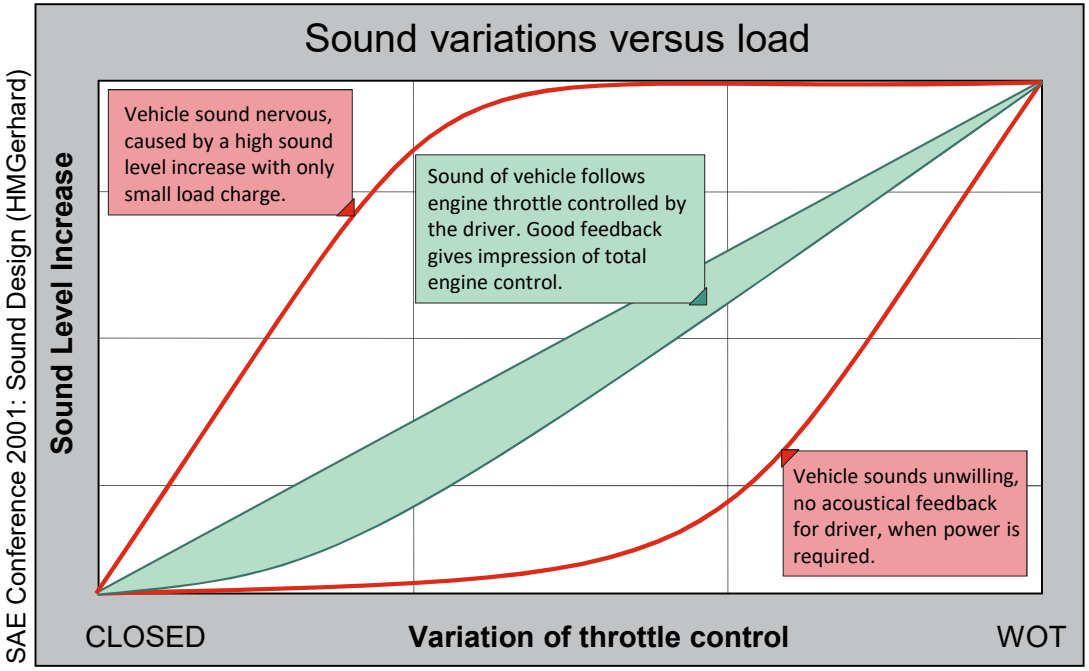
Strengths	Weaknesses
Prevents excessively loud noise emission in the ASEP control range.	Limits designed with assumption sound emission is correlated to throttle – does not account for loud partial throttle situations
Identifies and prohibits "test detection" strategies used in R51.02	Not all gears are in the scope of ASEP
Easily understood RPM vs. sound limits	RPM based limits not applicable for all products.

"L_{urban} – Assessment" – Current Situation

Strengths	Weaknesses
Prevents excessively loud noise emission in the ASEP control range.	Not applicable for accelerations lower than a_{urban}
Identifies and prohibits "test detection" strategies used in R51.02	Simple speed compensation
Assessment is sensitive to actual measured acceleration – if you don't make acceleration, but only make sound, you get a high result.	Assessment is sensitive to actual acceleration measured – acceleration measured may not be actual vehicle performance
Performance based and design neutral	
Applicable to vehicles with no combustion engine RPM.	Limitation concept more difficult to understand

Potential Sound Emission Goals for an ASEP Revision

- "Zero"-Emission of sound is not a suitable goal; in difference to other environmental fields, sound (or controlled emission) is an essential part of life.
- Sound is necessary for safety reasons ➔ UN R28 and UN R138
- Sound influences our senses and conveys important information.



Sound should follow physics – More power generation and higher vehicle speeds result in more sound.

In this manner, sound conveys necessary information to the driver, pedestrians, and other road users.

The "v x a"-Performance of a Vehicle in Real Traffic

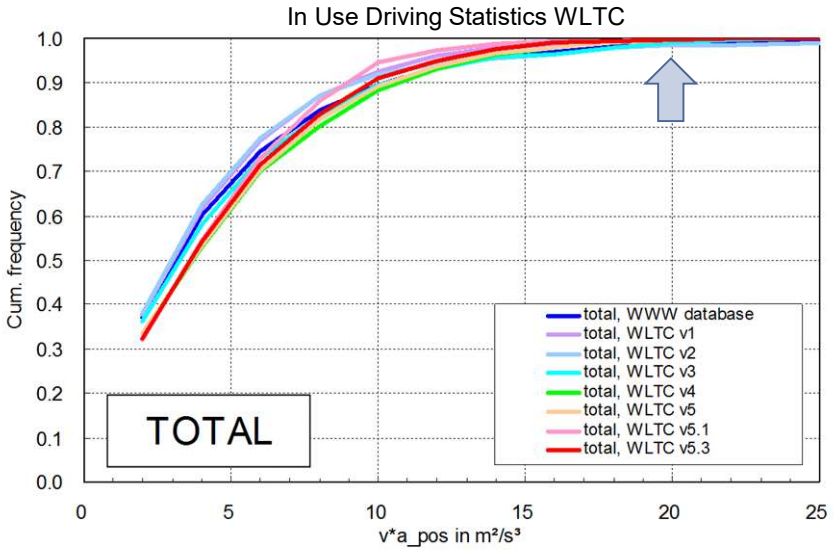
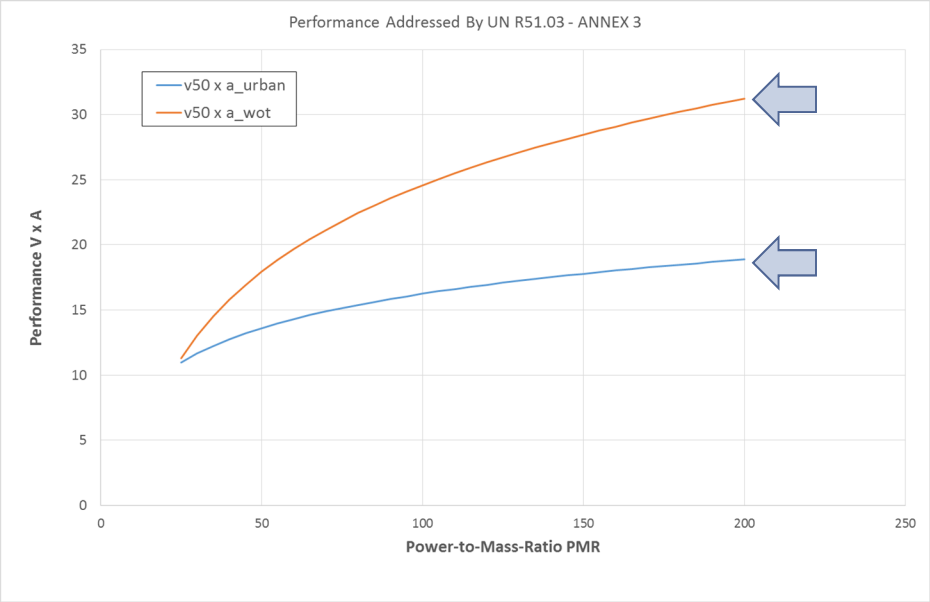


Figure 4-29 Cumulative frequency of multiplication of speed and acceleration (v*a) in WLTC

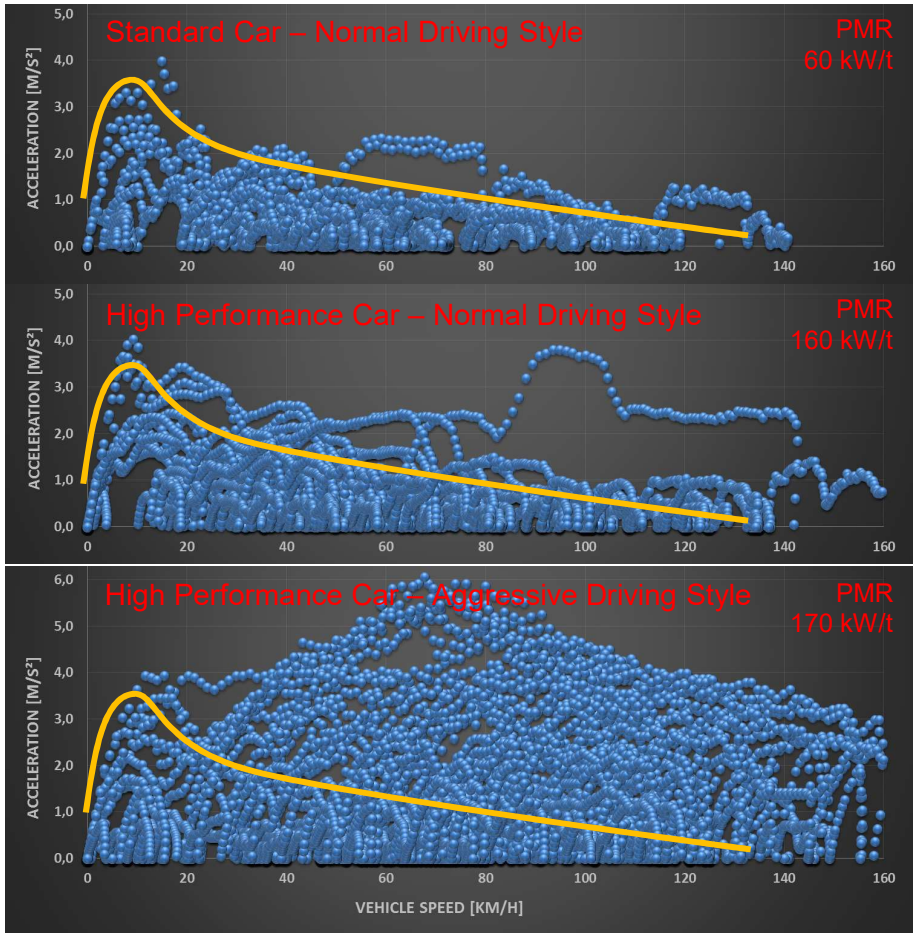


GTR15:
WLTC ➔ $(v \times a)_{WLTC} < 20\ m^2/s^3$

UN R51.03:
Annex 3 ➔ (v x a)TYPE = 10 … 32 m²/s³
Annex 7 ➔ $(v_{80km/h} \times a_{5m/s^2})_{ASEP} = 111\ m^2/s^3$

ASEP does already target to a five time higher performance range compared to the WLTP. However, does ASEP really address the real driving?

What is the performance of a vehicle in real traffic

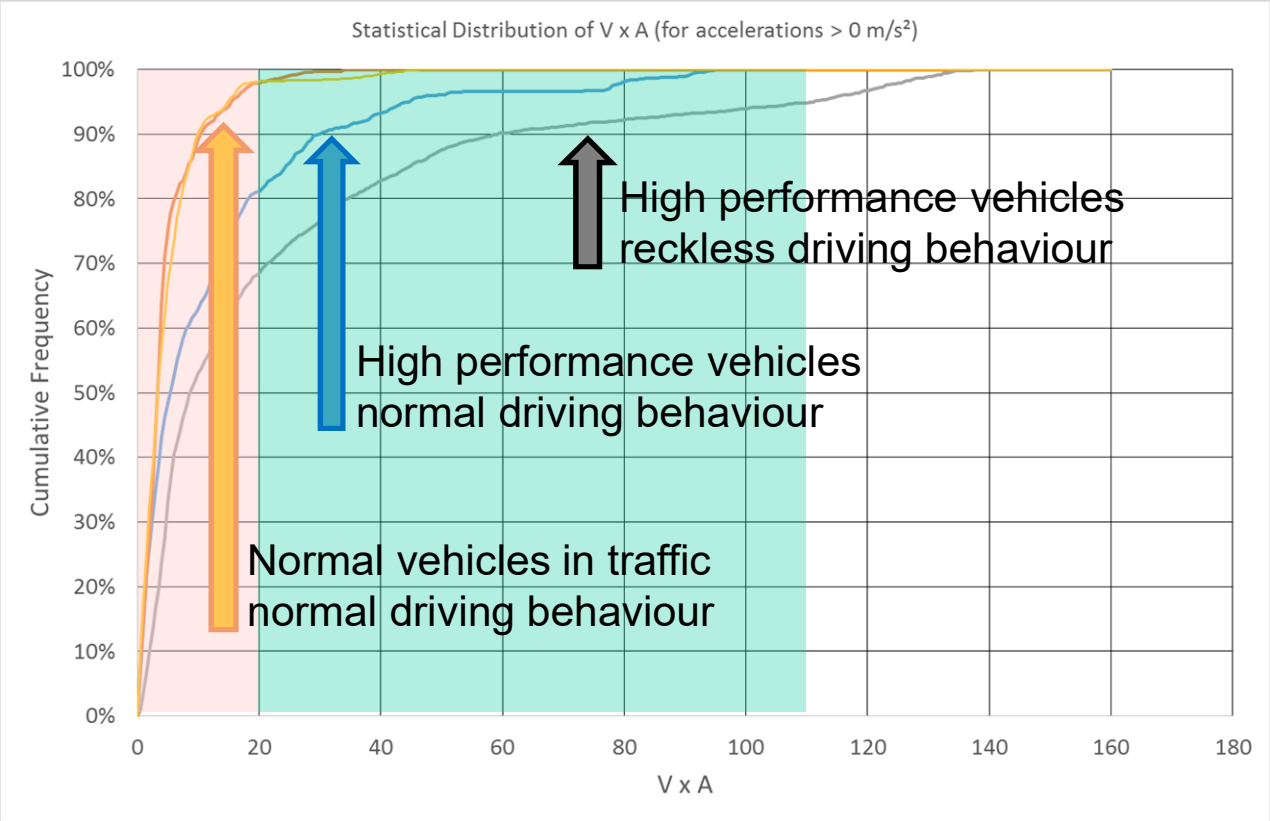


Regardless of the vehicle type and its power, a normal driving style can be characterized, by the orange curve.
Under normal driving this curve is sometimes exceeded, but rarely.

The second example shows, that even high performance vehicles are driven almost the same way as normal cars.

However, high performance cars allow to drive more extreme, so that their driving performance can be much higher.
But, full throttle at low speeds in low gears is even with aggressive driving not given.

Analysis of V x A Performance
Different Vehicles and Driving Styles



The WLTC performance V x A covers almost all driving events of **normal driving**.

The ASEP border covers even more than 95% of **ANY driving styles in ANY speed ranges** with even far more than 120 km/h.

It is not necessary to extend the performance area, it is more efficient to consider how that performance area is controlled.

A performance concept v x a similar to the emission field might help to control more efficient and fair, the sound of vehicles.

Conclusions

- Most of the vehicles on our streets are of no concern.
- The R51.03 ASEP will already restrict the sound emission to a large extent.
- Driving behaviour, manipulation, aftermarket and extreme designs require new regulatory solutions.
  - **It is important to consider how to make products more safe against manipulation.**
- Lower noise emission limits on the sound emission for normal products will have almost no positive effect ➔ see motorcycle field.
- The R51.03 ASEP focuses on extreme driving conditions with high performance, while real driving happens at much lower performance.

A revision of ASEP should aim at

- **the accelerations, gears, and speeds that are environmentally relevant; are used in traffic.**
- **Addresses single noise events capable of causing annoyance, which are not generated by high vehicle performance.**