Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

STEER

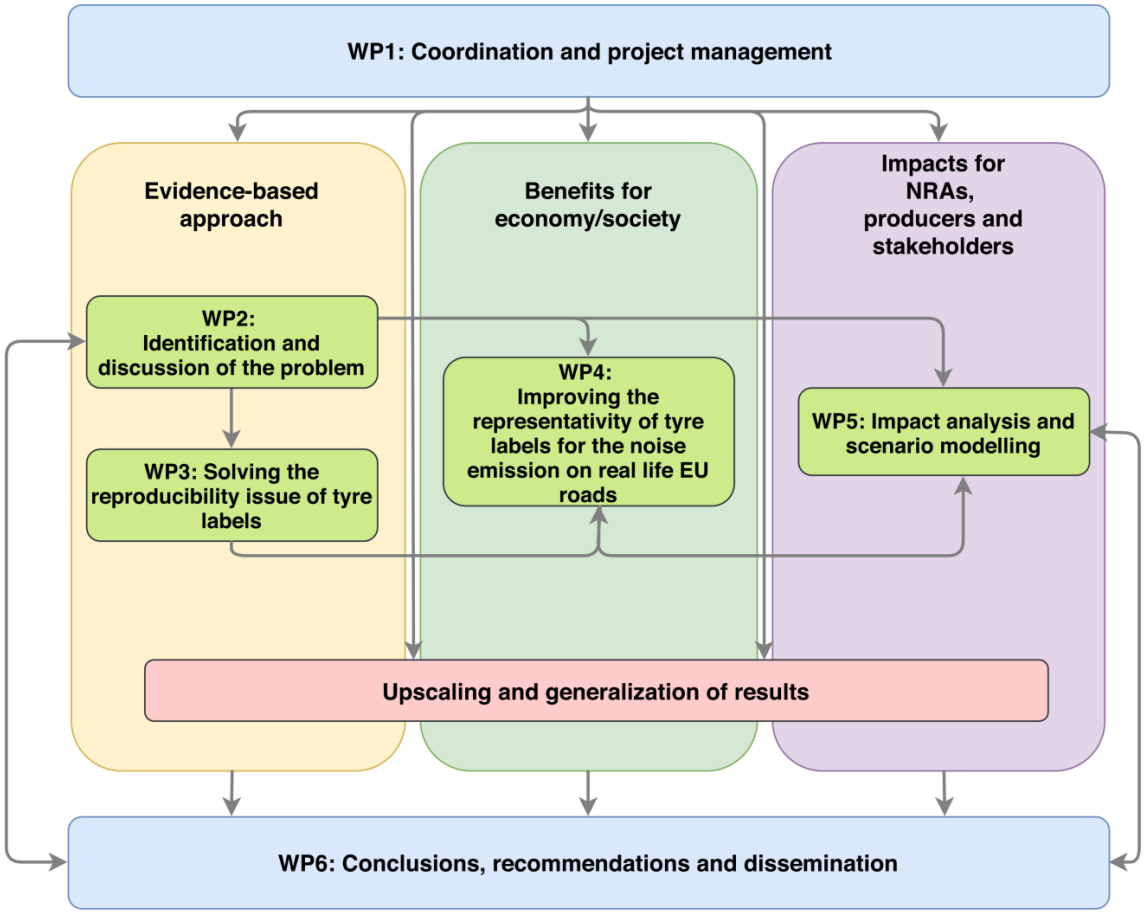
CEDR: Noise & Nuisance call 2019, final
Event
08.06.2022

STEER-Project

Deepening the solutions

STEER project structure

(**ST**rengthening the **E**ffect of quieter tyres on **E**uropean **R**oads)



G+P ENGINEERS

vti

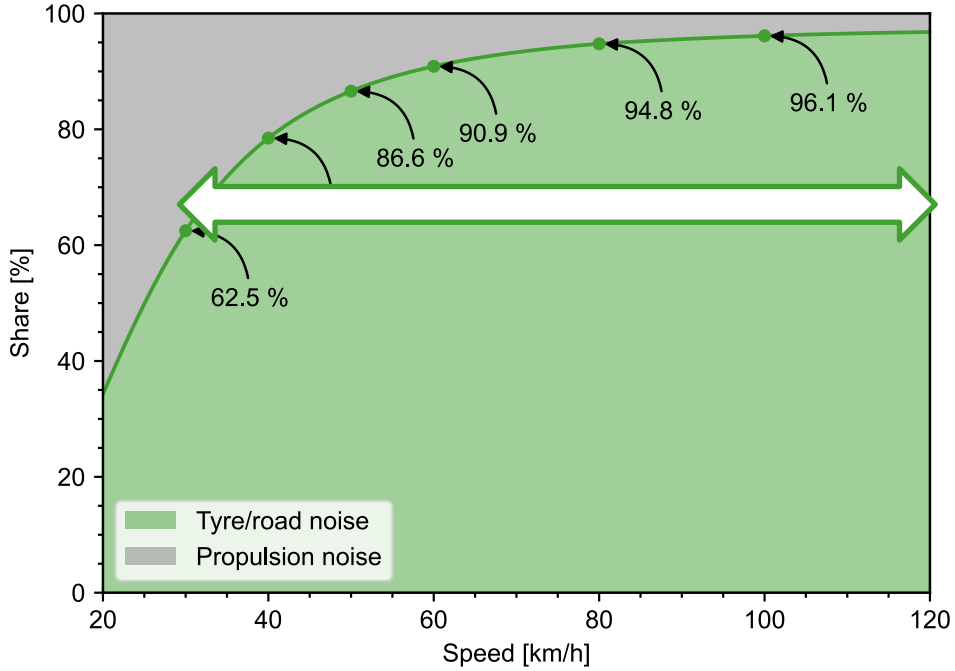
Belgian Road Research Centre
Together for sustainable roads

SINTEF

nokian TYRES

Introduction

Where tyre/road noise dominates..



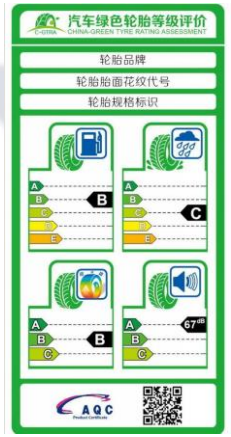
..are quieter tyres potentially effective

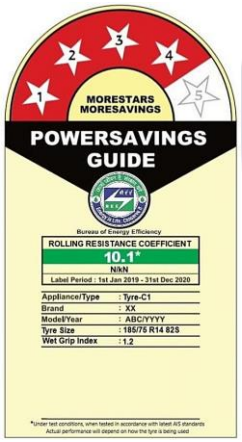
emissions for mixed traffic (8% heavies) at constant speed for a modern vehicle fleet

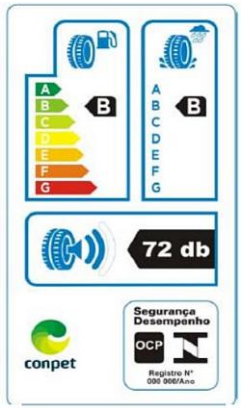
Quieter tyres potentially effective on highways and in cities (>30 km/h)

We are not alone

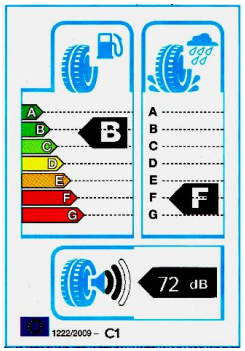
Japan	South Corea	China	Indian	Brasil
mandatory	mandatory	optional	(proposal)	mandatory
C1 only	C1 only			C1 only
No noise label	No noise label		No noise label	

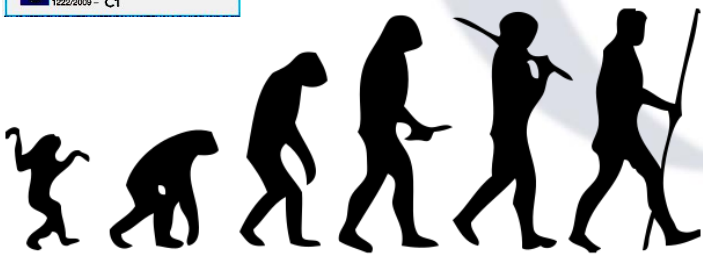






Evolution of the European tyre label





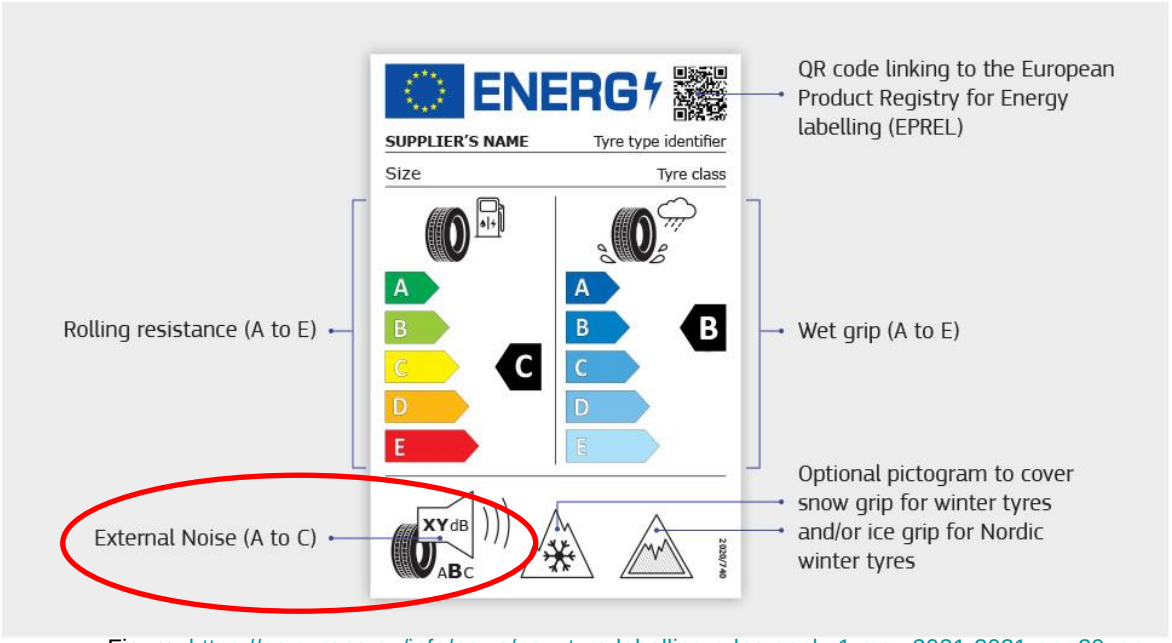
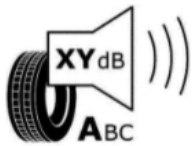
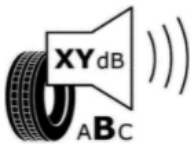


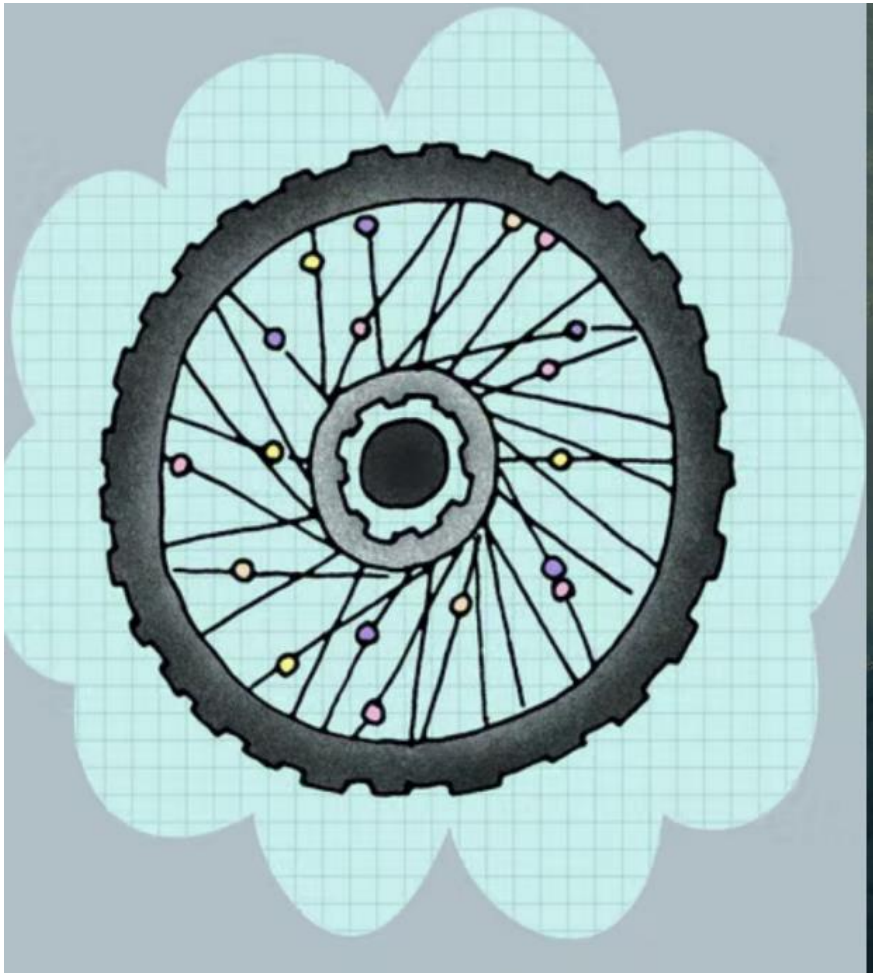
Figure: https://ec.europa.eu/info/news/new-tyre-labelling-rules-apply-1-may-2021-2021-apr-29_en

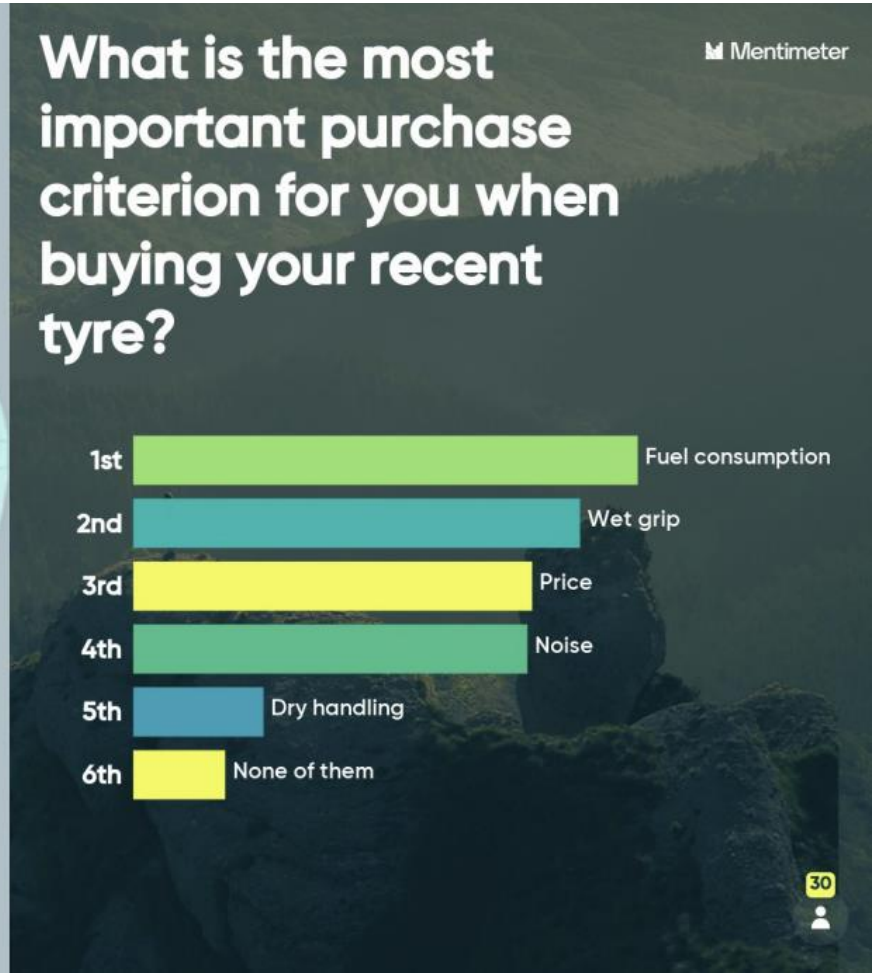
Noise label and label classes

$N \leq LV-3$	$LV-3 < N \leq LV$	$N > LV$
		

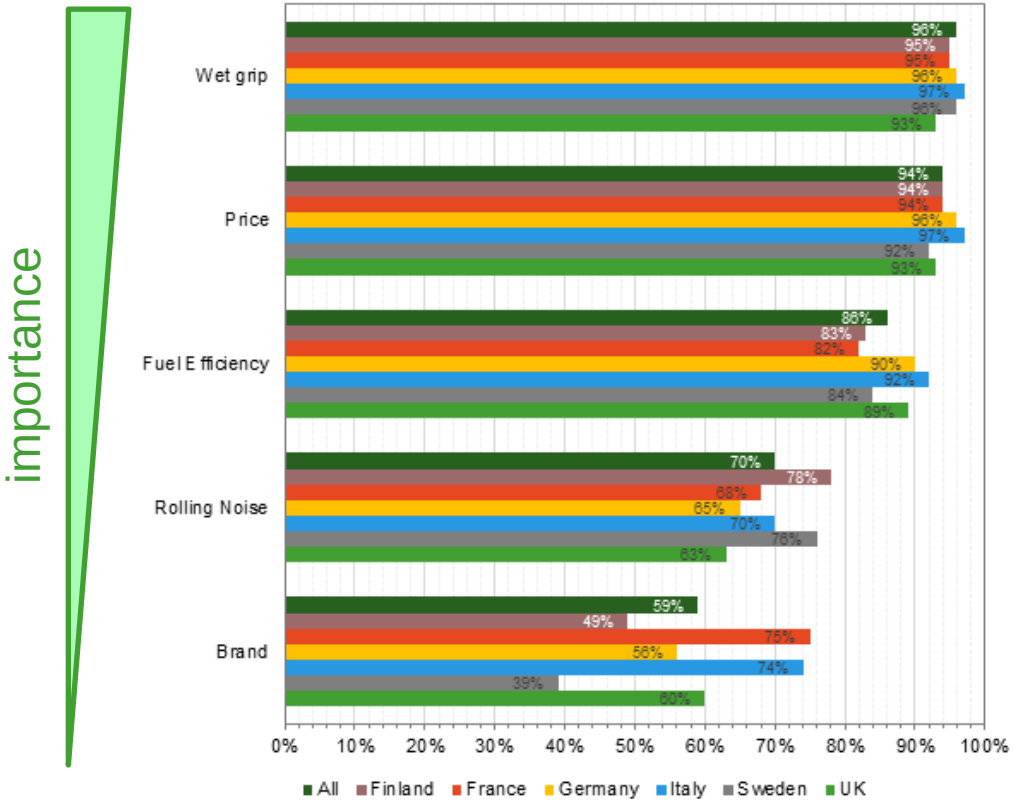
https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32020R0740&from=EN

You voted yesterday





Current status – importance of aspect



Importance of aspect (purchase criterion):

- "Price" high up
- "Rolling Noise" further down

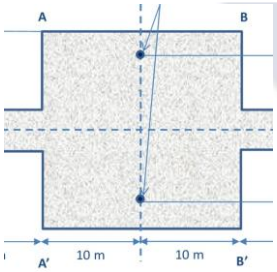
Source of data: Final Report--Review study on the Regulation (EC) No 1222 / 2009 on the labelling of tyres. Prepared by Viegand Maagøe A / S 1–152, Copenhagen, Denmark. (URL: https://ec.europa.eu/energy/sites/ener/files/documents/Study%20in%20support%20of%20the%20Review%20of%20the%20Tyre%20Labelling%20Regulation_final.pdf.), *graphic by the authors.*

Review of current label

Overview of noise testing procedures for vehicles

basis of R51.03

ISO 362-1	ISO 362-3	ISO 16254
External noise	indoor testing	External noise
M and N vehicles	M and N vehicles	M and N vehicles
		at standstill or low speeds



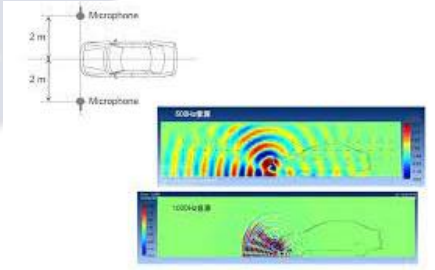


Image: https://unece.org/DAM/trans/doc/2016/wp29grb/GRB-64-07e.pdf

Image: https://unece.org/DAM/trans/doc/2019/wp29grb/GRBP-70-09.pdf

Tyre noise labelling procedure

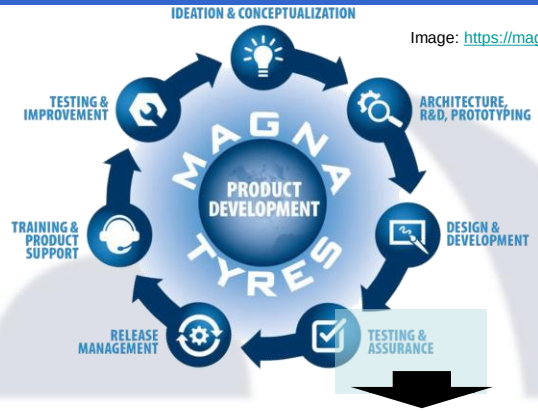
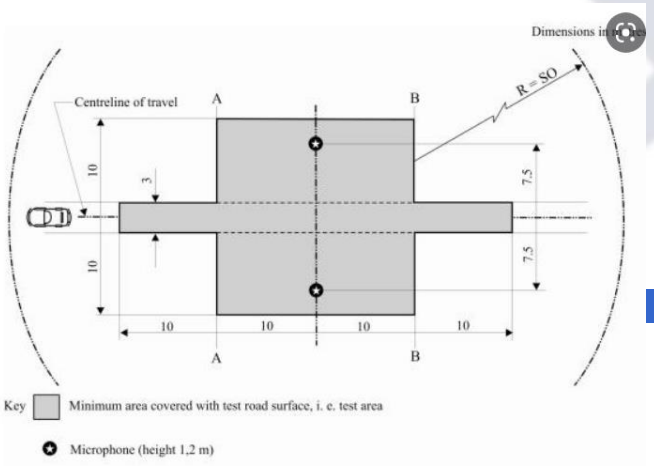


Image: https://magnatyres.com/nl/product-ontwikkeling-en-rd/

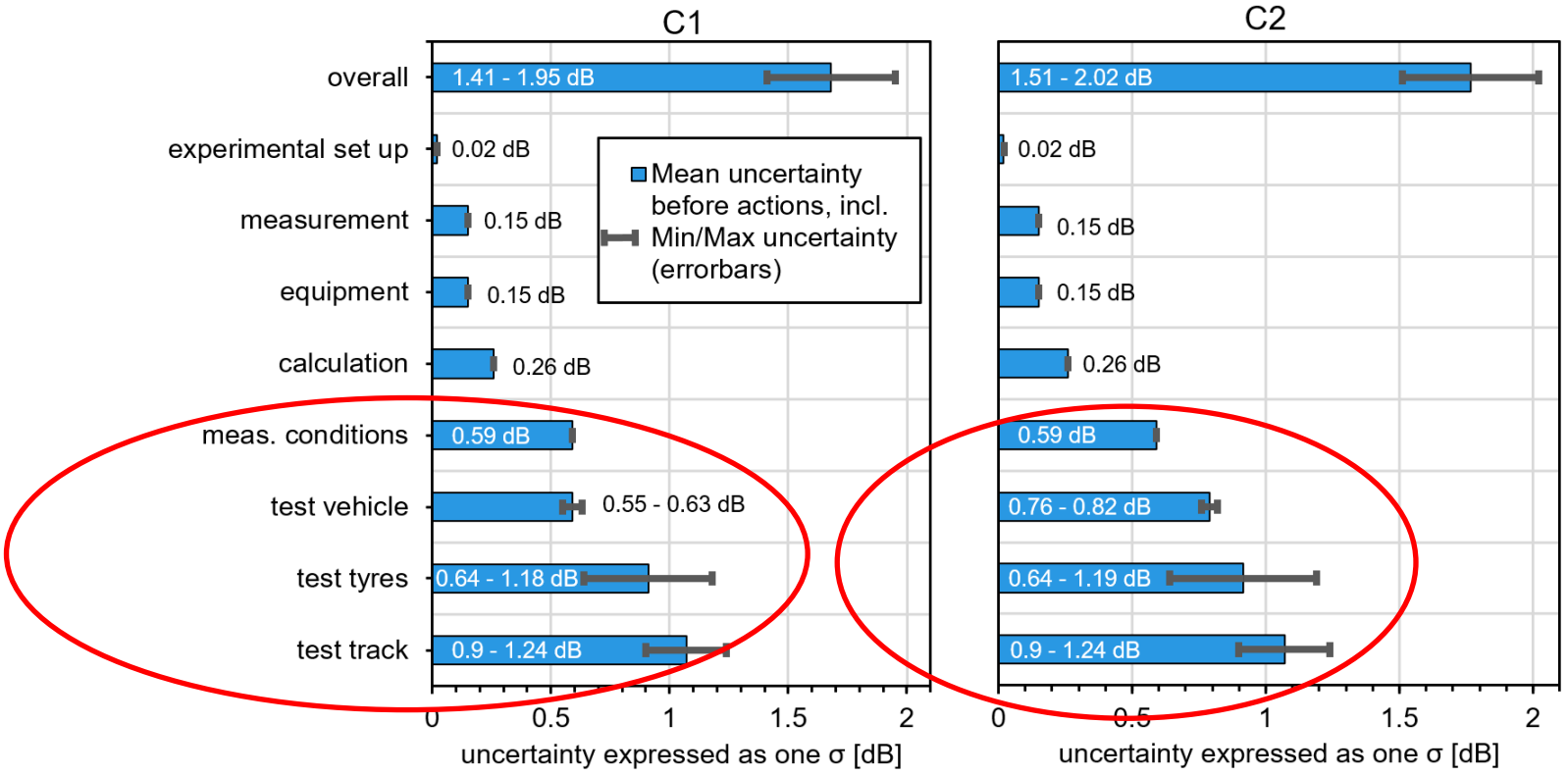
- selection of measurement equipment
- selection of test track
- selection of test vehicle
- selection of set of tyres to be tested

→ measurement set up and calibration of measurement equipment → monitoring of meteo conditions: coast-by measurements (16 pass bys minimum) → analysis of measurement data → determination of noise label



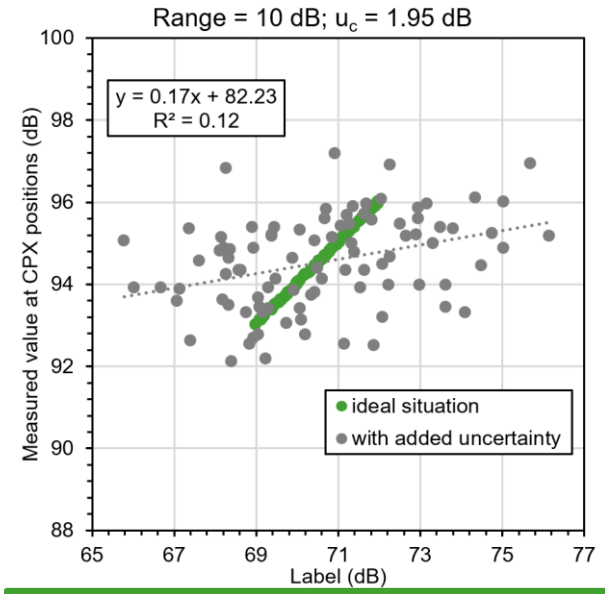
Coast-by (n=16)
at 70-90 km/h

Uncertainty of the current procedure

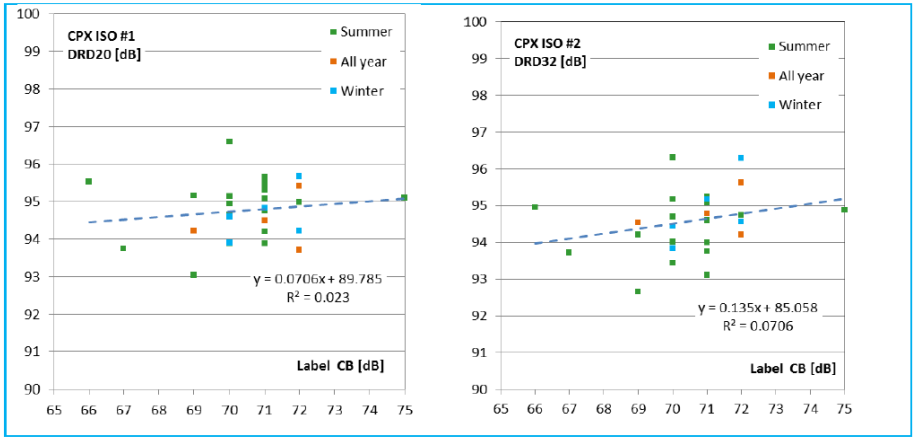


Implication of uncertainty of noise label

Scatter to expect for empirical studies



Scatter plots determined in the Nord Tyre Project



Low correlation coefficients are to be expected!

Reproducibility of the tyre label

16

Uncertainty of current procedure

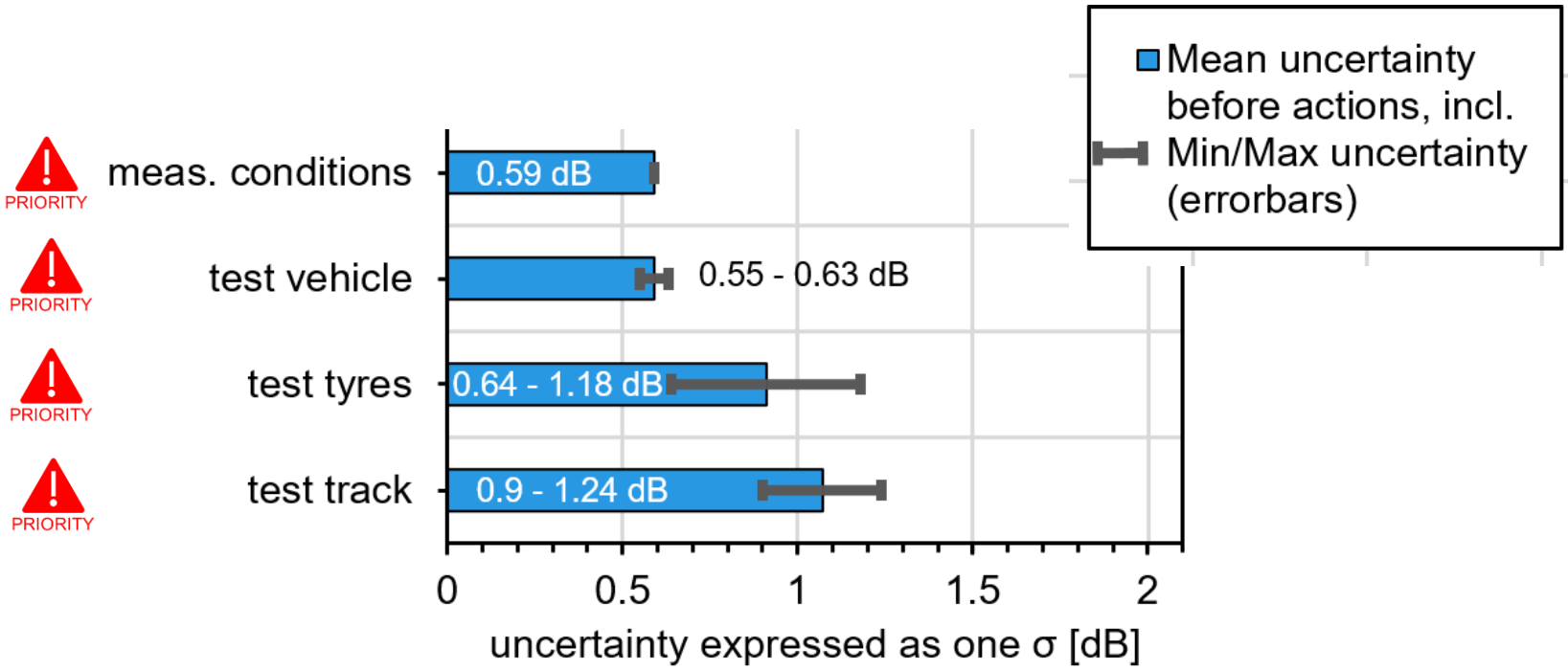
- Overall uncertainty compared with other measurement principles

	SPB	Noise label (R117)	CPX	Drum
standard uncertainty	1.1 dB (cat. P) 1.6 dB (cat. H)	1.41-1.95 dB (C1) 1.51-2.02 dB (C2)	0.3 dB (tyre P1) 0.5 dB (tyre H1)	0.1 dB

Level of standardization

→ Uncertainty of current labelling procedure too high

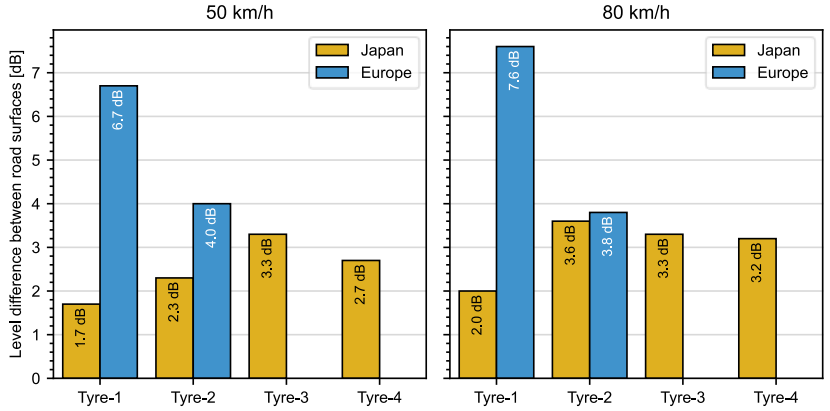
Important uncertainty contributions



Variability of ISO test track

- Problem: acoustic quality of ISO-Test tracks varies significantly (despite the construction requirements)

- RRT by M+P in 2005, in Europe: 7+2 test tracks
- RRT by JSAE in 2006, in Japan: 8 test tracks
- RRT by VDA in 2016, in Europe: 13 test tracks
- RRT by ETRTO (2018), in Europe: 4 test tracks
- RRT within project ELANORE (2021), in Europe: 3 test trac

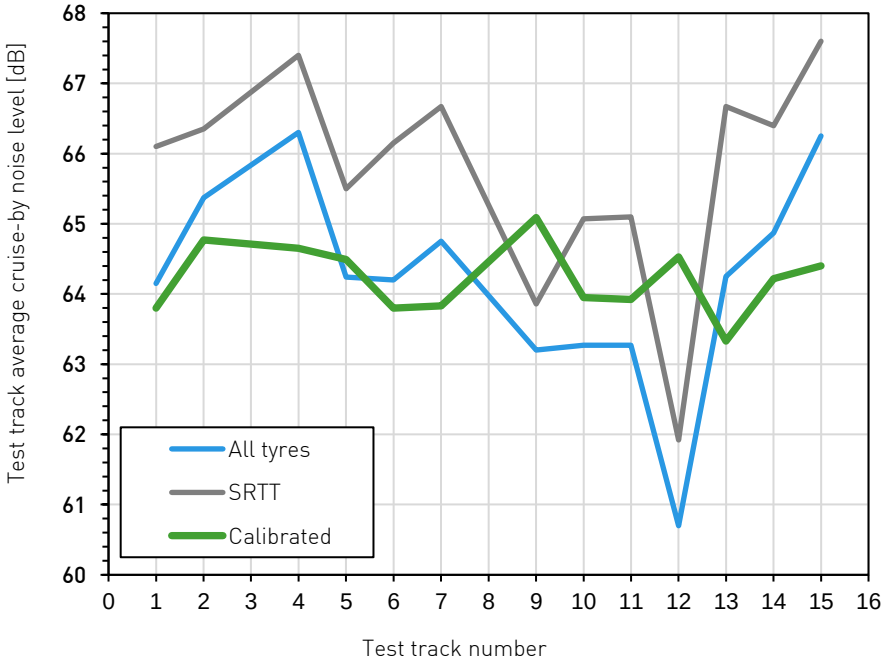


Data: JSAE, 2006. Test Results of Round Robin Test in Japan, (Unpublished), Presentation by Japan Society of Automotive Engineers (JSAE), 18-20 October 2006 (Document N144 in ISO/TC 43/SC 1/WG 42), Graphics by the autors.

→ Site to site variation of up to 6 dB

Solution: Reference tyre calibration procedure

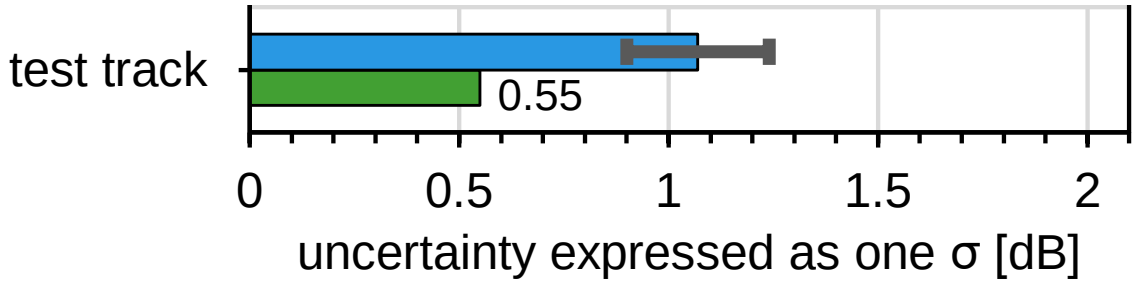
1. Using a set of reference tyres of the SRTT 16" type, specified in ISO/TS 11819-3,
2. mounted on a relatively well-defined vehicle,
3. conducting tyre/road noise measurements according to the method in R117,
4. normalizing the resulting noise level to a reference temperature using ISO/TS 13471-1,
5. and then normalizing the final result to some defined ISO 10844 reference level.



Recertification needed: Repetition after 2 years (presently after 4 years)

Solution: Reference tyre calibration procedure

IMPROVEMENT



→ Uncertainty contribution can be halved!

Testing entire tyre lines

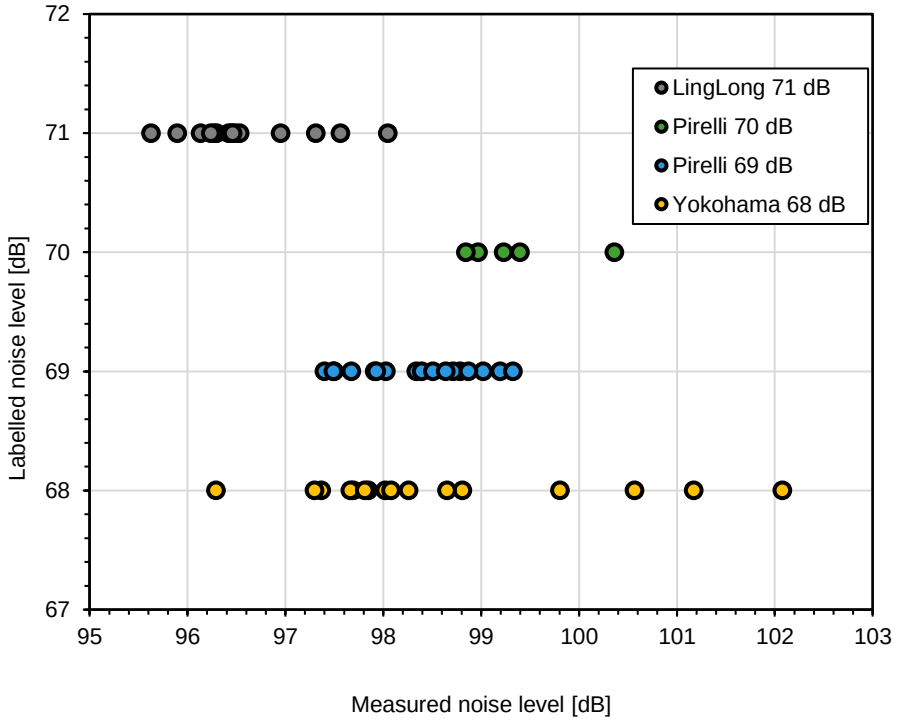
What is a so called **«tyre line»?**

- tyres that share the same trade description or product name but may have different dimensions, load index or speed rating

Why is it important?

- The labelling regulation does not require that all variants of tyres are tested. Often, **only the noisiest tyres are tested to save money** and give the other tyres the same label. Or often only a few tyre variants are tested.

Testing entire tyre lines



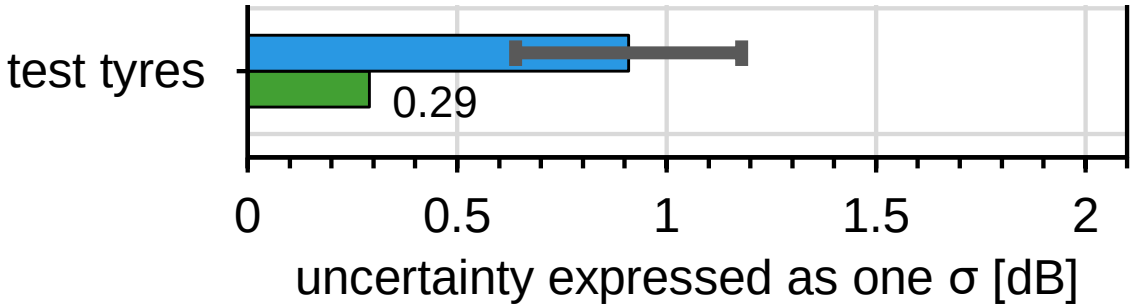
Solution: Implement indoor testing on laboratory drum

Indoor procedure:

- simplified measuring method
- determine differences between tyre variants within a tyre line
- use this difference to assign noise labels to all (or at least most) tyre variants with the type approval level as a reference.

Solution: Implement indoor testing on laboratory drum

IMPROVEMENT



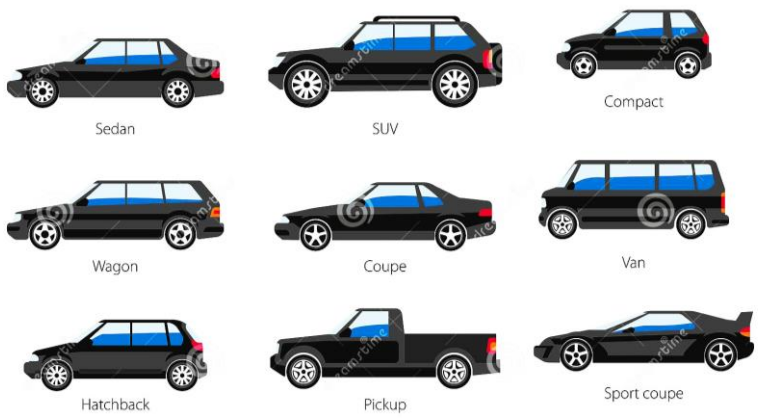
→ Uncertainty contribution can be reduced by two thirds!

Uncertainty related to test vehicle

- The vehicles used for testing according R117 are not very strictly defined.

→ High uncertainty contribution due to choice of vehicle/state of the vehicle

- Problem difficult to solve, as tyres need to be mounted to appropr. vehicle



Impact on uncertainty:

- Shielding effects
  (e.g. due to chassis height)
- Reflections
  (e.g. due to wheel chamber)
- Source positions
  (e.g. due to axis distance)

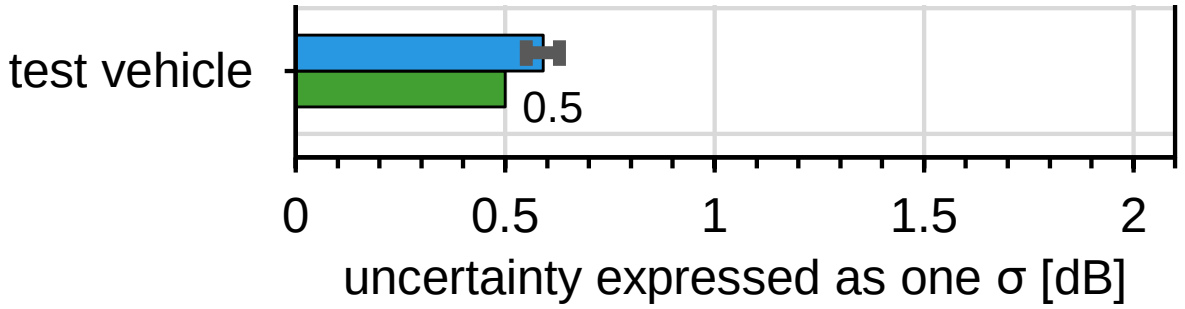
Solution:
Stricter requirements for test vehicles

→ Recommendation to reduce the wheelbase to be more restrictive (marginal improvement for C1 tyres, but significant for C2 tyres).

→ Better description of car underbody in relation to the ground clearance would be worthwile.

Solution: Implement stricter requirement for test vehicle

IMPROVEMENT



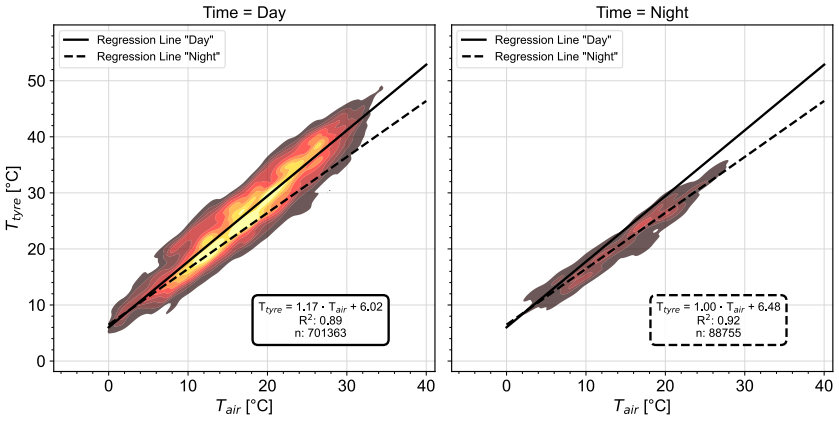
→ Uncertainty contribution from vehicle only slightly reduced!
→ May only be solved in the long-run (see longterm vision of tyre noise lable)

Temperature correction

- Temperature is a major source of uncertainty.

→ Challenge to find globally applicable correction procedure

- Which temperature to use for correction?
  - Tyre
  - Ambient (Air)
  - Surface (Road)



Solution: Temperature correction

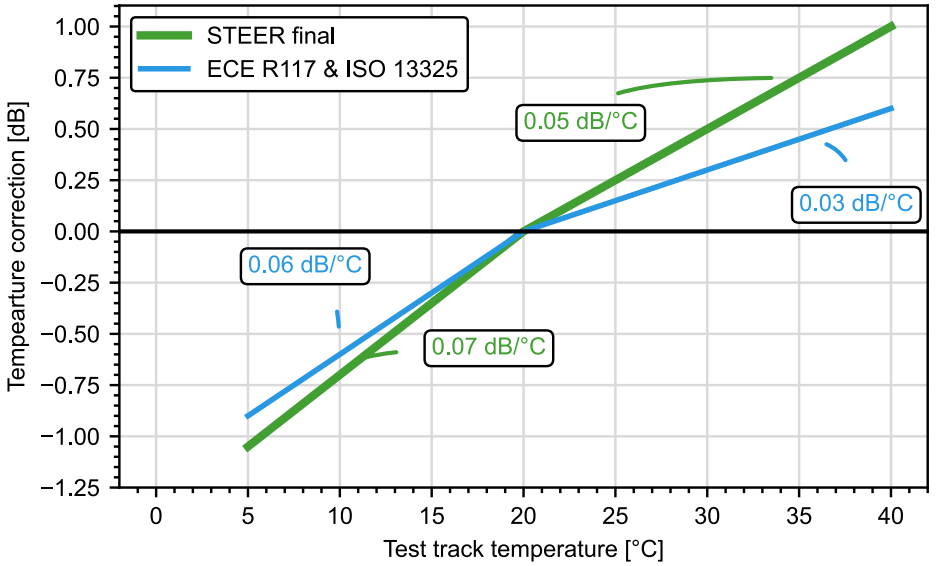
- Current correction procedure seems to favor correction at high temperatures.

Recommendation:

- Update coefficients (low-hanging fruits)

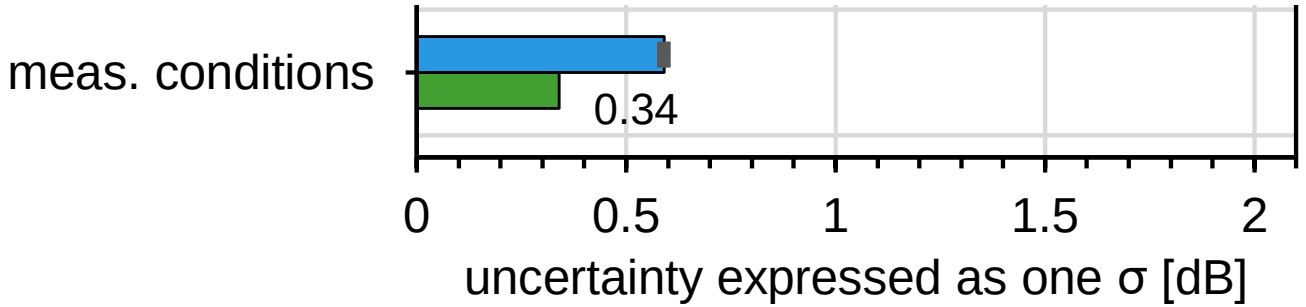
Suggestion (long-term):

- Spectral influence of the temperature correction is to b determined.
- Correction based on T_{air} and T_{road} combined



Solution: Implement indoor testing on laboratory drum

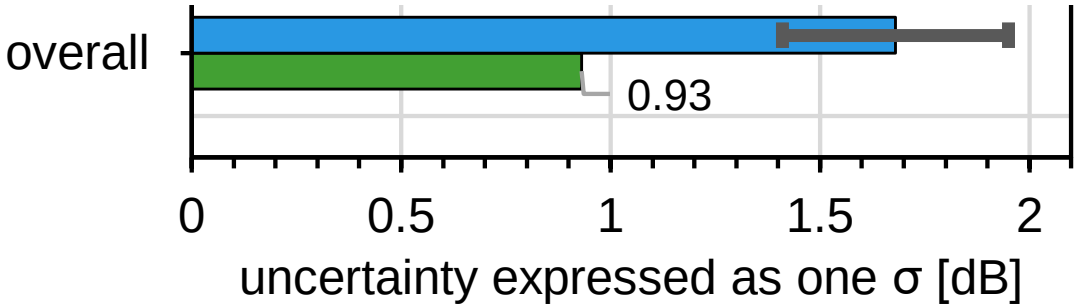
IMPROVEMENT



→ Uncertainty contribution can be reduced by a third!
→ constitutes a «low-hanging fruit», as it is easy to improve

Solution: Improvement of overall uncertainty

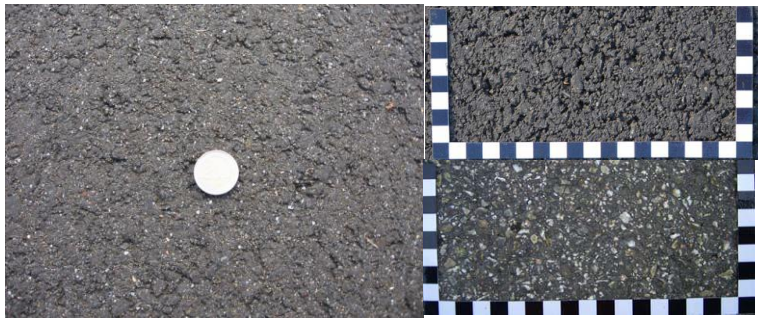
IMPROVEMENT



Overall uncertainty can be halved by implementation of STEER recommendations

Representativity of the tyre label

Representativity of the tyre noise label regarding real-world conditions



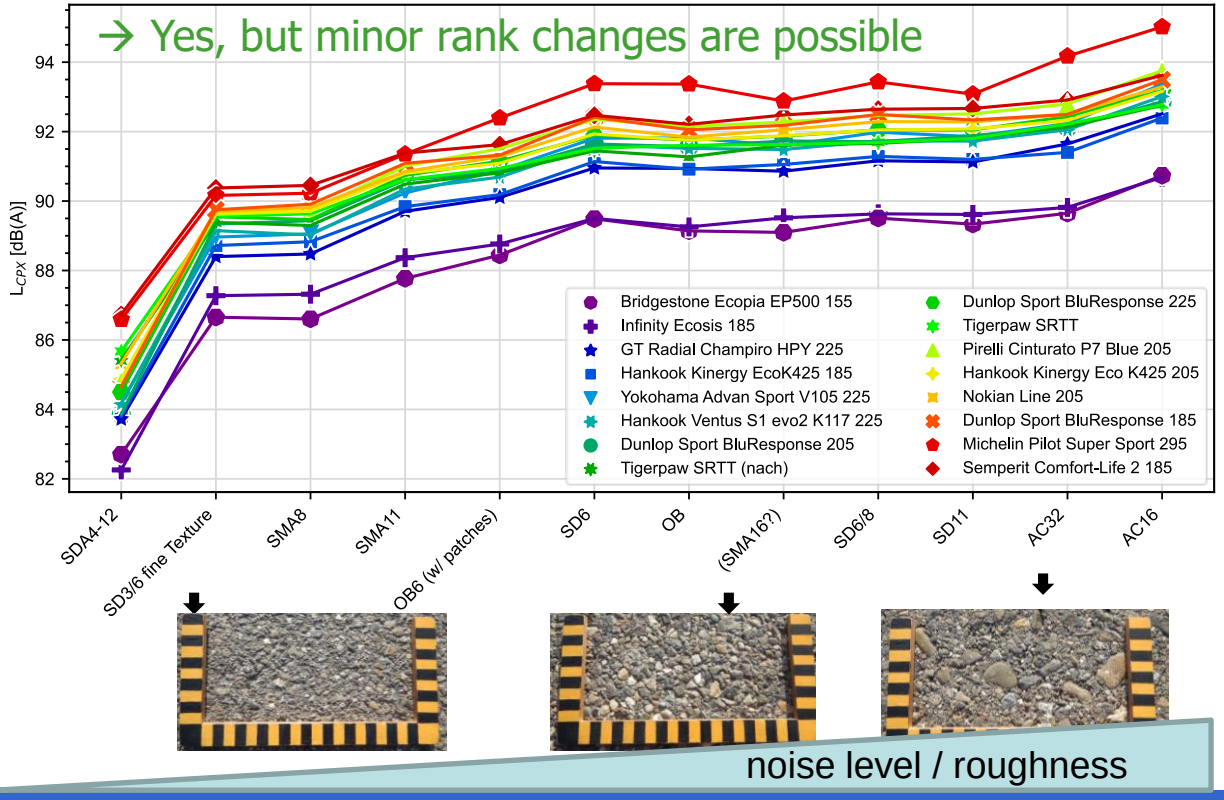
Description of the ISO Test surface

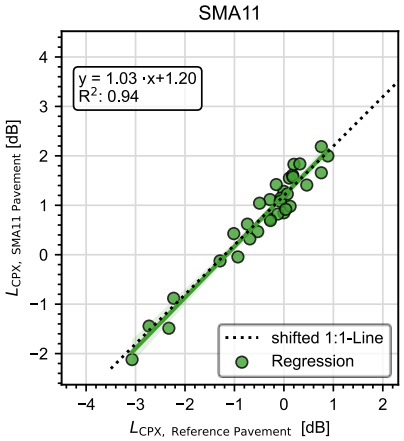
Parameter	ISO 10844:1994	ISO 10844:2014
Maximum chipping size	8 mm with allowable limits [6.3-10 mm]	8 mm with allowable limits [6.3-10 mm]
Maximum void content	Average of cores ≤ 8 %; no core > 10 %	-
Macrotexture (MTD or MPD)	MTD ≥ 0.4 mm	MPD = 0.5 mm ± 0.2 mm
Absorption coefficient α	α < 10 % for average of maximum reached in the area 400 – 800 Hz and in the area 800 – 1600 Hz	α < 8 % for any third octave band between 315 and 1600 Hz for driving lane; α < 10 % for propagation area

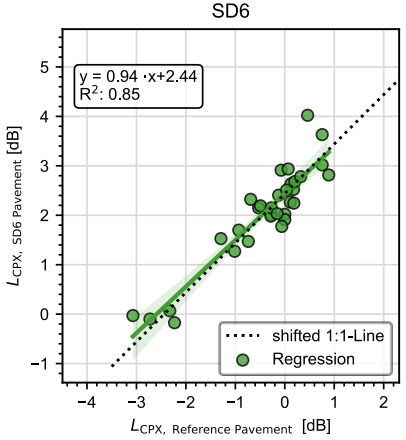
Representativity of tyre label

Is a quiet tyre quiet on all surfaces?

→ Yes, but minor rank changes are possible







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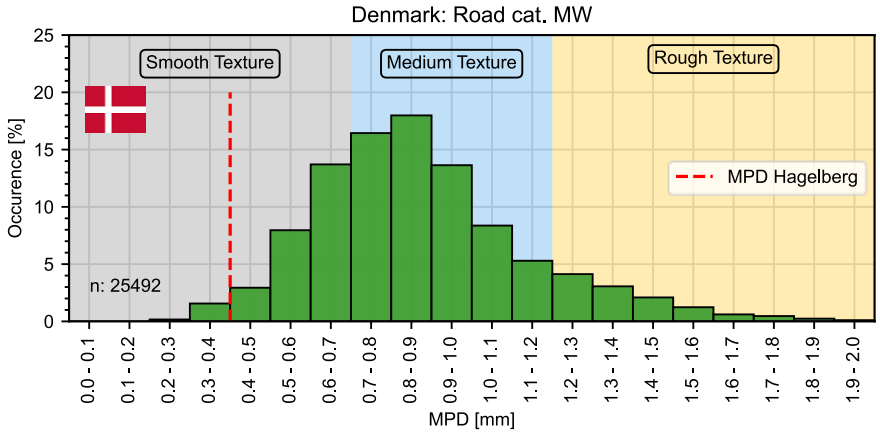
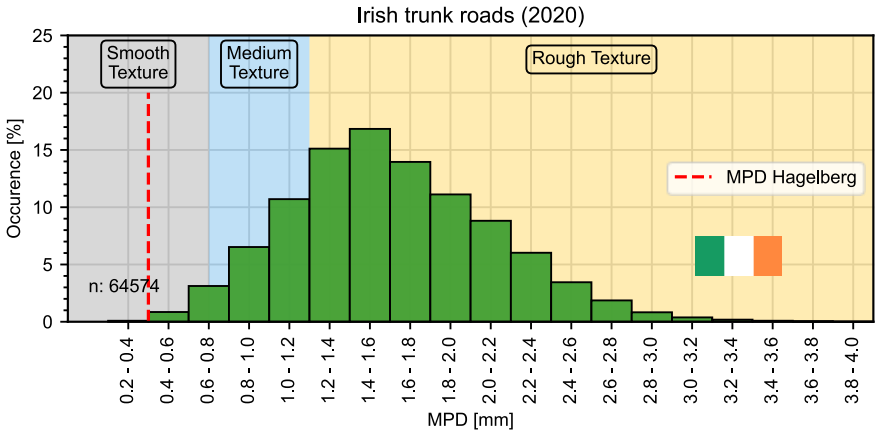
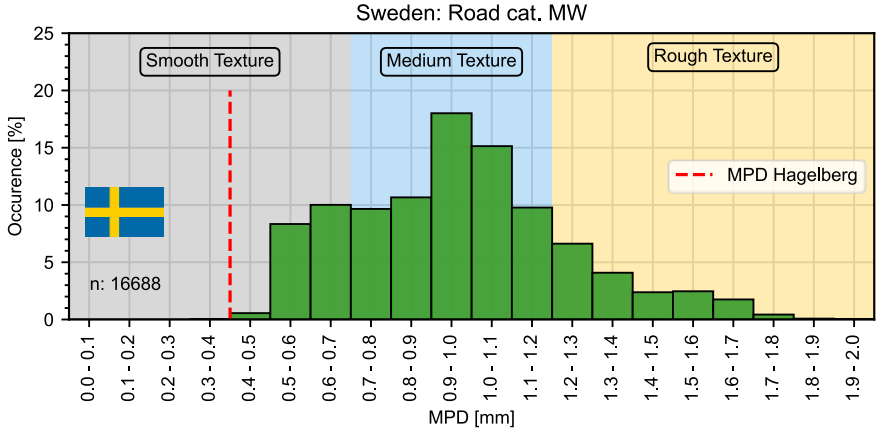
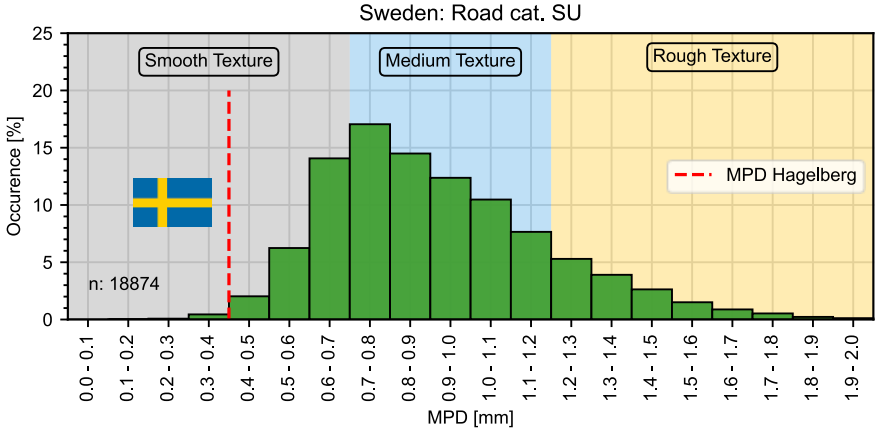
Roughness of Real-World surfaces (selection)









✓ Solution:

- Quieter tyres can unfold their potential on large parts of the European road network.
- Consider choosing "smooth" to "medium" textured road surfaces as a standard road surface on the road net-work in order to benefit from quieter tyres and its future potential. Also, with benefits for rolling resistance.
- Avoid "rough" surfaces (asphalts or surface dressings with aggegate sizes >= 14 mm) where residence live
- Smooth surfaces are best in combination with low noise tyres

Increasing the market share of quieter tyres

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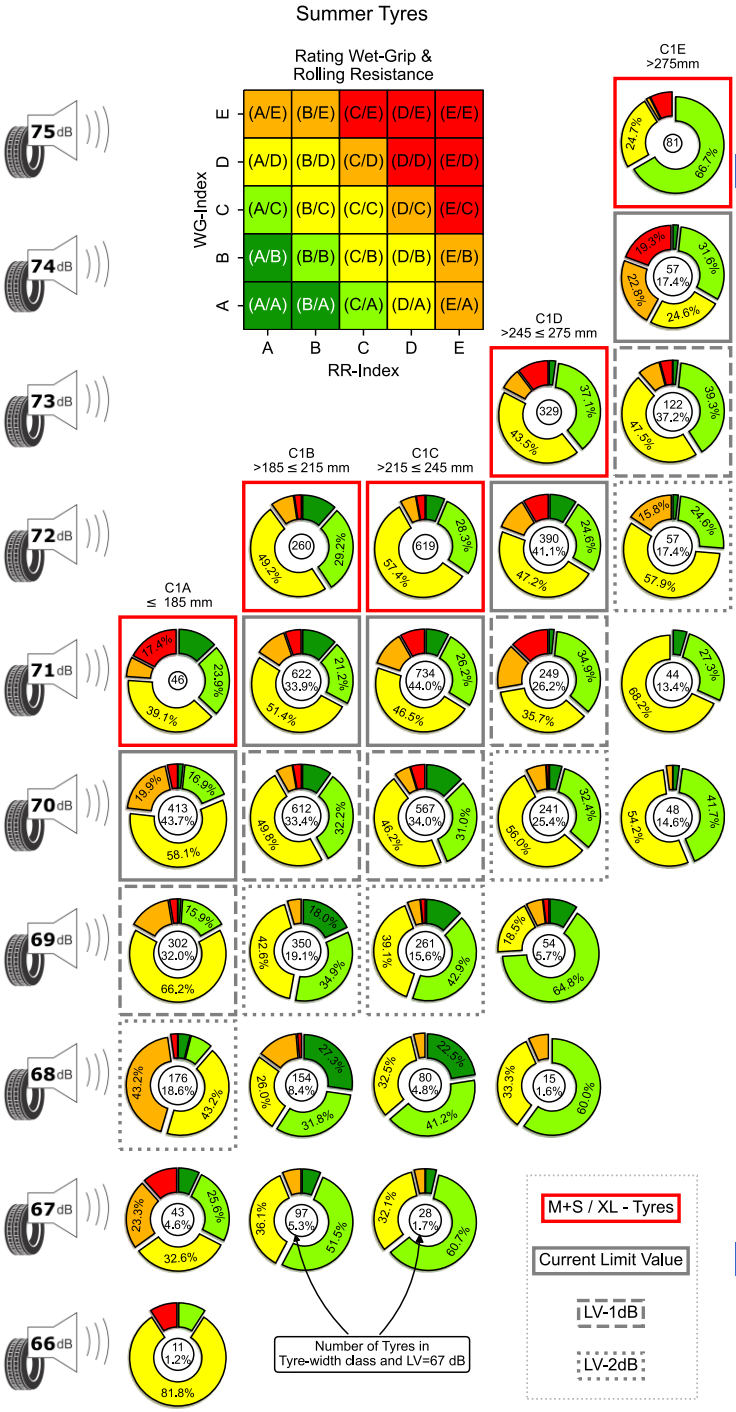
What tyres are on the market?

- Target conflicts between multiple categories? → Analysis of swiss database of tyres.
- Majority tyres are labelled close to the Limit Value (red boxes)
- Share of top performing (green colors) tyres is increasing with lower noise label values.

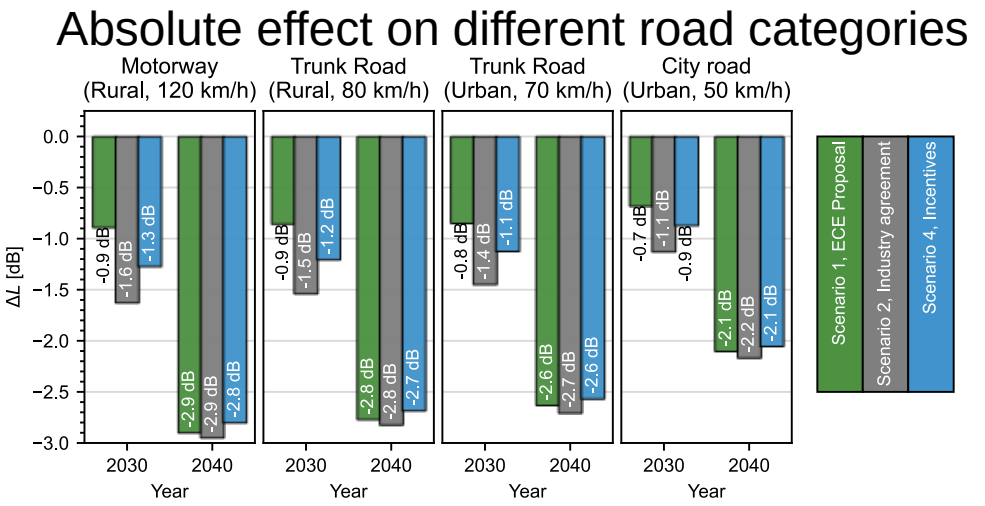


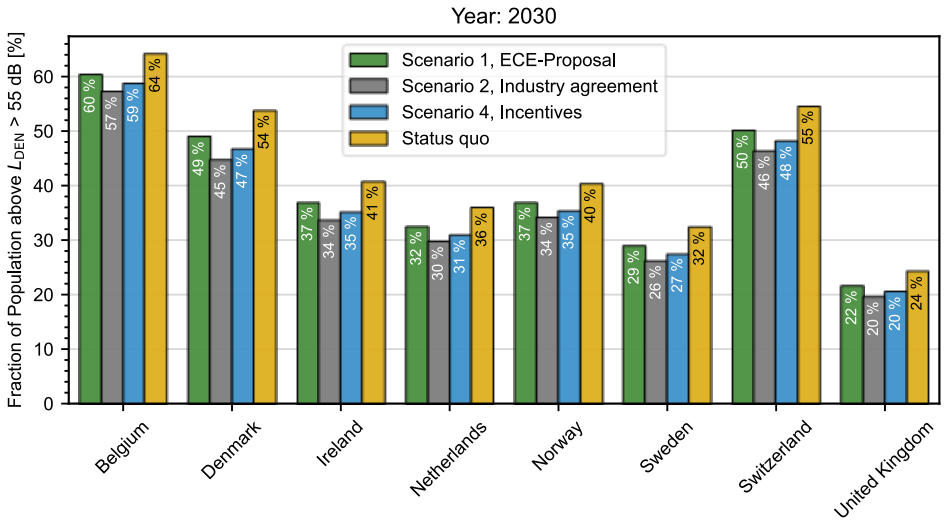
Scenarios for proliferation of quieter tyres

Scenario Name	Short description
Reference (Status quo)	Defined in 2009/661/EC, status quo, business as usual
Scenario 1, Baseline ECE Proposal	ECE Proposal 2022
Scenario 2, Industry agreement	Output-oriented noise levels average for tyres
Scenario 3, Subsidies for tyre manufacturers	Subsidies for tyre manufacturers to produce tyres with LV-3 (LV = noise limit value)
Scenario 4, Consumer incentives	Potential incentives to consumers buying class A tyre (LV-3 tyre)

Effect of scenarios

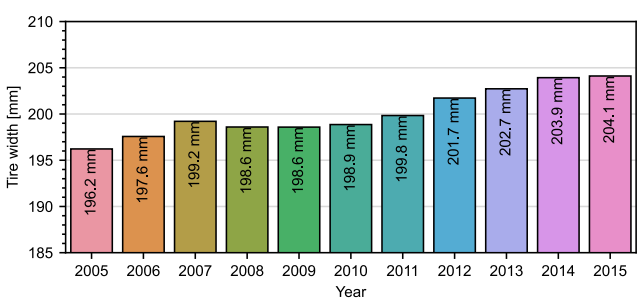
- High reduction potential for all scenarios (effects of up to 3 dB) are possible
- For some countries, ca. 10% of the population can be protected from harmful noise





Current market trends

- EV: Strong increase (Ban of CO_2 emitting cars by 2035)
- Tendency to heavier vehicles (SUV:s)
- Tendency to wider tyres
- Lower speed limits



Data: Grunder, S., Touring Club Switzerland (TCS), 2017, Entwicklung der PKW-Lärm-Emissionen bei der Zulassung Analyse der Stand- und Vorbeifahrtmessung der Jahre 2005 bis 2015

Data: Grunder, S., Touring Club Switzerlan (TCS) in German, 2017, Entwicklung der PKW-Lärm-Emissionen bei der Zulassung Analyse der Stand- und Vorbeifahrtmessung der Jahre 2005 bis 2015, https://www.bafu.admin.ch/dam/bafu/de/dokumente/laerm/externe-studien-berichte/entwicklung-der-pkw-laerm-emissionen-bei-der-zulassung.pdf.download.pdf/La%CC%88rmstudie_TCS_SMNA_2016_20170718.pdf

How to increase market share of quieter tyres

Act as early as possible (increasing electro mobility trend)

Industry agreement and *consumer incentives* are effective measures

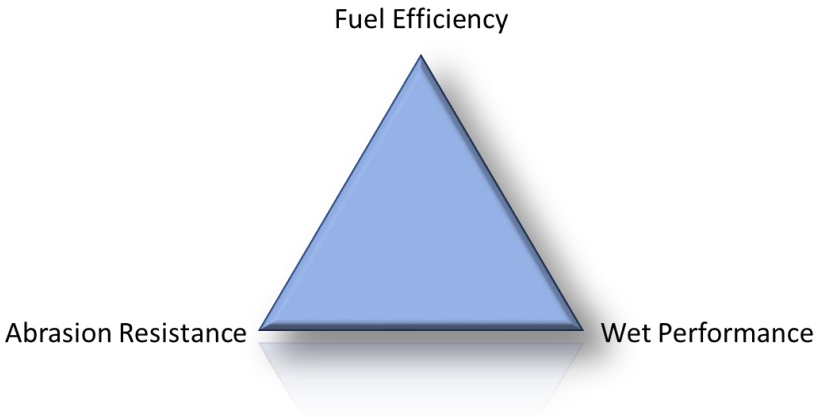
Raise awareness for the noise problem in the population

Consider support of consumer organisations to promote quieter tyres

Investigate and test measures for a possible implementation of *consumer incentives* to buy AAA-Tyres

Implement use of RFID systems to detect and encourage the use of low noise tyres in traffic

Impediments for tyre-manufacturers, or how to construct a low noise tyre.



- Optimization of one tyre performance parameter has always an impact on other parameters.
- Target conflicts between safety (wet grip) and noise according to ETRTO (European Tyre and Rim Technical Organisation) and ACEA (European automobile manufacturers association)

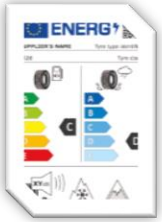
Impediments: Conclusions

- Tyre prototypes: 3 prototypes have been constructed within this project. However, trade-offs between noise and wet grip have been found. Compromises needed, without sacrificing too much of other parameters. → Typical in product development.
- However, empirical market data analysis has shown, that AAA-Tyres are already on the market.
- Tyre wear: Future label parameter? → Sustainability

Conclusions

Conclusions:
Regarding the European tyre label

- **European tyre label is important information tool for consumers**
- **Noise is currently not a decisive purchase criterion for consumers**
- **standard uncertainty of between 1.4 and 2.0 dB**
  → labelling procedure in its current form is far from optimal.
- **Measurement uncertainty can be halved** if the improvements proposed by STEER are implemented now (see recommendations).



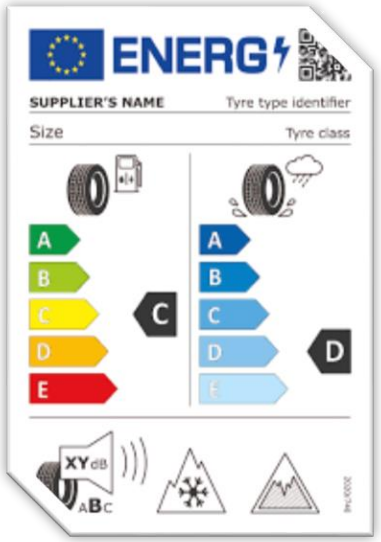
Recommendations: Regarding the European tyre label

Urgent need for improvements of the current labelling procedure

- Implement a **Reference Tyre Calibration Procedure**
- Implement a **procedure for testing entire tyre lines** on labaratory drum
- Implement **stricter requirements for test vehicles** (ground clearance and wheelbase)
- Improve **temperature correction** procedure

- Add **three legal noise classes** to label. (As before 2021)

→ ***EU Commission*** *(make additional requirements in 2020/740/EC)*



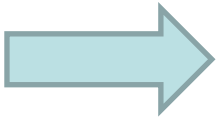
Conclusions: Regarding the impact of quieter tyres on European roads

- Efficiency for traffic noise reduction on European roads: the potential of quieter tyres can be almost fully achieved on large parts of the European road network.
- Reduced effectiveness only on roads with rough-textured surface: (max. chipping size ≥ 14 mm, some cement concrete surfaces),
- The combination of low noise tyres and low noise pavements is the best solution.

Recommendations: Regarding the impact of quieter tyres on European roads

NRA:

- Choose the optimal standard pavement of the road network
  - Consider choosing smooth to medium textured road surfaces (chipping size < 14 mm)
  - Avoid «rough-textured» road surfaces.
    → High noise exposure



NRA:s

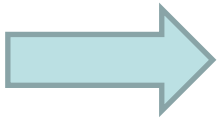
Conclusions: What to expect from quieter tyres in the future?

- Quiet tyres could make traffic on European roads up to 3 dB quieter in the future, but only if their market share can be increased with suitable measures.
- If no further measures are taken at this stage to increase the market share of quiet tyres, their potential can hardly be further exploited.
- In many European countries, considerable financial benefits can be expected from the avoidance of external costs. (example NL: annual benefit of about 25 million Euros)

Recommendations: Raise awareness and inform consumers

Raise awareness and inform the consumer about benefits

- **Raise awareness through information campaigns**: Labelling should be used as information tool to support consumers
- **Raise awareness of the noise problem among the general public**: Encourage consumer to opt for quieter products
- **When procuring road vehicles, consider requiring low-noise tyres**
- Use RFID systems to track vehicles with certain tyres.



NRA:s, environmental authorities, procurement authorities, national and local governments

Recommendations: Increasing the market share of quieter tyres

Implementation of measures

- Further investigate, specify and test the different scenarios
  - **Industry agreement / Consumer incentives**
- Combine scenarios with **additional incentives**
- **Benefits will likely offset the costs**
- **Act now to benefit from market trends → EV:s**
- **Act now to avoid jeopardising the benefits of new EU regulation**

EU Commission, NRA:s, National, regional and local governments

Planned dissemination

COMMUNICATION

- InterNoise22: Project STEER: Improving the EU Tyre Noise Label, (Schlatter)
- InterNoise22: The EU Tyre Noise Label: The problem with measuring the noise level of only a few of all tyre variants, (Sandberg)

- ICSV 2022: Project STEER: The effect of uncertainties in determining the EU Tyre Noise Label, (Goubert)

Planned targeted communications

Target groups

COMMUNICATION
- Recommendations for improved tyre labelling system → Standardization & regulatory bodies

COMMUNICATION
- Recommendations for improved representativity for countries with coarse road surfaces → Standardization & regulatory bodies

COMMUNICATION
- Evaluation of different measures enhancing market share of quiet tyres on European roads. → Administrations & political institutions; Manufacturers & related interest groups; Others

Discussion