



**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 overview

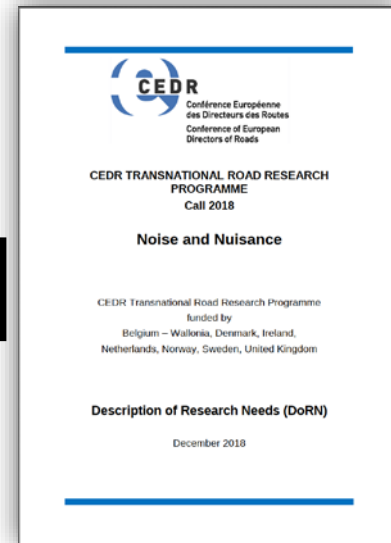
Table of content

1. Project overview
2. Introduction
3. Review of current label
4. Reproducibility
5. Representativity
6. Increasing the market share
7. Impediments
8. Conclusions & Recommendations

Requirements from tender document

Expected Outputs

- Investigations of the correlation between labelled values and real emission values on typical European road surfaces
- Recommendations for improvement of the tyre labelling system to obtain an acceptable correlation between labelled values and measured values on actual road surfaces both for passenger cars and trucks
- Analysis of the impediments for tyre manufacturers to produce quieter tyres (cost factors, technical constraints)
- Analysis of the effectiveness of different strategies/scenarios for the proliferation of quieter tyres by promoting it to car owners (e.g. campaigns, financial incentives, green deals) and how new technology will influence this.
- Interpretation of existing business case analyses from NRAs that have quantified the benefits of realistic scenarios for a successful tyre labelling system, in terms of for example health benefits, avoided costs for noise mitigation, and in the light of the WHO's Environmental Noise Guidelines for the European Region.
- Analysis of the short-term benefits of noise reduction to 2030 due to the impact of Regulation 661/2009 but also an analysis of the possible benefits of implementing a stricter low noise tyre regime

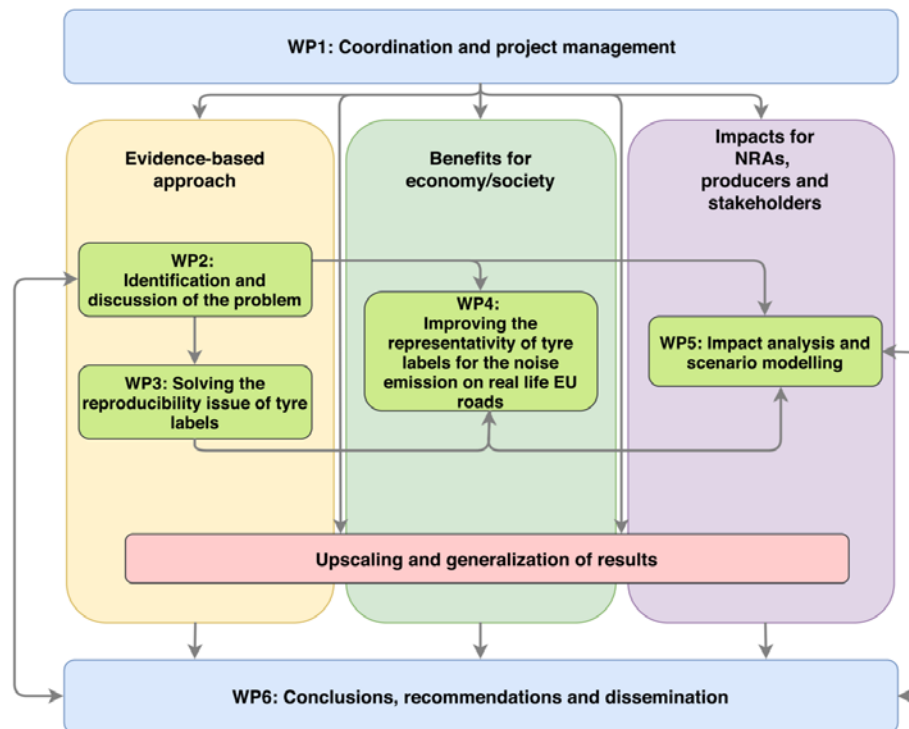


STEER: CEDR Transnational Research Programme – Call 2018 Noise and Nuisance

Project overview

STEER project structure

(STrengthening the Effect of quieter tyres on European Roads)



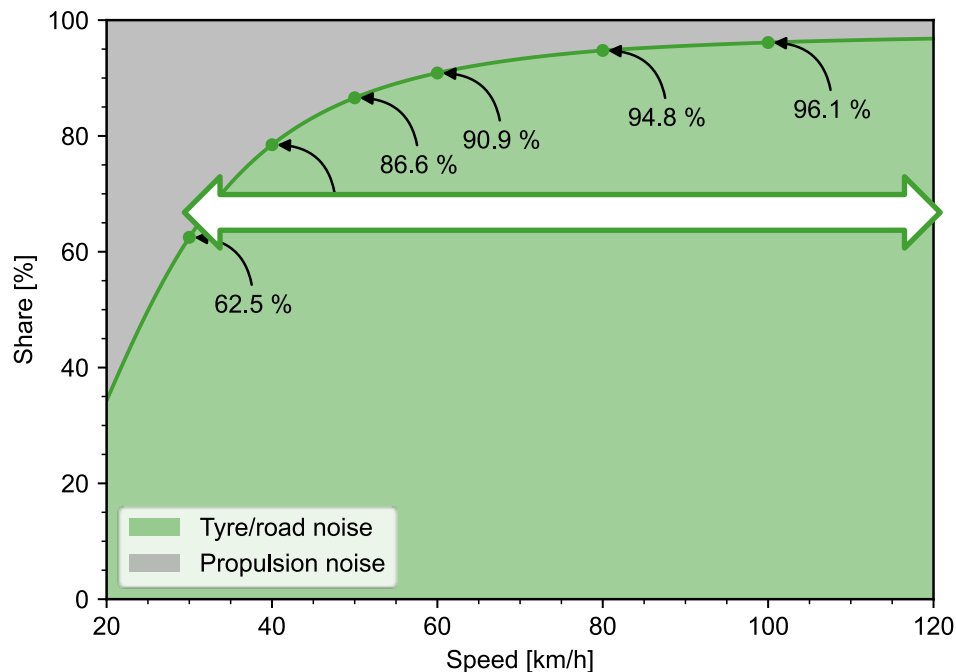
STEER: CEDR Transnational Research Programme – Call 2018 Noise and Nuisance

Partner



Introduction

Where tyre/road noise dominates..



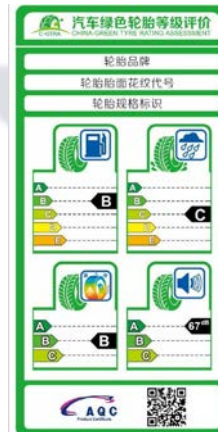
..are quieter tyres potentially effective

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

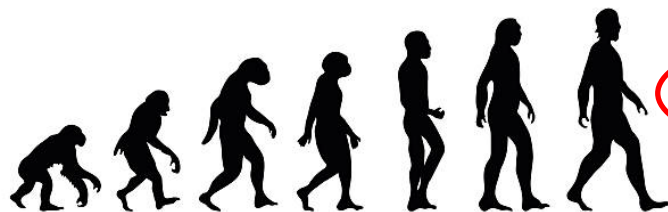
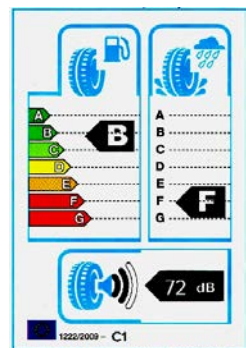
Quieter tyres potentially effective on highways and in cities (>30 km/h)

We are not alone

| Japan | South Korea | China | Indian | Brasil |
|----------------|----------------|----------|----------------|-----------|
| mandatory | mandatory | optional | (proposal) | mandatory |
| C1 only | C1 only | | | C1 only |
| No noise label | No noise label | | No noise label | |

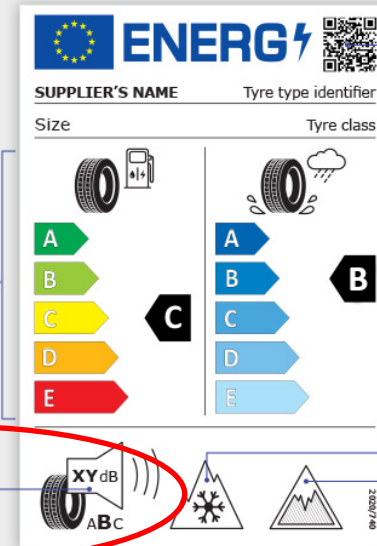


Evolution of the European tyre label



Rolling resistance (A to E)

External Noise (A to C)

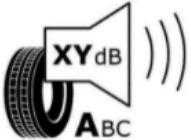
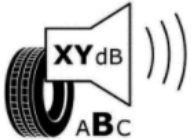
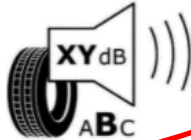


QR code linking to the European Product Registry for Energy Labelling (EPREL)

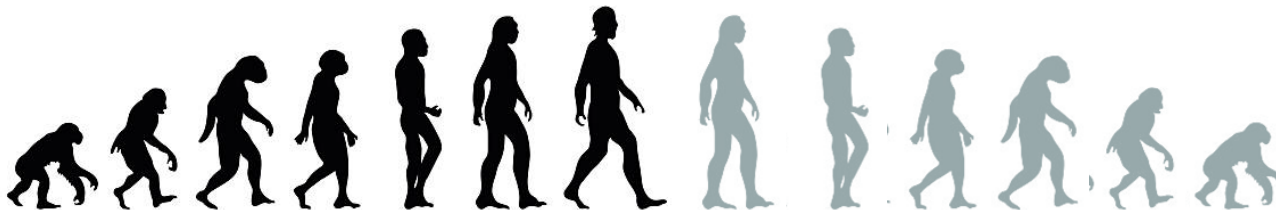
Wet grip (A to E)

Optional pictogram to cover snow grip for winter tyres and/or ice grip for Nordic winter tyres

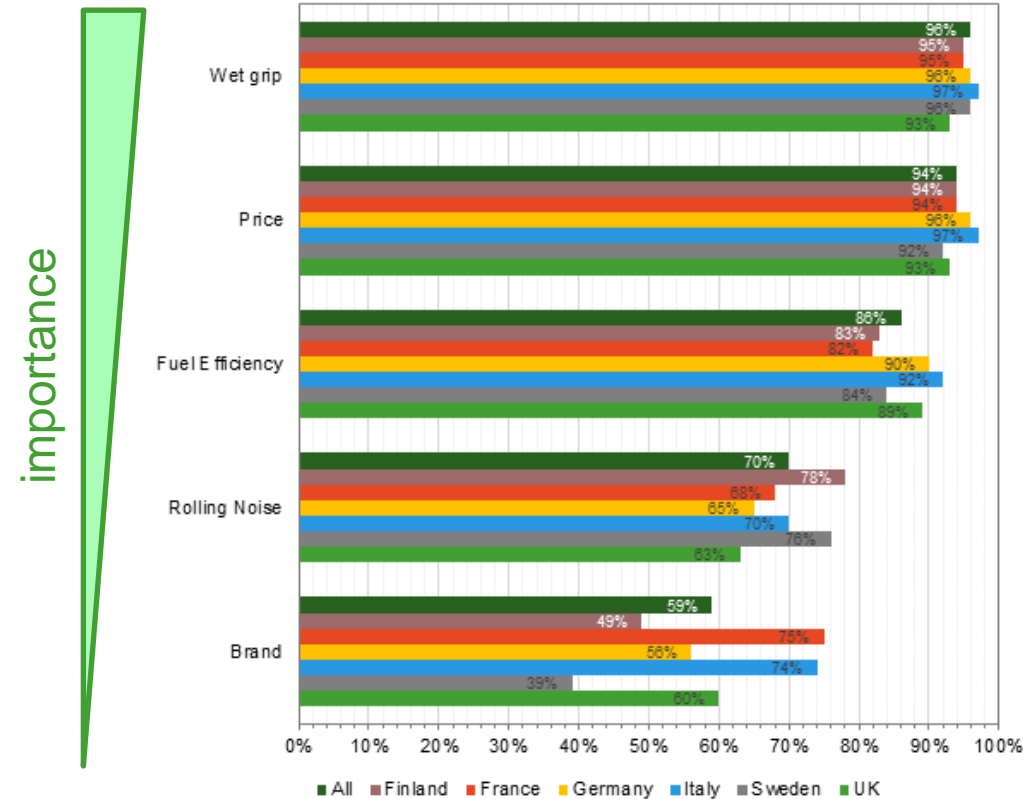
Noise label and label classes

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

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



Current status – importance of aspect



Importance of aspect
(purchase criterion):

- “Price” high up
- “Rolling Noise” further down

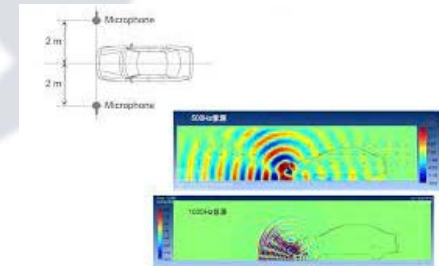
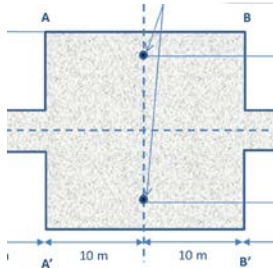
Source of data: Final Report--Review study on the Regulation (EC) No 1222 / 2009 on the labelling of tyres. Prepared by Viegand Maagøe A / S 1–152, Copenhagen, Denmark. (URL: https://ec.europa.eu/energy/sites/ener/files/documents/Study%20in%20support%20of%20the%20Review%20of%20the%20Tyre%20Labelling%20Regulation_final.pdf).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

Review of current label

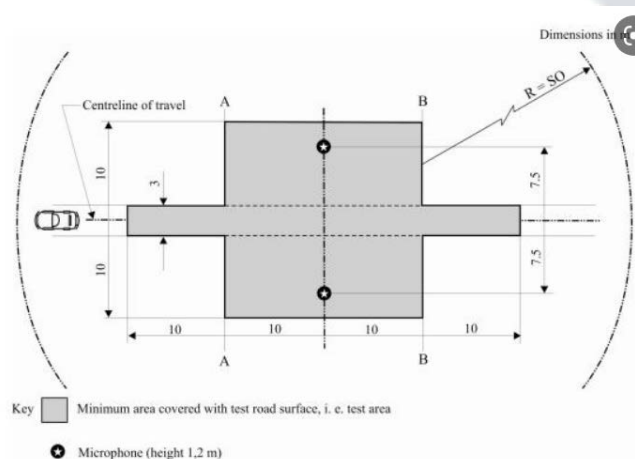
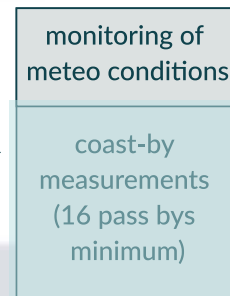
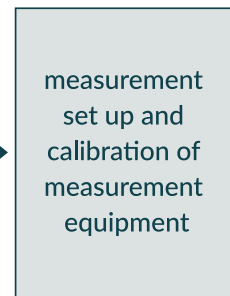
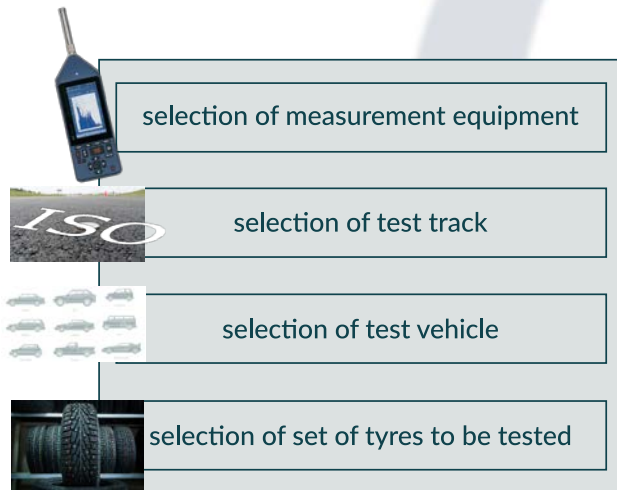
Overview of noise testing procedures for vehicles

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 |

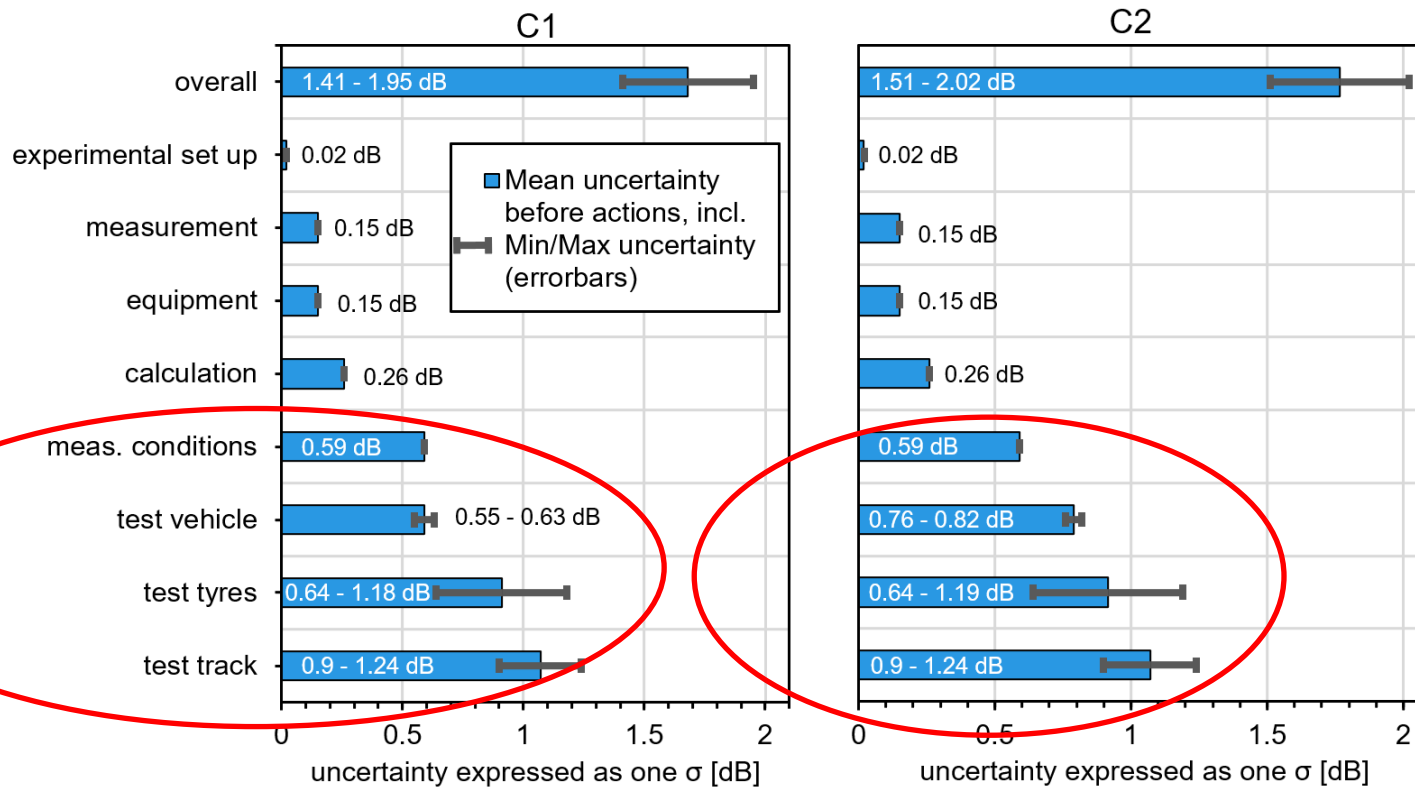


Tyre noise labelling procedure



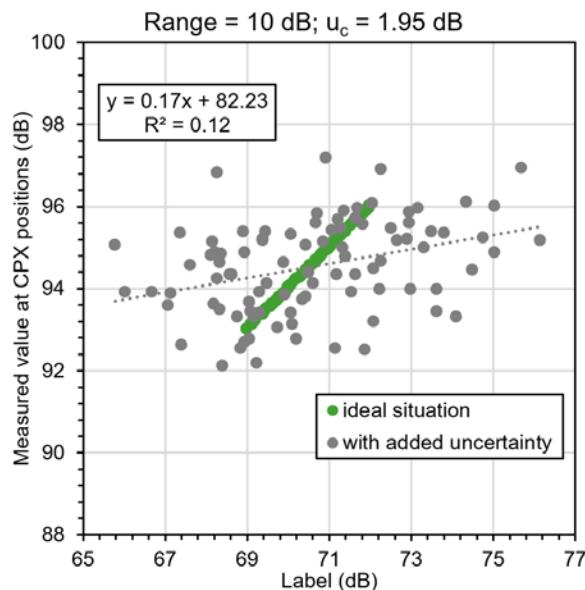
Coast-by (n=16)
at 70-90 km/h

Uncertainty of the current procedure

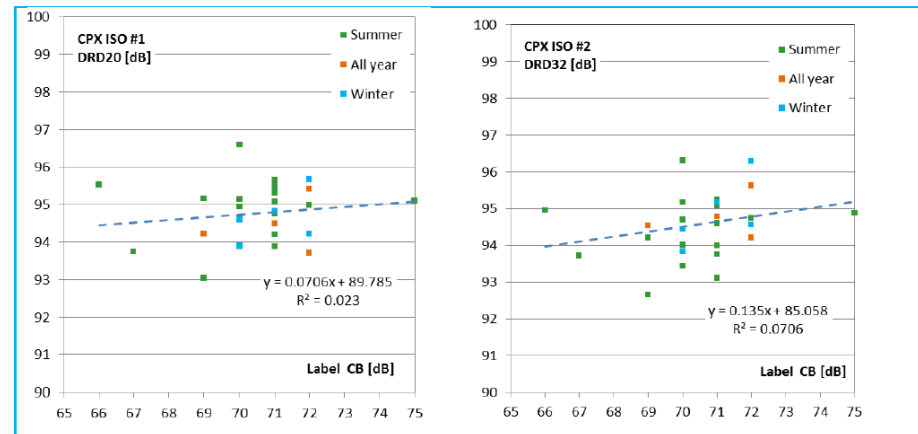


Implication of uncertainty of noise label

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

Uncertainty of current procedure

- Overall uncertainty compared with other measurement principles

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


 Level of standardization

→ Uncertainty of current labelling procedure too high

Important uncertainty contributions



meas. conditions

0.59 dB



test vehicle

0.55 - 0.63 dB



test tyres

0.64 - 1.18 dB



test track

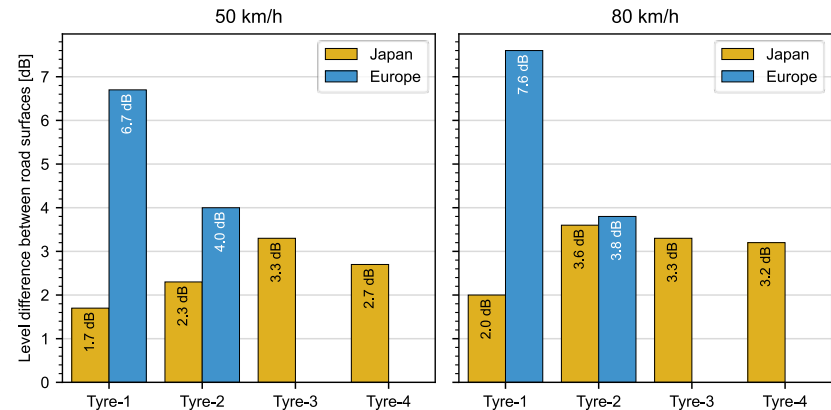
0.9 - 1.24 dB

0 0.5 1 1.5 2
uncertainty expressed as one σ [dB]

■ Mean uncertainty
before actions, incl.
■ Min/Max uncertainty
(errorbars)

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 tracks



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 authors.

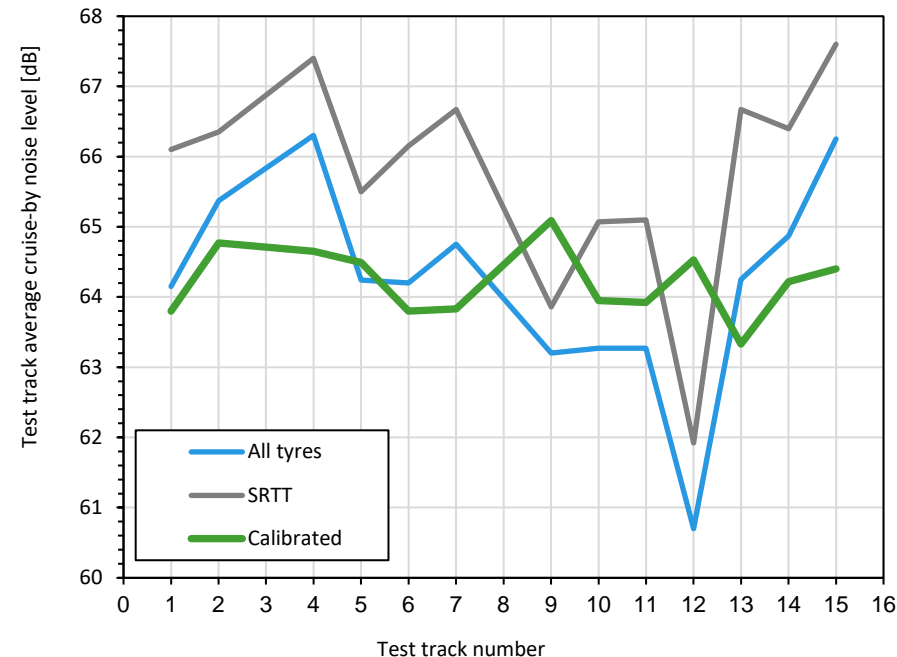
→ Site to site variation of up to 6 dB



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)

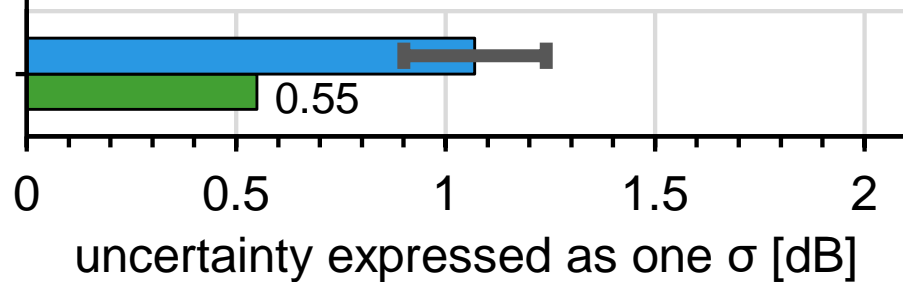


Solution: Reference tyre calibration procedure



IMPROVEMENT

test track



→ Uncertainty contribution can be halved!

Testing entire tyre lines

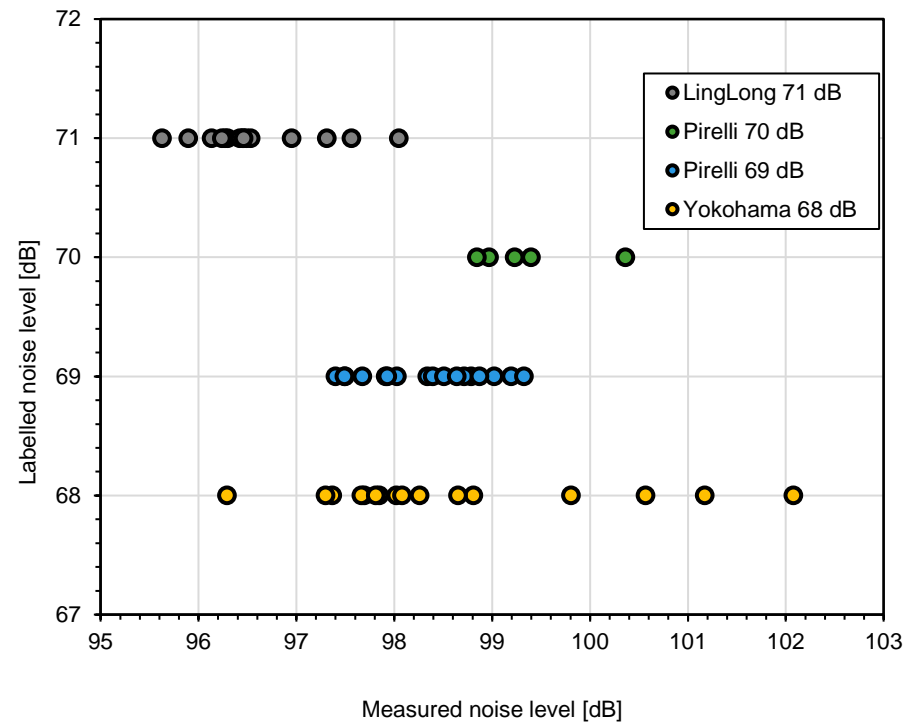
What is a so called «tyre line»?

- 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.

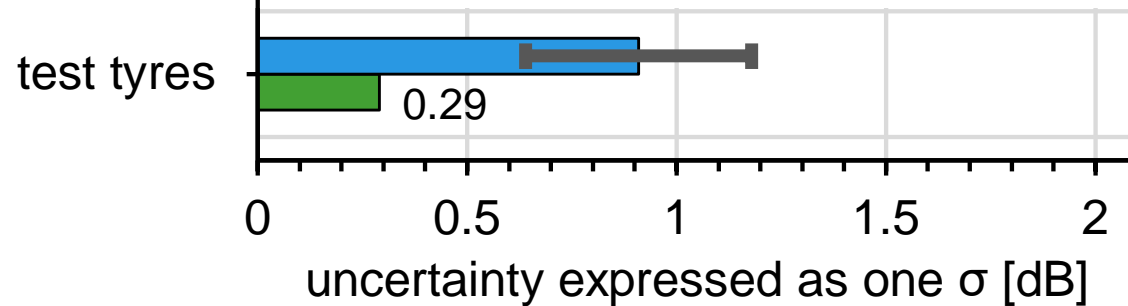




Solution: Implement indoor testing on laboratory drum



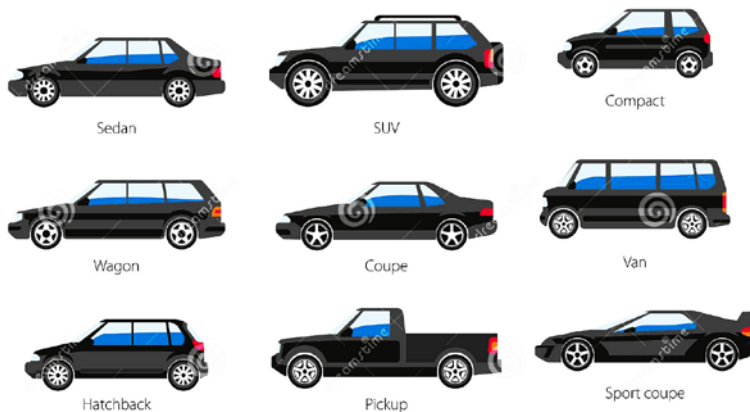
IMPROVEMENT



→ 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 appropri. 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)

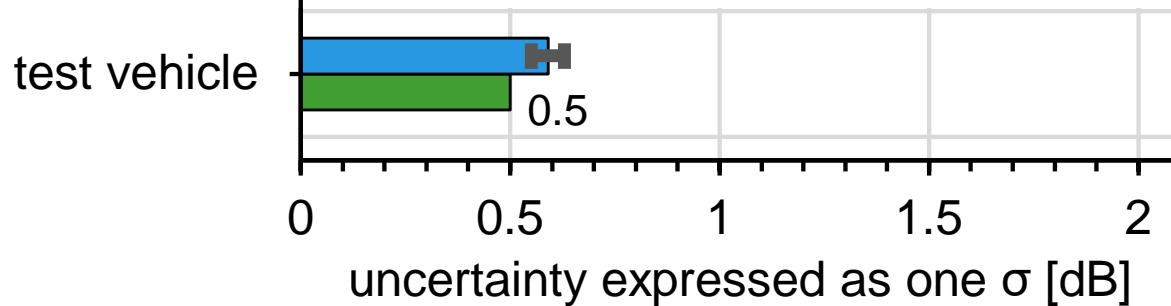


Solution:

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 worthwhile.

Solution: Implement stricter requirement for test vehicle



IMPROVEMENT

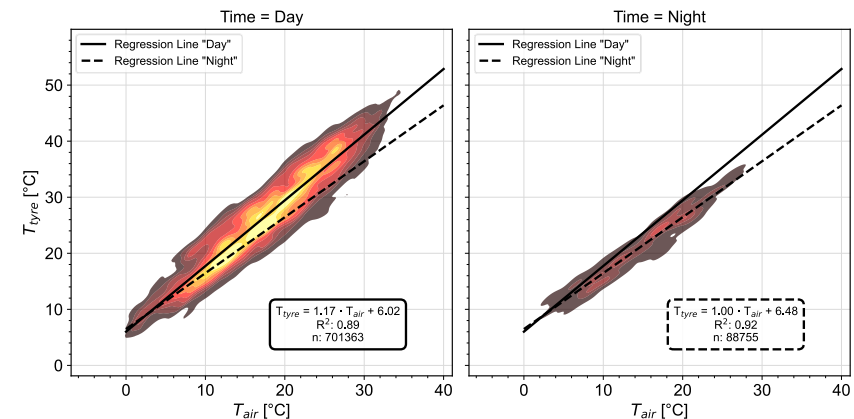
- Uncertainty contribution from vehicle only slightly reduced!
- May only be solved in the long-run (see longterm vision of tyre noise table)

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

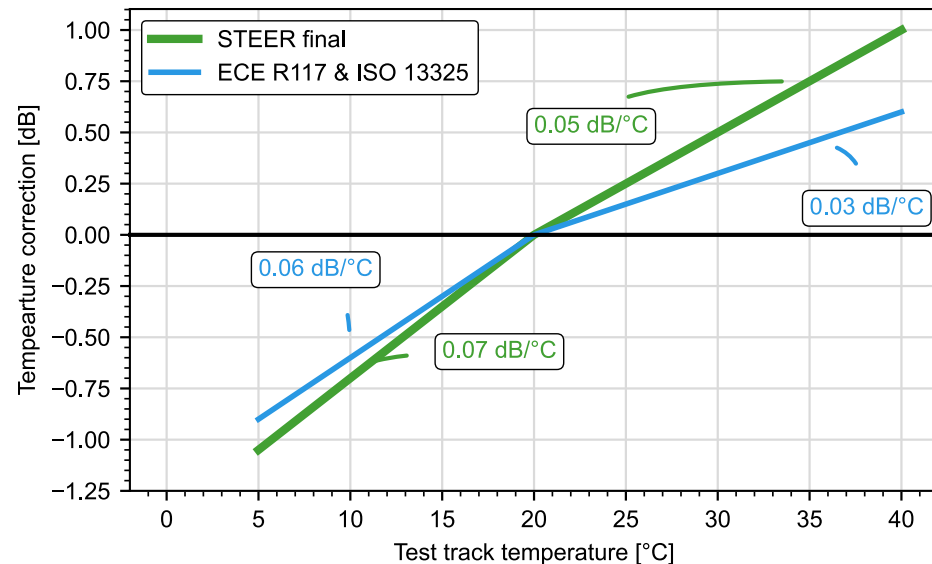
- Current correction procedure seems to favor correction at high temperatures.

Recommendation:

- Update coefficients (low-hanging fruits)

Suggestion (long-term):

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



Solution:

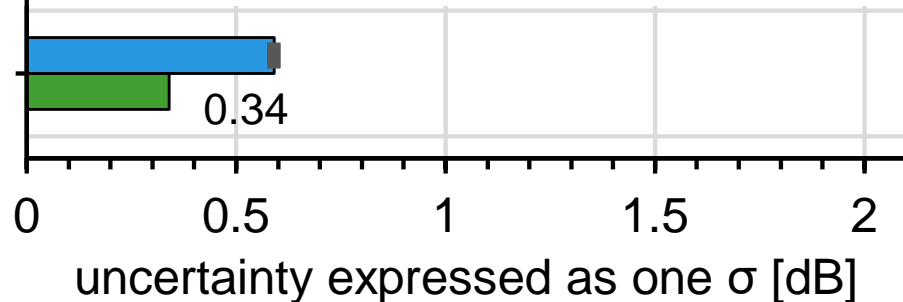


Implement indoor testing on laboratory drum



IMPROVEMENT

meas. conditions



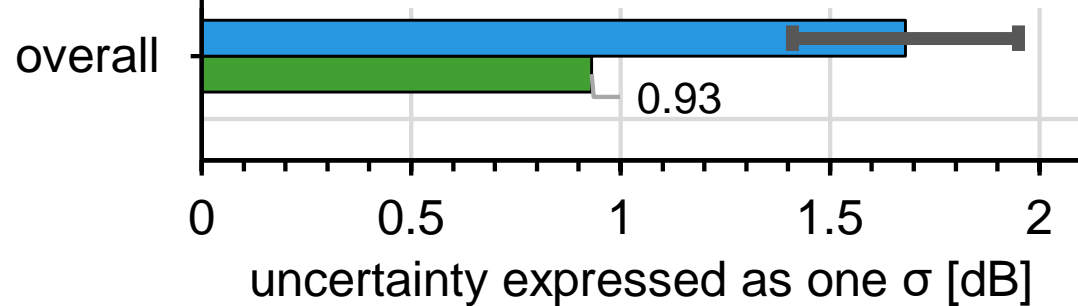
- Uncertainty contribution can be reduced by a third!
- constitutes a «low-hanging fruit», as it is easy to improve



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

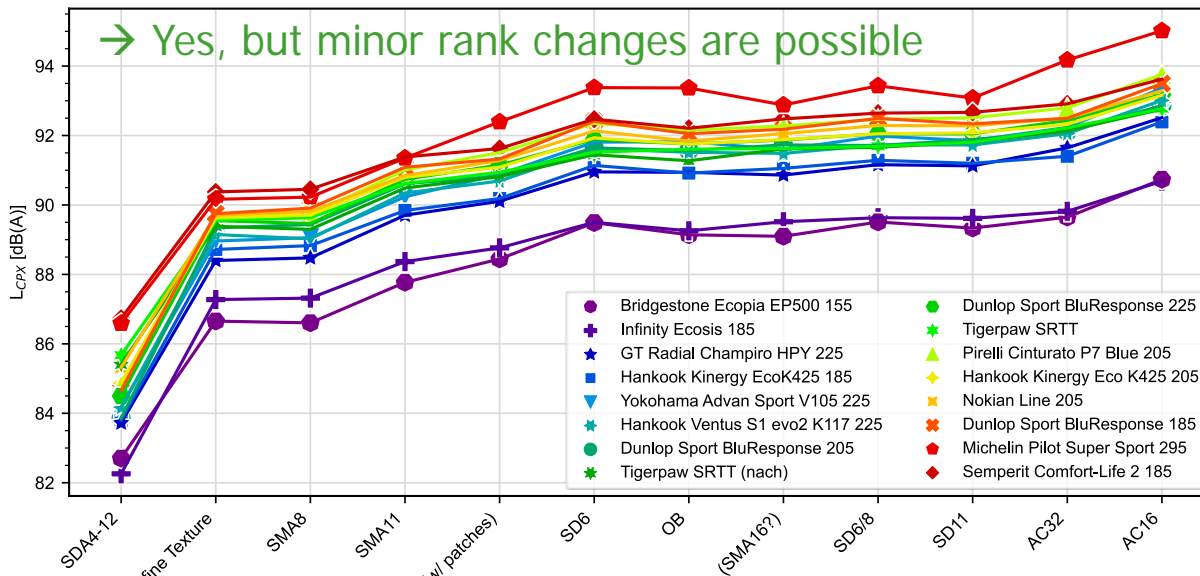


| Parameter | ISO 10844:1994 | ISO 10844:2014 |
|---------------------------------|--|---|
| Maximum chipping size | 8 mm with allowable limits [6.3-10 mm] | 8 mm with allowable limits [6.3-10 mm] |
| Maximum void content | Average of cores $\leq 8 \%$; no core $> 10 \%$ | - |
| Macrotexture (MTD or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

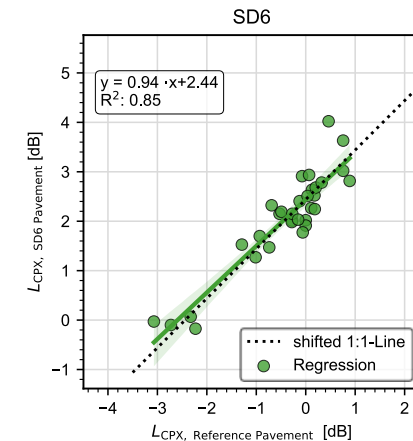
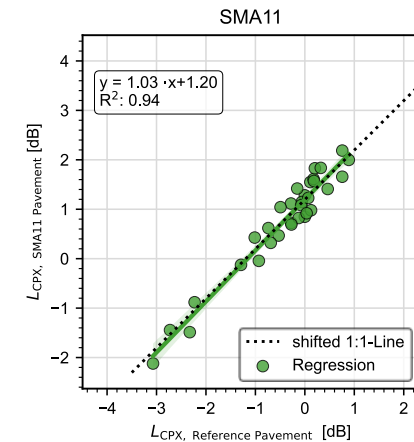
Representativity of tyre label

Is a quiet tyre quiet on all surfaces?

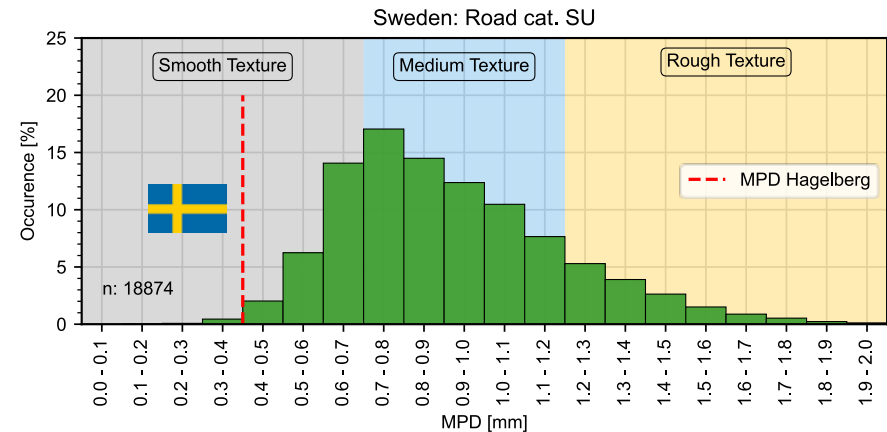
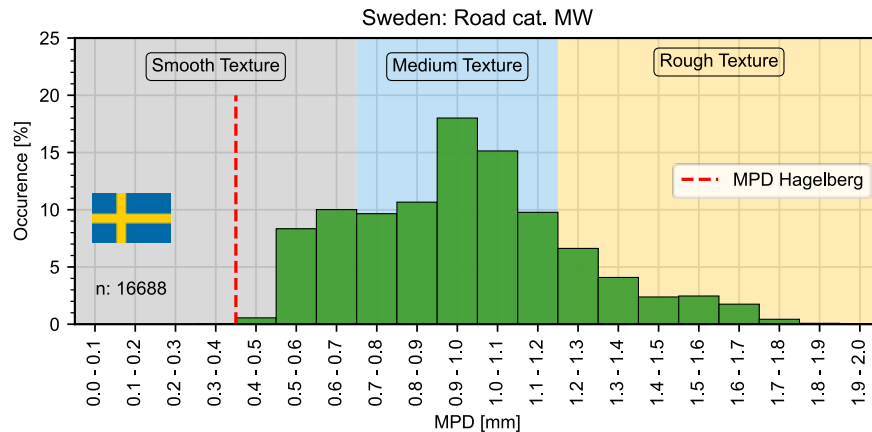
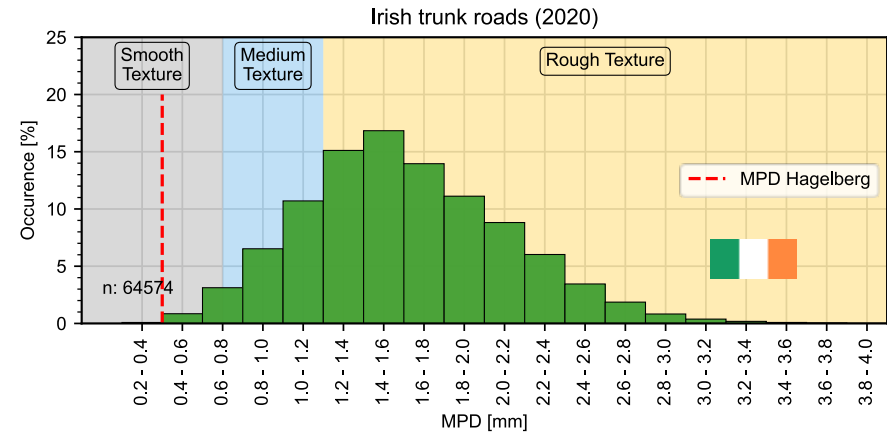
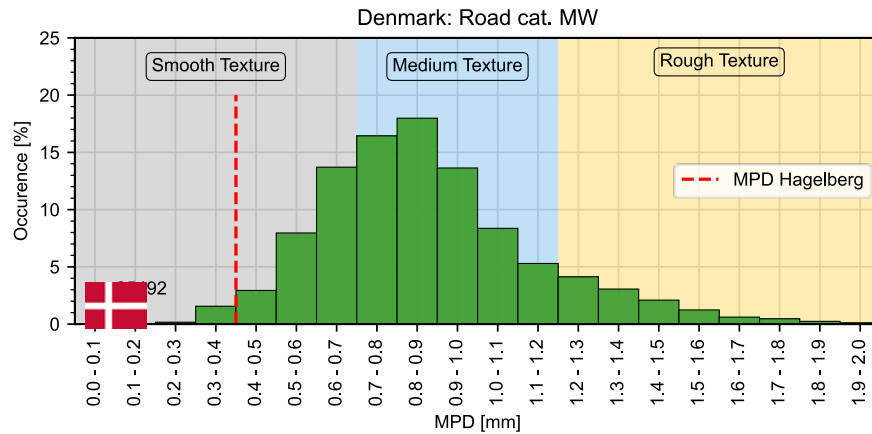
→ Yes, but minor rank changes are possible



noise level / roughness



Roughness of Real-World surfaces (selection)





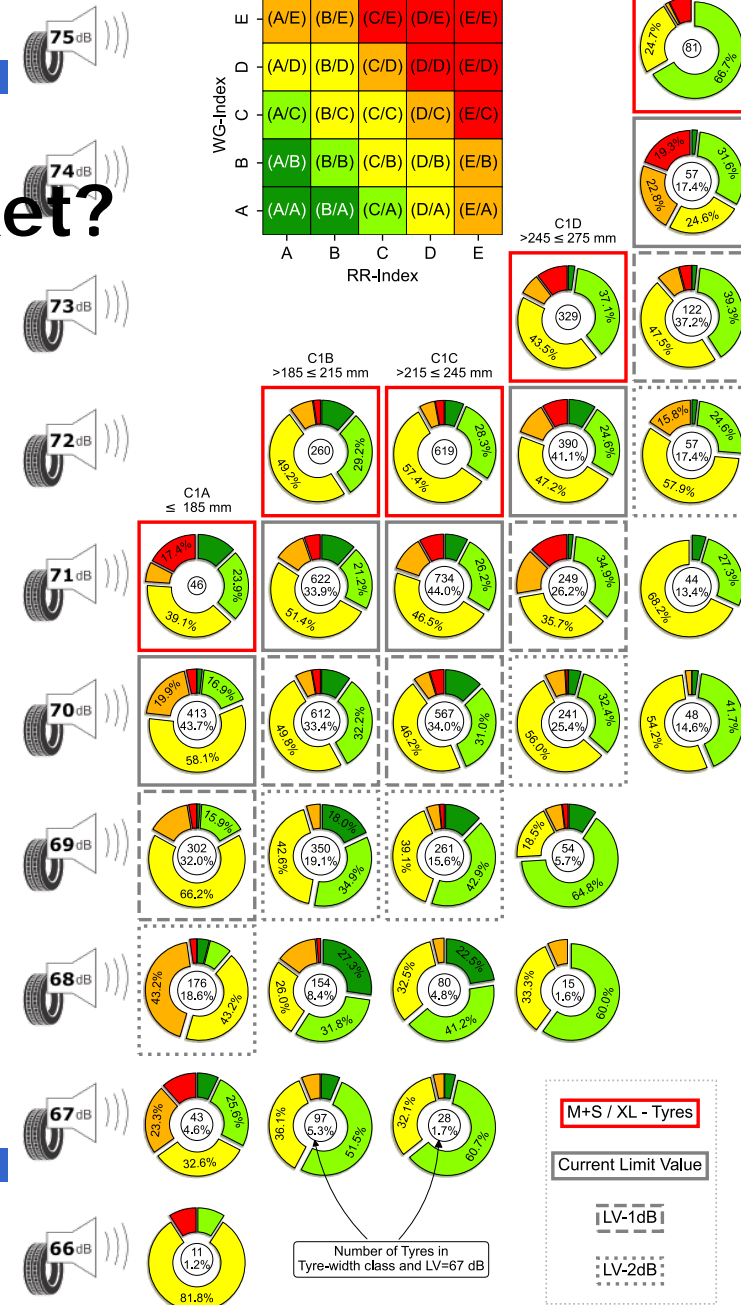
Solution:

- 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 aggregate sizes ≥ 14 mm) where residence live
- Smooth surfaces are best in combination with low noise tyres

Increasing the market share of quieter tyres

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.

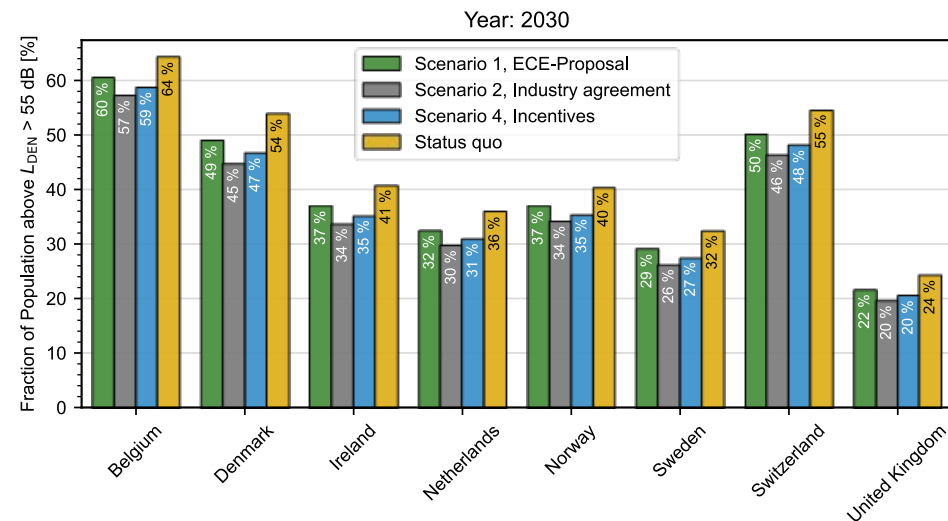
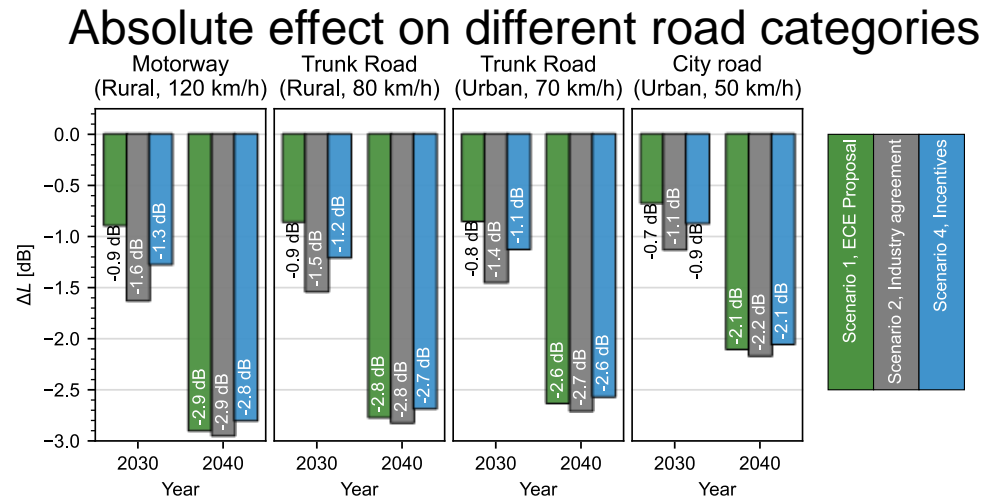


Scenarios for proliferation of quieter tyres

| 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





How to increase market share of quieter tyres



Act as early as possible
(increasing electro mobility
trend)



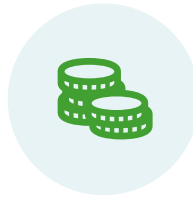
Industry agreement and
consumer incentives are
effective measures



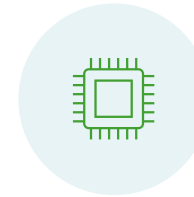
Raise awareness for the
noise problem in the
population



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

Current market trends



EV: Strong increase (Ban of CO₂ emitting cars by 2035)



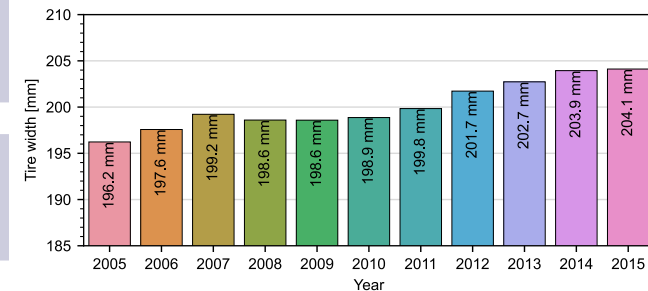
Tendency to heavier vehicles (SUV:s)



Tendency to wider tyres



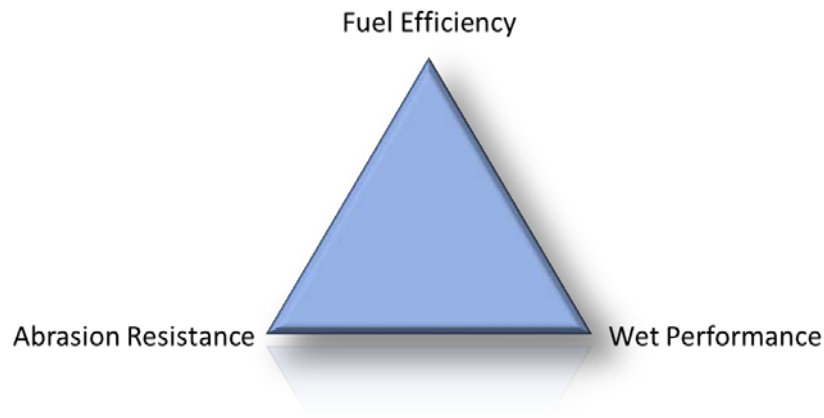
Lower speed limits



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, 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

Data: Grunder, S., Touring Club Switzerland (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

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

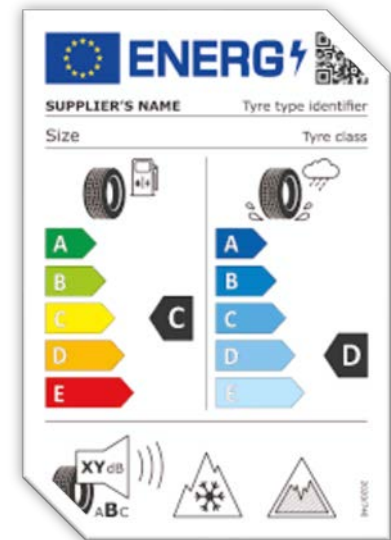
- European tyre label is important information tool for consumers
- Noise is currently not a decisive purchase criterion for consumers
- standard uncertainty of between 1.4 and 2.0 dB
→ labelling procedure in its current form is far from optimal.
- **Measurement uncertainty can be halved** if the improvements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



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
 - Avoid «rough-textured» road surfaces. → High noise exposure



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.



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**



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



COMMUNICATION

- Recommendations for improved representativity for countries with coarse road surfaces



COMMUNICATION

- Evaluation of different measures enhancing market share of quiet tyres on European roads.



**Thank you for your attention
... and the good
cooperation!!**

