Questions to
Study on sound level limits of M-and N-category vehicles
on TFVS-09-06 and TFVS-07-11

10th TFVS meeting

12. July 2022

JAPAN AUTOMOBILE STANDARDS INTERNATIONALIZATION CENTER

Background

Definition of Standard Scenario			
Road surface	Traffic flow	Vehicle sound	Tyre sound

The standard scenario is being discussed.
Subgroup Crossmatrix is considering four key factors.
In order to confirm the key factors in the study by European Commission, there are some questions to clarity the detail conditions for calculation.

Definition of 1st Standard Scenario

TFVS-09-06 by subgroup Crossmatrix

Work Package	Status	Current status	Next Steps
Road Surfaces J. S. Boersma, RDW (NL)		• **Dense Asphalt Concrete (DAC)** is proposed as a good reference. • Data from CEDR study provided: MPD is an estimation, since it is difficult to find.	• Define stone size and used national road construction culture • Check if limited specifications are sufficient for ETRTO tyre models
Traffic Flow H. Steven, Consultant (GER)		• **Urban main street with 6 lanes (3 per direction)** proposed as reference • dataset of traffic load and vehicle speed provided.	• Further split into subcategories needed with other work packages (vehicle and tyre)
Vehicle Sound K. Neuhaus, OICA		• EU Market is proposed as a 1st reference. • Vehicle categories of Cnossos compared to categories of UN Reg. No. 51 • Input to define standard vehicle per category due to competition law missing (open exchange not possible).	• Work out a legal process-proposal, how to get input data for definition of standard vehicles • Contact data stakeholders • Reduce UN Reg. 51 categories with market penetration data
Tyre sound M. Steffan, ETRTO		• Input of standard vehicles for definition of standard tyres missing	• Waiting for standard vehicle definition

Standard Vehicle

- Difficult to define, legal process needed
- Complex data collection on association level
- Support needed for:
  - Market penetration data
  - In use data needed (age, annual milage)

Data input/interface

- Data format ?
- Spectral format?
- generate additional standardized data (compared to TA data)

Road surface

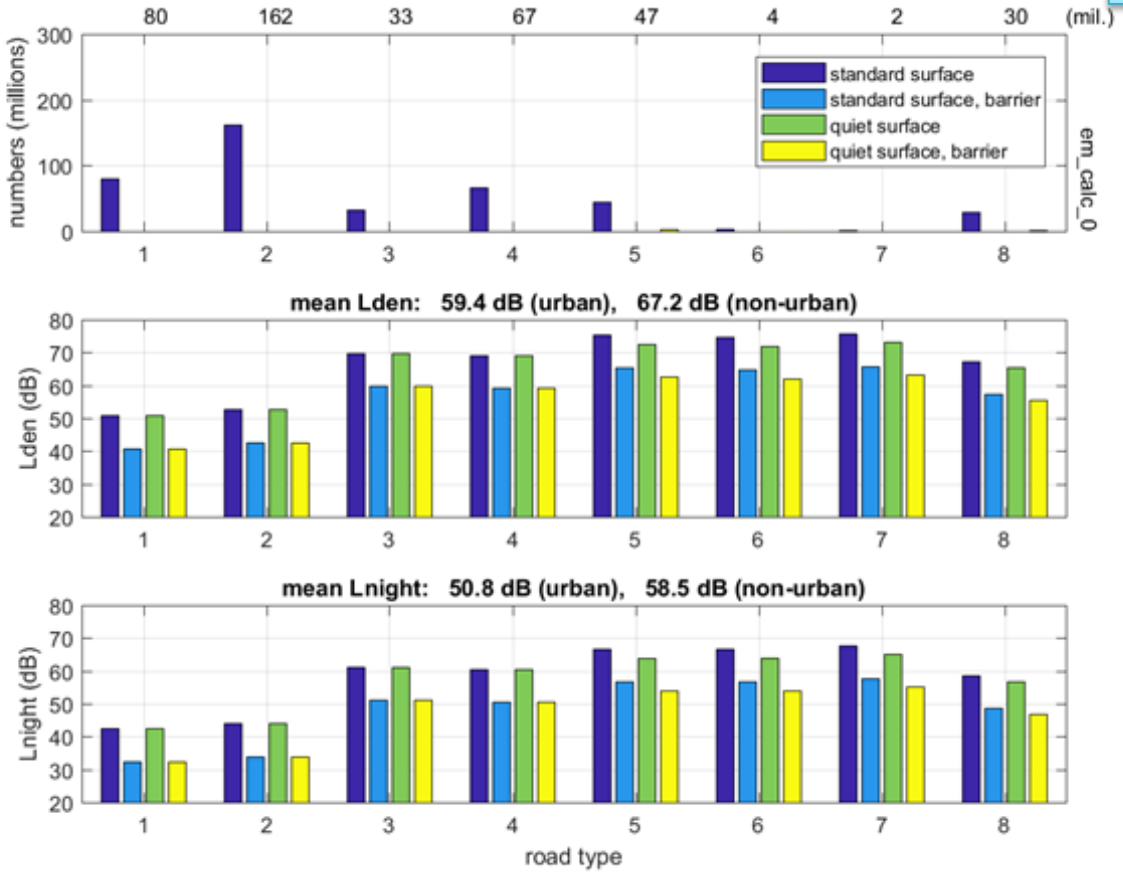
Definition of Standard Scenario			
Road surface	Traffic flow	Vehicle sound	Tyre sound

For each road type four subtypes are considered:

i. roads with a standard road surface,
ii. roads with a standard road surface and noise barriers (10 dB attenuation),
iii. roads with a quiet road surface,
iv. roads with a quiet road surface and noise barriers.

Question;
What is the standard road surface?
What is the quiet road surface?

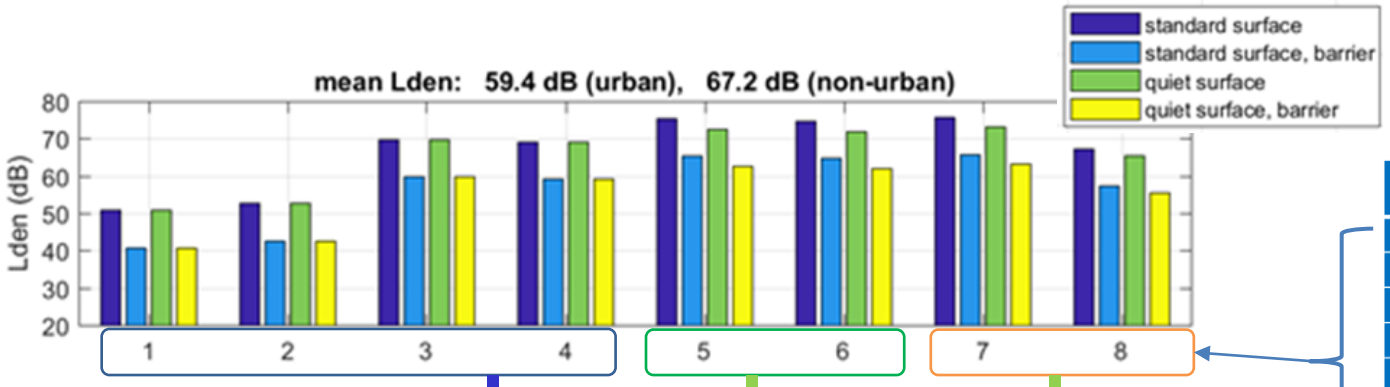
Fig26 @TFVS-09-20 Fig72 @TFVS-07-11



Information;
COMMISSION DIRECTIVE
(EU) 2015/996
— a virtual reference road surface, consisting of an average of dense asphalt concrete 0/11 and stone mastic asphalt 0/11, between 2 and 7 years old and in a representative maintenance condition

	Type	
1	Residential street, intermittent	Urban
2	Residential street, free	Urban
3	Main road, intermittent	Urban
4	Main road, free	Urban
5	Arterial road	Urban
6	Motorway	Urban
7	Motorway	Non-urban
8	Main road	Non-urban

Road surface



Definition of Standard Scenario			
Road surface	Traffic flow	Vehicle sound	Tyre sound

		Speed (kph) C1/C2/C3
1	Residential street, intermittent	30/30/30
2	Residential street, free	50/40/40
3	Main road, intermittent	50/40/40
4	Main road, free	50/50/50
5	Arterial road	80/70/70
6	Motorway	100/85/85
7	Motorway	115/85/85
8	Main road	80/80/80

Road surface

1=Dense asphalt concrete
2=Thin top layers
3=Porous asphalt
4=Double-layer porous asphalt
5=Double-layer porous asphalt fine

Road lengths

roads 2017-2020

1-2	3-4	5	6	7	8[67]	
965652	199796	94118	3824	34141	1517922	km inhabited road length
250	500	500	1000	50	20	inhabitants per km
0	0	4706	191	1707	75896	km barrier
0	0	4706	191	1707	75896	km quiet road length
1	1	2	2	3	3[68]	type quiet road surface

roads 2045

1-2	3-4	5	6	7	8	
965652	199796	94118	3824	34141	1517922	km inhabited road length
250	500	500	1000	50	20	inhabitants per km
0	0	4706	191	1707	75896	km barrier
0	0	4706	191	1707	75896	km quiet road length
1	1	2	2	3	3	type quiet road surface

Confirmation;
The road surfaces at road type 1 to 4 are kept standard surface, but not quiet surface.
The Correction coefficient of road surface (Table 46 @TFVS-07-11) are original and different from CNOSSO-EU.

Table 46 @TFVS-07-11

$$\Delta L_{W,\,surface} = s + t \cdot \log_{10}(v/v_{ref})$$

Vehicle category	coefficient	1	2	3	4	5
C1	s	0	-3.4	-1.4	-4.5	-6.5
	t	0	-2.5	-6.5	-3.0	-0.1
C2	s	0	-1.3	-3.1	-5.2	-5.3
	t	0	0.5	0.2	4.7	-0.8
C3	s	0	-1.3	-3.1	-5.2	-5.3
	t	0	0.5	0.2	4.7	-0.8

Traffic flow

Definition of Standard Scenario			
Road surface	Traffic flow	Vehicle sound	Tyre sound

Question;
Traffic flow is shown the table below, but what about distributions of vehicles in 24 hours?
for vehicle categories (C1/C2/C3
for time duration of day/evening/night to estimate Lden

It is about 78%/13%/9% for Day/Evening/Night

- light vehicles (C1),
- medium-heavy vehicles (C2),
- heavy vehicles (C3).

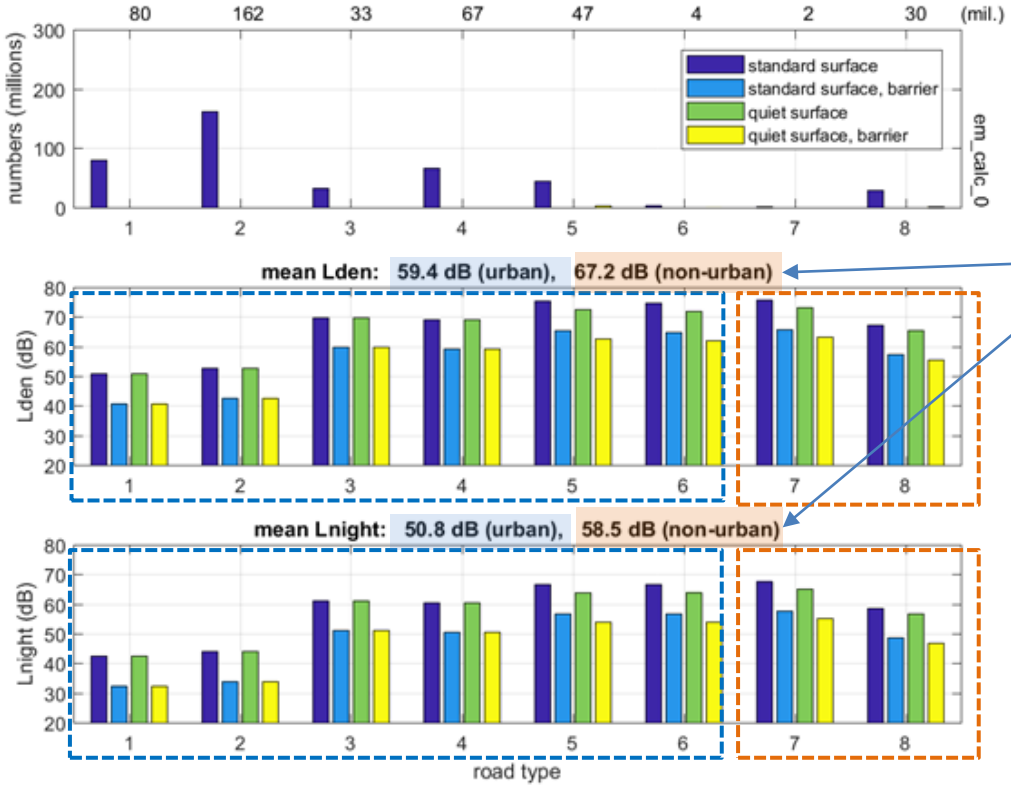
Table7 @TFVS-09-20 Table42 @TFVS-07-11

	Type		Vehicle flow Vehicles/24h	Speed (kph) C1/C2/C3
1	Residential street, intermittent	Urban	500	30/30/30
2	Residential street, free	Urban	500	50/40/40
3	Main road, intermittent	Urban	20000	50/40/40
4	Main road, free	Urban	20000	50/50/50
5	Arterial road	Urban	33700	80/70/70
6	Motorway	Urban	48500	100/85/85
7	Motorway	Non-urban	48500	115/85/85
8	Main road	Non-urban	16000	80/80/80

Traffic flow

Definition of Standard Scenario			
Road surface	Traffic flow	Vehicle sound	Tyre sound

Fig26 @TFVS-09-20 Fig72 @TFVS-07-11



A low percentage of quiet road surface is assumed for roads >= 50 km/h of around 5%, this is included in the calculation

Question;
How to calculate the mean value of Lden and Lnight with different road types?

	Type	
1	Residential street, intermittent	Urban
2	Residential street, free	Urban
3	Main road, intermittent	Urban
4	Main road, free	Urban
5	Arterial road	Urban
6	Motorway	Urban
7	Motorway	Non-urban
8	Main road	Non-urban

Scenario	Lden		Lnight		ΔLden		ΔLnight	
	Urban	Non-urban	Urban	Non-urban	Urban	Non-urban	Urban	Non-urban
0. Baseline	59.4	67.2	50.8	58.5	-	-	-	-
A. Available limit space	59.1	67.1	50.5	58.4	-0.3	-0.1	-0.3	-0.1
B. Targeted tightening	59.0	67.0	50.4	58.4	-0.4	-0.1	-0.5	-0.2

Vehicle sound

Definition of Standard Scenario			
Road surface	Traffic flow	Vehicle sound	Tyre sound

Question;
CNOSSOS vehicle emission model was modified in the report.

- Is the modification same as DIRCTIVE (EU) 2021/1226?
  If it is different from 2021/1226, the equations for sound emission model should be reported.
- How to consider the effect of acceleration and deceleration part?

CNOSSOS was applied, with adjustments where necessary, from the Dutch model

$\Delta L_{WR,acc,m,k}$

Slide74 @TFVS-09-20

Cnossos vehicle emission model with corrections

=1.4 + 0.01p - 0.01a
with p=percentage of medium and heavy vehicles and a = distance to the junction
See
https://wetten.overheid.nl/BWBR0031722/2022-03-01

- *In order to calculate the emission of individual vehicles, the Cnossos model for vehicle noise emission is used with some modifications.*
- *The final mean noise levels ($L_{den,urban}$, $L_{den,non-urban}$, $L_{night,urban}$, $L_{night,non-urban}$) are used for modification of the END exposure distributions, as illustrated in Figure 25.*
- *The Cnossos model has separate contributions from propulsion noise and rolling noise. Three vehicle categories are considered:*
  - light vehicles (C1), → Car 90%, Van 10%
  - medium-heavy vehicles (C2), → Truck 90%, Bus 10%
  - heavy vehicles (C3).

The Dutch traffic noise model includes light/medium/heavy vehicles and mopeds, motorcycles and trams.

Question;
Are there vehicle emission model for separated categories?

Vehicle sound

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Calculation of noise reduction measures

- *For the vehicle emission reductions **(a)**, six types are considered*
  1. 2015: no reduction, fleet as in 2015,
  2. 2016: reduction according to 2016 emission limits (540/2014 phase 1),
  3. 2020/22: reduction according to 2020/22 emission limits (540/2014 phase 2),
  4. 2024/26: reduction according to 2024/26 emission limits (540/2014 phase 3),
  5. **hybrid vehicles: reduction of propulsion noise by 5 dB (mainly for plug-in hybrids),**
  6. **electric vehicles: reduction of propulsion noise by 10 dB.**

Vehicle emission corrections (propulsion noise) for six emission limits / vehicle types and five vehicle categories

Vehicle category	2015 dB	2016 dB	2020/22 dB	2024/26 dB	Hybrid dB	Electric dB
car, C1	0	-0.186	-2.1	-4.1	-5	-10
van, C1	0	-0.186	-2.1	-4.1	-5	-10
bus, C2	0	0	-1.8	-2.8	-5	-10
truck, C2	0	0	-1.8	-2.8	-5	-10
heavy truck C3	0	0	-1.5	-3.5	-5	-10

Comment;
Need a common procedure to determine vehicle emission model according to revised sound limits.