L-vehicles Emissions and Noise mitigation Solutions

Addendum to Deliverable D4.3 Noise measurement data from standardised tests

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

Deliverable No.	D4.3	
Deliverable title	Noise measurement data from standardised tests	
Deliverable type	DATA	
Dissemination level	Public	
Deliverable leader	RWTH Aachen (ika)	
Contractual due date	31.08.2024	
Actual submission date	28.02.2025	
Version	1.0	
Written by	Carolin Schliephake (RWTH Aachen (ika)) Saeed Shariatinia (RWTH Aachen (ika))	28.02.2025
Approved by	IDIADA, EMISIA, TUG	28.02.2025

Revisions table

Version	Date	Change
1.0	28.02.2025	First submission to the EC

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

Table of contents

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

Executive summary

This document is an addendum to the deliverable D4.3. This deliverable focuses on the noise measurement data from standardized tests, i.e. conducted based on the current type approval procedures for L-category vehicles on different tracks. Within the scope of this deliverable, 60 L-category vehicles have to be measured. The aim of this deliverable is to store the data in a well-defined structure and grant access to the public. This document is intended only as an aid to understanding the data structure and providing information on its accessibility.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

List of abbreviations

ASEP	Additional Sound Emission Provisions
PMR	Power-to-mass ratio
RD	Real Driving
RW	Real World Driving Cycle
TA	Type Approval

List of tables

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

1 Overview on vehicles tested

In this section, an overview is given on the vehicles that have been tested in the scope of this deliverable. The selected vehicles were chosen with the aim of covering all sub-categories of vehicles in the grant agreement. In addition, a representative selection of the current fleet was considered. Table 1.1 provides an overview of the tested vehicles as well as the type approval regulation each vehicles underlies. Overall, 60 vehicles have been measured according to the type approval.

Table 1.1: Vehicle test matrix for noise emission tests

LV sub-category	Current Type Approval Regulation	Conducted Type Approval Measurements
L1e-B	R63	8
L2e	R9	0
L3e-A1	R41	13
L3e-A2		11
L3e-A3		15
L3e-AxE		2
L4e	R9	0
L5e	R9	6
L6e-A	R9	0
L6e-B		1
L7e-B1	R9	2
L7e-B2		2
Total		**60**

It is to be noted, that the first measurement campaign includes measurements of vehicles with newly derived real-world driving scenarios, critical regarding noise emission, and also standardized measurements according to type approval, on different tracks. In the second measurement campaign, only standardized measurements are performed. This deliverable only includes standardized tests from both campaigns.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

2 Observations

During the vehicle procurement process, it was observed that the availability of certain subcategories is highly limited. This limitation arises from the current fleet composition within the European Union, necessitating a revision of the vehicle table outlined in the grant agreement (Grant Agreement Table 4: "First Draft of Test Matrix in LENS"). Specifically, the number of vehicles in the L1b subcategory had to be reduced by two, while the Le3-A1 subcategory required an increase of three vehicles. Additionally, one more vehicle was added to the Le3-A2 subcategory, and five more vehicles were included in the L3e-A3 category. In contrast, the number of vehicles in the L3e-AxE subcategory was reduced by two. The L5e subcategory saw an increase of two vehicles, whereas the L6e-A subcategory required a reduction of four vehicles. Furthermore, the number of vehicles in the L6e-B subcategory was reduced by one. Finally, both the L7e-B1 and L7e-B2 subcategories had to be adjusted by removing one vehicle each.

The dataset analysis enables a comprehensive evaluation of the dependencies between the year of registration, the power-to-mass ratio (PMR), and mileage for vehicles of category L under the three regulatory frameworks: R9, R41, and R63. In particular, the observed exceedances of regulatory limits across all three regulations indicate that the type approval process allows little margin for deviation.

For R9, all datasets are subject to the same type approval limit. However, the measured L_{urban} noise levels vary significantly, ranging between 70 dB and 90 dB. No clear correlation can be established between the year of registration or the PMR and the measured noise levels. This suggests that vehicles with a higher PMR or an earlier registration year are not necessarily louder in the measurements compared to those with a lower PMR or newer registration dates.

The R63 datasets are characterized by different type approval limits, with exceedances observed for all thresholds. Notably, the registration year, which spans from 2009 to 2024, does not appear to influence type approval results. The recorded L_{urban} values range from 70 dB to 76 dB, while the mileage distribution varies significantly, from under 20 km to over 40,000 km. A potential trend of increasing noise levels with higher mileage is observed. However, given the small sample size of only eight vehicles, this finding should be interpreted with caution.

The most extensive dataset is available for R41. Vehicles in this dataset exhibit a PMR ranging from 29 to 128, registration years between 2004 and 2024, and mileage spanning from approximately 250 km to 60,000 km. Overall, no distinct trend can be identified. The measured L_{urban} values range from 70 dB to 82 dB, with one notable outlier reaching 95 dB.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

3 Data structure and availability

The measurement data is analyzed and the results are made publically available on demand. The following specifications in Table 3.1 are included within the data stored.

Table 3.1: Structure of stored data, excerpt [1-3]

Data type	Explanation
Approval number	Regulations for the different L-category vehicles (R9, R41.05, R63)
Category	Vehicle category according to regulation Nr. 168/2013
Sub-category	Vehicle sub-category according to regulation Nr. 168/2013
Testing date	Date of the type approval testing
Registration year	Year the vehicle was first registrered
Rated engine power	Engine power at rated operating point in kW
Rated engine speed	Engine speed to rated engine power in min^{-1}
Max. vehicle speed	Maximum vehicle speed in km/h
PMR	Power-to-mass-ratio index, ratio of the rated maximum net power of a vehicle to its mass
a_{urban}	Acceleration with respect to L_{urban} in m/s^2
$a_{wot,ref}$	Full throttle reference acceleration in m/s^2
L_{wot}	Wide-open-throttle test result in dB(A)
L_{crs}	Constant speed test results in dB(A)
L_{urban}	Final test result in dB(A)
L_{urban} limit**	Limit value in dB(A)
$L_{stationary}$	Stationary test result in dB(A)
$n_{stationary}$	Engine speed for stationary noise test in min^{-1}
L_{ASEP} 2nd gear*	Result at RD-ASEP additional operating conditions in dB(A)
Limit RD-ASEP 2nd gear**	Limit RD-ASEP additional operating conditions in dB(A)
L_{ASEP} 3rd gear*	Result at RD-ASEP additional operating conditions in dB(A)
Limit RD-ASEP 3rd gear**	Limit RD-ASEP additional operating conditions in dB(A)
L_{ASEP} 4th gear*	Result at RD-ASEP additional operating conditions in dB(A)
Limit RD-ASEP 4th gear**	Limit RD-ASEP additional operating conditions in dB(A)

* if conducted

** This limit is increased in 1 dB(A) in case of COP. See item 8.3 of the Regulation.

1 PMR< 50, ASEP does not apply. See Annex 7, item 1.1 of the Regulation.

2 CVT's are exempted from this requirement. See Annex 7, item 1.2 of the Regulation

These specifications are in accordance with the regulations for type approval tests. For further information, it is referred to the specific regulations [1-3].

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

References

[1] Addendum 40: Regulation No. 41: Uniform provisions concerning the approval of motor cycles with regard to noise.

[2] Addendum 8: Regulation No. 9: Uniform provisions concerning the approval of category L2, L4 and L5 vehicles with regard to sound emission.

[3] Addendum 62: Regulation No. 63: Uniform provisions concerning the approval of L1 category vehicles with regard to sound emission.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Commission or CINEA. Neither the European Commission nor CINEA can be held responsible for them.