

## LIGHT UTILITY VEHICLE DATA IN LATVIA: METHODOLOGY, KEY FINDINGS, AND APPLICATIONS

Dita ZEMĪTE<sup>1,2</sup>, Aiva NIEDRA<sup>3</sup>, Mihails SAVRASOVŠ<sup>4</sup>,  
Nadežda SPIRIDOVSKA<sup>4</sup>, Evelīna BUDILOVIČA<sup>4</sup>✉

<sup>1</sup>Faculty of Social Sciences, Vidzeme University of Applied Sciences, Valmiera, Latvia

<sup>2</sup>Environmental Statistics Department, Central Statistical Bureau of Latvia, Riga, Latvia

<sup>3</sup>Data Science and Methods Support Section, Central Statistical Bureau of Latvia, Riga, Latvia

<sup>4</sup>Transport and Telecommunication institute, Riga, Latvia

### Highlights:

- methodological contribution: the study develops and tests a survey-based methodology for collecting data on LUVs (category N1) in Latvia by Central Statistical Bureau, a vehicle class mostly excluded from official EU freight transport statistics, using quarterly stratified simple random sampling, calibrated survey weighting and 28 strata, achieving a response rate of 64.7%;
- usage patterns and operational inefficiencies: during the survey period, approximately 42.2% of N1 category vehicles were used daily. It is noteworthy that trips without cargo - attributable to return and transfer - account for approximately 73% of all trips in both urban and extra-urban contexts, indicating significant opportunities to optimize routes and reduce emissions;
- relevance of transport and emissions: although N1 account for only approximately 1% of the country's freight tkm, they account for more than half of the total vkm and approximately 14% of road transport GHG emissions, highlighting their disproportionate environmental impact in urban logistics;
- applications for policy and planning: the resulting dataset is positioned as a valuable input for macroscopic transport models (e.g., an EMME-based model for Riga and the Pierīga region (Latvia)), regional economic development analysis and sustainable urban mobility and logistics plans. The authors recommend methodological improvements - in particular, variables of origin and destination and integration with automatically recorded or commercially obtained data.

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**Abstract.** The number of Light Utility Vehicles (LUVs) in the national vehicle registers keeps increasing, especially in the context of the COVID-19 pandemic. This trend is mainly due to the accelerated growth of e-commerce and home delivery services, as well as the shift in delivery methods from traditional courier and postal services to the use of parcel lockers. Although LUV accounts for a relatively small share of total freight tonnage compared to other freight modes, it accounts for a disproportionately large share of Vehicle-Kilometres (vkm) travelled, particularly in densely populated urban areas. This contributes to increased transport-related emissions and poses significant challenges for urban transport systems, including increased infrastructure pressure, traffic congestion and complexity in traffic management, particularly in relation to the planning of low or zero-emission zones in cities. In the EU, official freight transport statistics may not include vehicles with a maximum permissible load of up to 3500 kg, meaning that such vehicles are not systematically collected. Therefore, the development of appropriate methodologies and the analysis of available data on LUV are both necessary and valuable, especially given their increasing prevalence. These efforts can provide essential insights to support evidence-based transport planning and policymaking. The importance of detailed freight transport statistics is underlined by major EU policy initiatives such as the *White Paper* (EC 2011), the *European Green Deal* (EC 2019) and the *Sustainable and Smart Mobility Strategy* (EC 2020) aimed at reducing GreenHouse Gas (GHG) emissions from the transport sector. The goal of this research is to propose a methodology for LUV data collection, share data insights from its initial approval by presenting key findings, and suggest further uses of the data.

**Keywords:** light utility vehicle, transport emissions, road freight statistics.

✉ Corresponding author. E-mail: [budilovica.e@tsi.lv](mailto:budilovica.e@tsi.lv)

### Notations

CATI – computer-assisted telephone interviewing;  
CATTU – classification of administrative territories and territorial units;

CAWI – computer-assisted web interviewing;  
CSB – Central Statistical Bureau;  
EU – European Union;

- GDP – gross domestic product;
- GDPR – general data protection regulation;
- GHG – greenhouse gas;
- LPG – liquefied petroleum gas;
- LUV – light utility vehicle;
- N1 – commercial vehicles with a maximum mass not exceeding 3500 kg and designed exclusively or principally for the carriage of goods;
- RTSD – Road Traffic Safety Directorate;
- SULP – sustainable urban logistics plan;
- SUMP – sustainable urban mobility plan;
- tkm – tonne-kilometres is a unit of measure of freight transport, which represents the transport of one tonne of goods (including packaging and tare weights of intermodal transport units) by road transport mode over one kilometre;
- TEN-T – trans-European transport network;
- UNECE – United Nations Economic Commission for Europe;
- VIN – vehicle identification number;
- vkm – vehicle-kilometres unit of measurement representing the movement of a road motor vehicle over one kilometre (loaded or empty).

## 1. Introduction

The expansion of e-commerce and changes in last-mile delivery strategies have significantly increased the demand for LUVs in urban environments, as mentioned by Morganti & Browne (2018) and Allen *et al.* (2016). Holguín Veras *et al.* (2020) and Lauenstein & Schank (2022) suggested that LUVs, despite their modest share of overall freight tonnage, are responsible for a large proportion of urban vkm travelled, which contributes disproportionately to GHG emissions and local air. Also, as Stosiak (2015) mentioned, LUVs are a source of noise across a wider frequency range than negatively affects humans. Mitigating these environmental impacts is a central goal of European policy initiatives such as the *European Green Deal* (EC 2019) and the *Sustainable and Smart Mobility Strategy* (EC 2020), which promote the transition to zero-emission urban logistics (EEA 2022). However, there remains a lack of detailed operational data on LUV usage patterns, limiting the effectiveness of interventions like low-emission zones and urban logistics optimisation as mentioned by Holguín Veras *et al.* (2020) and Browne *et al.* (2012). Therefore, comprehensive empirical research on LUV fleet characteristics and travel behaviour is essential to underpin data-driven policymaking and support the shift toward more sustainable urban freight systems. In the EU, 28.9 million LUV were registered in 2024, reflecting a continuous upward trend since 2017 with an average annual growth rate of around 2% (Eurostat 2025b). As of 1 January 2025, almost 70000 LUVs were registered in Latvia (CSDD 2025). This represents a 25% increase in registrations compared to 2017, indicating an expansion of the LUV fleet at the national level. The increase was observed in 2022 compared to 2021, which coincided with the growth of e-commerce and home delivery services during the pandemic.

In this article, the terminology for vehicle classification will follow the system set out in the Eurostat draft methodological document for the compilation of statistics on LUV (Eurostat 2023). However, several synonymous terms exist in other methodological sources. For example, in the *Glossary of Transport Statistics* (Eurostat 2019) developed jointly by Eurostat, International Transport Forum, and UNECE, the category is referred to as light goods road vehicle, and this definition largely corresponds to category N1 (UNECE 2023). According to these classifications, vehicles of category N1 are defined as “commercial vehicles with a maximum mass not exceeding 3500 kg and designed exclusively or principally for the carriage of goods”. This includes vans used primarily for the carriage of goods, pickups, small trucks and 2- or 3-wheeled vehicles that also meet the specified weight limit. The following analysis will apply the definition of category N1 vehicles and examine their scope in the context of this study.

Despite the expansion of the N1 category vehicle fleet in Latvia, comprehensive data on their actual use was not available till 2025, including information on vehicle load carried, types of use, volume and type of goods transported, as well as route characteristics, such as the number and distribution of stops.

In the transport system of Latvia, freight transport by road is significant; its share in domestic transport is increasing, as the volume of rail freight decreases. In 2024, 54% of total freight tkm were carried by road freight transport, of which LUV category transport accounted for only 1% (LOS 2025a). In comparison, the vkm travelled by LUV were almost half of the total freight mileage based on data for 2023, according to RTSD of Latvia calculations for odometer mileage in the respective calendar year (LOS 2024).

At the global and national level, reducing GHG emissions in the transport sector is recognised as a critical objective in achieving overall emission reduction targets. Given the dominant position of freight and passenger road transport, 97% of the GHG emissions from the transport sector in Latvia in 2023 were attributable to road transport, and LUV category vehicles accounted for approximately 13% of these emissions (LOS 2025b).

The 2024 evaluation of Latvia's Transport Policy by Ministry of Transport of the Republic of Latvia (Satiksmes ministrija 2021) indicates that the planned reduction in GHG emissions in the transport sector has not been achieved yet. The proportion of domestic rail freight (tkm) in total domestic freight transport by rail and road is decreasing, which is the opposite of the development of a transport system with railways as its backbone, as stated in the national transport policy (Satiksmes ministrija 2024).

The purpose of this study was to develop a data collection methodology, carry out the analysis of data gathered during the 12 months of 2024, and examine indicators of the LUV fleet, including intensity of use, volume and type of transported cargo, and route characteristics such as the number and distribution of stops, before ultimately presenting an overview of the potential applications of the collected data (LOS 2025c).

The structure of this research comprises a detailed description of the methodology, including an explanation of the survey organisation, sample design, and weighting procedures. The following publication presents the insights and key findings from the collected data, and the article concludes with potential future applications and identifies additional data sources that could enhance future research efforts.

## 2. Methodology

The study was conducted within the framework of the project EU under Grant No 101119289 – 2022-LV-TRANSPORT “Development of New Transport Statistics, Transport by Light Utility Vehicles” (LOS 2025c), in which the authors participated. Within this project, the relevance and necessity of research on the use of LUV were highlighted, and the methodological guidelines provided were tested in the Latvian context.

The primary objective of the study was to collect comprehensive data on the LUV vehicle fleet, including fleet composition, occupancy rates, annual mileage (by road type), trip purposes, number of stops, freight transport volumes by type of goods, and the intensity of use.

In general, the scope of the collection of statistics for LUV is broader than for N2 and N3 vehicles that in EU statistics is governed by Regulation 70/2012 (EC 2012) on carriage of goods by road, as these vehicles are used not only for the transport of goods, but also for the provision of services to customers, the transport of tools necessary for the provision of services or even empty journeys for other purposes.

The activity of LUVs includes freight transport, the provision of services using the vehicle to transport tools or equipment necessary for the service, as well as cargo or the transport of tools only or empty journeys, for example, infrastructure inspection trips. To help respondents complete the survey, a schematic diagram was created showing the combinations and the relevant sections of the survey form. To simplify data collection and compilation, the weight of the tools carried by the LUV was not included in the freight transport. For example, if the LUV only carried a chainsaw necessary for the service task, the journey was recorded in the survey as an empty journey without cargo carried.

The uniqueness of this research lies in the fact that it was carried out for the 1st time in Latvia and also represents one of the few such studies in Europe. The aim was to assess the share of LUV in total road transport tkm (Eurostat 2025a), taking into account the increase in the number of registered vehicles and their relatively large and growing share in the total number of road transport vkm. Notably, the CSB of Latvia, the institution responsible for the collection and analysis of official statistics at the national level, participated in the study, ensuring methodological consistency and compliance with international standards.

This study used data from the 2024 LUV survey. The survey methodology was developed following a structured sequence of steps:

- review of existing methodological guidelines, including the *Draft Methodological Document for the Task Force on Light Utility Vehicles (Version 10)* developed by Eurostat (2023), as well as a review of relevant survey practices from the Netherlands, Sweden, Poland and Switzerland;
- identification of respondents – determination of the target population and creation of the sampling frame;
- questionnaire development – development of a standardised survey instrument for owners and users of LUVs;
- pilot testing of the questionnaire by an independent market research company and representatives of LUV owners from different companies across various economic activities.

Survey implementation – conducting the survey using the official electronic data collection system (CSP 2025). The overall response rate was relatively high at 64.7%, with a corresponding non-response rate of 35.3%. Of the non-responses, the majority (95.4%) were due to lack of contact with the respondents, 3% were due to vehicles not meeting the sample population criteria at the time of the survey, and 1.6% were due to companies being inactive during the survey period. CAWI was used as the survey method in 45.7% of cases, and CATI in 19% of cases, to respond to the survey.

The variables collected via the survey were divided into groups of characteristics of the vehicle, the vehicle ownership and use or main reason why the vehicle was not used during the survey period, the odometer readings of the vehicle during the survey period, the main purpose of use of the vehicle (transport of freight, postal and courier services, construction transport, activity in other sectors, e.g., telecommunication, forestry, sectors related to water, heat, gas supply, air purification, sewerage and different type of use like transport of passengers, trips from home address to work and other private, non-commercial use. For variables related to trips and cargo carried, a distinction was made between trips with and without cargo, with 2 or fewer stops and trips with 3 or more stops.

An example of the variables available in the survey for laden and unladen journeys involving 3 or more stops includes: type of cargo classified according to the ten groups of the NTS 2007 (Eurostat 2007), weight of the cargo in kilograms, starting and ending points of the journey (CATTU), 1st and last stop of the journey (CATTU), total distance travelled in kilometres, kilometres travelled without load and number of stops.

Each respondent in the sample was required to record all trips made on 2 specified consecutive weekdays as specified in the sample. The survey period started at 00:00 on the 1st day and lasted 48 hours, ending at 23:59 on the 2nd day. If the trip began on the 2nd day but ended after 23:59, all trip details still had to be recorded. The data was collected over just 2 days to lessen the respondent burden; the results were subsequently extrapolated to represent a whole week.

## 2.1. Sample and sample design

The target population of the survey included LUV registered under the category of N1 with a gross vehicle weight of up to 3500 kg (inclusive), owned by legal entities registered in Latvia and individuals who are residents of Latvia. Eligible vehicles must have passed a technical inspection at the time of the sample selection and must be legally permitted for use. The LUV framework included both general information about the vehicle, such as VIN, year of manufacture, unladen weight of the vehicle, license plate number, last odometer reading during technical inspection, model, registration date, fuel type and similar information, as well as information about the owner and holder of the vehicle, including the name of the owner (both legal and natural persons), available address and taxpayer code.

The sampling frame was designed to accurately reflect the characteristics of the target population, ensuring representativeness and compliance with the survey objectives.

Registers were used to construct the sampling frame for the LUV survey:

- the National Register of Vehicles by RTSD of Latvia;
- the register of permits for commercial freight transportation by LUV in the territory of Latvia by the Road Transport Administration;
- the Statistical Business Register maintained by CSB;
- the Population Register.

The survey excludes special purpose vehicles, such as fire engines, border guard vehicles, police cars, ambulances and other special vehicles. In addition, also excluded are semi-trailer trucks, truck chassis, LUVs older than 25 years, as well as vehicles belonging to companies in various liquidation status (F – received a certificate for liquidation, G – company is deceased, M – operations terminated without legal liquidation, N – company is legally liquidated, P – ministry or local government decision on liquidation, R – liquidated, R – liquidated in the Register of Enterprises) in the Statistical Enterprise Register of CSB, which are not included in the survey. During the analysis of the National Register of Vehicles (RTSD of Latvia), mostly larger, premium, and luxury M1 category vehicles (passenger cars) manufactured before 2011 with minor modifications to the rear seats were registered as N1 category vehicles to benefit from lower taxes. These cases were manually removed from the sampling frame by reviewing the relevant manufacturers and models.

The sample design is based on a stratified simple random sampling method. Stratification is based on several key variables of the LUV: the type of primary user (legal entity or individual), the number of vehicles owned by the respondent that matched the target population (categorised as 1-5 or 6 and more), whether the company operated in *Statistical Classification of Economic Activities NACE Revision 2* (EC 2006), Section H “Transportation and Storage” and the age of the vehicle. The sample allocation was determined using the R package (<https://www.r-project.org>) “surveyplanning”, namely the “dom\_optimal\_allocation function” (Breidaks et al. 2020), which calculates the opti-

mal allocation across strata based on predefined parameters (28 strata in the LUV sample). LUVs are mainly used for commercial purposes and are often owned by companies with fleets of various sizes. Their operating patterns differ significantly from private passenger cars, in terms of mileage, payload and frequency of use, the data shows that in 2024, the highest activity in terms of the total number of trips for LUV vehicles was in the middle of the week – on Wednesdays and Thursdays (40.5%), but the lowest – on Saturdays and Sundays (8.9 %) (LOS 2025c). These unique characteristics require targeted stratification (e.g., by type of vehicle owner and industry) and specialised outlier detection mechanisms adapted to high-variability data.

Initially, the allocation was calculated for the entire year to divide the sample into 4 quarters. The sample size in each stratum was then proportionally adjusted according to the number of weeks in the year (52 weeks for 2024). An exception was made for sector H “Transportation and Storage”, which was fully surveyed.

The sample was drawn for each quarter separately, and quarterly sampling frames were also created. Respondents with 5 or fewer vehicles were randomly assigned to one of the 4 quarters and included in the sample for that quarter only. However, all vehicles in sector H and respondents with 6 or more vehicles were eligible for participation in each quarter. Given the dynamic nature of the vehicle population (new registrations, deregistrations, changes of ownership, etc.), quarterly sampling allowed for adjustments to be made and new eligible respondents to be included.

The sample consisted of a total of 6267 vehicles per year, evenly distributed across 4 quarters. Invitations to participate in the survey were sent to registered email addresses of LUV owners or users, and data were collected using an electronic questionnaire administered using the official online data collection system by CSB (CSP 2025) from 1 January 2024 to 31 January 2025, for the last reference month being December 2024.

## 2.2. Survey weighting methodology

The weighting procedure was implemented in several stages. Initially, outliers were identified, after which the design weights were adjusted to account for unit non-response. These adjusted design weights were then calibrated to account for the effects of the survey day and the type of main vehicle user (legal entity or individuals). The calibration for the survey days aimed to reduce time-related bias and to align the data with the theoretical distribution in the reference period. Given the time lag between sampling and data collection, coverage errors were possible. Units identified as over-covered during the data collection process were appropriately flagged and removed from the data set, and the corresponding weights were adjusted.

The weights were calculated separately for each quarter. The sampling frame for the 1st quarter consisted of 48137 vehicles divided into 28 strata. No responses were received in the stratum labelled “f\_11” in the 1st 3 quarters. As a result, post-stratification was applied. The units

of this stratum were redistributed based on the main type of user (legal entity or natural person) and the age of the vehicle, without considering the size group attribute. Consequently, these vehicles were redistributed into the strata "f\_I0\_v01", "f\_I0\_v02" and "f\_I0\_v03". This approach was applied consistently across all survey quarters.

Outlier detection was performed for 3 main indicators: kilometres travelled [km], tonne-kilometres [tkm] and tonnes transported [t]. A combined methodology was used, incorporating several methods: the method described by Last & Kandel (2001) for automated detection of outliers in real-world data, statistical cut-offs based on box plots, proportional values of indicators in strata and the number of non-zero respondents in each stratum. Outliers were identified separately for each stratum. However, no bias was detected in strata where any of the main indicators (km, tkm or t) had fewer than 4 non-zero respondents, nor in strata where users were individuals.

The weighting process involved non-response adjustment followed by linear calibration of the weights using survey day and vehicle user type as calibration variables. Although several weighting methods were considered during the design phase, linear calibration was considered the most appropriate in this context.

Precision assessment was performed using the ultimate cluster method (Hansen *et al.* 1993), incorporating Taylor linearization for nonlinear statistics. In addition, residual estimation from regression models was used to account for weight calibration. As sample selection and weight construction were performed quarterly, quality assessment was also performed quarterly.

### 3. Results

Using the described methodology, the dataset was collected, which demonstrated numerous results, highlighting various aspects of how LUVs (N1 category) are utilised in Latvia. The data were analysed from many angles, includ-

ing the age and fuel type of vehicles, who owns them, the types of trips they make, the distance they travel, and the kinds of goods they carry. In this section, only the most important and interesting findings are presented. These selected results help to understand the current situation in Latvia better and also provide useful insights for planning and comparisons at the European level.

Latvia's LUV fleet is showing clear signs of ageing. More than half of the fleet is over 10 years old, and nearly 48.2% fall in the 11...20 years range, with vehicles aged 11...15 years being the most common (24.3% or 12127 units). In contrast, only 17.7% of the fleet is under 5 years old, indicating that fleet renewal is occurring at a slow pace and pointing to potential challenges in modernising transport infrastructure (Figure 1).

The fleet also remains heavily dependent on diesel. Diesel-powered LUVs make up an overwhelming 96.5% of the total (48262 units). In comparison, the share of alternative fuels remains marginal, with petrol at 1.9%, petrol + LPG at 0.6%, and electricity at just 0.5%. Combined fuel vehicles, fully CNG and LPG vehicles and hybrids with electricity are comparable in number to electric LUVs (0.5%) (CSDD 2025). This heavy reliance on diesel underlines the urgent need to promote cleaner alternatives and prepare infrastructure for the energy transition (Figure 2).

Occupancy or intensity of use of LUV. In 2024, it was reported that 42.2% of N1 category vehicles registered in Latvia were used every day during the survey reporting period (Figure 3). Similar usage patterns have been observed by statistical authorities in Switzerland (BFS SE 2024) and Swedish Transport Administration (TRAFVA 2023), indicating a consistent trend in this vehicle category across European countries. Among vehicles that were not used during the survey period, the most frequently cited reason was operational downtime (51.8%), indicating seasonal trends in the use of N1 category vehicles. This was followed by driver leave (20.5%) and vehicle maintenance or repair (14.5%). Other reasons were generally unspecified reasons (7.7%)

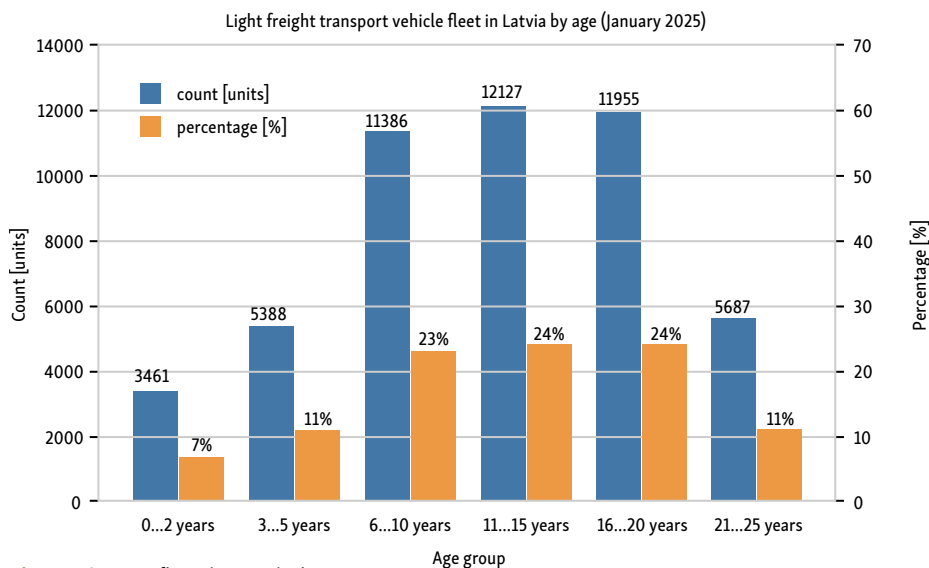


Figure 1. LUV fleet in Latvia by age

and leasing agreements (5.5%), which prevented the vehicle from being used during the survey (Figure 4). These patterns reflect operational bottlenecks that businesses may want to address to improve efficiency.

Mileage statistics indicate that non-urban vehicles travel more than urban ones across most categories, except for postal and courier services, where urban delivery dominates (4.2 million km urban vs. 3.4 million km non-urban). This illustrates how different logistic patterns influence vehicle use nationwide (Figure 5).

Interestingly, “no cargo” trips – likely due to returns or repositioning – make up a striking 73% of all trips. This pattern remains consistent across urban and non-urban

environments and may indicate areas for route optimisation and cost reduction (Figure 6).

Diesel dominates mileage as well, contributing more than 97% of the total kilometres travelled, around 521 million annually. Electric vehicles make a small contribution, limited mainly to urban areas on weekdays (~2 million km), with practically no use in rural zones (Figure 7).

In terms of transport work, measured in [tkm], the leading cargo types nationwide are food products (~21.9 million tkm) and mail or parcel deliveries (~17.9 million tkm). Parcels and food products lead urban freight, while rural transport includes more grouped goods and food items (Figure 8).

Generally, these findings help paint a comprehensive

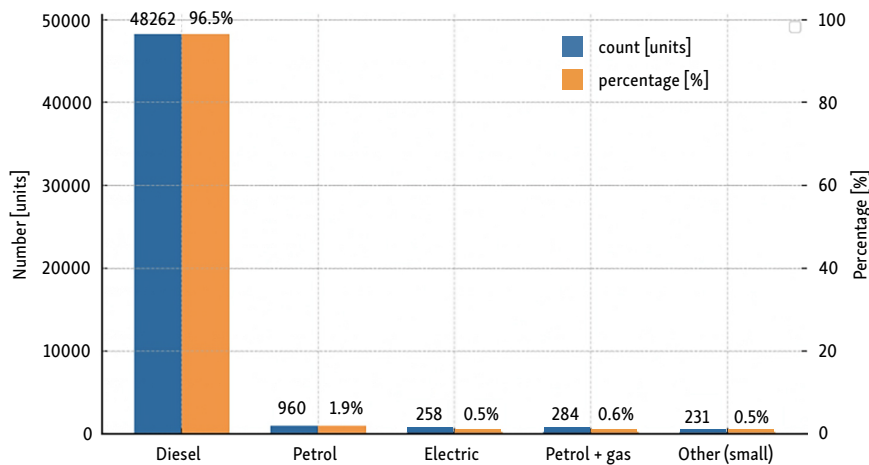


Figure 2. LUV fleet in Latvia by type of fuel used

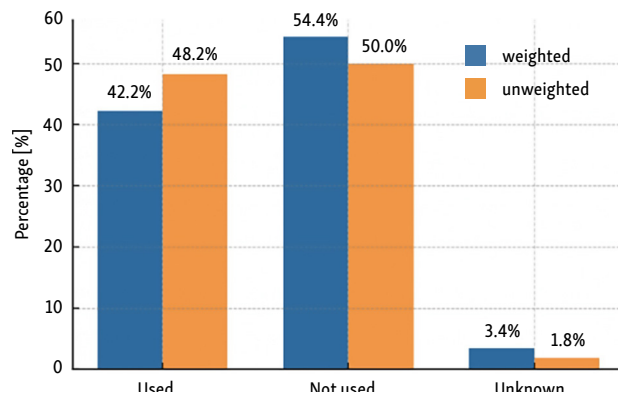


Figure 3. Vehicle usage during the survey period

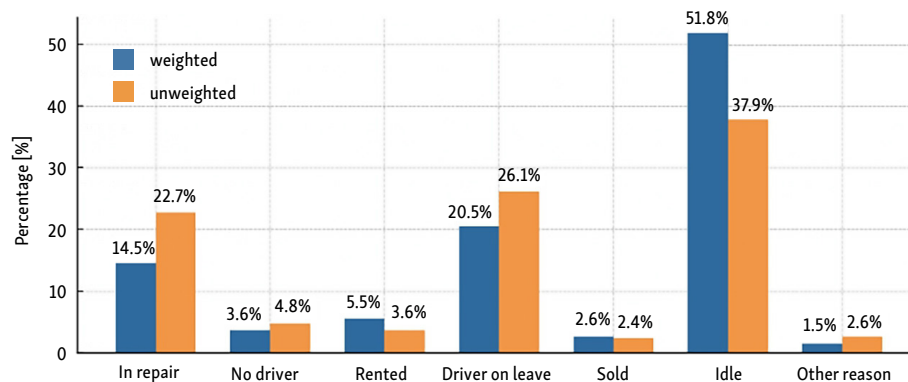


Figure 4. Reasons why the vehicle was not used during the survey period

picture of how LUVs are used in practice and the role they play in national logistics, urban mobility, and commercial activity.

At the national level, the results provide strong evidence to support policy development in areas such as fleet modernisation, energy transition, emissions reduction, and urban logistics planning. The dominance of diesel, the high share of older vehicles, and the large proportion of trips without cargo highlight key areas where efficiency and sustainability can be improved. The survey also revealed

significant patterns in daily mileage, differences between urban and rural use, and sector-specific transport needs – all of which can be used to better align infrastructure investments, taxation schemes, and environmental strategies with real transport practices.

On the European level, the Latvian experience contributes valuable methodological and empirical input to the wider effort of improving freight transport statistics.

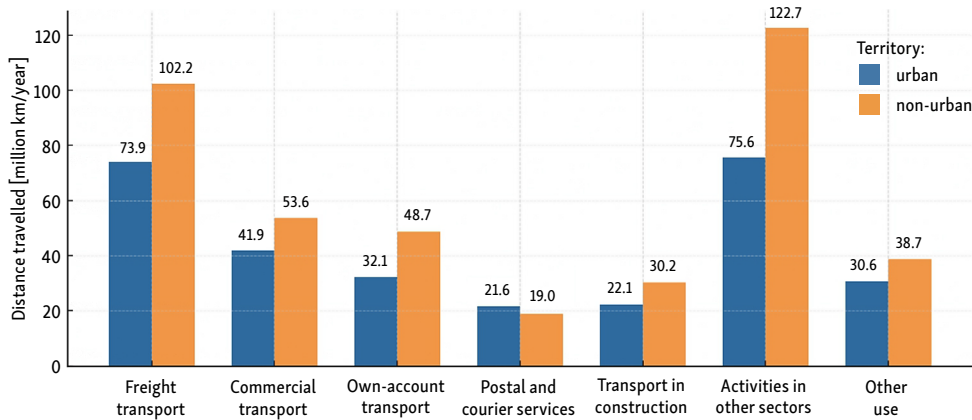


Figure 5. Travel distance by trip purpose

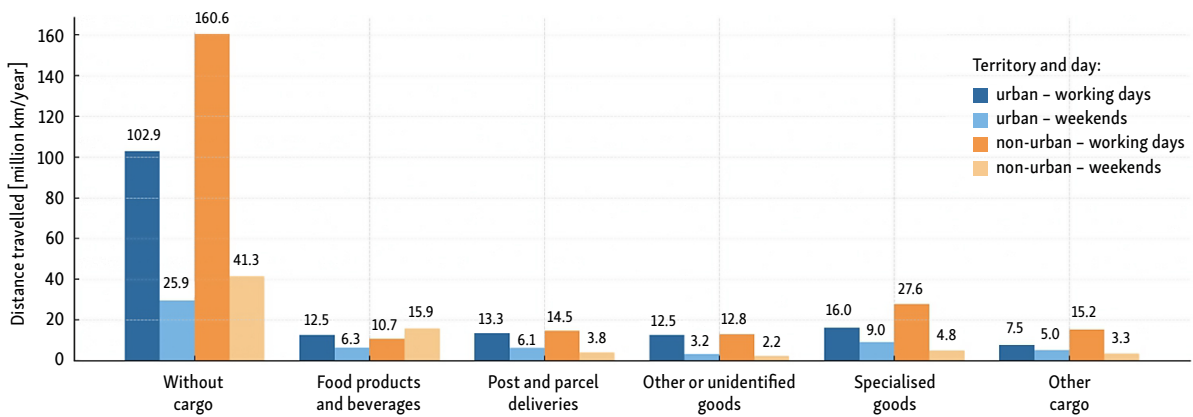


Figure 6. Travel distance by trip purpose (return)

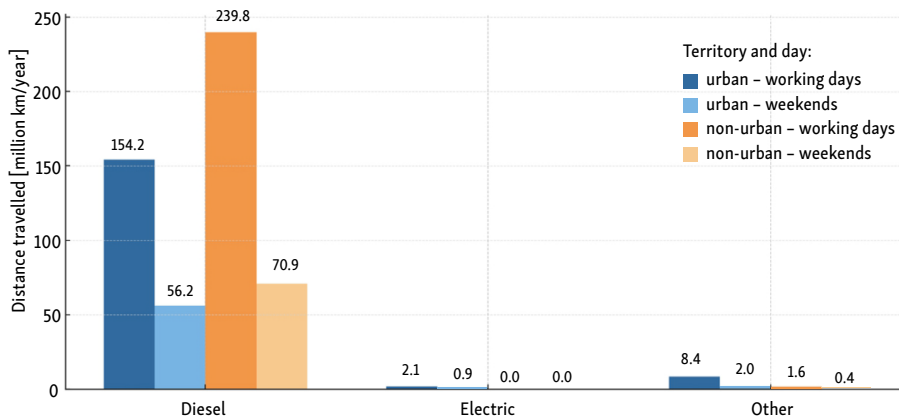


Figure 7. Travel distance by fuel type

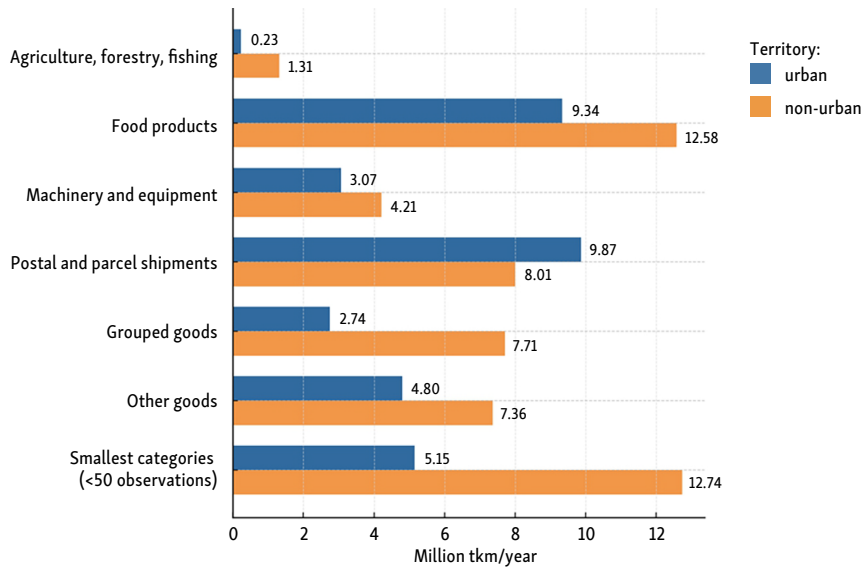


Figure 8. Tonne-kilometres travelled by type of cargo

## 4. Methodology applications

The significance of the collected dataset on LUV goes beyond providing simple statistical information about the use of a specific vehicle type and its related commercial activities. This data can serve as a resource in several vital areas of applications, 2 of which are described above: transport simulation tool improvement and regional economic development indicator analysis. Moreover, this data can also be used to estimate air pollution from exhaust fumes and predict areas with increased noise levels resulting from heavy traffic.

### 4.1. Source of data for macroscopic transport models

The collected data can serve as a resource in several important areas of application, particularly in the strategic planning and modelling of transport systems. A macroscopic transport flow simulation model based on EMME software (Bentley 2026) is already being developed and used in Riga city (model). This model is utilised for strategic transport system development planning and decision-making both in Riga and the Pieriga region (Latvia). Additionally, the model is widely applied in local spatial planning processes, providing information on current and projected transport flows. The model plays a significant role in the SUMP development process.

The model covers multiple modes of transport – private vehicles, public transport, heavy freight, and LUVs. One of the key challenges in maintaining the model is the need for regular updates of input data, including origin-destination matrices, which describe movement patterns. The quality of these matrices has a significant impact on the reliability of the model's outputs. Traditionally, such matrices are calculated based on mobility and household surveys, while their calibration is completed using traffic

counting data. However, these types of surveys are expensive and primarily focused on human mobility rather than freight movement.

In this context, the data collected on LUV can serve as a source for updating the model, as it includes information on both routes and cargo volumes transported. If similar surveys were conducted regularly – once a year or every 2 years – the resulting data set would become a systematic and reliable source of information, enabling the following:

- increase the accuracy of transport planning by improving the detail of mobility models for LUVs;
- model the impact of development scenarios on the environment and infrastructure more effectively, including the effects of freight transport on road congestion and emissions;
- make data-driven decisions for long-term urban planning in Riga and the Pieriga region, as well as for overall improvements in transport organisation, ensuring more efficient traffic flow, the development of urban logistics, and sustainable mobility;
- identify and model critical traffic bottlenecks and overloaded corridors where the intensity of freight transport significantly affects traffic flow;
- plan specialised infrastructure, such as truck parking areas, delivery zones in cities, and logistics centres along major highways or city outskirts;
- optimise urban and regional delivery strategies, for example, by determining optimal times and routes for deliveries to reduce traffic congestion during peak hours;
- support the development of emission reduction strategies by analysing freight transport movement patterns and evaluating transitions to alternative fuel types or micromobility solutions;
- model the development of mobility services, such as the potential for new delivery or freight-sharing platforms in specific areas;

- integrate freight transport into sustainable mobility plans, for example, by setting special conditions for freight movements within urban “green zones”;
- support crisis management planning by simulating changes in freight movement during emergencies, such as natural disasters or similar situations.

To apply the collected data, the presented methodology shall be updated, and changes shall be proposed to it. One of the core and most important changes is related to the approach of the respondents in indicating the origin and destination of the trip. Now, methodology is using, so called CATTU codes (represents the official geographical units in Latvia), while in some cases they are too large, for example Riga is represented as one unit, therefore the usage of specific address or postal codes would be recommended, as this would allow to link data to Riga transport model’s analytical zones. In addition, it would be useful to combine the survey data with data from automatically recording travel devices or purchasing data from service providers. Such an approach could be useful for obtaining more precise and continuous data on the actual movement dynamics of LUVs, particularly in urban areas and the Pieriga region, where transport activity is the most intense.

#### 4.2. Support for regional economic development analysis

The collected LUV data set can serve as an important tool for regional economic development analysis and decision-making. Transport activity often correlates with the intensity of commercial activity, logistics flows, and the availability of services in a given area. By analysing the collected data on freight movement volumes and their distribution across territories, it is possible to:

- assess the relationship between transport demand and economic indicators (e.g., GDP, employment levels);
- identify potential areas for future investments or infrastructure development;
- plan the location of industrial parks, logistics centres, and distribution points based on freight flow data;
- develop forecasts for future transport demand based on business growth trends;
- support the development of regional and municipal economic development strategies by aligning them with actual transport activity trends;
- promote sustainable mobility solutions by optimising freight transport to reduce emissions and traffic congestion;
- plan the location of electric vehicle charging stations, particularly considering the intensity of LUV movements in specific areas; this approach encourages the use of electric vehicles for cargo transport;
- ensure data usability in SUMP, allowing freight movement to be integrated as a component in urban planning and transport solution development;
- support the planning and development of the TEN-T network by using LUV data as a basis for evaluating regional and interregional freight flows, particularly

along routes connecting cities to TEN-T corridors and terminals.

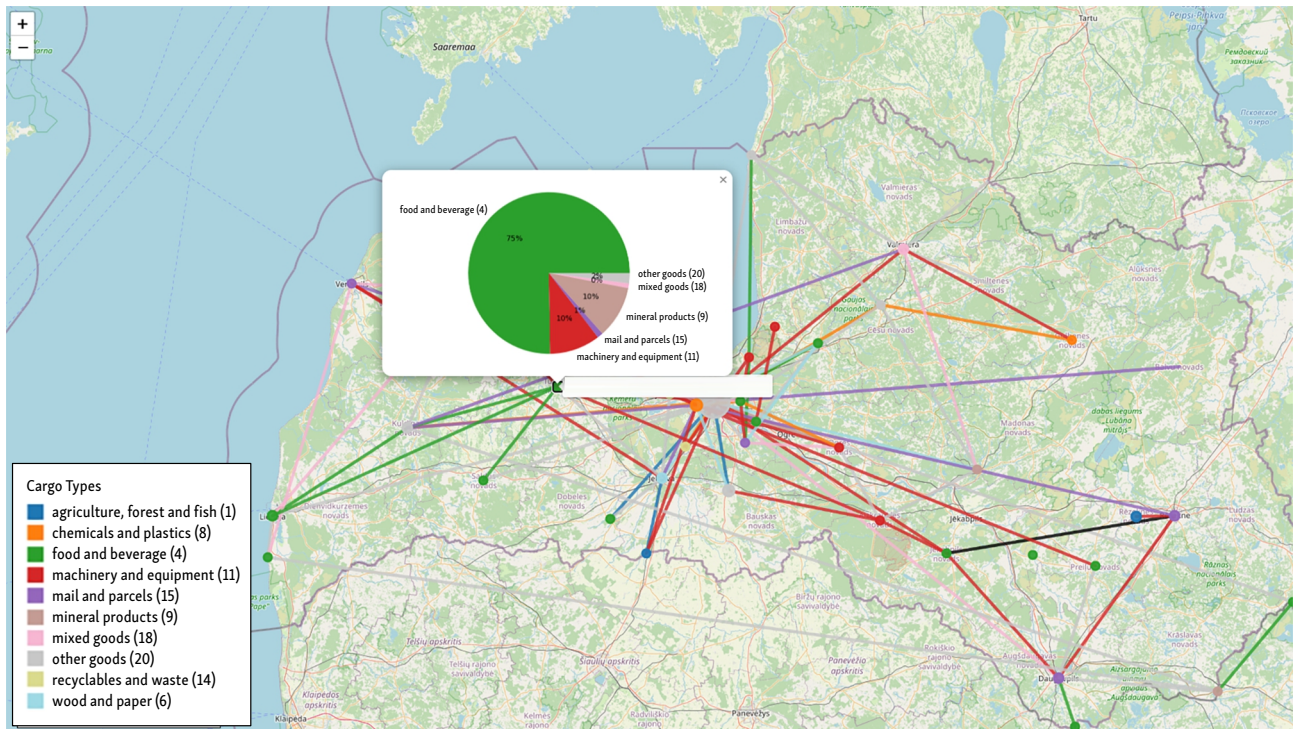
Collected datasets could ensure a more integrated approach to regional policy development, based on objective transport and economic indicators. However, in this case, it would be necessary to provide decision-makers with user-friendly analytical tools that can present the collected data in a graphical format. For this purpose, it would be necessary to develop data visualisation tools that would be publicly accessible. The development of these tools could be carried out using modern Business Intelligence (BI) solutions, such as Tableau, Power BI, or other equivalent platforms. It would also be valuable to ensure the ability to compare data across different years to identify trends better. If such a tool is implemented, it would become a valuable decision-support instrument usable at both the national and regional levels. The Figure 9 and Figure 10 demonstrate the prototype of such a tool, which highlights the dominant cargo types between origin and destination, with detailed information, allowing users to select specific links or nodes.

## 5. Conclusions

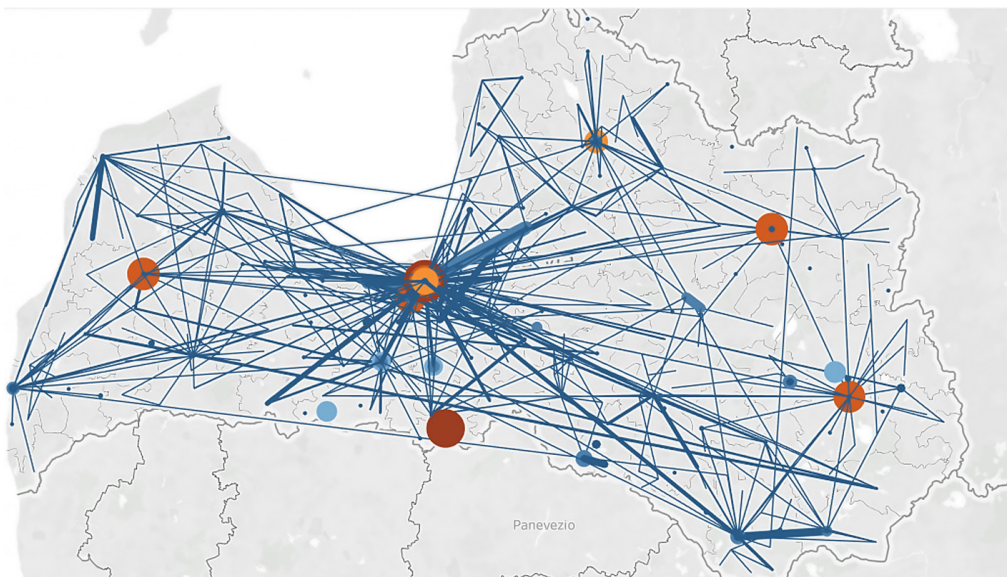
This study presented the 1st systematic effort in Latvia, and among the earliest in Europe, to collect and analyse data on the use of LUV. The findings confirm the increasing importance of LUV in national freight transport and urban logistics, particularly in the context of e-commerce growth and changing delivery patterns. Despite their modest share in total freight tkm, LUVs contribute disproportionately to vkm travelled and GHG emissions, thus posing significant challenges for sustainable mobility planning.

Although the current methodology was developed and implemented in Latvia, it has the potential to be replicated in other countries. However, some adaptations may be necessary due to differences in data availability, national vehicle registration systems and fleet ownership structures. Furthermore, legal and privacy constraints (e.g., GDPR compliance) may affect the selection of the sampling frame in countries with more limited access to registers. Local calibration variables may also differ, especially in countries where privately owned LUVs are more common. Therefore, it is recommended to conduct an initial feasibility study before implementing it in new contexts.

Since a large number of trips were recorded as empty – possibly due to the survey methodology – the LUV survey methodology could be improved by including the weight of service tools or equipment, if only these items are carried during the journey. Respondents could report the types and names of tools, and their weight could be estimated during data processing. Although this might slightly increase the workload of respondents and introduce some measurement uncertainty depending on the data sources available, it would improve the accuracy of cargo volume estimates, reduce trips classified as empty and allow for the assessment of the impact of cargo on road infrastructure.



**Figure 9.** Dominant cargo type visualisation



**Figure 10.** Significant cargo nodes and links

The results revealed several critical trends: the Latvian LUV fleet is ageing, with more than half of vehicles over 10 years old; diesel remains the dominant fuel, with minimal adoption of alternatives; and a large proportion of trips are performed without cargo, indicating inefficiencies in current operations. While the number of electric LUVs is growing, operators still report technological and organisational barriers that hinder wider adoption, such as vehicle range limitations and misalignment with business models.

The study also demonstrated the value of integrating LUV data into transport modelling and regional economic

analysis. The data set provides a robust basis for updating macroscopic transport models, supporting SUMP and SULPs, and informing infrastructure investment and environmental strategies. Importantly, the involvement of the CSB of Latvia ensured methodological rigour and alignment with international statistical standards, strengthening the validity and policy relevance of the results.

Overall, the research underscores the necessity of regular, systematic data collection on LUV at both national and European levels. Continuous surveys, complemented by automatically recorded or purchased mobility data,

would enhance monitoring capacity, support evidence-based policymaking, and facilitate the transition towards more efficient, low-emission urban freight systems. The Latvian experience provides a replicable methodological framework for other EU Member States where official statistics on LUV are not yet established.

## Author contributions

The authors confirm contribution to the article as follows:

- methodology: *Dita Zemīte, Aiva Niedra*;
- analysis and interpretation of results: *Nadežda Spiridovska, Mihails Savrasovs*;
- draft manuscript preparation: *Dita Zemīte, Evelīna Budiloviča, Mihails Savrasovs*.

All authors reviewed the results and approved the final version of the manuscript.

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## Declaration on the use of Artificial Intelligence (AI)

During the preparation of this manuscript, the authors used *ChatGPT* (August 2025 version) [*Large language model*] to improve language clarity and assist on English grammar checking.

The prompts used were proofread this text for grammar and clarity for the purpose of an academic article.

The output from these prompts was used to improve English language usage in the article, as well as sentence structure and enhance grammatical accuracy.

While the authors acknowledge the usage of AI, the authors maintain that they, *Dita Zemīte, Aiva Niedra, Mihails Savrasovs, Nadežda Spiridovska, Evelīna Budiloviča*, are the sole authors of this article and take full responsibility for the content therein, as outlined in COPE recommendations and journal policies.

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