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ANALYSIS OF ROAD SAFETY AUDITS CONDUCTED IN 2024–2025

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Abstract. The road safety policy of Lithuania and the European Union is based on a shift from a reactive approach, when decisions are made based on the analysis of historical traffic accidents, to a proactive application of the principles of a safe system. This direction was strengthened by the 2019 update of Directive 2008/96/EC of the European Parliament and of the Council, which expanded the scope of application of mandatory road infrastructure safety management procedures, covering not only the Trans-European Transport Network (TEN-T) roads, but also motorways and other major roads. The provisions of the directive have been transposed into Lithuanian legislation, and the amendments to the road safety audit procedure that entered into force in 2022 have established additional requirements for auditors and expanded the scope of the audit to all state and local roads and streets intended for public traffic. The study analyses 47 road safety audits carried out by the VILNIUS TECH Road Research Institute in 2024–2025. 519 road infrastructure safety problems were identified, with an average of 11.04 problems per audit. Most audits (87%) were carried out at the project preparation stage, and 13% – before the road was put into operation. According to the degree of importance, 45% of the problems were classified as medium, 24% – high, 31% – low. The most frequently identified problems were related to road signs and vertical markings (9.09%). When assessing the safety of vulnerable road users, a significant part was accounted for by pedestrian infrastructure problems: inappropriate tactile indicator schemes (5.41%), absence of tactile indicators (4.42%) and inconsistencies in the geometry of pedestrian crossings (3.44%). The results confirm the need to strengthen the control of design solutions and ensure consistent application of regulatory requirements in road infrastructure projects.

Keywords: directive, road safety audit, road safety, road design problems.

1. Introduction

Road safety is one of the most important indicators of the efficiency and sustainability of the modern transport system, directly affecting public health, economic losses and the overall quality of life. At the European Union, road infrastructure safety management is considered an essential preventive direction, and road safety auditing (hereinafter RSA) is recognized as one of the main instruments that allows for the systematic identification of potential road safety problems before they occur in real traffic conditions (European Parliament & Council of the European Union, 2019). This is particularly important for achieving long-term strategic goals, such as Vision Zero, which aim to significantly reduce the number of deaths and serious injuries on the roads.

RSA is increasingly being analysed in the broader context of the European Union's road safety policy. Reports from the European Court of Auditors highlight that infrastructure safety management measures, including RSA, are essential for achieving consistent improvements in road safety indicators across all Member States (European Court of Auditors, 2024). RSA is defined as a proactive method to identify safety risks during the planning, design and construction stages of road projects before accidents or safety problems occur, in order to improve overall road safety (AlHamad et al., 2023; Ahmed et al., 2013; Calderón Ramírez et al., 2023). Empirical studies confirm the impact of RSA on real road safety. A review and meta-analysis by Elvik and Vaa (2004) indicate that the application of infrastructure safety audits can significantly reduce the number of road accidents and the frequency of injuries. This shows that systematic safety auditing is not only a formal process, but also a tool that can have a tangible impact on accident reduction (Elvik & Vaa, 2004).

In the Lithuanian context, road safety auditing is also considered an important tool for ensuring the quality of planning and design. Tumavičė et al. (2020) analyzed 317 road safety audits conducted in Lithuania in 2011–2017 and identified 2897 road infrastructure safety problems. The results of the study revealed that the most common problems identified during the audit are related to inappropriate intersection design solutions, unsecured

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visibility of road users, unsecured pedestrian and cyclist safety, and inappropriate application of speed control measures (Tumavičė et al., 2020). It was also found that the share of pedestrian and cyclist safety problems increased more than threefold – from 8.7% (2012) to 26.6% (2017), which indicates the increasing relevance of safety problems for vulnerable road users and is in line with the direction of the update of Directive 2008/96/EC of the European Parliament and of the Council, focused on ensuring safer infrastructure.

The development of the RSA system in Lithuania after 2022 had a significant impact on Legal and institutional changes were implemented. National legal acts clearly defined the stages of RSA application, established the qualification requirements and liability principles of auditors (Ministry of Transport of the Republic of Lithuania, 2022a, 2022b). These changes created the prerequisites for the standardized application of road safety audits, focused on reducing real traffic safety risks, and not just formal compliance with regulatory requirements.

2. Methodology of analysis

This study analyzes 47 road safety audits conducted at the Road Research Institute of Vilnius Gediminas Technical University. Various national road, pedestrian and bicycle paths, intersections, roadways and parking lot projects throughout Lithuania were audited. The audits were conducted from May 2024 to May 2025.

The audits were divided according to the project preparation stage at which they were conducted:

– project preparation,
– before the road is put into operation,
– in the initial stage of road operation.

After analyzing the projects submitted for road safety audits, 519 various road infrastructure safety problems (hereinafter referred to as problems) were identified. Each identified problem, depending on its nature, was assigned to one or more of the 36 groups presented below (see Table 1).

First, each problem was assessed according to the importance of the group assigned to it, which was determined as the percentage of the number of problems assigned to the respective category, calculated from the total number of problems identified that year.

The second indicator assessed was the significance of each specific problem group throughout the entire analyzed period of 2024–2025. This indicator is expressed as a percentage and shows the significance of the respective category.

3. Overview

After analyzing the data from the aforementioned audit reports and the problems identified in them, it was

Table 1. List of problem groups (source: made by the authors)

No.	Problem groups	No.	Problem groups
1	Inadequate road signs and vertical markings	19	Inappropriate road plan elements (horizontal beams)
2	Other remarks	20	Road recognition and homogeneity
3	Inadequate horizontal markings	21	Inappropriate intersection geometry
4	Inadequate road barriers	22	Inappropriate roadway geometry
5	Inadequate surface water drainage	23	Other traffic safety improvement measures (fences, etc.)
6	Inadequate tactile indicator schemes	24	Inappropriate intersection configuration
7	No barriers/pedestrian fences	25	Reflectors/signal columns
8	No tactile indicators. Lanes of the same color and texture	26	Inappropriate location of route transport stops
9	Lack of directional lighting	27	Lack of road/street crossing
10	Inadequate geometry of pedestrian crossing/unmarked crossing	28	Incompatibility of road signs and horizontal markings
11	Lack of path sections	29	Inappropriate intersection type
12	Improperly smooth carriageway, improperly leveled	30	Lack of road (street) and path lighting
13	Inadequate visibility due to track geometry	31	Inappropriate stop geometry
14	Inadequate/unsafe type of pedestrian crossing	32	Inappropriate longitudinal profile elements
15	Gauge not ensured. Obstacles on the roadway, roadside, roadsides	33	Paths with inappropriate parameters (including longitudinal slope)
16	Unsatisfied visibility at intersections and exits	34	Notes with traffic lights
17	Comments with exits (geometry, configuration, exit in the wrong place	35	Inappropriate parking space layout scheme. Inappropriate configuration of vehicle parking spaces
18	No speed control devices/speed control devices	36	Vehicle parking spaces are located where they should not be

estimated that on average 11.04 problems were identified during one audit. Detailed RSA statistics are presented in Table 2.

Table 2. Distribution of road safety audits and identified problems (source: made by the authors)

Year	Road safety audit count	Problems found	Problems per audit
2024–2025	47	519	11.04

Tumavičė et al. (2020) analyzed reports of road safety audits conducted in the period 2011–2017. In 2011, 2 audits were conducted, in 2012 the volume of audits increased to 48, and in 2017 – 105 audits. The number of identified problems increased along with the volume of audits: in 2011 – 19 problems, in 2012 – 401 problems, and in 2017 – 1108 problems. It was found that in the period 2011–2014 the average number of problems per audit was relatively low (from 5.62 to 6.23). This can be attributed to simpler projects, lower road category, short road sections and less experience of auditors.

In the period 2015–2017, there has been a noticeable increase in the number of identified problems, which reached 10.55 problems per audit in 2017. This trend indicates a wider application of the road safety audit procedure and the increasing experience of road safety auditors.

The average for the period 2024–2025 (11.04 problems per audit) exceeds even the highest values of 2011–2017. This reflects stricter road safety requirements, greater attention by auditors to the safety of vulnerable road users (pedestrians and cyclists), as well as a more comprehensive and standardized procedure for road safety audits (RSA).

An analysis of the distribution of road safety audits conducted in 2024–2025 by audit stage showed that the vast majority of audits (87%) were conducted at the road infrastructure project preparation stage, and the remaining 13% were conducted before the start of road operation. Meanwhile, no audits were conducted at the initial road operation stage (see Figure 1).

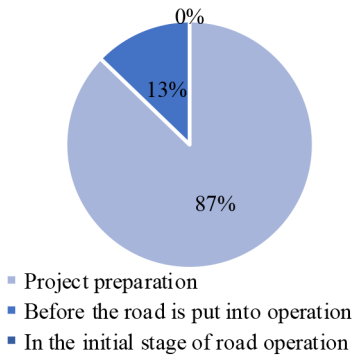

Figure 1. Distribution of audits carried out in 2024–2025 by stage, in percentage (source: made by the authors)

Since the road safety audit at the initial stage of road operation became mandatory, not enough time has passed to objectively and comprehensively assess the effectiveness and practical results of this stage. Since this audit is carried out only when the road has been in operation for approximately 12–18 months after its completion, some of the implemented projects have not yet reached the required operational life. In addition, this audit stage is implemented less frequently in practice, as mandatory application is envisaged for a relatively small part of road infrastructure objects.

The problems identified during the road safety audit are also classified according to the degree of importance of the problem. The degree of importance (high, medium, low) is a criterion used in regulatory documents to assess the risk to road safety posed by the identified problem. Based on this assessment, the priority for eliminating the problem is also determined.

The analysis of identified problems by degree of importance (see Figure 2) conducted in 2024–2025 showed that most problems were classified as medium importance (about 45%), which allows us to state that a large part of the identified problems may have a significant negative impact on traffic safety, especially if they are not eliminated in a timely manner or are repeated in different projects. High-importance problems accounted for about 24% and should be assessed as critical, as they can directly increase the risk of traffic accidents and lead to serious consequences, and a relatively large share of them indicates that solutions are identified in the projects that can significantly affect the safety of road users.

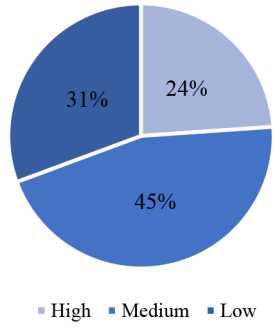

Figure 2. Distribution of problems in several infrastructure projects by degree of importance, in percentages (source: made by the authors)

Low-importance problems accounted for about 31% and are usually related to problems with a lower direct impact, but their abundance may indicate uneven quality of design solutions and the need to strengthen design consistency and compliance with regulatory requirements (see Figure 2).

The study analyzes problems that were divided into 36 groups. The analysis of identified road safety audit problems in 2024–2025 showed that the most commonly identified problems are related to traffic organization measures, infrastructure for vulnerable road users, and

individual road engineering solutions. The largest share of all identified problems was made up of inappropriate road signs and vertical markings (9.09%), inappropriate horizontal markings (7.13%) and other types of remarks (7.37%). This shows that the quality of information provision to road users and the clarity of traffic organization solutions remain very relevant. A significant part of the problems was related to road infrastructure protection measures and operational aspects – inappropriate road barriers accounted for 6.63%, surface water drainage solutions for 5.41%, and the lack of barriers or pedestrian fences for 4.91%. These results suggest that some of the identified problems are related to the detailing of project solutions (see Table 3).

When assessing the safety of vulnerable road users, it was found that audits often record problems related to the accessibility and safety of pedestrian infrastructure. Inappropriate tactile indicator schemes accounted for 5.41%, the absence of tactile indicators – 4.42%, and deficiencies in the geometry of pedestrian crossings – 3.44%. Also identified were the lack of footpath sections (3.19%) and unsafe or inappropriate type of pedestrian crossing (2.95%), which allows us to state that the design solutions do not sufficiently ensure the safe and comfortable movement of vulnerable road users. Additionally, visibility problems are distinguished, which occur both due to the geometry of the route (3.19%), and at intersections and exits, where visibility is limited by greenery and fences (2.70%). Ensuring visibility remains a significant risk factor for traffic safety. The fewest problems were identified related to improperly equipped vehicle parking spaces, which accounted for only 0.25% of all identified problems (see Table 3).

Tumavičė et al. (2020) analyzed the problems in road safety audit reports conducted in the period 2011–2017. The problems were divided into 12 different groups. During the analyzed period, a clear trend was found that the most common problems were related to road signs and vertical markings, which reached their highest value in 2012 (39.4%), and in subsequent years consistently decreased to 19.7% in 2017. This decrease can be attributed to the gradually improving design practice, experience

Table 3. List of problem groups and their percentage (source: made by the authors)

No.	Problem groups	Percentage (%)
1	Inadequate road signs and vertical markings	9.09
2	Other remarks	7.37
3	Inadequate horizontal markings	7.13
4	Inadequate road barriers	6.63
5	Inadequate surface water drainage	5.41
6	Inadequate tactile indicator schemes	5.41
7	No barriers/pedestrian fences	4.91
8	No tactile indicators. Lanes of the same color and texture	4.42
9	Lack of directional lighting	3.44
10	Inadequate geometry of pedestrian crossing/unmarked crossing	3.44
11	Lack of path sections	3.19
12	Improperly smooth carriageway, improperly leveled	3.19
13	Inadequate visibility due to track geometry	3.19
14	Inadequate/unsafe type of pedestrian crossing	2.95
15	Gauge not ensured. Obstacles on the roadway, roadside, roadsides	2.70
16	Unsatisfied visibility at intersections and exits	2.70
17	Comments with exits (geometry, configuration, exit in the wrong place	2.46
18	No speed control devices/speed control devices	2.21
19	Inappropriate road plan elements (horizontal beams)	1.97
20	Road recognition and homogeneity	1.97
21	Inappropriate intersection geometry	1.72
22	Inappropriate roadway geometry	1.72
23	Other traffic safety improvement measures (fences, etc.)	1.72
24	Inappropriate intersection configuration	1.47
25	Reflectors/signal columns	1.47
26	Inappropriate location of route transport stops	1.47
27	Lack of road/street crossing	1.23
28	Incompatibility of road signs and horizontal markings	1.23
29	Inappropriate intersection type	0.74
30	Lack of road (street) and path lighting	0.74
31	Inappropriate stop geometry	0.74
32	Inappropriate longitudinal profile elements	0.49
33	Paths with inappropriate parameters (including longitudinal slope)	0.49
34	Notes with traffic lights	0.49
35	Inappropriate parking space layout scheme. Inappropriate configuration of vehicle parking spaces	0.25
36	Vehicle parking spaces are located where they should not be	0.25

in applying regulatory documents, and greater attention to traffic management solutions. It is observed that some of the previously frequently identified design or installation errors are recurring less frequently over time, and the application of design solutions is gradually becoming more consistent and homogeneous. This can be seen as one of the benefits of proactive road safety audits, as the comments and recommendations provided during the audit provide the opportunity for designers to learn from previous cases, improve the quality of solutions and avoid recurring problems in future projects. In addition, the feedback mechanism between auditors, road managers and designers also has a significant positive impact. In practice, when discussing the audit results during meetings, auditors are provided with information about which proposed solutions did not work in real operating conditions, therefore, in subsequent audits such recommendations are provided less frequently or are adjusted.

It is noteworthy that the results of the 2024–2025 survey also show that road signs and vertical markings remain the most relevant problem, despite the fact that their relative share is only 9.09% of all identified problems. This percentage change cannot be interpreted as a real decrease in the significance of the problem, since in the latest survey the problems were classified into 36 groups, compared to 12 groups in the previous period.

In 2011–2017, an increase in pedestrian and cyclist problems was observed from 8.7% (2012) to 26.6% (2017). These figures show that the network of pedestrian and bicycle paths is being expanded and audits are increasingly identifying problems related to the infrastructure of vulnerable road users (crossings, paths, visibility, etc.).

The 2024–2025 study confirms this trend. When assessing the safety of vulnerable road users, it was found that audits often record problems related to the accessibility and safety of pedestrian infrastructure. Inappropriate tactile indicator schemes accounted for 5.41%, the absence of tactile indicators – 4.42%, and deficiencies in the geometry of pedestrian crossings – 3.44%. Also identified were the lack of path sections (3.19%) and unsafe or inappropriate type of pedestrian crossing (2.95%), which allows us to state that design solutions still do not consistently ensure safe and comfortable movement for pedestrians, including road users with limited mobility.

Comparing the results of 2024–2025 with the distribution of problems by group in the previous 2011–2017 period, a structural shift is visible from a more general description of conflict situations towards a more detailed assessment of specific infrastructure elements.

Such a detailed classification of problems allows for more precise identification of specific problems, but at the same time breaks down the overall percentage of one problem group. Nevertheless, road sign and vertical marking problems remain dominant in both analyzed periods, which indicates the long-term and systemic nature of the problem.

It can be stated that the quality of road signs and vertical marking solutions and the safety of vulnerable road users remain one of the most sensitive areas of road infrastructure safety, and the recurrence of these problems in different periods emphasizes the need to further strengthen control of the design process, the application of regulatory documents and the role of road safety audits.

4. Conclusions

1. An analysis of road safety audit reports from 2024–2025 found that 519 problems were identified in 47 audits, with an average of 11.04 problems recorded per audit. This indicator is higher than even the highest values in the 2011–2017 period, suggesting that road safety audits have become more comprehensive and rigorous in recent times.
2. In 2024–2025, most road safety audits (87%) were carried out at the project preparation stage, and 13% before the start of road operation, therefore auditing in Lithuania is mainly applied as a preventive measure. No audits were carried out at the initial stage of road operation, as this stage has only recently become mandatory and requires 12–18 months of road operation, therefore its effectiveness can only be assessed in the future, after more data has been accumulated.
3. The distribution of problems by severity for 2024–2025 shows that the majority of problems are of medium severity (about 45%) and can significantly affect traffic safety. High-severity problems (about 24%) are critical and emphasize the need to strengthen the quality of safety solutions at the design stage. Low-severity problems (about 31%) have a less direct impact, but their abundance may indicate gaps in design consistency and compliance with regulatory requirements.
4. Structural analysis of the problems showed that the most common problems identified in road safety audits were related to traffic management measures, infrastructure for vulnerable road users and road engineering solutions. The largest share was made up of inadequate road signs and vertical markings (9.09%), horizontal markings (7.13%) and other remarks (7.37%), therefore the clarity of traffic information remains a priority area.
5. Comparing the results of the audits for 2024–2025 and 2011–2017, it was found that problems with road signs and vertical markings remain a systemic and most relevant problem in both periods. Although their share in 2024–2025 is lower (9.09%), this is more related to a more detailed classification of problems than to a real decrease in significance. The trend of increasing attention being paid to the safety of vulnerable road users has also been confirmed, as problems with pedestrian infrastructure are often identified. Therefore, it is necessary to

further strengthen design control and the application of regulatory requirements.

6. It is recommended that designers pay more attention to the placement of road signs and the compatibility of vertical and horizontal markings. When planning infrastructure solutions, it is necessary to avoid errors related to the safety of vulnerable road users. Design solutions must ensure clear and unambiguous presentation of information, in accordance with applicable regulatory requirements and principles of good practice.

References

Ahmed, I., Puan, O. C., & Ismail, C. R. (2013). A comparative review of road safety audit guidelines of selected countries. *Jurnal Teknologi*, *65*(3), 67–74. https://doi.org/10.11113/jt.v65.2148

AlHamad, S., Almallah, M., Naser, M. N., Alhajyaseen, W. K. M., & de Roos, M. P. (2023). Examining the role of road safety audits worldwide: Exploring road safety experts' opinions. *International Journal of Injury Control and Safety Promotion*, *30*(1), 106–115. https://doi.org/10.1080/17457300.2022.2114090

Calderón Ramírez, J. A., Núñez López, I., García Gómez, L. G., & Montoya Alcaraz, M. A. (2023). Main guidelines in road safety audits: A literature review. *Frontiers in Built Environment*, *9*, Article 1282251. https://doi.org/10.3389/fbuil.2023.1282251

Elvik, R., & Vaa, T. (2004). *The handbook of road safety measures* (2nd ed.). Elsevier.

European Court of Auditors. (2024). *Reaching EU road safety objectives: Time to move up a gear* (Special report 04/2024). https://www.eca.europa.eu/ECAPublications/SR-2024-04/SR-2024-04_EN.pdf

European Parliament, & Council of the European Union. (2019). *Directive (EU) 2019/1936 on road infrastructure safety management*. https://eur-lex.europa.eu/eli/dir/2019/1936/oj

Ministry of Transport of the Republic of Lithuania. (2022a, February 17). *On the approval of the requirements and procedure for conducting road safety audits* (Order No. 3-97). https://www.e-tar.lt/portal/lt/legalAct/35fa18e08fb811ecaf3aba0cb308998c

Ministry of Transport of the Republic of Lithuania. (2022b, February 24). *On the approval of the requirements and procedure for the training, examination, issuance, suspension, lifting of suspension and lifting of validity of road safety auditors* (Order No. 3-108). https://www.e-tar.lt/portal/lt/legalAct/69bb77f0956211ecaf3aba0cb308998c

Tumavičė, A., Jasiūnienė, V., & Kravcovas, I. (2020). Identification and analysis of problems in the implementation of road safety audit in Lithuania. *The Baltic Journal of Road and Bridge Engineering*, *15*(2), 111–126. https://doi.org/10.7250/bjrbe.2020-15.475