Environmental and Social Due Diligence, Impact Assessment and Road Safety Audit for the Moldova TEN-T Road Network Rehabilitation Project, DTM 55768

Road Safety Audit Tranche 2: M3 Road Lot 1, Lot 4

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European Bank
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2. Background of the project

The European Bank for Reconstruction and Development (EBRD) is considering the provision of a sovereign loan to the Republic of Moldova to support the rehabilitation, upgrading, and construction of priority national road corridors. The investment is structured into four tranches under a wider national programme, with the current assignment focused on Tranche 1 (Category B) and Tranche 2 (Category A). These works are of strategic importance to Moldova’s transport sector, as they aim to improve regional connectivity, enhance cross-border linkages with Romania and Ukraine, and contribute to safer, more reliable mobility for all road users.

Tranche 1: R7 Road (Category B)

Tranche 1 covers approximately **104.8 km of the R7 Road**, extending from the junction with the R14 to Costești at the Romanian border, and including a separate section from Soroca to the Ukrainian border. The tranche is divided into six lots:

- **Lot 1:** R14 – Drochia (29 km)
- **Lot 2:** Drochia – Rîșcani (27.4 km)
- **Lot 3:** Rîșcani – Costești (30 km)
- **Lot 4:** Drochia Bypass (6 km)
- **Lot 5:** Connection with the new bridge over the River Prut at the Romanian border (5 km)
- **Lot 6:** Soroca – Ukrainian border (7.4 km)

This tranche has been categorised as Category B under the EBRD Environmental and Social (E&S) Policy, as the expected environmental and social impacts are site-specific, temporary, and manageable with standard mitigation measures.

Note: This Road Safety Audit (RSA) has been undertaken for Tranche 1, covering Lot 1, Lot 2, and Lot 3, where sufficient design information was available to carry out a meaningful assessment. Lots 4, 5, and 6 are not included in this audit, as no detailed drawings or related information have been produced for these sections to date. However, general safety recommendations for Lots 4, 5, and 6 have been indicated based on the outcomes of the assessments for Lots 1–3 and observations made during the site visit, to guide future design development and ensure that road safety principles are considered early. Separate report has been prepared for the Road Safety Audit of Lot 1, Lot 2 and Lot 3 for Tranche 1.

Tranche 2: M3 Road (Category A)

Tranche 2 addresses 70.9 km of the M3 Road, an essential north–south corridor linking Chișinău with Comrat, Giurgiulești, and the Romanian border. The tranche is divided into four lots:

- **Lot 1:** Airport Interchange – Porumbrei (34.4 km)
- **Lot 2:** Porumbrei – Cimișlia (19 km), involving rehabilitation and widening from 2 to 4 lanes (Category A)
- **Lot 3:** Cimișlia – Comrat (12 km)
- **Lot 4:** Giurgiulești Ring Road (5.5 km)

Due to the widening works over more than 10 km in Lot 2, Tranche 2 has been classified as Category A. This requires the preparation of a full Environmental and Social Impact Assessment (ESIA) and associated documentation, with public disclosure for a minimum of 120 days.

Note: Road Safety Audit (RSA) has been undertaken for Tranche 2, covering Lot 1 and Lot 4, where sufficient design information was available to carry out a meaningful assessment. Lots 2 and 3 are not included, as no detailed *drawings or related information have been produced for these sections to date. However, general safety recommendations for Lots 2 and 3 have been indicated based on the outcomes of the assessments for Lots 1 and 4 and observations made during the site visit, to guide future design development and ensure that road safety principles are considered early.*

Investment Structure

The total capital expenditure (CAPEX) for the two tranches amounts to EUR 403.6 million, with an additional EUR 20.18 million allocated for supervision and project implementation support (S&PIU), bringing the total programme value to EUR 423.78 million.

- **Tranche 1:** EUR 237.30 million (CAPEX + S&PIU)
- **Tranche 2:** EUR 186.48 million (CAPEX + S&PIU)

Strategic Importance

The Project will play a critical role in modernising Moldova's core road network, reducing travel times, supporting trade and regional integration, and improving accessibility to border crossings. The inclusion of a comprehensive RSA aligns with EBRD's commitment to embedding international best practices in road safety, ensuring that the upgraded corridors not only improve mobility but also contribute to the long-term reduction of road traffic collisions and fatalities.

Moldova's road network is a lifeline for economic development, given the country's lack of navigable waterways and limited railway coverage. The rehabilitation and modernisation of the road network, including the R7 and M3 corridors under the present project, will:

- Enhance cross-border trade and integration with the EU transport system.
- Support regional development and accessibility.
- Improve safety standards in line with international best practice.

3. Road network and safety performance in Moldova

The Republic of Moldova has a road network that plays a vital role in ensuring the country's economic activity, mobility, and regional integration. Positioned between Romania and Ukraine, Moldova's transport system provides a key transit corridor for trade flows between the European Union, the Commonwealth of Independent States (CIS), and the Black Sea region. The efficiency, safety, and reliability of the national road network are therefore of strategic importance not only to the domestic economy but also to regional connectivity.

According to Article 2 of the Law on Roads No. 509 (22/06/1995, last amended in 2020), the road network of the Republic of Moldova is classified into two main categories:

- Public roads, and
- Private roads.

From a functional perspective, public roads are further divided into:

- European roads,
- National roads, and
- Local roads.

Within the category of national roads, the following subtypes are distinguished:

- Highways,
- Express roads,
- Republican roads, and
- Regional roads.

Local roads are classified as:

- Roads of district (municipal) interest,
- Communal roads, and
- Streets.

European roads (E-roads) are defined as international transport corridors crossing the territory of the Republic of Moldova in accordance with the European Agreement on Main International Traffic Arteries (AGR), administered by the United Nations Economic Commission for Europe (UNECE). These roads may overlap with highways, express roads, or republican roads.

National roads are state-owned public roads that provide the main international connections, link the capital with municipalities and major cities, and connect places of republican significance. They fall into four categories:

- Highways (M): High-capacity, high-speed roads for motor vehicles only, with at least two lanes per direction, a median, a stopping lane, grade-separated intersections, and controlled access via junctions.
- Express Roads (M): Roads with two or more lanes, accessible only through grade-separated junctions or regulated intersections, where stopping and parking on the carriageway are prohibited.
- Republican Roads (R): Roads linking Chișinău with other cities, municipalities, industrial centres, cultural and natural landmarks, and major transport hubs such as railway stations, airports, and river ports.
- Regional Roads (G): Roads of regional importance, connecting settlements across two or more districts or at least four localities within one district.

The road infrastructure of the Republic of Moldova totals 10,680 km of public roads, of which:

- 5,952 km are national public roads,
- 3,708 km are local public roads, and
- 1,070 km are public roads located on the left bank of the Dniester River.

The network managed by the State Road Administration (SRA) consists of 5,951.9 km of national public roads, broken down as follows:

- Express roads (M): 631.1 km
- Republican roads (R): 1,995.6 km
- Regional roads (G): 3,304.1 km
- Local public roads (L): 21.1 km

Additionally, 3,708 km of local public roads are under the authority of regional and municipal administrations.

The detailed structure of the network under SRA management is presented in Table 1.

Road Category	Length (km)	Share of Network (%)
Express roads (M)	631.1	10.6 %
Republican roads (R)	1,995.6	33.5 %
Regional roads (G)	3,304.1	55.5 %
Local public roads (L)	21.1	0.4 %
Total	5,951.9	100

Table 3-1. Moldova road network managed by the State Road Administration[1]

3.1. Road Surface and Condition

In 2020, approximately 46.8% of Moldova's road network was assessed as being in poor condition. The country's significant investment gap becomes evident when compared with international benchmarks. According to the 2019 Global Competitiveness Report, the quality of Moldova's road infrastructure ranked among the lowest globally—126th out of 140 countries—and was identified as the poorest in the Europe and Central Asia (ECA) region[2].

The Republic of Moldova applies a systematic and continuous data collection process to monitor the condition and quality of its road pavement network on an annual basis. The assessment is based on the International Roughness Index (IRI), a globally recognized indicator used to quantify road surface roughness and overall ride quality. The IRI reflects the smoothness of the pavement, where lower values correspond to better surface conditions and higher values indicate increased deterioration and the need for maintenance or rehabilitation. This indicator enables the identification of specific road sections or categories that require timely interventions, supporting efficient asset management and investment prioritization. Figure 1 illustrates the evolution of the IRI across Moldova's national public road network between 2018 and 2023, showing how pavement conditions have varied over time at the national level.

[1] The State Road Administration, 2023.

[2] Moldova Rural Connectivity Project (P180153), environmental and social management plan for C8.1&C8.2 (C8) corridor (G88 & G86 road) (Cornesti – M5-C8.3), 2024.

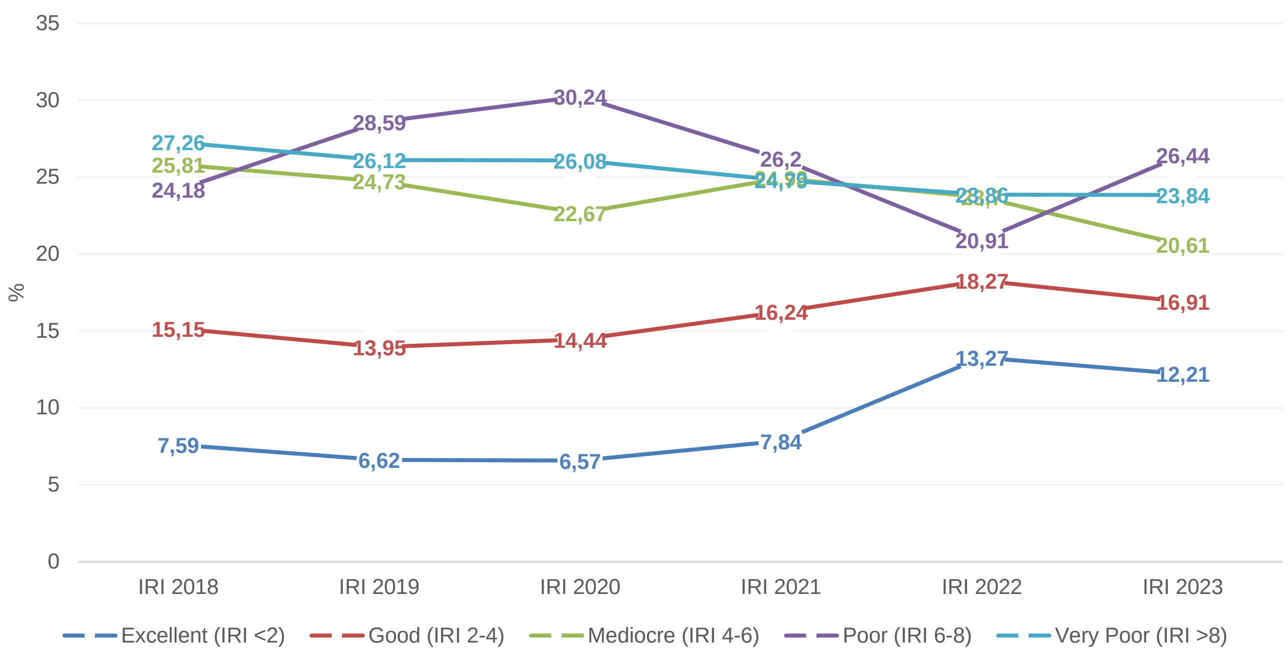


Figure 3-1. The evolution of road condition of national public roads according to the IRI index during the years 2018-2023

Source: Presentation of Ministry of infrastructure and regional development, S.E. State Road Administration, May 28, 2024 for Transport Community.

Between 2018 and 2023, the condition of Moldova's national public roads showed moderate fluctuations in surface quality. The share of "Excellent" (IRI <2) roads slightly increased—from 7.6% in 2018 to 12.2% in 2023, indicating some improvement in top-condition sections. "Good" (IRI 2–4) roads also grew modestly from 15.2% to 16.9%, suggesting gradual maintenance progress. However, the proportion of "Mediocre" (IRI 4–6) roads declined from 25.8% to 20.6%, while "Poor" (IRI 6–8) conditions fluctuated notably—peaking at 30.2% in 2020, then dropping in 2022 before rising again to 26.4% in 2023. The share of "Very Poor" (IRI >8) roads remained relatively stable, decreasing slightly from 27.3% to 23.8%.

Overall, the data show a modest improvement in the best-quality road segments, but a persistent share of deteriorated sections, highlighting the ongoing need for targeted rehabilitation and maintenance across the national road network.

3.2. Road vehicle fleet

Each year, thousands of new and used vehicles are registered in the Republic of Moldova, and this trend is expected to continue as economic conditions improve and the country's motorisation level remains comparatively low. The national vehicle fleet is now about twice as large as in the early 2010s, when around 610,000 vehicles were registered. According to the State Register of Transport (RST), Moldova exceeded 1,000,000 registered motor vehicles in May 2019. Overall, car ownership in Moldova doubles approximately every 15 years, illustrating a consistent rise in private mobility and vehicle use.

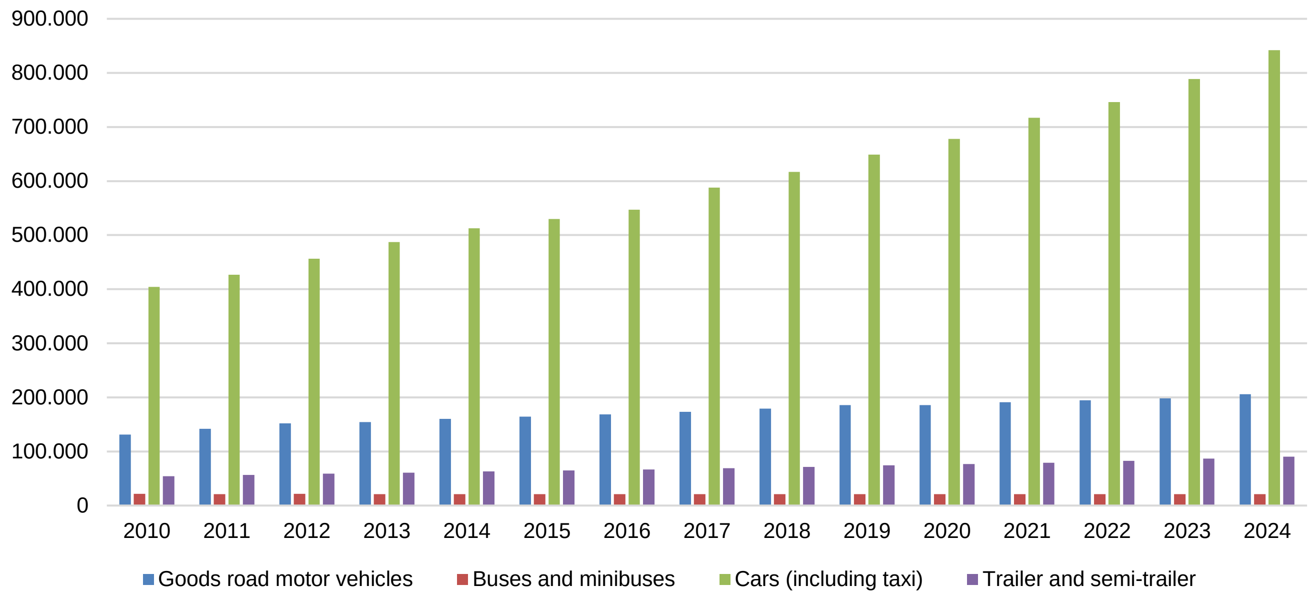


Figure 3-2. Number of registered motor vehicles

Source: Statistical databank (Biroul național de statistică al Republicii Moldova)

The structure of Moldova's transport fleet continues to evolve in line with economic growth, trade integration, and infrastructure improvements. The majority of vehicles are passenger cars, accounting for roughly 80 percent of the national fleet, while commercial vehicles—such as light vans, trucks, and buses—make up a smaller but steadily expanding share due to increasing demand for logistics and public transport services. The average vehicle age remains high, at around 15 years, reflecting the predominance of imported second-hand cars, primarily from the EU. Nonetheless, gradual fleet renewal is underway, supported by policies promoting energy-efficient and lower-emission vehicles. The consistent annual increase of approximately 4.7 percent in total registrations highlights both the growing importance of road transport in Moldova's economy and the need for continued investment in road safety, emissions control, and sustainable mobility initiatives.

3.3. Road accidents

A dedicated unit within the National Inspectorate for Public Security under the General Police Inspectorate (GPI), hereafter referred to as the Traffic Police, is responsible for collecting crash data. Traffic crash information is initially recorded on a paper-based form at the scene and subsequently entered into the central crash database—the Automated Information System "State Register of Road Accidents" (AIS RAR)—following a quality control process. This crash database has been in use since 2014 but has not undergone any upgrades since its implementation.

Based on the graph, the number of registered traffic accidents has generally decreased over the period 2017–2024, falling from 2,640 in 2017 to 1,986 in 2024, representing an overall reduction of approximately 24.8%. A notable drop occurred in 2020, when accidents fell to 2,003, likely influenced by reduced mobility during the COVID-19 pandemic. After a temporary increase in 2021 to 2,548, the numbers continued to decline, stabilizing around 1,976–1,986 in 2023–2024.

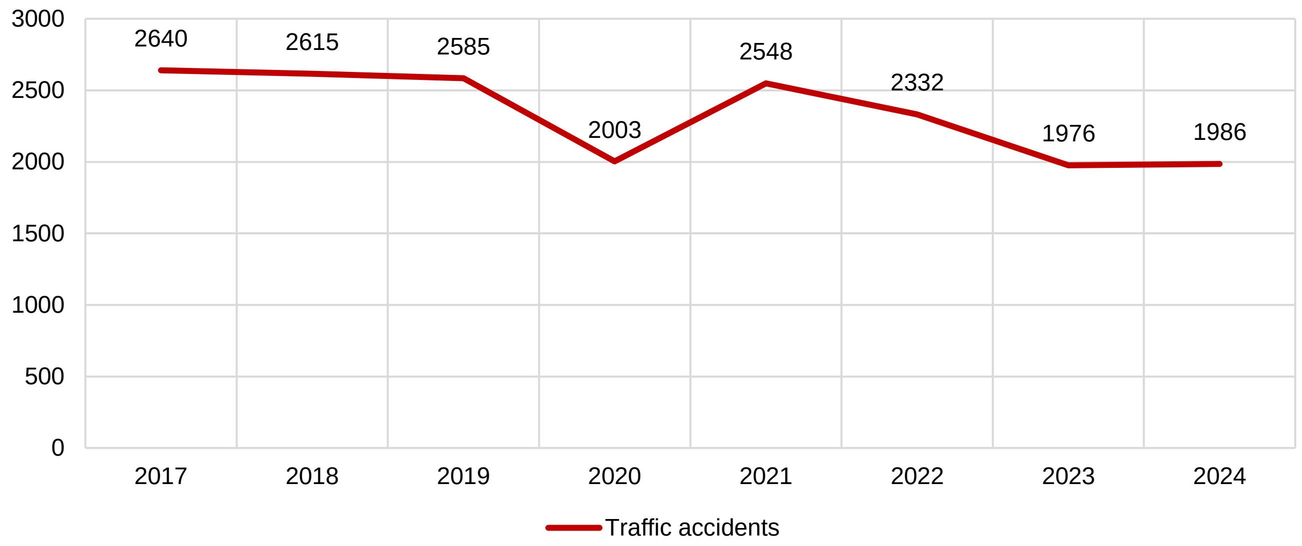


Figure 3-3. Number of registered road accidents

Source: Road Safety Performance Review Moldova (United Nations, 2024); Automobile Club of Moldova (ACM)

The trend in road accident fatalities in Moldova from 2005 to 2024 shows a significant overall decline, despite an initial surge. Fatalities peaked in 2008 at 509 deaths, up from 391 in 2005. Following this peak, the country achieved a major breakthrough in road safety, marked by a steep, one-year reduction from 445 fatalities in 2012 to 301 in 2013. This reduction suggests the successful implementation of new road safety policies or enforcement measures. The downward trend largely continued over the next decade, with the numbers stabilizing around 300 before entering a renewed decline. The lowest fatality count in the entire period was recorded in 2023 at 197. By 2024, the preliminary data indicates a slight increase to 202 fatalities. Overall, the reduction from the 2008 peak of 509 to the 2023 low of 197 represents a remarkable decrease of approximately 61.3%, demonstrating considerable long-term progress in making Moldova's roads safer.

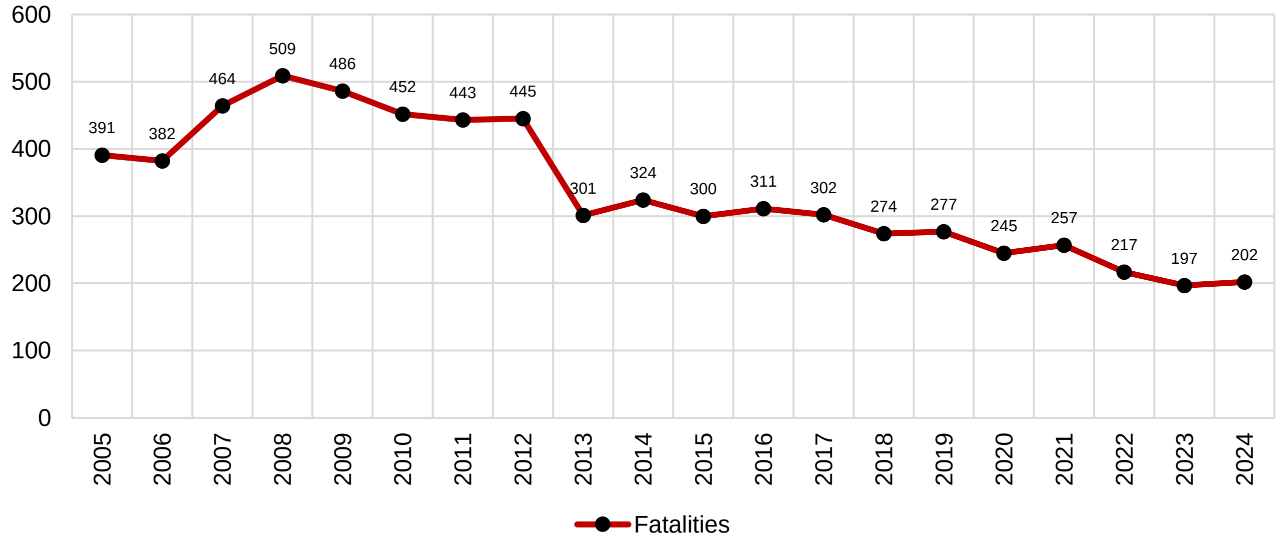


Figure 3-4. Number of fatalities in road accidents

Source: UNECE Transport Statistics Database, compiled from national and international official sources.

The analysis of persons injured in road accidents in Moldova from 2005 to 2024 shows a fluctuating trajectory with an overall moderate decrease. The number of injured initially surged, reaching its peak in 2010 at 3,745 individuals. Following this high point, the figures entered a phase of gradual decline until 2019. A defining moment occurred in

2020, with the sharpest drop to 2,265 injured, an outcome strongly linked to reduced mobility during the COVID-19 pandemic. A post-pandemic rebound pushed the number back up significantly to 2,862 in 2021 before a renewed decline led to 2,289 injuries in 2023. The latest data for 2024 shows a slight increase to 2,375. Despite the volatility, the overall reduction from the 2010 peak to the 2023 low is significant. However, the sustained number of injuries indicates that while fatality reduction has been a major success, efforts to reduce the frequency of injury-causing accidents remain a persistent challenge for Moldovan road safety.

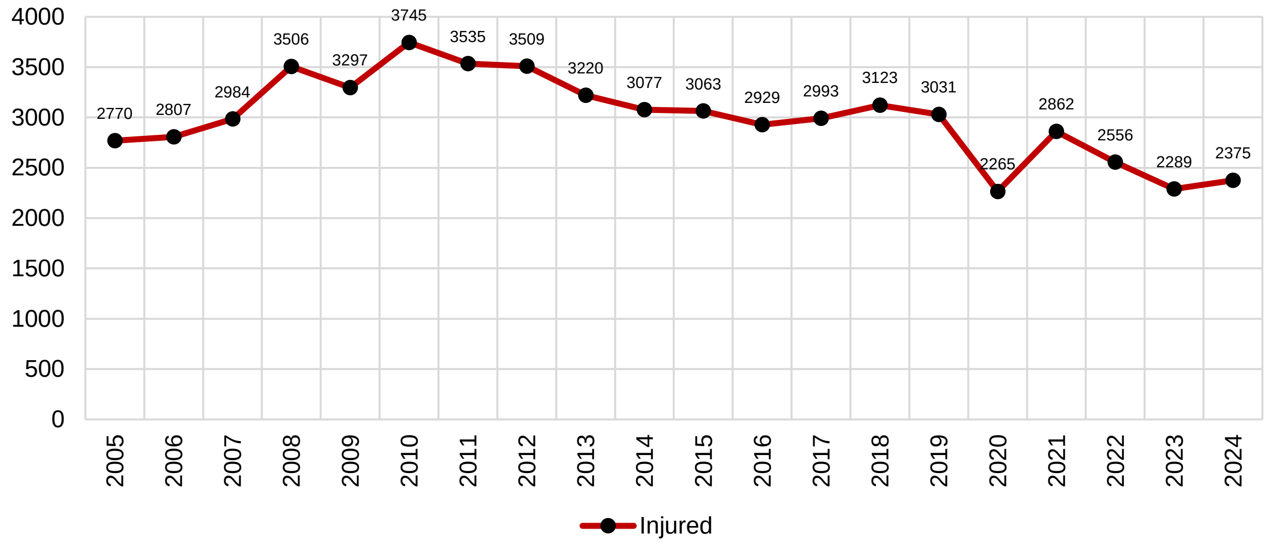


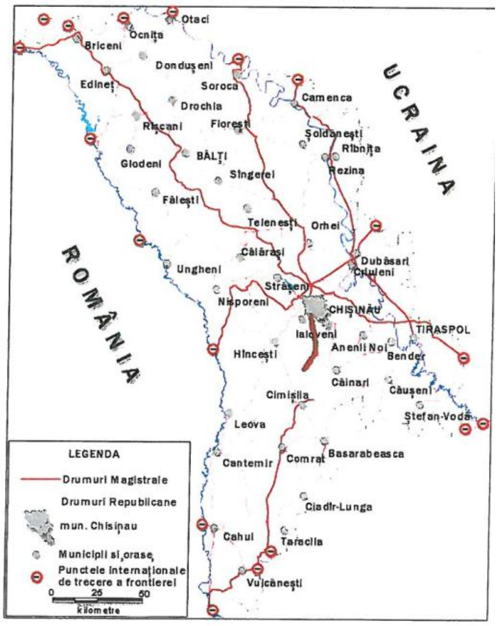
Figure 3-5. Number of injured in road accidents

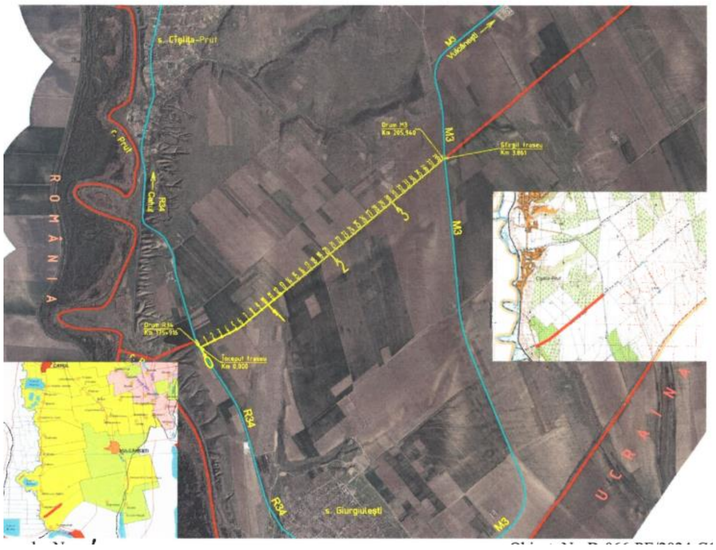
Source: UNECE Transport Statistics Database, compiled from national and international official sources.

3.4. Project rationale

The M3 road serves as the most direct and essential connection between Chisinau and Giurgiulesti, providing access to both the Danube River and the Black Sea. It also forms a key segment of the European Road E577 route linking Poltava, Kirovograd, Chisinau, Giurgiulesti, Galati, and Slobozia, and acts as an important link between TEN-T corridors IV and IX. However, its current condition—characterised by a deteriorated pavement and insufficient capacity for heavy freight—forces traffic onto longer alternative routes. This increases transport costs and limits opportunities for local businesses along the corridor. Comprehensive rehabilitation and reconstruction of the M3 would strengthen trade, transport, industry, and tourism, while also improving access to key agricultural markets. Upgrading the M3 is essential for ensuring reliable connectivity between Moldova's central and southern regions.

As part of the European integration process, the EU–Republic of Moldova Association Agreement highlights the need to implement the priority actions defined in Moldova's Transport Infrastructure Investment Strategy. This strategy focuses on rehabilitating and expanding key international rail and road corridors that traverse the country, beginning with the M3 route (Chisinau–Giurgiulesti) and the M5 corridor (Ukrainian border – Criva – Balti – Chisinau – Tiraspol – Ukrainian border).





Lot 1 Airport Interchange – Porumbrei (34.4 km)

Lot 4 Giurgiulești Ring Road

Figure 3-6. M3 road construction lots which has been assessed

Source: Project documentation and traffic management plans for each section

4. Road safety audit

4.1. Road Safety Audit Methodology and approach

In accordance with international road safety audit standards and their intended purpose, the Consultant will study the purpose and function of the road in the hierarchy, route selection, applicable standards, number and types of intersections. In addition, the Consultant will evaluate the basic principles and design of the scheme and will include horizontal and vertical alignments, lines of sight, cross-cliffs, vulnerable user needs, layout, connectivity, lighting, etc. An analysis of accidents will also be carried out to identify the most recurring problems that cause road users to be injured or killed on the roads. In the light of this analysis and the design solutions envisaged in this project, recommendations will be proposed for the improvement of the project in order to minimize the risk of accidents on this section of road in question. Most cost-effectiveness improvements and solutions will be recommended. The road safety audit reviews all the information received, assesses the geographical location of the road, traffic accident data and other relevant information. All provided information (toms of documentation) are taking into consideration and verification for best cost-effective solutions of the project design. The Consultant's auditors will provide an independent opinion and justification of the situation and a final report. The general process of RSA services of the Consultant is shown in the figure below. The final RSA report will consist of: general information about the project, such as the name of the project, the stage of the project at which the audit was carried out, the location of the facility on the site (map provided), a description of the road environment, traffic composition, traffic volume, road accidents and etc.; a narrative, ranged from high to low risk, which will contain and describe the weaknesses identified during the audit and unsafe elements of the road design, schemes with marked unsafe road elements, road safety goals and alternatives to achieve them, analysis results the influence of these alternatives, as well as photographs, graphics and other useful materials about the object in question; comments and suggestions on elimination of weak points and unsafe road elements identified in the rating of projects from high potential risk to low. Recommendations and suggestions for improvement will be provided for each identified problematic part in illustrative diagrams or pictures from best practice examples.

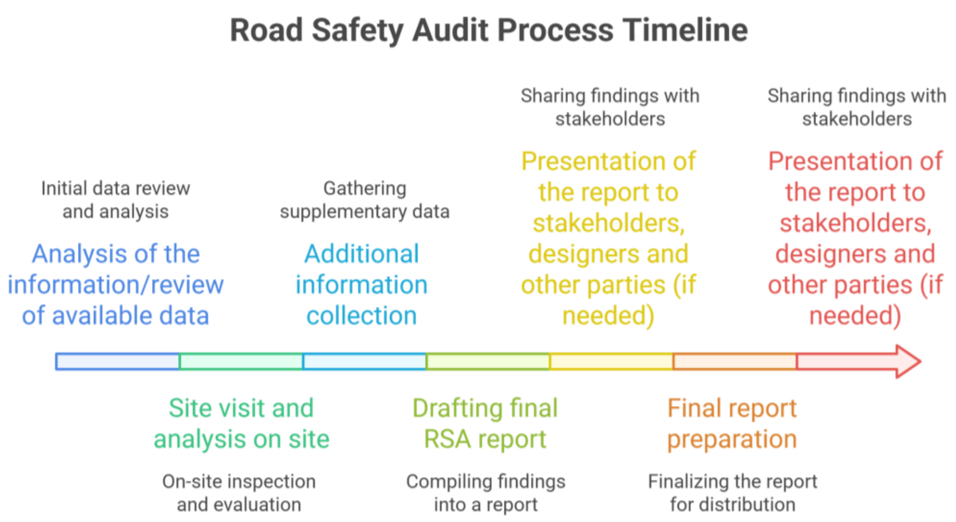


Figure 4-1. Road Safety Audit (RSA) process timeline

Source: The Consultant

In conducting Road Safety Audits (RSA), the consultants' approach is fundamentally centered on the human element, recognizing the cognitive and physical limitations of road users as the primary reference point. This perspective is grounded in an integrated understanding of the interaction between the human, the vehicle, and the infrastructure. The consultants acknowledge that road users are the most vulnerable component in the traffic system; therefore, the design and assessment of infrastructure must account for their capabilities and limitations.
RSA methodology places strong emphasis on anticipating and mitigating potential risks by aligning infrastructure design with the real-world behavior and limitations of drivers, pedestrians, and other road users. The core objective is twofold: to prevent road traffic crashes, and where prevention is not possible, to minimize the severity of their consequences.
The Consultants advocate for a systemic approach to traffic safety, in which infrastructure, regulations, vehicles, and user behavior are treated as interconnected elements. Infrastructure should be designed to avoid conflicts between vehicles with large differences in speed, direction, and mass, and it should clearly communicate to users what behavior is expected of them. Within this framework, we stress that it is the road environment—and not the road user—that must compensate for human error by providing clear guidance, forgiving design, and safe operating conditions.
By adopting this user-centric and system-oriented approach, we aim to ensure that road safety is proactively built into the design and management of transportation systems, ultimately creating safer roads for all.

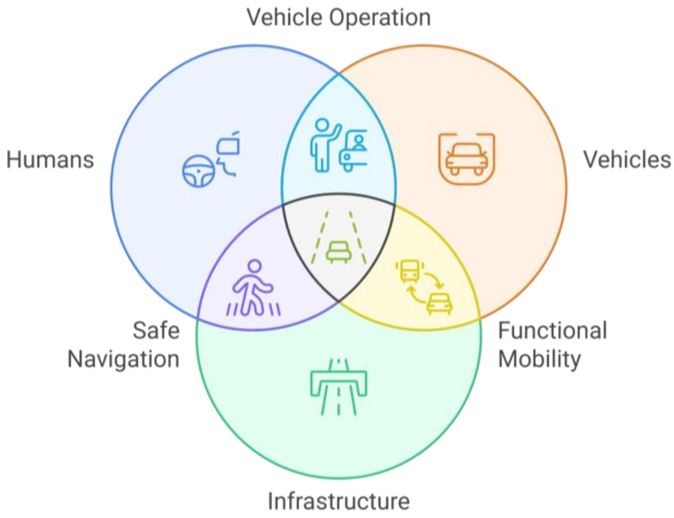


Figure 4-2. Road safety system

Source: The Consultant

When conducting an RSA, the process begins with a comprehensive review of all available documentation and site visit of the road section under analysis. The visual materials play a critical role in helping auditors form a holistic understanding of the road environment, including its physical layout, surrounding context, types and volumes of road users, and observable behaviors. Submitted documents, such as project proposals and technical plans, provide valuable insight into the scope of the project, its design intentions, and how it is expected to be implemented. Each section of the road is examined thoroughly—kilometer by kilometer—by correlating the existing conditions observed through footage with the proposed design plans. The analysis is grounded in the application of European Union best practices for road safety.
Based on this assessment, the audit team proposes the most suitable road safety interventions, often recommending modifications to the original design to enhance safety performance. These recommendations are

tailored not only to the existing traffic environment but also with a forward-looking perspective, taking into account expected increases in traffic volume. The ultimate goal is to support the development of road infrastructure that is both safe and sustainable under real-world conditions.

4.2. Functions of the road

Every road must ensure a certain level of traffic quality and correspond to three purposes/functions:

1. Freeway/transit purpose (transit roads): for fast and undisturbed traffic – roads of very high and high traffic quality and speed.
2. Collector and distributor purpose (distribution/regional roads): When the traffic at junctions is distributed between different territories and areas – roads of average traffic quality.
3. Local purpose (approach/local roads): When conditions to approach homesteads, fields and other territories using descents are created - roads of minimal traffic quality.

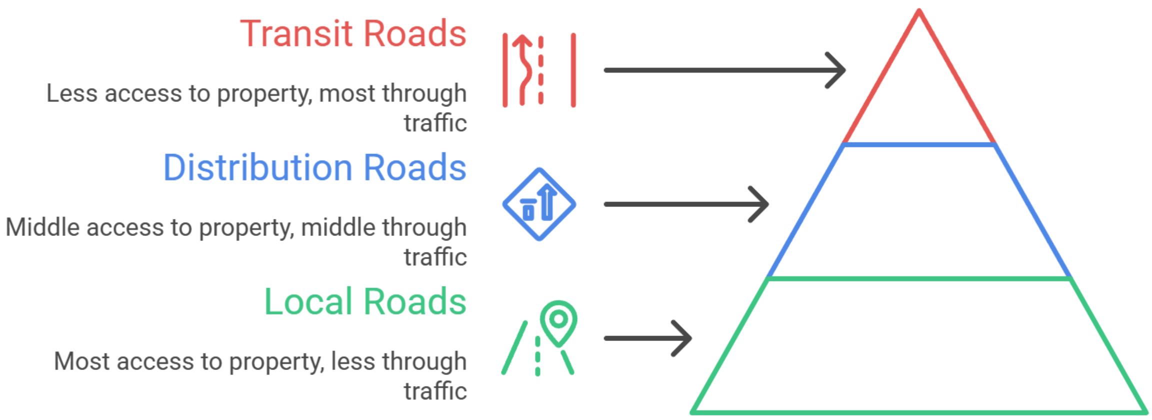


Figure 4-3. Functions of the road

Source: The Consultant

The M3 road serves one primary and strategic function: transit. As a major transit corridor, it is intended to ensure efficient, high-speed, and secure movement of people and goods between key national and international destinations. Its role extends beyond simple connectivity—it forms a backbone for regional mobility, supports economic exchange, and enables seamless integration with broader transport networks. By providing a direct route for long-distance and freight traffic, the M3 is expected to minimise travel time, reduce logistic costs, and maintain a consistent traffic flow without unnecessary interruptions from local access. In essence, the M3 is designed not as a local service road, but as a critical transit artery essential for Moldova's economic development and international transport connectivity.

4.3. Technical Design Solutions for M3 road

LOT 1: Airport Interchange – Porumbrei (34.4 km)

The information described below has been extracted from the project documentation: "Execution project, Volume 2. Drawing sheets, Road works, Part I, Site plan, Longitudinal profile, Typical cross-sections, Details, Synoptic, Reinforcements".

General Characteristics

The technical classification of the road, in accordance with SNiP 2.05.02-85, is Category IB, designated as an expressway. The alignment of the M3 road between km 0+000 and km 34+350 will remain unchanged, with a design speed of 120 km/h as prescribed by the standard. Nevertheless, depending on local conditions, certain parameters may be adjusted for economic efficiency and enhanced safety. As an existing expressway, the general geometric characteristics of the M3 cross-section will be retained, including a platform width of 24.50–27.50 m, a carriageway consisting of four 3.75 m lanes, a median of 2.00–3.50 m, shoulders of 2.50–3.75 m, and edge strips of 0.5–1.0 m. Bridges and overpasses will be designed in accordance with SNiP 2.05.03-84 “Bridges and Overpasses” and other applicable standards. To ensure adequate surface drainage, the existing transverse slope of the roadway will be maintained. The minimum values proposed in the geometric design standards serve as guidance and should not be interpreted as strict thresholds. Although these values represent established design practices that should typically be met, the decision to rehabilitate a specific road section must be supported by a detailed technical and economic evaluation. In certain cases, relaxing standards may be necessary to achieve an acceptable return on investment; however, any reduction in design criteria must be approached with caution to avoid compromising safety on the upgraded road section.

Once the design speed of 120 km/h is established, the longitudinal and vertical profile parameters of the alignment can generally be maintained as designed for the majority of road sections.

Longitudinal profile

The longitudinal profile of the road will follow the existing ground elevations as closely as possible to minimize the required thickness of the leveling layer, thereby providing economic benefits to the project.

Road structure

In accordance with the applicable requirements and the designated technical category of the road, the design parameters were established and corresponding rehabilitation solutions for the road system were developed. The key parameters are as follows:

No.	Name of Indicators	Technical Parameters
1	Road category	I b
2	Number of traffic lanes	4
3	Shoulder width / Standard lane width, m	3,75
4	Load, kN / Pressure P, MPa / D, cm	115 kN / 0.6 MPa / 39.83 cm
5	Frost depth, m	0.70
6	Climate zone	IV
7	Service life, years	20
8	Reliability grade, according to CP D.02.08-2014	0.95

Table 4-1. Geometric parameters and dimensions

Source: Execution project, Volume 2. Drawing sheets, Road works, Part I, Site plan, Longitudinal profile, Typical cross-sections, Details, Synoptic, Reinforcements

Pavement construction

Throughout the entire road section from Km 0+000 to Km 34+350, it was necessary to raise the design level (red line) by approximately 19 cm following the repair of existing slabs or their replacement with a new pavement structure.

Two pavement structure types were designed:

New Road System Type 1 — applied where more than three consecutive degraded slabs must be replaced.

- 5 cm asphalt concrete wearing course based on bituminous mastic SMSc-1/2.2 SM, STB 1033:2008, bitumen BND 60/90
- 6 cm dense asphalt concrete SKBg-I/2.75 SM, STB 1033:2008, bitumen BND 60/90 (bonding layer)
- 8 cm high-porosity asphalt concrete SKVPg-II SM, STB 1033:2008, bitumen BND 60/90 (base layer)
- 24 cm cement-stabilized natural aggregates
- 20 cm ballast

New Road System Type 2 — applied where up to three consecutive degraded slabs must be replaced.

- 5 cm asphalt concrete wearing course based on bituminous mastic SMSc-1/2.2 SM, STB 1033:2008, bitumen BND 60/90
- 6 cm dense asphalt concrete SKBg-I/2.75 SM, STB 1033:2008, bitumen BND 60/90 (bonding layer
- 8 cm high-porosity asphalt concrete SKVPg-II SM, STB 1033:2008, bitumen BND 60/90 (base layer)

Levelling layer — variable thickness:

- 22–24 cm - Concrete layer
- 18–25 cm - Existing base layer

The pavement structure was designed using the CALDEROM 2000 calculation software. One of the most important criteria influencing the design is the projected traffic load, as future traffic volumes have a direct impact on the structural capacity and performance of the rehabilitated pavement throughout its intended service life. Weather conditions also play a significant role, as unfavourable climatic effects combined with insufficiently durable materials can lead to premature failure.

Following rehabilitation, the pavement must be capable of withstanding all loads expected during the design period. This requires the use of materials with adequate long-term durability and the application of appropriate recycling technologies to ensure efficient use of existing materials.

Road surface rehabilitation is recommended considering the following key factors:

- Severe deterioration of the pavement structure on several sections;
- Inadequate drainage in certain areas;
- Demands imposed by forecasted traffic volumes.

Cross sections

The project documentation includes several distinct cross-section types to address different road conditions. The following illustrations highlight only the cross-sections most frequently applied.

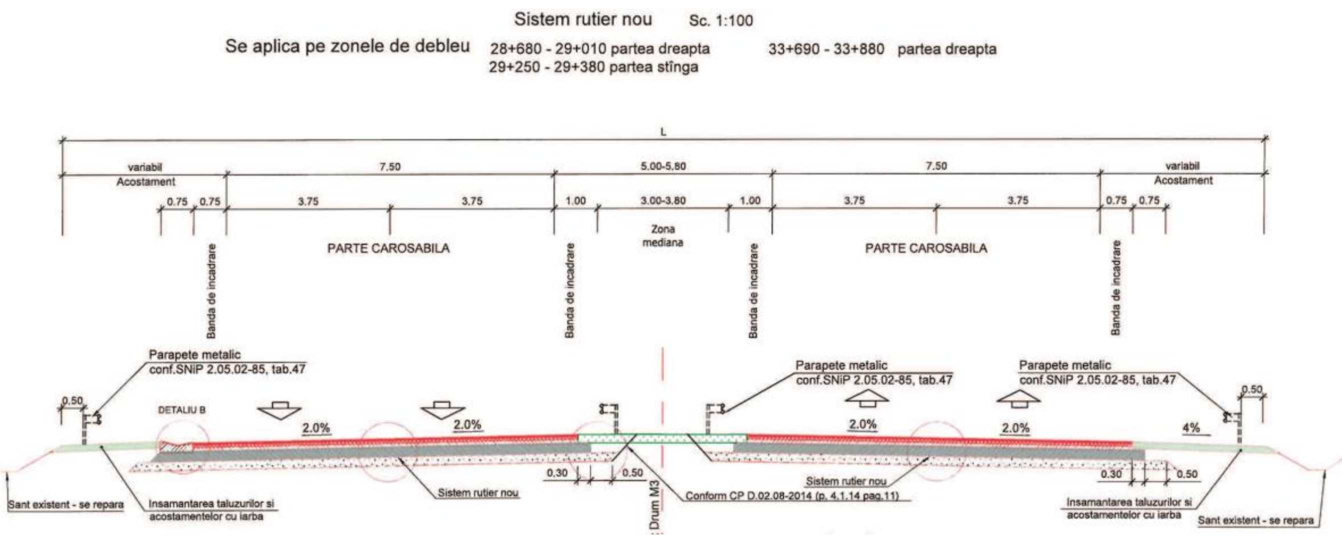


Figure 4-4. Type 7 cross-section

Source: Execution project, Volume 2. Drawing sheets, Road works, Part I, Site plan, Longitudinal profile, Typical cross-sections, Details, Synoptic, Reinforcements

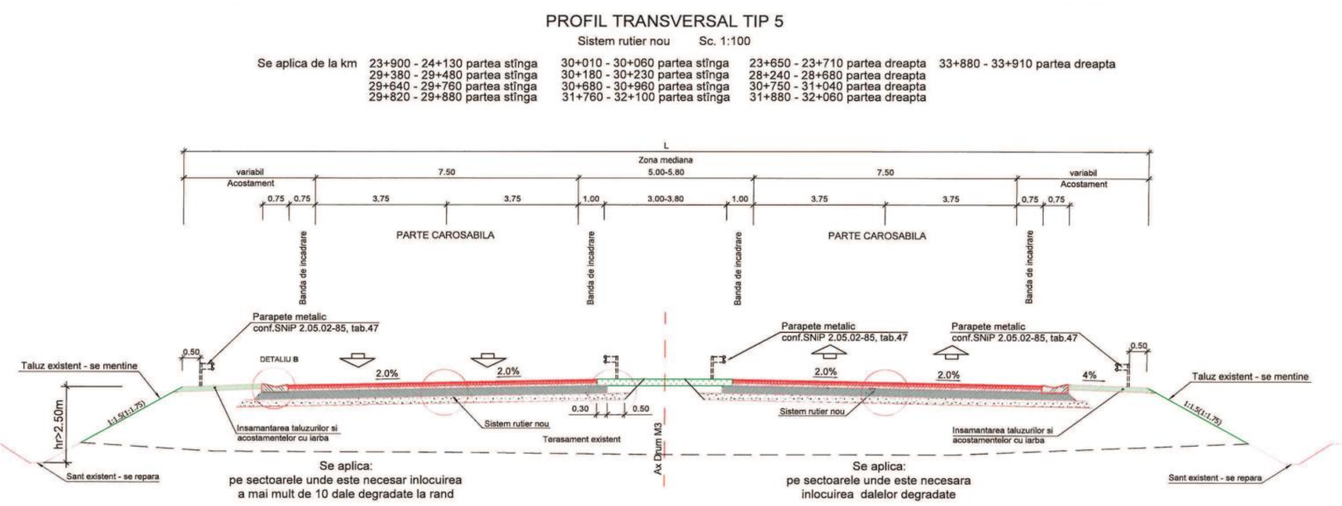


Figure 4-5. Type 5 cross-section

Source: Execution project, Volume 2. Drawing sheets, Road works, Part I, Site plan, Longitudinal profile, Typical cross-sections, Details, Synoptic, Reinforcements

LOT 4: Giurgiulești Ring Road

The information described below has been extracted from the project documentation: Design works for the elaboration of the execution project regarding the construction of the bypass road of Giurgiulesti village, Cahul district.

Route plan

The designed road section is located in Cahul District, within the administrative boundaries of the villages of Cîșlița-Prut and Giurgiulești. The proposed alignment traverses land situated along the border separating the territories of these two localities. The starting point of the Giurgiulești bypass is positioned at km 175+915 of the R34 Hâncești–Leova–Cahul–Giurgiulești road (according to the R34 rehabilitation project), and it terminates at the junction with the M3 road at km 10+580, as defined in project no. RBTC/W-SWEC-19/11 “RSP/W9/05 Construction of M3 Slobozia Mare Bypass km 0+000–km 18+290.”

From a logistical perspective, the road is of major importance to the southern region of Moldova, a fact underscored by the beneficiary's initiation of design tender procedures. The construction of the bypass will redirect heavy vehicle traffic toward the border crossing points with Ukraine and Romania, relieving the village of Giurgiulești from transit flows that currently cause significant inconvenience to residents and present safety hazards. In the context of regional development, the road also represents a foundation for additional projects proposed by Local Public Authorities, contributing to improved community well-being and increased public satisfaction.

Longitudinal profile

The longitudinal profile of the Giurgiulești village bypass road features terrain slopes ranging from a minimum of 3.00 ‰ to a maximum of 47.70 ‰, primarily located on vertical curves. These gradients result from the generally flat terrain and from technical–economic design requirements, including connections to private agricultural lands and the R34 and M3 roads. Construction levels (verification and control) are established to ensure proper roadway drainage and compliance with geometric layout requirements, incorporating systems for collecting and discharging stormwater, as well as integrating side roads. The roadway surface slopes are consistent with the cross-sectional and typical pavement profiles. In accordance with NCM D.02.01:2024 (Tables 4 and 10), the maximum allowable longitudinal slope for this road category, at a design speed of 100 km/h, is 50 ‰, and the designed profile remains within this limit. The vertical alignment is executed using straight grades and slopes that fully meet the regulatory parameters for the given technical category. The minimum concave curve radius is 3918.54 m—greater than the required minimum of 3000 m—while the maximum concave radius reaches 45,188.75 m. For convex curves, the minimum radius is 10,000 m, consistent with the standard requirement for a 100 km/h design speed, and the maximum radius is 103,168.04 m. Transitions between sections with differing longitudinal slopes are designed using vertical curves, with radii selected based on the algebraic difference of slopes in accordance with Table 10 of NCM D.02.01:2024.

Cross-sectional profile

The carriageway width for the designed road segment complies with Tables 2 and 5 of NCM D.02.01:2024, corresponding to a Class III road from CH 00+00.00 to CH 38+61.00, with the following key parameters:

- Carriageway width: Lpc = 7.00 m
- Additional width: Lac = 2.00 m, including Lbî = 0.50 m
- Design speed: Vc = 100 km/h

Throughout the Giurgiulești village bypass, the carriageway is designed with transverse slopes of 25‰ toward the edges on alignment sections CH 00+00.00–CH 04+40.00 and CH 06+80.00–CH 38+61.00, as illustrated in the graphical cross-sectional and typical profiles. On the curved section CH 04+40.00–CH 06+80.00, a superelevation with a maximum cant of 40‰ toward the inside of the curve is applied in accordance with point 5.5.5 of NCM D.02.01:2024.

Road structure

Throughout its entire length, the road section traverses the administrative areas of the villages of Cîșlița-Prut and Giurgiulești, running along the boundary that separates the two localities. The alignment is oriented perpendicular to the Prut River. While it does not intersect any permanent watercourses, it does cross three temporary streams. Along the route, three new culvert pipes are installed, complemented by two additional culverts at the junctions with the R34 and M3 roads, as well as one existing culvert that remains in place.

Parameter	Unit of Measurement	Quantity
Technical category of the road	–	III
Design speed	km/h	100
Length of the route	m	3561.00
Width of the carriageway	m	7.00
Width of the shoulders	m	2.00
Width of the roadway platform	m	11.00
Transverse slope of the carriageway	‰	25
Transverse slope of the shoulders	‰	40
Minimum radius of curvature in plan	m	200.00
Number of plan deviations	units	4
Total area of the carriageway	m²	37,963.59
Side roads	units	9
Side road length	m	1918.00
Maximum longitudinal slope	‰	47.70
Minimum longitudinal slope	‰	3.00
Minimum concave radius	m	3918.59
Maximum concave radius	m	45,485.75
Minimum convex radius	m	1000.00
Maximum convex radius	m	103,168.04
Monolithic trapezoidal concrete drains (b=0.4; h=0.6; e=0.6)	m	3600.00
Rapid monolithic trapezoidal concrete drains (b=0.4; h=0.6)	m	2600.00
Curbs	m	723.00
Carriageway drains	m	5702.00
Shoulder inlets	units	7
Culverts 1.0×1.0 m	units	2
Culverts Ø1.0 m	units	3
Culverts Ø1.2 m	units	3
Culverts 2.0×2.0 m	units	1
Culverts Ø0.80 m	units	6
Road signs	units	32
Road marking	m²	21,582
Protective barrier H2 A W4	m	2472.00
Guide posts	units	227

Table 4-2. Geometric parameters and dimensions

Source: Design works for the elaboration of the execution project regarding the construction of the bypass road of Giurgiulesti village, Cahul district.

For calculating the projected traffic over the 16-year service life of the road surfacing, an annual growth rate of 3.0% was applied. The key design parameters used in the calculation are as follows:

1. Road technical category according to NCM D.02.01:2024 – Category III;
2. Climatic zone – Zone IV;
3. Type of surfacing – Permanent asphalt concrete;
4. Axle load for road system calculation – 115 kN;
5. Recommended service life according to CP D.02.08-2018 (Annex F, Table F.2) – 16 years;
6. Standard statistical load transmitted by a vehicle wheel – 55 kN;
7. Average specific pressure on the surfacing – 0.60 MPa;
8. Calculation diameter of the wheel imprint under dynamic loading – 39 cm;
9. Calculation diameter of the wheel imprint under static loading – 34 cm;
10. Coefficient of increase in intensity – 1.03;
11. Required compaction coefficient of embankment soil – 1.01–0.98;
12. Reliability degree according to CP D.02.08-2018 (Table 5.1) – 0.90;
13. Transport structure used for dimensioning the pavement system:

- Trucks with 4 axles: 720.00 vehicles/24h
- Passenger cars A11.5: 2809.00 vehicles/24h
- Minibuses A11.5: 352.00 vehicles/24h
- Buses A11.5: 12.00 vehicles/24h
- Trucks with 2 axles A11.5: 131.00 vehicles/24h
- Trucks with 3–4 axles A11.5: 28.00 vehicles/24h

Variant 1 — Dimensioning and verification results:

1. Dimensioning according to allowable deflection (CP D02.08-2014 §5.5): total deflection modulus = 450.21 MPa; required resistance coefficient = 1.100; actual resistance coefficient = 1.235.
2. Fatigue resistance of monolithic layers to tensile bending stresses (CP D02.08-2014 §5.7): asphalt concrete thickness = 12.0 cm; tensile stress in upper monolithic layers = 1.187 MPa; material resistance to repeated tensile bending = 1.150 MPa; required bearing-capacity coefficient (accounting for reliability) = 0.940; actual resistance coefficient = 0.969.
3. Shear resistance of subgrade and less cohesive layers (CP D02.08-2014 §5.6): calculation footprint diameter = 39 cm; total layer thickness = 71.0 cm; average modulus of elasticity of upper layers = 513.18 MPa; total modulus of elasticity of lower layers = 55.00 MPa; internal friction angle = 12°; active shear stress = 0.01309 MPa; limit of active shear stress = 0.02983 MPa; coefficient Kd = 2.00; required bearing-capacity coefficient (accounting for reliability) = 0.940; actual resistance coefficient = 2.278.

Variant 2 — Dimensioning and verification results:

1. Dimensioning according to allowable deflection (CP D02.08-2014 §5.5): total deflection modulus = 452.75 MPa; required resistance coefficient = 1.100; actual resistance coefficient = 1.242.
2. Fatigue resistance of monolithic layers to tensile bending stresses (CP D02.08-2014 §5.7): asphalt concrete thickness = 12.0 cm; tensile stress in upper monolithic layers = 1.181 MPa; material resistance to repeated tensile bending = 1.150 MPa; required bearing-capacity coefficient (accounting for reliability) = 0.940; actual resistance coefficient = 0.973.
3. Shear resistance of subgrade and less cohesive layers (CP D02.08-2014 §5.6): calculation footprint diameter = 39 cm; total layer thickness = 70.0 cm; average modulus of elasticity of upper layers = 529.09 MPa; total modulus of elasticity of lower layers = 55.00 MPa; internal friction angle = 12°; active shear stress = 0.01312 MPa; limit of active shear stress = 0.02975 MPa; coefficient Kd = 2.00; required bearing-capacity coefficient (accounting for reliability) = 0.940; actual resistance coefficient = 2.267.

Variant 3 — Dimensioning and verification results:

1. Dimensioning according to allowable deflection (CP D02.08-2014 §5.5): total deflection modulus = 433.58 MPa; required resistance coefficient = 1.100; actual resistance coefficient = 1.189.
2. Fatigue resistance of monolithic layers to tensile bending stresses (CP D02.08-2014 §5.7): asphalt concrete thickness = 11.0 cm; tensile stress in upper monolithic layers = 1.202 MPa; material resistance to repeated tensile bending = 1.150 MPa; required bearing-capacity coefficient (accounting for reliability) = 0.940; actual resistance coefficient = 0.957.
3. Shear resistance of subgrade and less cohesive layers (CP D02.08-2014 §5.6): calculation footprint diameter = 39 cm; total layer thickness = 82.0 cm; average modulus of elasticity of upper layers = 416.48 MPa; total modulus of elasticity of lower layers = 55.00 MPa; internal friction angle = 12°; active shear stress = 0.01201 MPa; limit of active shear stress = 0.03249 MPa; coefficient Kd = 2.00; required bearing-capacity coefficient

(accounting for reliability) = 0.940; actual resistance coefficient = 2.705.

<u>Cross sections</u>

The project documentation includes 8 distinct cross-section types to address different road conditions. The following illustrations highlight only the cross-sections most frequently applied.

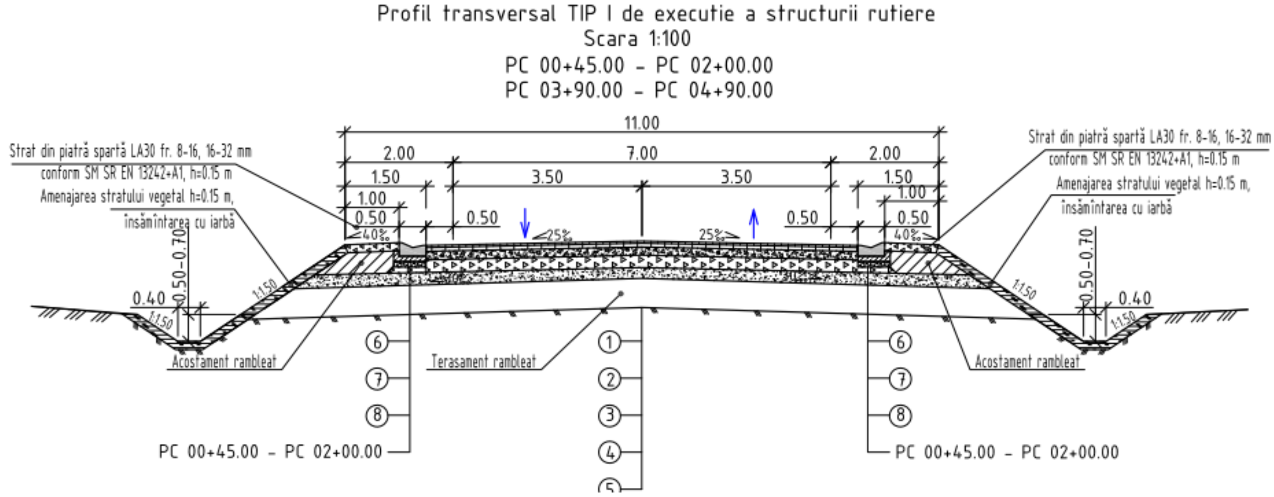


Figure 4-6. Type 1 cross-section

Source: Design works for the elaboration of the execution project regarding the construction of the bypass road of Giurgiulesti village, Cahul district, Etapa I. Lucrări de drum.

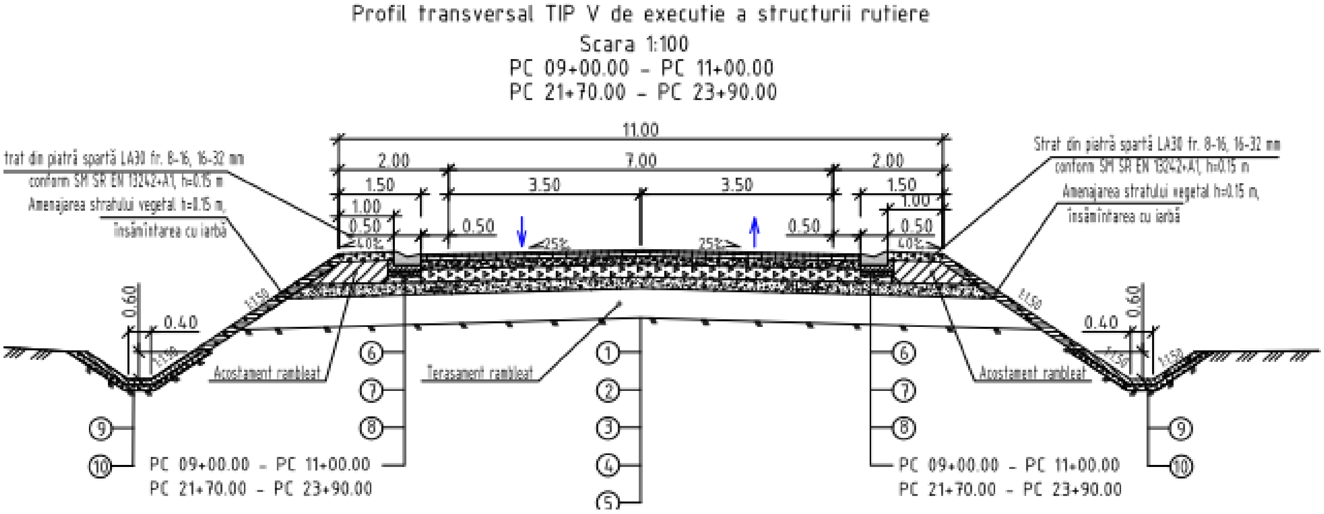


Figure 4-7. Type 9 cross-section

Source: Design works for the elaboration of the execution project regarding the construction of the bypass road of Giurgiulesti village, Cahul district, Etapa I. Lucrări de drum.

4.4. Traffic Accident analysis on M3 road

Note: The assessed road— Giurgiulești Ring Road—is not yet operational. As a result, there have been no traffic accidents reported on this road so far. Since the road is still under development and not open to regular traffic, safety data and incident records for this section are currently unavailable. The following paragraph presents the traffic accident data for the existing M3 road.

The analysis of traffic accidents on the M3 road is based on data from the last two years (2023–2024). At the national level, the Republic of Moldova recorded 1,976 traffic accidents in 2023, resulting in 2,289 injuries and 197 fatalities. In 2024, these numbers slightly increased to 1,986 accidents, 2,375 injuries, and 202 fatalities, reflecting a modest upward trend in road traffic incidents and casualties.

The M3 road corresponds to a disproportionately high number of road accidents, despite its intended role as a fast, high-speed transit corridor. In 2023, the M3 accounted for 4.76% of all reported accidents nationwide, and 3.22% in 2024, indicating a persistent safety concern. Injuries on the corridor followed a similar pattern, making up 5.33% of all national road injuries in 2023 and 2.82% in 2024. Even more concerning, fatalities on the M3 represented 7.1% of all road deaths in 2023 and 3.5% in 2024. These figures highlight that, although the M3 is designed to support smooth, fast, and efficient transit movement, it continues to generate a notable share of serious and fatal crashes. This suggests that the corridor's current design, condition, and operational environment may not be adequate to ensure safe high-speed travel, and that targeted safety improvements are necessary to reduce risk along this critical route.

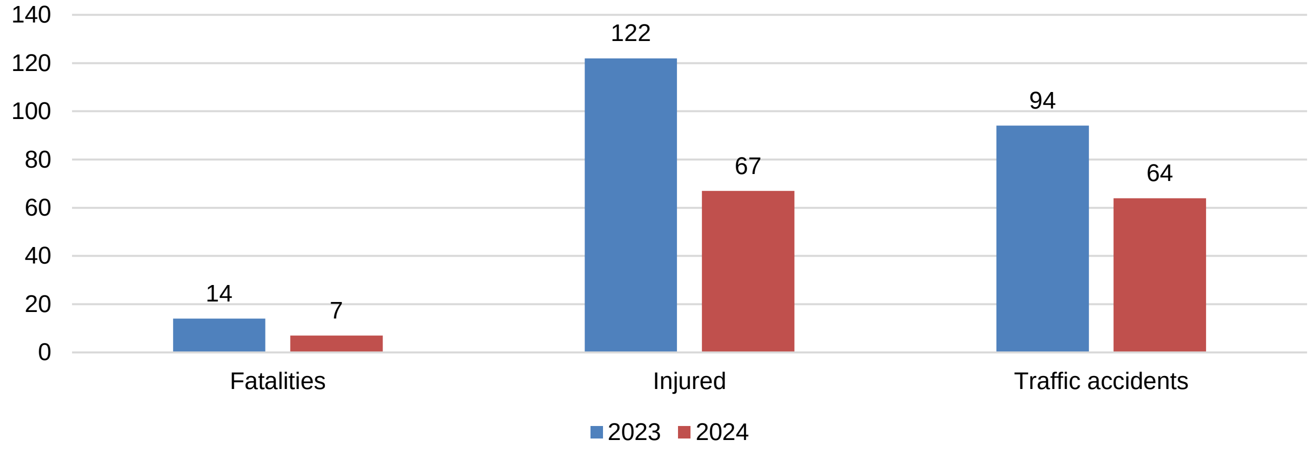


Figure 4-8. Number of traffic accidents, injuries, and fatalities on the M3 road during the 2023–2024 period

Source: compiled from national and international official sources.

The analysis of the road accident data reveals a highly uneven distribution of hazards, primarily concentrated in the initial segment. The road segment from Kilometer 0 to Kilometer 10 is the most dangerous area, showing the highest frequency of accidents with a maximum peak near Kilometer 0 (approximately 19 accidents). This suggests that the beginning of the road, potentially an entry/exit point or a complex urban interchange, is a critical area for safety intervention. Accident frequency drops off sharply after Kilometer 10, entering a long stretch of road from about Kilometer 20 to Kilometer 100 where the rate is consistently low, hovering near 0 or 1 accident per kilometer, indicating a relatively safe, stable segment. However, a second, more moderate cluster of risk appears around Kilometer 116 to Kilometer 122, peaking at 4 accidents at Kilometer 121, identifying a secondary hotspot for investigation. Overall, the road's accident profile is dominated by a few critical segments, particularly the starting 10 kilometers, while the vast majority of the 183-kilometer stretch exhibits low accident rates.

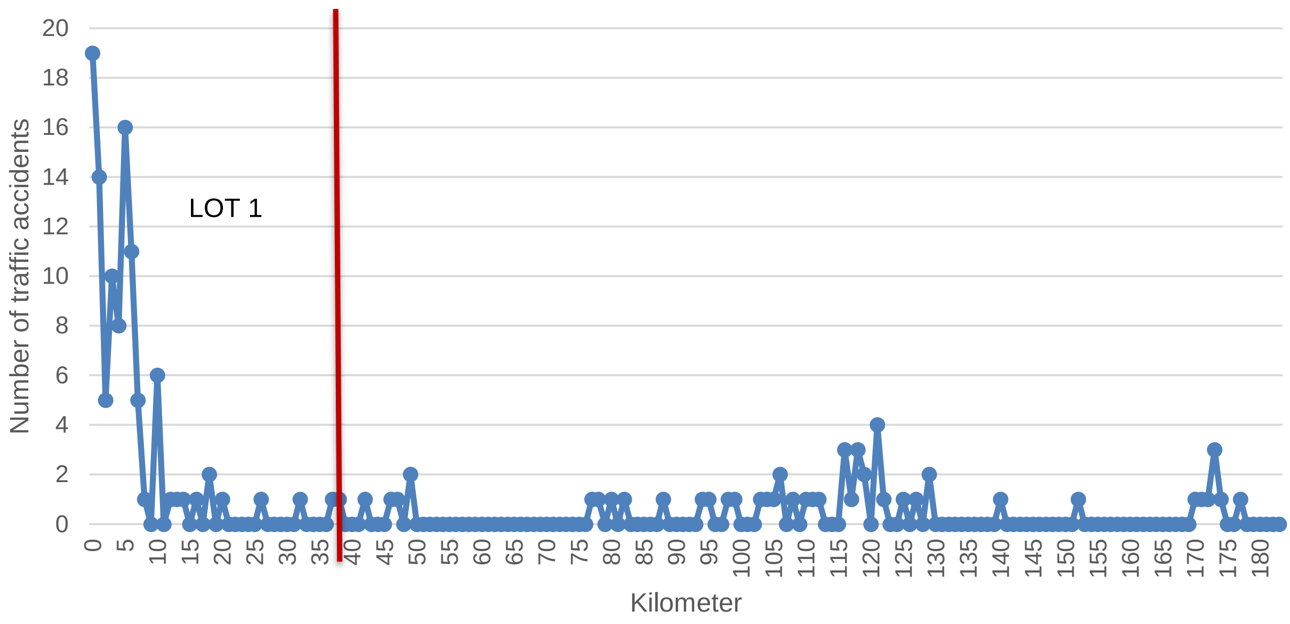


Figure 4-9. Number of traffic accidents on the M3 road during the 2023–2024 period

Source: compiled from national and international official sources.

The traffic accident cause analysis reveals that the vast majority of incidents are the result of driver error, rather than external factors like road conditions or technical failures. The leading cause by a significant margin is inappropriate speed for visibility, conditions, or the road situation, accounting for the highest bar on the chart (approximately 45 accidents). Closely following this are failures related to right-of-way, specifically failure to give way to pedestrians (around 22 accidents) and failure to give way to other vehicles (around 21 accidents). This pattern clearly indicates that poor situational awareness, improper speed management, and neglecting fundamental yielding rules are the critical areas of driver performance contributing to the highest number of crashes. Other contributing factors include failure to check when changing lanes or turning and failure to maintain distance between vehicles, both causing a notable number of accidents. Conversely, factors often cited as major risks, such as drunkenness, slippery roads, reckless driving, and technical malfunctions, all register as low-frequency causes, each accounting for fewer than five accidents. Therefore, any effective accident prevention strategy should overwhelmingly focus on educational and enforcement measures targeting driver compliance with speed limits and yielding laws.

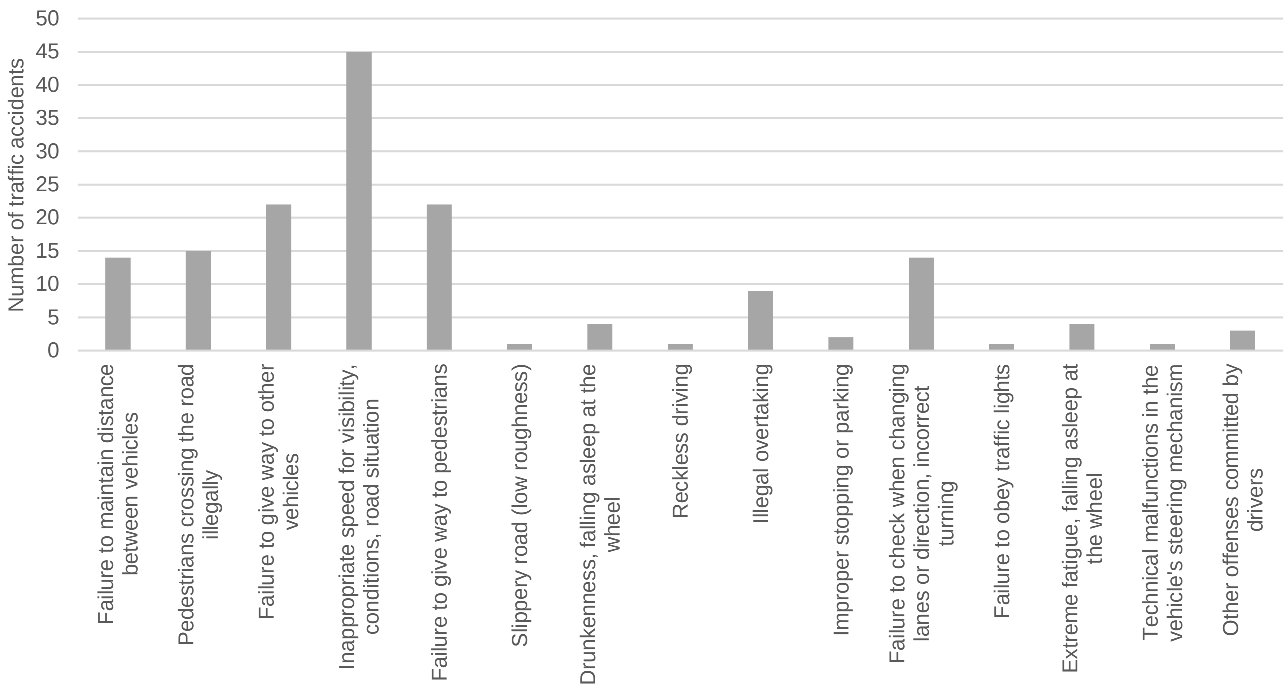


Figure 4-10. Types of traffic accidents on the M3 road during the 2023-2024 period

Source: compiled from national and international official sources.

4.5. Current situation

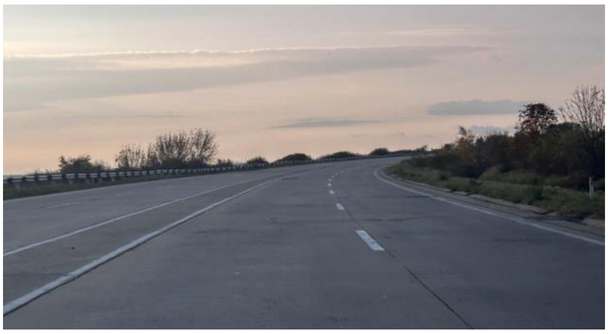
The analyzed M3 road is a key corridor connecting major regions within Moldova. The planned improvements and reconstruction of this road would offer an opportunity to provide a more convenient, safer, and faster connection, not only for domestic transport but also for enhancing trade and economic relations with neighboring countries. Based on the information obtained from the site visit, it can be concluded that the existing road:

- Some stretches of the road are currently unsafe due to at-grade (level) intersections and regular four-leg intersections.
- There is no ring road/bypass around Giurgiulești, which causes significant traffic and safety issues for city residents.
- The road changes category along its length, alternating between four lanes and two lanes, which affects traffic flow and safety.
- The pavement is heavily deteriorated, with numerous cracks and other signs of wear, reducing driving comfort and increasing accident risk.

Regarding the Figure 4 – Process of Road Safety Audits and following the methodology – site visit is crucial. For this reason, the site was visited by our expert on 2025 October 21st. The pictures of current road are listed below in Figure 17. In next subsections, common risks and deficiencies will be detailed:

Project PC ~10+00

Project PC ~42+00



Project PC ~100+00

Project PC ~167+00

Ringroad of Giurgiulești

Part of E87 road near Giurgiulești

Figure 4-11. Current situation of the road

Source: The Consultant, 2025 October.

4.6. Meetings with stakeholders

As part of the Road Safety Audit process, a meeting was held with the Mayor, who outlined the current situation and key issues affecting the city. Given that the city is located on a route connecting two national borders, the area experiences significant heavy vehicle traffic. The Mayor highlighted the challenges this generates for road safety, including congestion, high traffic volumes, and the impact of heavy vehicles on road conditions. This engagement provided the audit team with valuable context and a clearer understanding of the operational environment, allowing community perspectives and local insights to be incorporated into the assessment and recommendations.

Meeting with mayor of Giurgulești

Meeting with representatives of Administratia Nationala A Drumurilor

Figure 4-12. Photos from various meetings with stakeholders

4.7. Project documentation

LOT 1: Airport Interchange – Porumbrei (34.4 km)

Consultants analyzed the documents related to Lot 1 – Airport Interchange – Porumbrei, which provided a comprehensive overview of the planned road. The review offered detailed insights into the project's scope, design considerations, and anticipated infrastructure requirements. This analysis served as a key reference for understanding the technical, environmental, and logistical aspects of the planned development.

Nr. ord. (No. Index)	Denumire volum (Volume Name) - Romanian	Denumire volum (Volume Name) - English
PIESE SCRISE (WRITTEN PARTS)		
Volum 1	Memoriu tehnic	Technical Report
PIESE DESENATE. LUCRARI DE DRUM (DRAWINGS. ROAD WORKS)		
Volum 2.I - D	Plan,Lung,Tr.Tip,Detalii,Sinoptic,Consolidari	Plan, Longit. Section, Typical Cross-Section, Details, Synoptic, Consolidations
Volum 2.II - D	Profile transversale curente km 0+000- km 18+000	Current Cross-Sections km 0+000- km 18+000
Volum 2.III - D	Profile transversale curente km 18+000- km 34+350	Current Cross-Sections km 18+000- km 34+350
NOD RUTIER Km 31+960 (ROAD INTERCHANGE Km 31+960)		
Volum 2.IV - N	Plan,Lung,Tr.Tip, Tr.Curente, Detalii...	Plan, Longit. Section, Typical Cross-Section, Current Cross-Sections, Details...
SEMNALIZARE (SIGNALLING)		
Volum 2.V - SM	Semnalizare si marcaje rutiere	Road Signalling and Markings
PODURI (BRIDGES)		
Volum 2.VI - LA	Lucrări de arta	Art Works (Structures)
Pertea VI -LA 1	Lucrări de arta. Pod km 0+672	Art Works (Structure). Bridge km 0+672
Pertea VI -LA 2	Lucrări de arta. Pod km 0+872	Art Works (Structure). Bridge km 0+872
Pertea VI -LA 3	Lucrări de arta. Pod km 4+036	Art Works (Structure). Bridge km 4+036
Pertea VI -LA 4	Lucrări de arta. Pod km 4+470	Art Works (Structure). Bridge km 4+470
Pertea VI -LA 5	Lucrări de arta. Pod km 16+403	Art Works (Structure). Bridge km 16+403
Pertea VI -LA 6	Lucrări de arta. Pod km 17+227	Art Works (Structure). Bridge km 17+227
Pertea VI -LA 7	Lucrări de arta. Pod km 20+894	Art Works (Structure). Bridge km 20+894
Pertea VI -LA 8	Lucrări de arta. Pod km 23+378	Art Works (Structure). Bridge km 23+378
Pertea VI -LA 9	Lucrări de arta. Pod km 23+616	Art Works (Structure). Bridge km 23+616
Pertea VI -LA 10	Lucrări de arta. Pod km 31+964	Art Works (Structure). Bridge km 31+964
Anexe (Annexes)		
	Studii Topografice	Topographical Studies
	Studii de Trafic	Traffic Studies
	Studii Hidrometeorologice si a sistemului de drenaj	Hydrometeorological and Drainage System Studies
	Studii Geologice si geotehnice	Geological and Geotechnical Studies
	Investigare tehnica a sistemului rutier	Technical Investigation of the Road System
	Expertiza tehnica lucrari de arta	Technical Expertise of Art Works (Structures)
	Impactului asupra mediului	Environmental Impact

Table 4-3. List of documents analysed for Lot 1 – Airport Interchange – Porumbrei

Source: Documentation of Design services for repair works of the M3 road Chișinău – Cimișlia – Vulcanești – Giurgiulești – border with Romania km 0+000–km 34+350

LOT 4: Giurgiulești Ring Road

Consultants analyzed the documents related to Lot 4 – Giurgiulești Ring Road, which provided a comprehensive overview of the planned route. The review offered detailed insights into the project's scope, design considerations, and anticipated infrastructure requirements. This analysis served as a key reference for understanding the technical, environmental, and logistical aspects of the planned development.

Nr. Volume/ Volumul	Index, Book/ Indicele, Cartea	Volume Name/ Denumire volum.
Volume / Volumul I	**Book 1 /** Cartea 1	**Explanatory memorandum, volumes of works. /** Memoriu explicativ, volume de lucrări.
	Book 2 / Cartea 2	**Tehnical Specifications.**/ Specificații tehnice.
	Book 3 / Cartea 3	**Bill of Quantities.**/ Lista centralizată de cantități.
Volume / Volumul II	D-066-PE/2024-CG	**Road works. /**Lucrări de Drum.
Volume / Volumul III	D-066-PE/2024-TSE	**Telecommunications networks.** Rețelele de telecomunicății.
Volume / Volumul IV	D-066-PE/2024-LEA	**Power distribution lines.** Linii de transport a energiei electrice.
Volume / Volumul V	D-066-PE/2024-IEE	**Road Lighting.** Iluminat electric exterior.
Volume / Volumul VI	D-066-PE/2024-AGE	**Gas Supply. Outlying Pipelines.** Alimentări cu gaze. Conducte exterioare.
Volume / Volumul VII	D-066-SP/2024-GÎ	**Borrow pit for the extraction of unconsolidated sedimentary rocks./** Groapa de împrumut pentru extragerea rocilor sedimentare neconsolidate.
Volume / Volumul VIII	D-066-PE/2024-EIM	**Environmental impact** / Evaluarea impactului asupra mediului.
Volume / Volumul IX	D-066-PE/2024-POC	**Construction organization project /** Proiect organizarea construcției.
Volume / Volumul X	D-066-PE/2024-AT	**Materials for land allocation** / Materiale pentru alocarea terenurilor.
Volume / Volumul XI	D-066-PE/2024-D	Calculul costului de deviz. Deviz centralizator. Devize locale.
Attachment / Anexa I	Anexa I D-066-PE/2024-RTG	**Topographical Survey Report** / Raport Topo-geodezic.
Attachment / Anexa II	Anexa II D-066-PE/2024-RIG	**Geotechnical Report /** Raport Inginero-geologic.
Attachment / Anexa III	Anexa III D-066-PE/2024-RHM	**Hydrometeorological Report** / Raport Hidrometeorologic.

Table 4-4. List of documents analysed for Lot 4 – Giurgiulești Ring Road

Source: Design works for the elaboration of the execution project regarding the construction of the bypass road of Giurgiulesti village, Cahul district, Volume / Volumul I Book 2 / Cartea 2. Tehnical Specifications./ Specificații tehnice.

5. Recommendations

5.1. General recommendations

The M3 corridor in Moldova functions primarily as a high-standard transit route, designed to support efficient long-distance movement, high travel speeds, and strong regional and international connectivity. From an operational perspective, the road exhibits typical motorway-type characteristics: two traffic lanes in each direction on upgraded sections, wide shoulders, and intersection layouts intended to support uninterrupted traffic flow. Numerous connections exist along the road; however, in line with motorway design principles, these should be accommodated exclusively through proper acceleration and deceleration lanes, and any crossing of the carriageway should occur only at grade-separated (two-level) interchanges to eliminate conflict points and reduce collision risk. Maintaining these standards is essential to ensuring that the M3 continues to operate reliably and safely as a transit corridor, especially given its role in linking Moldova with two international borders and facilitating significant freight movement.

However, one section—Lot 4, the Giurgiulești bypass—does not fully correspond to motorway road-category requirements due to its functional context and geometric characteristics. This part of the corridor operates not solely as a high-speed transit route but also as a major bypass serving the Giurgiulești settlement. Its purpose is to remove heavy traffic from the local road network and direct it toward the border-crossing points with Romania and Ukraine. As a result, this segment must balance transit efficiency with local accessibility, heavy-vehicle turning movements, and safe integration of nearby traffic. The geometric standards here differ from the motorway sections, and specific safety considerations are required to ensure safe operation for all user groups.

To address these challenges, the following report sections outline a series of measures based on international best practices. These recommendations include infrastructure enhancements, speed-management strategies, junction design improvements, and organisational interventions proven effective in improving safety on high-speed roads intersecting with urban or semi-urban environments.

5.2. Safety barriers

Designed

The type of road safety barriers shown in the provided design significant safety deficiencies. Their exposed and unprotected terminal ends pose a severe hazard to road users, particularly at higher speeds. In the event of a collision, these barrier ends can function as rigid, penetrating objects, increasing the likelihood of catastrophic vehicle damage and potentially leading to fatal or life-threatening injuries. Such configurations do not meet modern road safety standards, which require barrier terminals to be designed in a way that absorbs impact energy and prevents spearing, overturning, or abrupt vehicle deceleration.

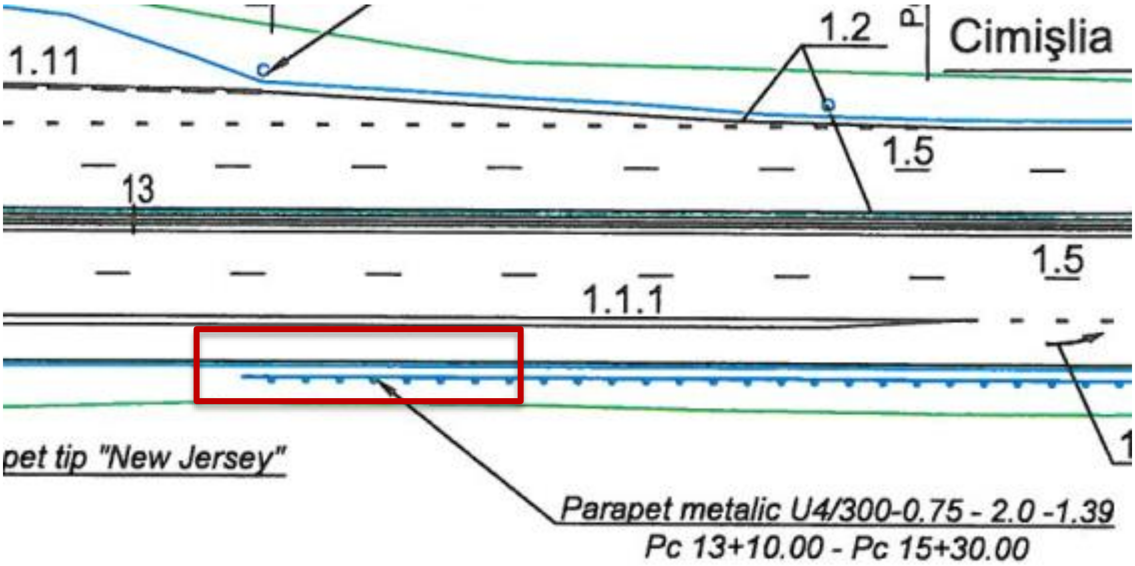


Figure 5-1. Currently designed road safety barriers

Source: M3 Execution project, volume 2, drawings, road works, part V, road signalling and markings

Recommended

To ensure compliance with recognised safety principles and to minimise the risk of severe injuries, all barrier terminal ends should be properly treated. Specifically, the ends of the barriers must be embedded into the ground (anchored or buried) and curved or rotated away from the carriageway. This configuration prevents direct frontal impact with a rigid barrier end and substantially improves overall roadside safety.

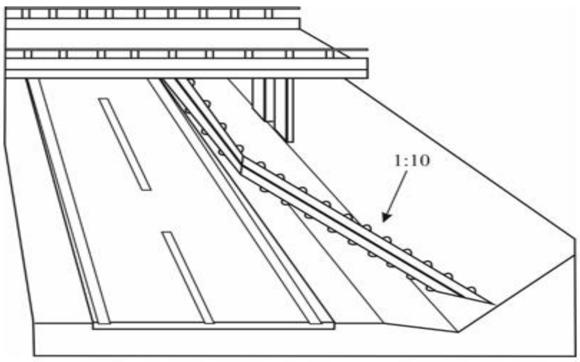


Figure 5-2. Recommended design for road safety barriers

Source: The Consultant

5.3. Roundabouts

Designed

Roundabouts are widely recognised as one of the safest types of at-grade intersections due to their substantially lower number of conflict points compared with conventional junction designs. For example, a typical four-leg intersection contains 32 potential conflict points, while a single-lane roundabout reduces this number to just 8—representing a fourfold improvement in safety.

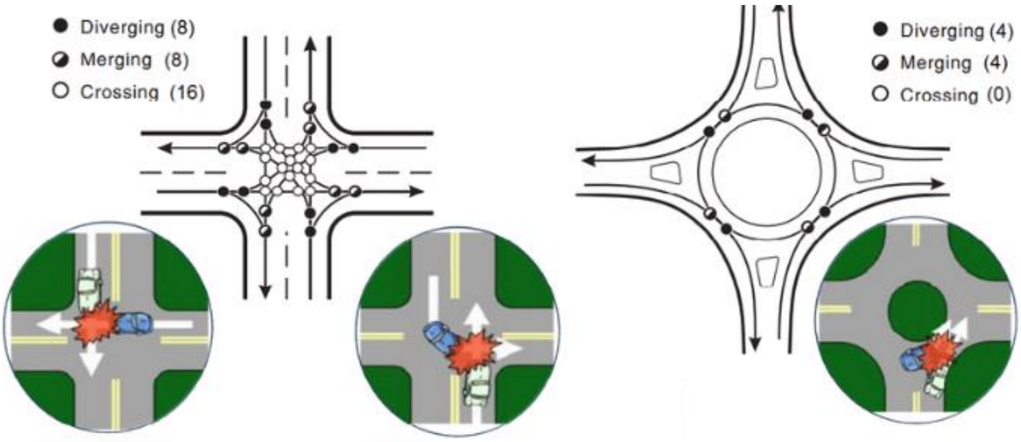


Figure 5-3. Simplified illustrations of potential vehicle conflict points at a basic roundabout (8) vs. a 4-leg intersection (32)

Source: Dupuis, Yohan & Subirats, Peggy & Vasseur, Pascal. (2016). A Survey of Vision-Based Traffic Monitoring of Road Intersections. IEEE Transactions on Intelligent Transportation Systems. 17. 1-18. 10.1109/TITS.2016.2530146.

However, the safety performance of a roundabout is strongly influenced by its internal configuration, particularly the number of circulating lanes. A standard single-lane roundabout has 8 conflict points, whereas a two-lane roundabout increases this number to 24, and a turbo roundabout features approximately 14 conflict points due to its guided lane structure.

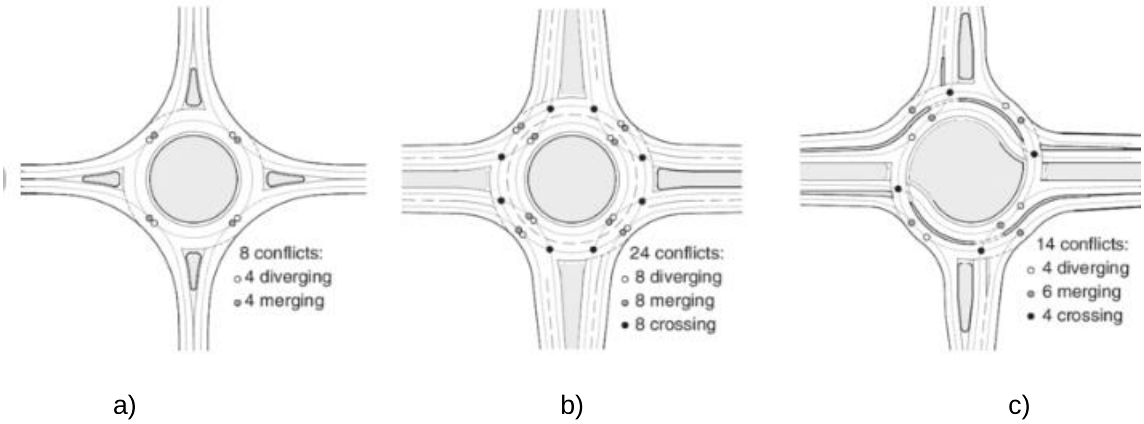
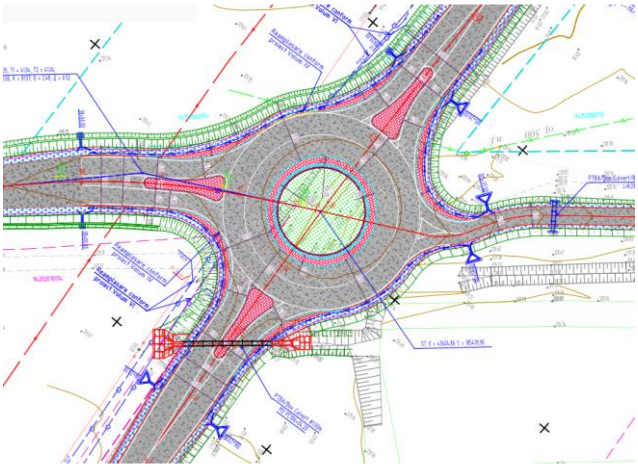


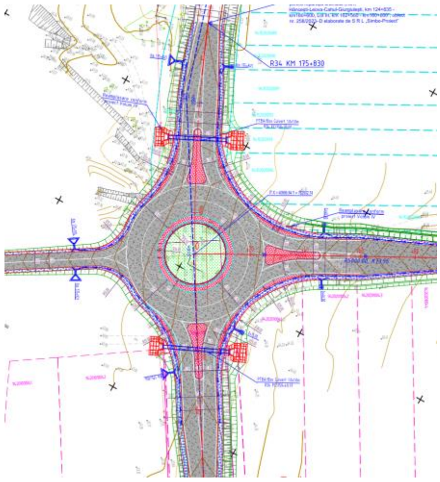
Figure 5-4. Types of conflicts at (a) single-lane roundabouts, (b) two-lane roundabouts, and (c) turboroundabouts.

Source: Vasconcelos, António & Silva, Ana & Seco, Álvaro & Fernandes, Paulo & Coelho, Margarida. (2014). Turboroundabouts: Multicriterion Assessment of Intersection Capacity, Safety, and Emissions. Transportation Research Record Journal of the Transportation Research Board. 2402. 28-37. 10.3141/2402-04.

During the field visit in Moldova, it was observed that the majority of roundabouts—both in urban and rural areas—are designed uniformly, frequently applying two-lane or even three-lane configurations regardless of traffic demand or safety considerations. While the roundabout form itself is inherently safer, an unsuitable design with too many circulating lanes can significantly reduce these benefits. Multi-lane roundabouts require more complex decision-making, increase the likelihood of lane-changing conflicts, and create higher stress levels for drivers, particularly in environments where lane discipline may be inconsistent. As a result, instead of improving safety, an overly complex roundabout layout can actually elevate crash risk and create confusion among road users.



LOT 4



LOT 4

Figure 5-5. Currently designed layouts of roundabouts

Source: Project documentation

Recommended

It is strongly recommended to revise the current approach to roundabout design and adopt safer, more modern configurations—especially turbo roundabouts, which provide clearer traffic guidance and significantly reduce the number of conflict points compared to conventional multi-lane roundabouts. Turbo roundabouts are designed with physically or visually enforced lane separation, guiding drivers into dedicated paths and preventing dangerous lane-changing maneuvers within the roundabout. This design not only improves safety performance but also reduces driver stress, particularly in locations with high traffic volumes or complex turning movements. By limiting conflict zones and ensuring predictable vehicle trajectories, turbo roundabouts offer a safer and more intuitive alternative to traditional two- or three-lane roundabouts commonly observed in Moldovan cities and rural areas.

Example of typical roundabout reconfiguration to turbo-roundabout while using only horizontal marking and rumble strips used for separation of lanes

Example of typical turbo-roundabout with physical lane separation

Figure 5-6. Example of roundabout transformed from typical 2 lane roundabout to turbo-roundabout and typical turbo-roundabout

Source: The Consultant

In addition, it is essential that drivers are properly informed about the required lane selection before entering the roundabout. This should be achieved through a combination of clear advance signage, pavement markings, and lane-assignment diagrams placed at an adequate distance from the roundabout, corresponding to the local design speed. Advance information enables drivers to choose the correct lane early, reducing last-minute lane changes and minimizing the likelihood of collisions inside the roundabout. Consistent and unified signing and marking standards across the national road network would further enhance comprehension and predictability for all road users.

Figure 5-7. Examples of road signs to inform about lane selection in roundabouts

Source: The Consultant

Implementing these recommendations—transitioning to turbo roundabout configurations and improving advance driver information—will significantly enhance the safety, efficiency, and user-friendliness of roundabouts. Such measures would help ensure that these intersections function as intended: as one of the safest forms of at-grade junctions, adapted to real-world traffic patterns and aligned with international best practices.

5.4. Rumble strips

Recommended

As a safety enhancement recommendation for the M3 highway in Moldova—particularly given its long, uninterrupted segments that can contribute to driver fatigue—it is advisable to implement rumble strips along the corridor. Extended highway sections often lead to reduced alertness, delayed reaction times, and unintentional lane departures, making rumble strips an effective countermeasure. Depending on pavement conditions and maintenance capabilities, both milled rumble strips and thermoplastic transverse or edge-line rumble strips can be applied. These treatments are internationally recognised as cost-effective measures for reducing run-off-road and head-on collisions by providing strong tactile and audible feedback when a vehicle begins to drift from its lane. Installing rumble strips along road edges, on shoulders, and at key transition areas—such as approaches to interchanges, junctions, and curves—can significantly improve lane discipline and alert fatigued drivers. For optimal performance, rumble strips should be complemented with clear signage and road markings, ensuring full integration within the overall safety strategy for the M3 corridor.

a) b)

Figure 5-8. a) milled rumble strip; b) thermoplastic rumble strip

Source: The Consultant; Tapconet

5.5. Road lightning

Recommended

Road lighting is one of the most effective measures for improving safety, particularly on rural or high-risk road sections where visibility is limited during nighttime or adverse weather conditions. Adequate lighting helps drivers better identify road geometry, obstacles, pedestrians, and other vehicles, significantly reducing the likelihood of crashes such as run-off-road collisions, pedestrian accidents, and conflicts at intersections. Well-lit roads also contribute to a more comfortable and predictable driving environment, lowering driver fatigue and enhancing overall traffic flow.

Modern lighting technologies further increase these benefits by enabling energy-efficient and sustainable solutions. Contemporary solar-powered lighting systems can capture and store sunlight during the day through integrated photovoltaic panels. The stored energy is then used to power luminaires throughout the night, providing reliable illumination without requiring connection to the electrical grid. These systems are especially valuable in remote or high-risk locations where conventional electricity supply may be limited or expensive to install. By ensuring continuous lighting with minimal operational costs and reduced environmental impact, solar-based road lighting enhances night-time safety while supporting a more resilient and cost-effective infrastructure.

Figure 5-9. Solar powered road lightning posts

Source: Hei Solar Solutions

5.6. Access points

The M3 is being designed as a high-speed, high-capacity arterial road intended to accommodate intensive traffic flows. At present, a considerable number of minor access roads and direct connections join the planned corridor. Without appropriate access management measures, there is a risk that agricultural machinery and other slow-moving vehicles will use these connections to enter the M3 directly.

Given the operational characteristics of the M3—namely high design speeds and substantial traffic volumes—the presence of agricultural equipment would create significant speed differentials and disrupt traffic flow stability. This would increase the likelihood of rear-end collisions, unsafe overtaking, and other high-severity crashes.

Therefore, it is essential at the design stage to ensure that agricultural machinery does not access the M3 directly, but instead reaches farmland parcels and other adjacent properties via designated collector or local connecting roads. Such an approach would preserve the functional classification of the M3 as a high-speed corridor and ensure an adequate level of traffic safety on the main carriageway.

The provision of parallel roads is essential where highways pass through or alongside agricultural areas, as highways are designed to support high speeds and uninterrupted driving comfort, which can be significantly compromised by the presence of **slow-moving farming vehicles and equipment**.

- Large speed differentials between highway traffic and agricultural machinery increase the risk of collisions, particularly rear-end crashes.
- In addition, farming equipment entering the highway from fields can deposit soil, mud, or agricultural materials onto the pavement, reducing tire friction and creating slippery conditions that negatively affect road safety.
- Agricultural vehicles also tend to have limited maneuverability, wide turning radii, and reduced visibility, making safe merging and lane changes on high-speed facilities difficult.

For these reasons, parallel roads specifically designed to accommodate agricultural traffic are necessary to provide safe, direct access to land plots while preserving highway safety, operational efficiency, and overall traffic reliability.

The locations listed below could be addressed through these preliminary solutions. Their implementation would ensure continued access to existing properties and facilities, while at the same time restricting direct access to the M3 road and preserving its function as a high-speed corridor.

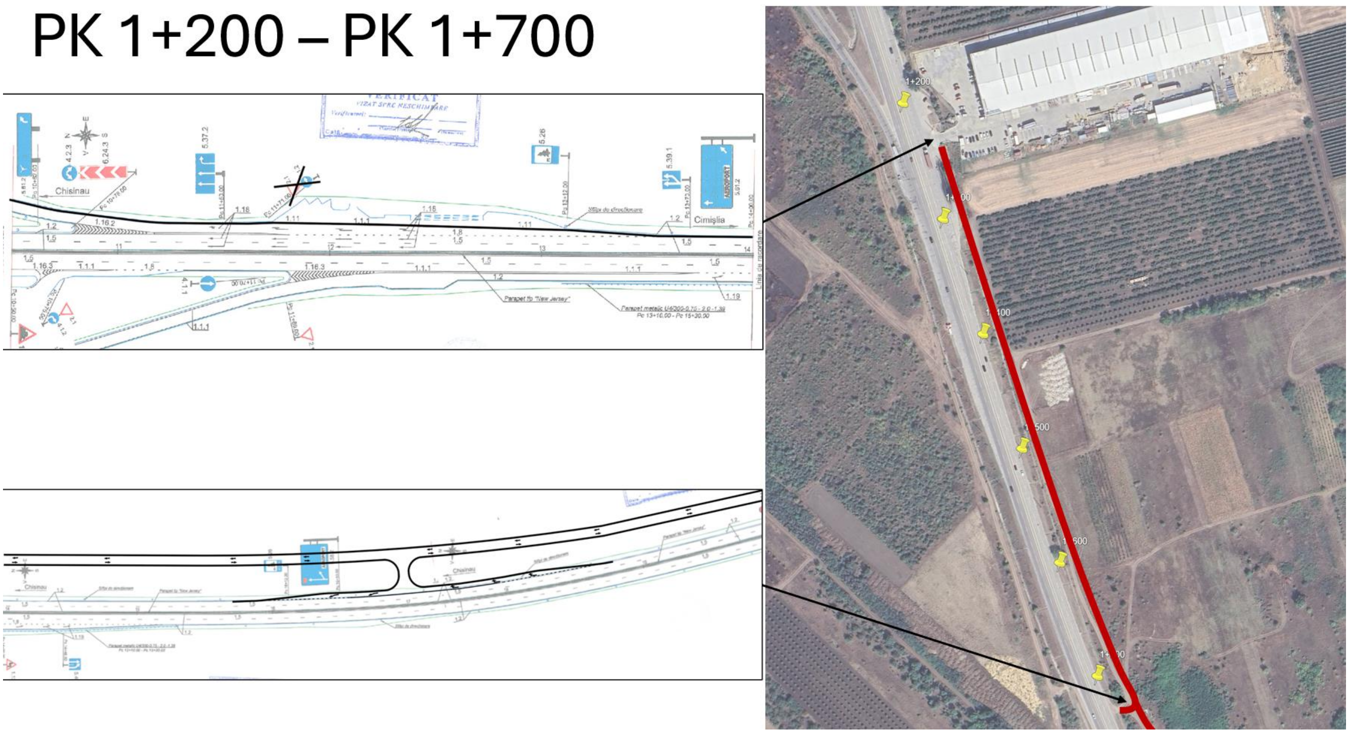


Figure 5-10 Access points to PC 1+200 – PC 1+700

Source: The Consultant

Currently, the settlement of Bacioi is served by a single primary access to the M3 corridor via road L458 on the southern side, or alternatively via Bacioii Noi Street on the northern side. However, with the anticipated expansion of the northern part of the settlement—particularly in the area of Bacioii Noi Street—the existing transport infrastructure may become insufficient to accommodate future traffic demand and capacity requirements.

Therefore, it would be reasonable to plan an additional connection that would allow Bacioi residents to access the M3 safely and conveniently. In this context, community members would prefer to retain the existing access at Strada Plopilor. Such access would only be feasible if implemented in compliance with road safety standards, including the installation of dedicated deceleration and acceleration lanes to ensure safe merging and diverging maneuvers.

Figure 5-11. Access points to PC 2+80 – PC 4+20

Source: The Consultant

In this case, the proposed concept is to eliminate the direct access from the factory to the M3 road. Instead, a collector/distributor road would be constructed, providing controlled access to and from the M3 via dedicated acceleration and deceleration lanes.

Additionally, the access point would be relocated further away from the grade-separated interchange. As a result, vehicles exiting the factory would have sufficient distance and time to perform merging maneuvers safely and to adjust their speed to match the operating speed of traffic on the M3 highway.

This solution would reduce conflict points in the immediate vicinity of the interchange, improve traffic flow stability, and significantly enhance safety conditions on the main carriageway.

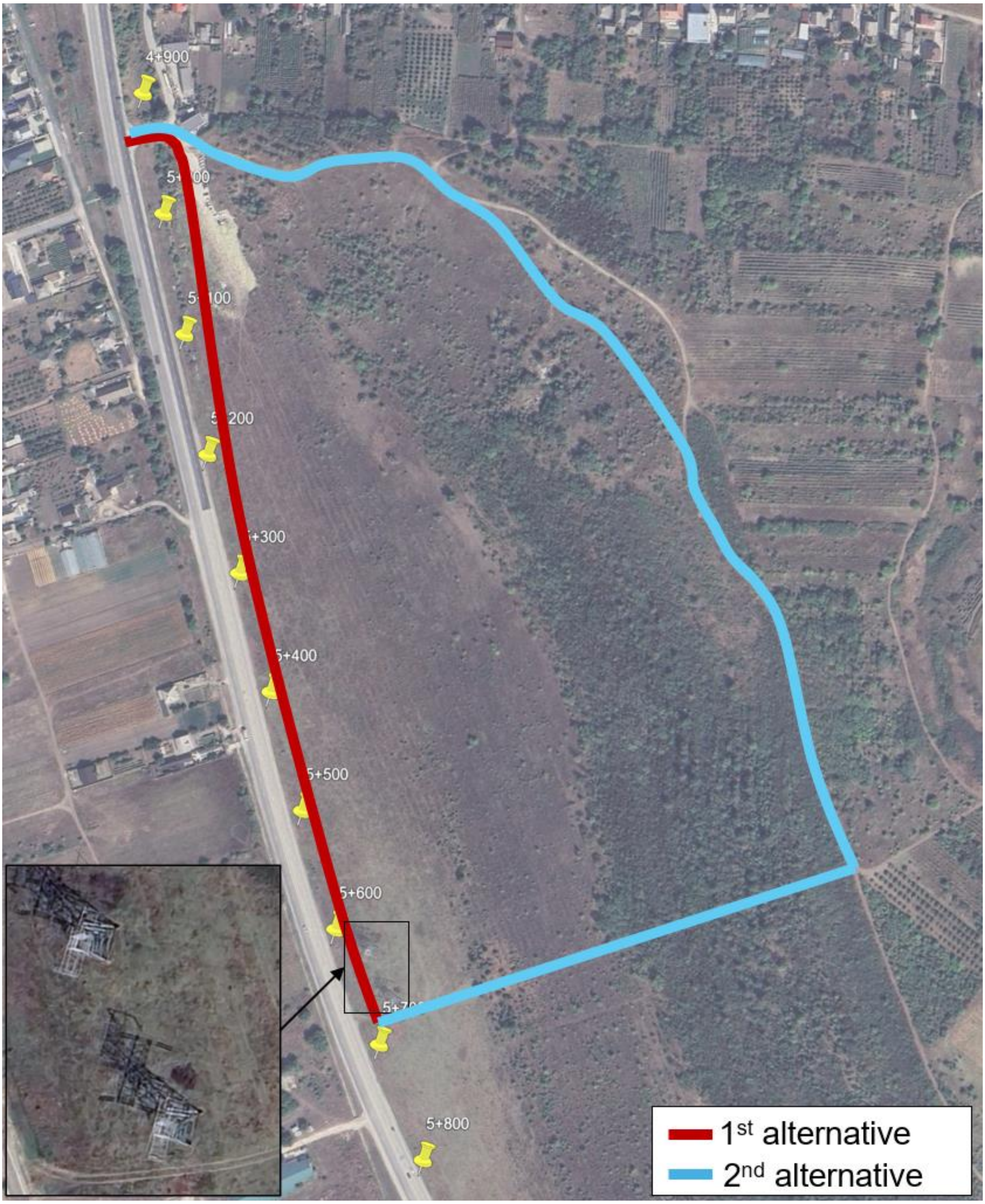


Figure 5-12. Access points to PC 5+00 – PC 5+70

Source: The Consultant

Currently, at PC 47, an access road to Straisteni settlement is being designed (retaining the existing connection). However, residents are not provided with an option to travel toward Chisinau, as no grade-separated interchange or alternative connecting roads are planned.

It is recommended to assess feasible alternatives to ensure convenient connectivity either by providing direct access to the M3 motorway through a grade-separated interchange or by utilizing the nearby grade-separated interchange and connecting traffic to road L458.

Figure 5-13. Access points to PC 4+10 – PC 4+80

Source: The Consultant

At chainage PC 49, an access road is planned to connect the residential area to the highway. However, at approximately PC 57, there is an informal, worn access track leading toward the electrical substations. In its current state, this track creates the potential for uncontrolled access to the high-speed corridor.

To ensure safe and convenient access to this area—where operational access may be required—it is recommended to physically restrict the existing access at approximately PC 57 by installing safety barriers.

Two alternative solutions may be considered:

- 1st alternative: Construct a dedicated connecting (collector) road providing controlled access to the substation area via the planned road network.
- 2nd alternative: Retain the existing infrastructure arrangement and ensure access to the facility through other available local roads, without maintaining direct or informal access to the highway corridor.

Both options aim to eliminate uncontrolled entry points to the M3 while maintaining functional access to critical infrastructure.

PK 5+00 – PK 5+70

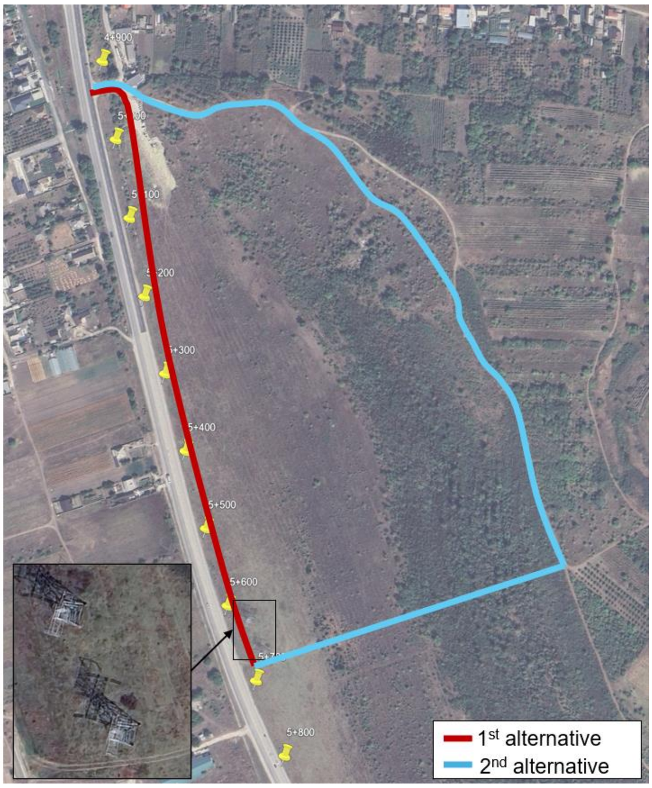


Figure 5-14. Access points to PC 5+00 – PC 5+70

Source: The Consultant

At the location under consideration, there are currently two residential properties. From a road safety and functional classification perspective, these properties should not have direct access to the M3 high-speed road. Direct connections from individual residential driveways to a highway operating at high speeds and traffic volumes would introduce unacceptable conflict points and increase crash risk.

Therefore, alternative access arrangements must be provided to ensure that these residential properties are reached via local or collector roads, thereby eliminating direct access to the M3 and preserving the safety and operational integrity of the main carriageway.

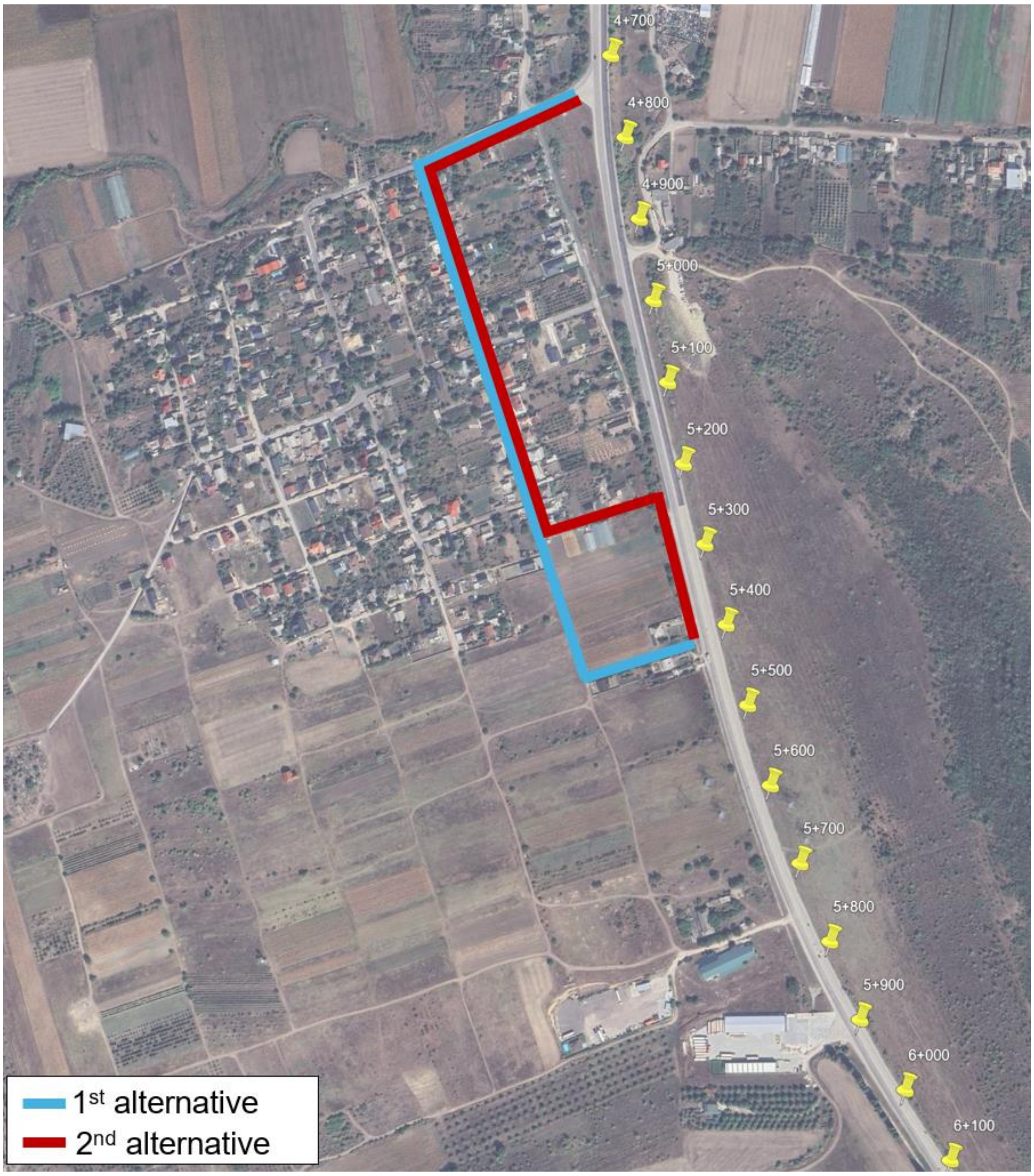


Figure 5-15. Access points to PC 4+70 – PC 5+40

Source: The Consultant

Slightly further from the previously assessed location, another access point is being designed, including dedicated acceleration and deceleration lanes. However, this solution alone does not ensure adequate access to the existing adjacent properties.

Therefore, an optimal access management solution should be developed, integrating both the previously mentioned residential houses and other nearby properties. The objective should be to provide a shared collector or connecting road that serves the maximum feasible number of residential plots and land parcels.

Such consolidation of access would minimize the number of direct connections to the M3, reduce conflict points, and maintain the operational safety and functional hierarchy of the high-speed corridor.

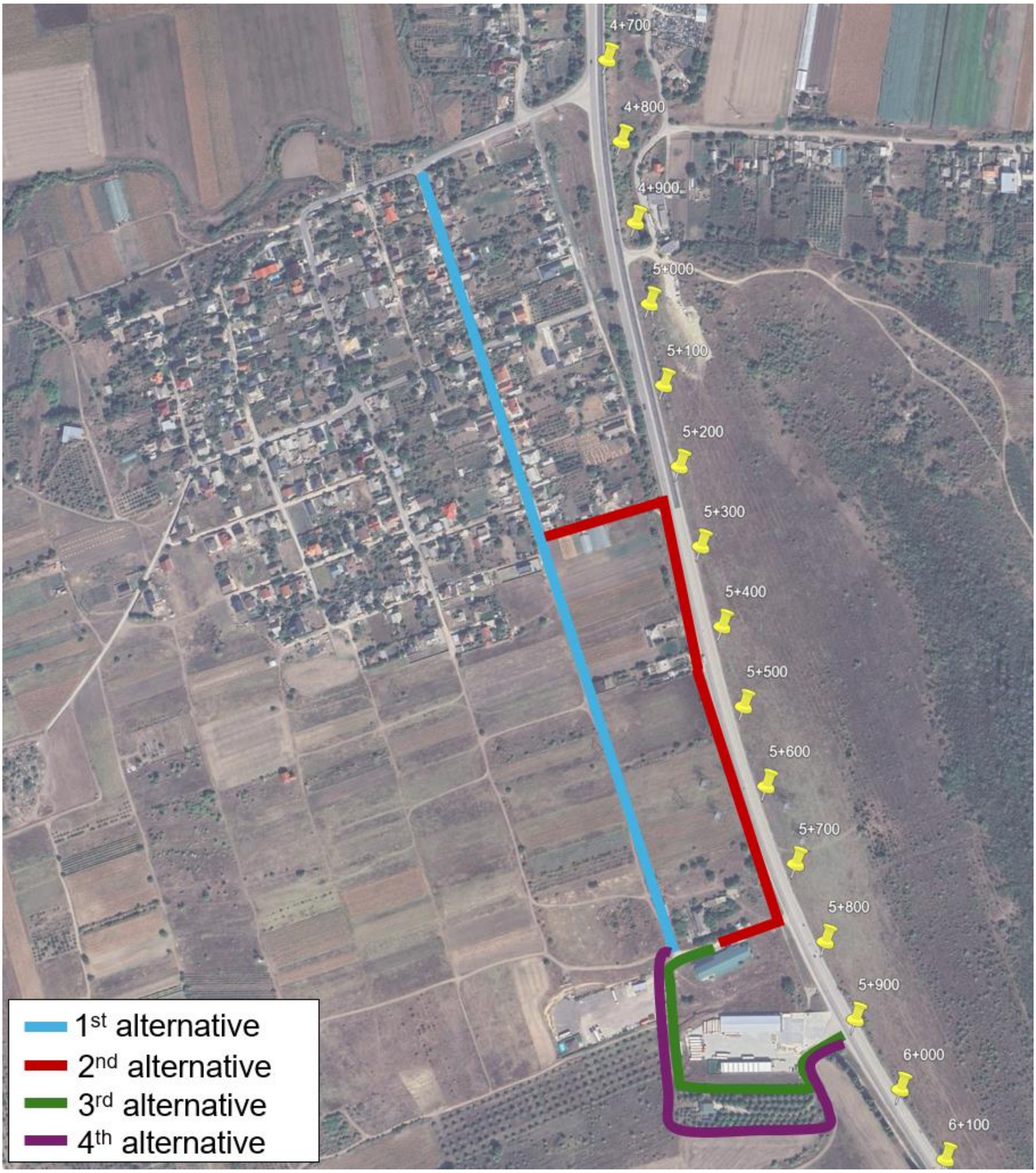


Figure 5-16. Access points to PC 4+70 – PC 5+90

Source: The Consultant

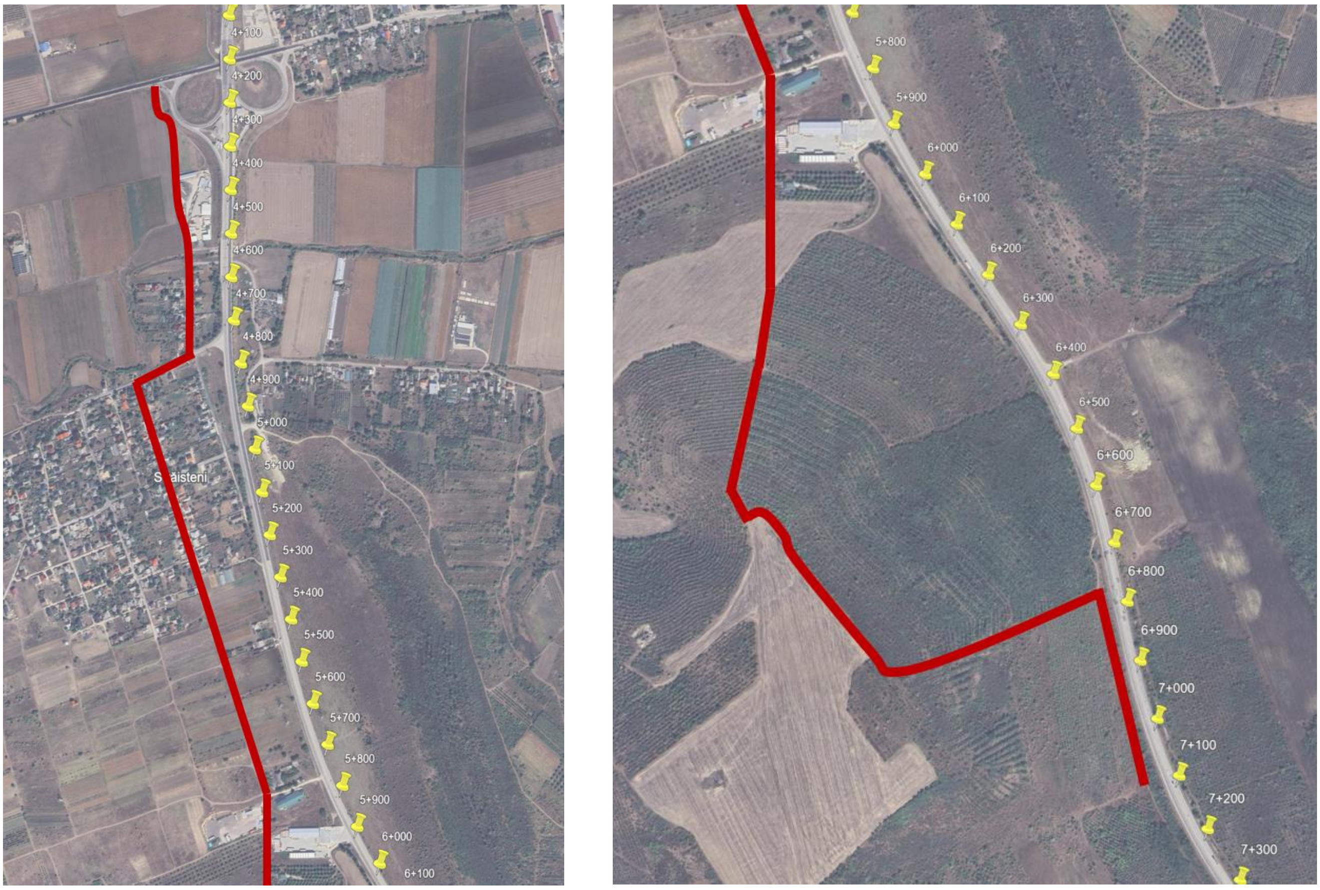


Figure 5-17. Access points to PC 4+10 – PC 7+10

Source: The Consultant

Ensuring access to all agricultural land parcels is a complex task, particularly given that local residents are currently accustomed to using the M3 road and turning directly into established access points. This existing pattern of movement creates expectations of direct and convenient access.

However, within the framework of a high-speed, high-volume corridor, maintaining such direct access arrangements is not compatible with road safety and functional classification principles. While the majority of agricultural plots can still be reached through alternative local or collector roads, the resulting routes will inevitably be less direct. Access may require longer travel distances and additional time compared to the current situation.

Although this represents a reduction in convenience, it is a necessary trade-off to ensure improved traffic safety, controlled access management, and the preservation of the M3's operational performance as a high-speed arterial route.

In addition, due consideration should be given to local businesses and traffic intensity patterns when determining which junction should function as the primary access point. At present, one access is planned to serve an agricultural enterprise; however, less favorable traffic conditions are being created for another business that may generate relatively high traffic volumes throughout the day.

From a traffic safety perspective, the situation at both locations is comparable. Therefore, the decision regarding the principal junction should be based on traffic demand, functional hierarchy, and long-term development considerations. In either case, it is essential to ensure safe turning movements to and from the M3 by providing dedicated deceleration and acceleration lanes that meet applicable design standards.

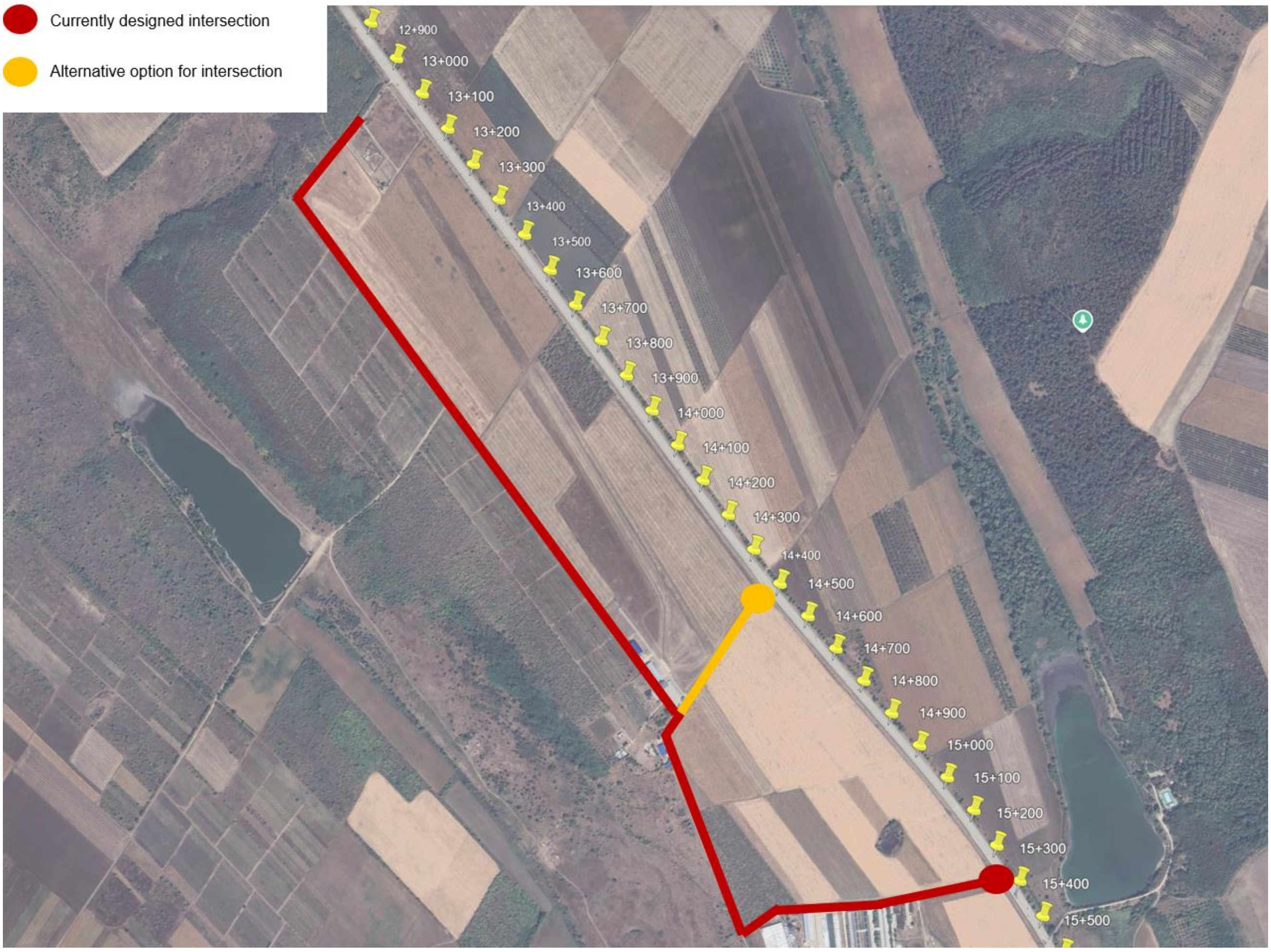


Figure 5-18. Access points to PC 13+00 – PC 15+20

Source: The Consultant

At approximately chainage Pk 15+500, there is an existing recreational area and restaurant; however, no safe access arrangement is currently planned.

It is recommended to provide a safe entry and exit solution, either by installing dedicated deceleration and acceleration lanes along the M3 or by developing an alternative access road connecting the M3 to the restaurant, thereby ensuring compliant and safe traffic operations.

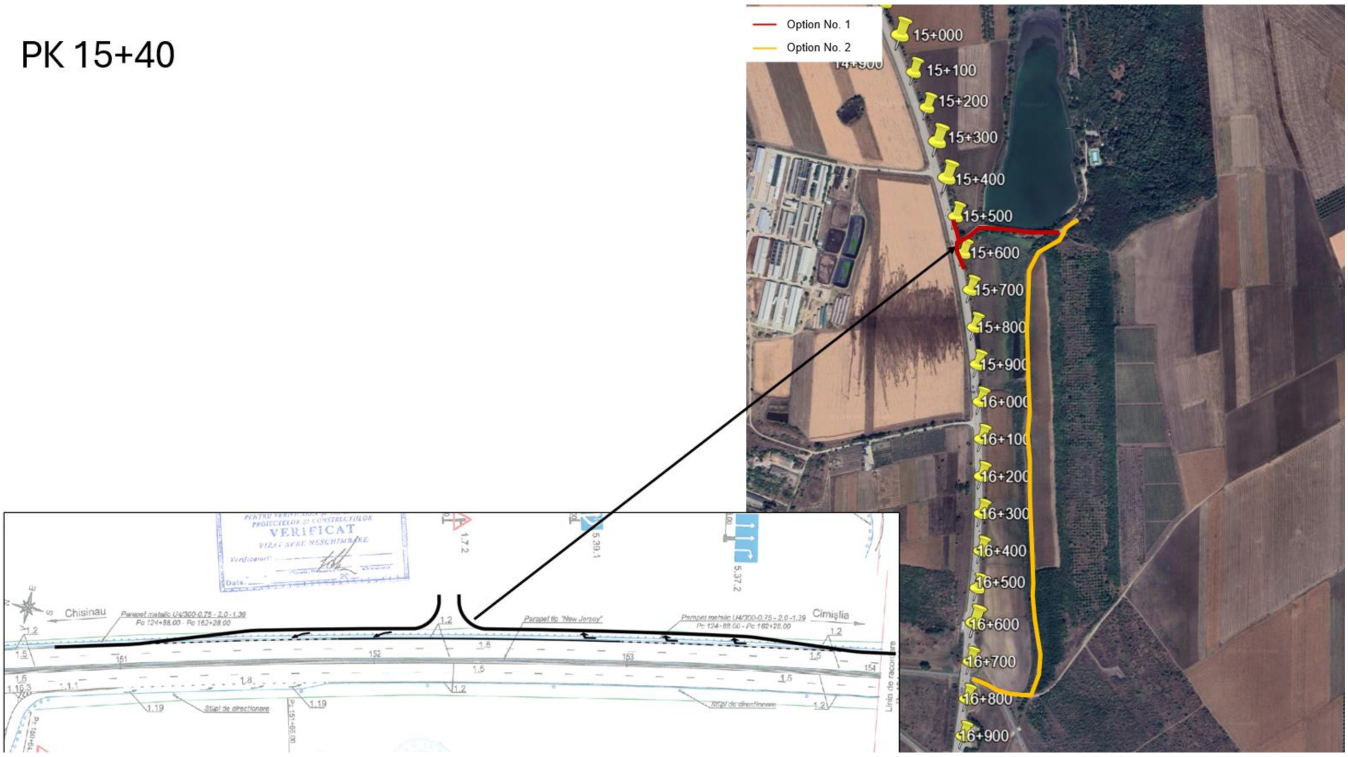


Figure 5-19. Access points to PC 15+40

Source: The Consultant

At approximately chainage PC 30+70, there are currently several industrial facilities with existing informal access points. Constructing multiple new access roads in close proximity to each other would create numerous conflict points along the high-speed M3 corridor, which is undesirable from both a traffic safety and operational performance perspective.

It should also be noted that the existing industrial facilities are relatively large in scale and generate heavy vehicle traffic. Rerouting heavy goods vehicles through the town via alternative local roads could lead to opposition from residents due to increased noise, safety concerns, and environmental impacts.

A balanced solution could involve formalizing access by providing a right-in/right-out configuration only, supplemented with dedicated deceleration and acceleration lanes. Such an arrangement would reduce conflict points, maintain corridor safety standards, and at the same time ensure reasonable accessibility and operational convenience for business operators.

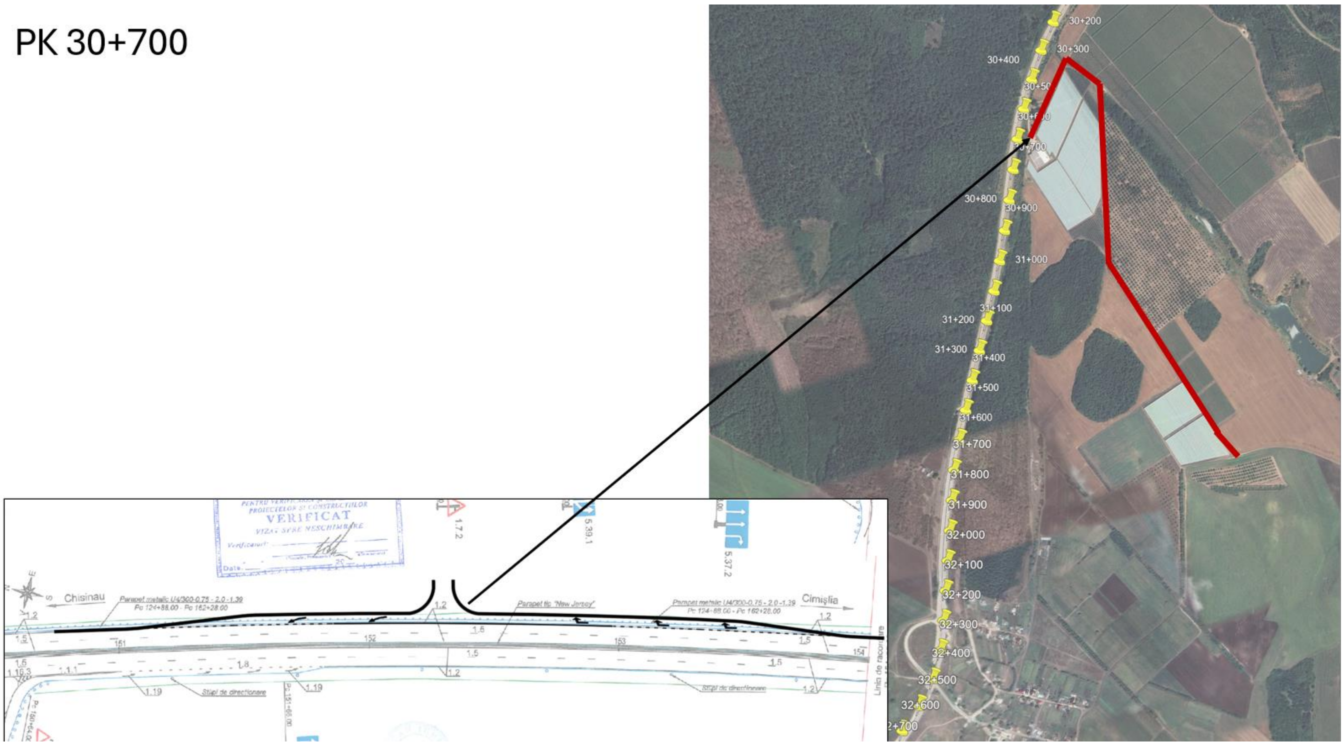


Figure 5-20. Access points to PC 30+70

Source: The Consultant

At approximately chainage PC 31+70, there is an existing grade-separated interchange. However, the current layout includes an additional access road directly connecting residential properties to this location. From a road safety perspective, direct access at this point is unsafe due to high-speed traffic on the M3 and the complexity of merging and diverging maneuvers near the interchange.

It is therefore recommended to provide access to these residential properties via a dedicated connecting (collector) road branching from the existing exit ramp. This solution would handle lower traffic volumes locally and eliminate the need for direct access to the M3, thereby improving safety and reducing potential conflict points at the interchange.

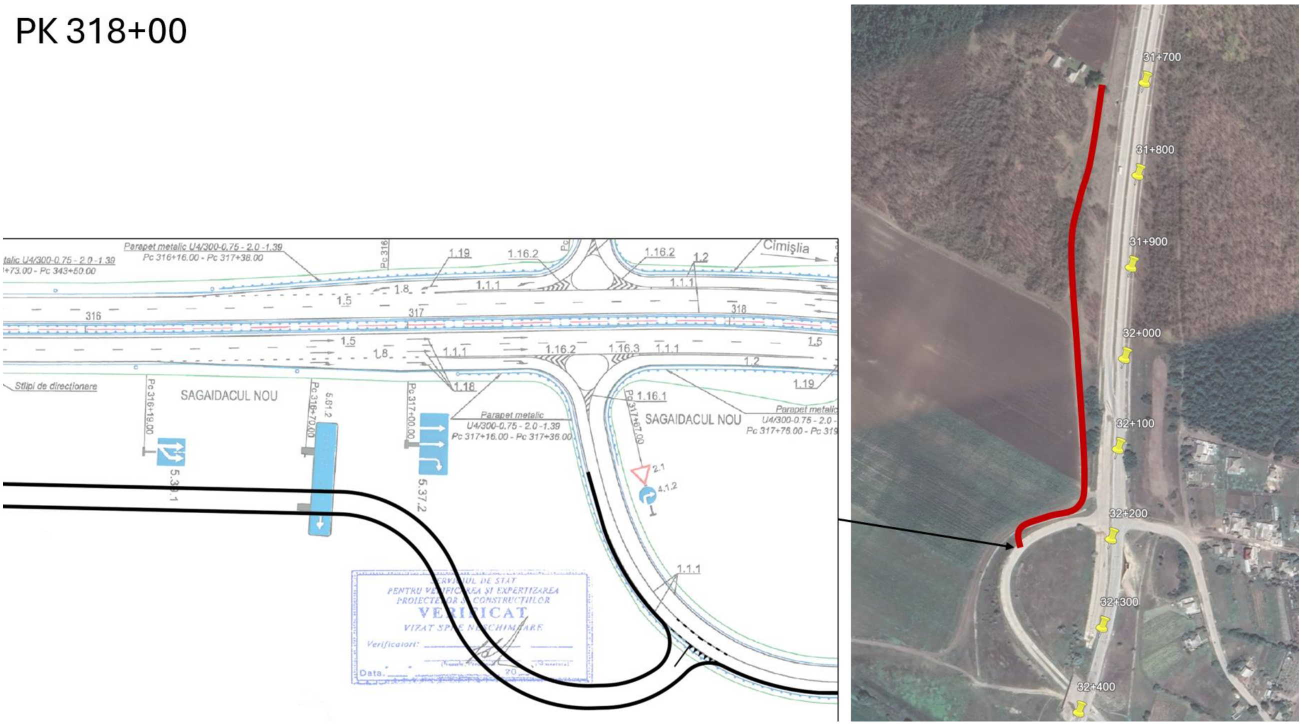


Figure 5-21. Access points to PC 31+80

Source: The Consultant

5.7. Road noise barriers

Although road noise barriers are not directly related to traffic safety, their placement and integration must be carefully addressed within the project to avoid creating hazardous or operationally unfavorable conditions along the M3 corridor. The design should предусibly allocate sufficient space within the right-of-way for potential future installation of noise barriers, ensuring that they do not interfere with visibility triangles, junction layouts, drainage systems, maintenance access, or roadside safety zones. Poorly positioned barriers can negatively affect sight distance, driver perception, and emergency access if not properly coordinated with geometric design.

It is likely that noise barriers will be required near larger settlements such as Bacioi, Razeni, and Straisteni, where the M3 runs in close proximity to residential areas and is expected to generate significant traffic noise due to high design speeds and traffic volumes, including heavy vehicles. In such contexts, noise mitigation measures become particularly important from both an environmental and public health standpoint.

Noise barriers provide multiple benefits: they reduce long-term exposure to traffic-generated noise, improve living conditions for nearby residents, contribute to compliance with environmental noise regulations, and enhance overall social acceptance of major road infrastructure projects. By mitigating noise levels, they can also indirectly improve driver comfort and reduce stress in densely populated corridors. Therefore, even though they are not a primary safety feature, their early consideration in the planning and design stages is essential to ensure a coherent, safe, and sustainable M3 corridor development.

5.8. Bypasses

Urban bypasses play a critical role in improving the overall performance and sustainability of transport systems around cities. By diverting transit traffic—particularly heavy goods vehicles and long-distance through movements—away from the urban street network, bypasses significantly reduce congestion levels within built-up areas. This leads to shorter and more reliable travel times for local traffic, improved road safety conditions due to reduced conflicts between local and transit vehicles, and lower environmental impacts in densely populated districts. In addition, removing non-destination traffic from city centers decreases noise levels and air pollution exposure, enhancing overall urban livability. Strategically designed bypasses also improve the efficiency of regional and national transport corridors by providing uninterrupted, higher-speed connections that are better suited for freight and intercity travel. As a result, urban road networks can function more effectively in serving local accessibility needs, while the bypass infrastructure accommodates high-capacity transit flows outside the city core.

The M3 currently runs through Razeni with direct accesses and turning movements still permitted, so impacts on local mobility are limited. However, once reconstructed with full access control—removing left turns and reducing direct connections—conditions for residents may worsen significantly. The settlement is developed on both sides of the road, and a cemetery generates notable pedestrian and vehicle traffic, yet no convenient pedestrian crossing is currently planned, raising safety concerns. One option is to retain the existing alignment through Razeni while upgrading pedestrian and local infrastructure, including a safe crossing near the cemetery. Alternatively, a bypass could reroute the M3 outside the settlement, allowing the current alignment to function as a lower-speed local street with full access and turning movements.

Figure 5-22. Preliminary bypass for Razeni

Source: The Consultant

Currently, the R26 road functions as one of the principal corridors connecting Cimișlia with Ukraine and, as a consequence, accommodates the highest volume of heavy goods vehicle (HGV) traffic in the area. In addition, a significant number of HGV movements operate within Cimișlia itself. Therefore, it is necessary to consider either short-term measures—such as targeted junction upgrades and the implementation of enhanced traffic safety solutions within the urban area—or, alternatively, a long-term strategy involving the development of a full bypass of Cimișlia. Such a bypass would connect the main regional directions externally, allowing the existing urban street network to serve predominantly local traffic only.

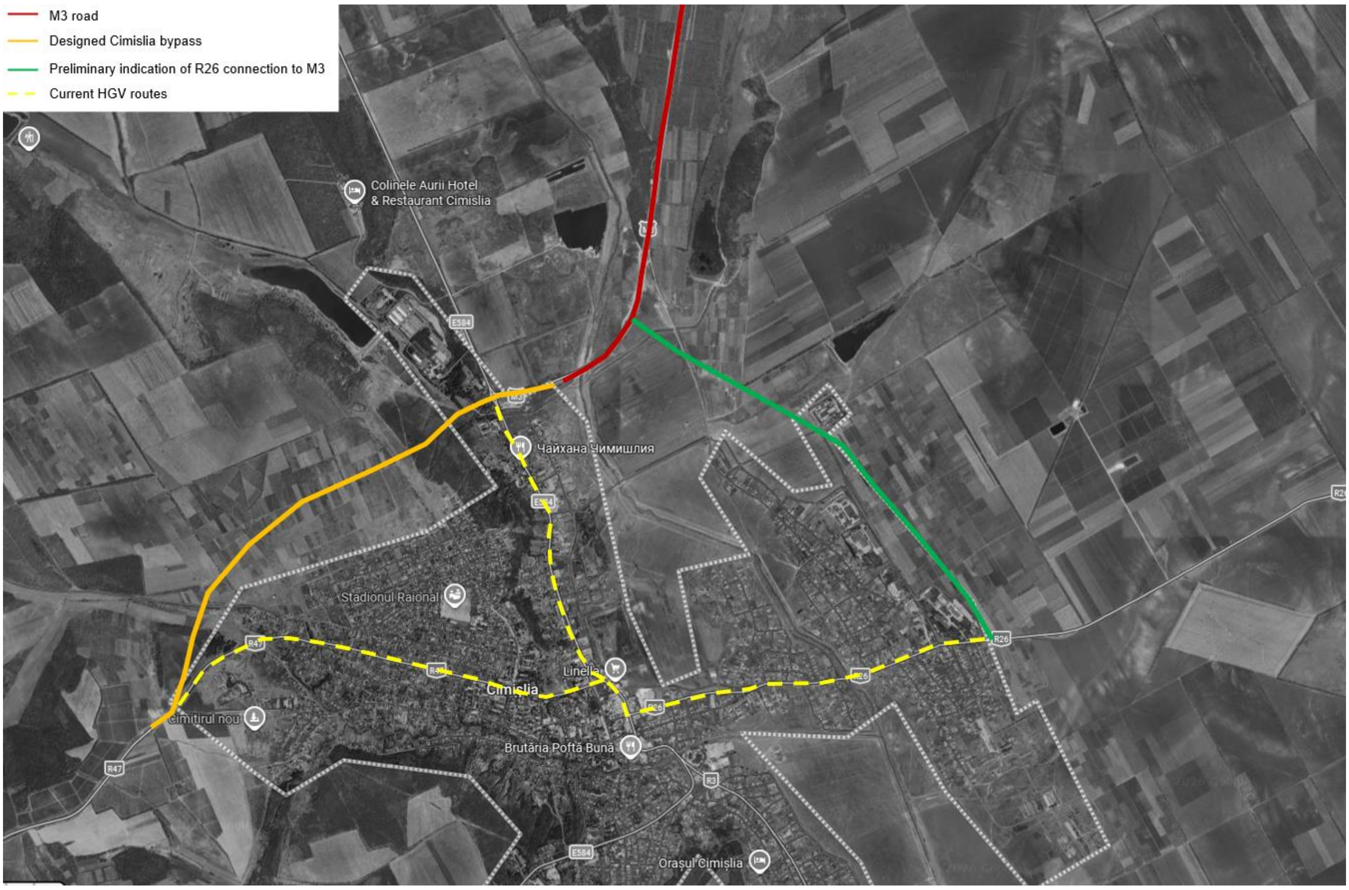


Figure 5-23. Preliminary bypass for Cimislia

Source: The Consultant

5.9. Emergency stops / rest areas

It is recommended that designated driver rest areas be incorporated along the full length of the M3 corridor across all LOTS sections. These rest places should be strategically distributed at regular intervals, taking into account traffic intensity, the proportion of heavy goods vehicles (HGVs), expected travel times, and road safety considerations. Properly planned rest areas contribute significantly to fatigue management, regulatory compliance with driver working and rest time requirements, and overall traffic safety performance. Depending on projected demand, the rest facilities may vary in scale—from basic short-stop lay-bys to more comprehensive service areas equipped with parking spaces for passenger cars and HGVs, sanitary facilities, lighting, and basic amenities.

In parallel, it is essential to assess the applicable national legislation, technical regulations, and road design standards to determine the requirements for emergency stopping lanes and dedicated emergency stopping places. Where traffic volumes and design speeds justify it, the inclusion of emergency stopping lanes would enhance operational safety by providing refuge space for disabled vehicles, reducing the likelihood of secondary incidents, and maintaining traffic flow continuity. In sections where full-width emergency lanes are not feasible, periodic emergency lay-bys should be evaluated as an alternative solution.

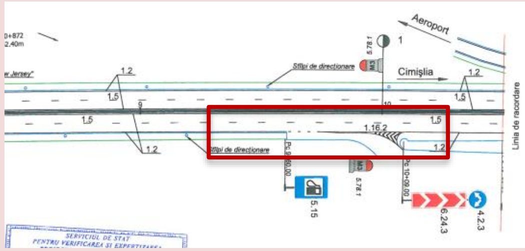
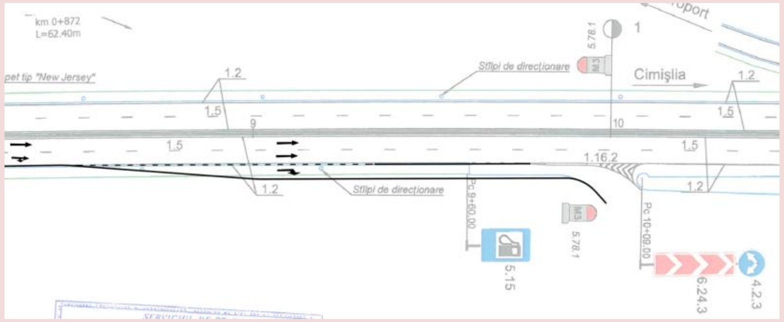
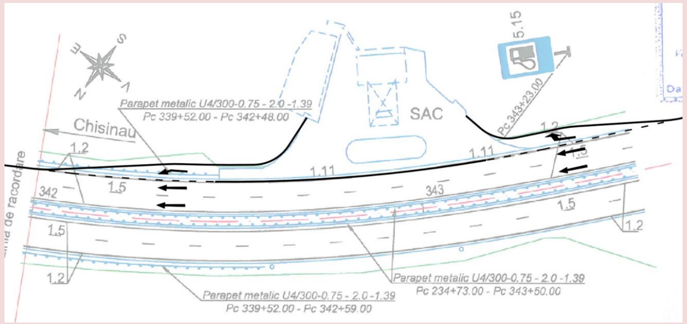
Overall, integrating rest areas and emergency stopping infrastructure into the M3 development across all LOTS would strengthen the functional reliability, safety level, and long-term operational resilience of the corridor.

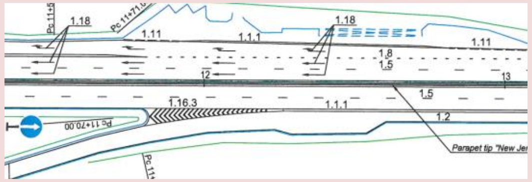
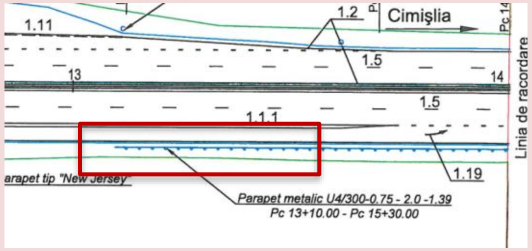
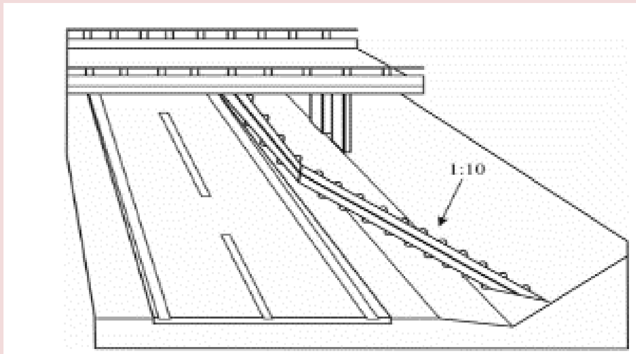
Figure 5-24. Emergency stop area

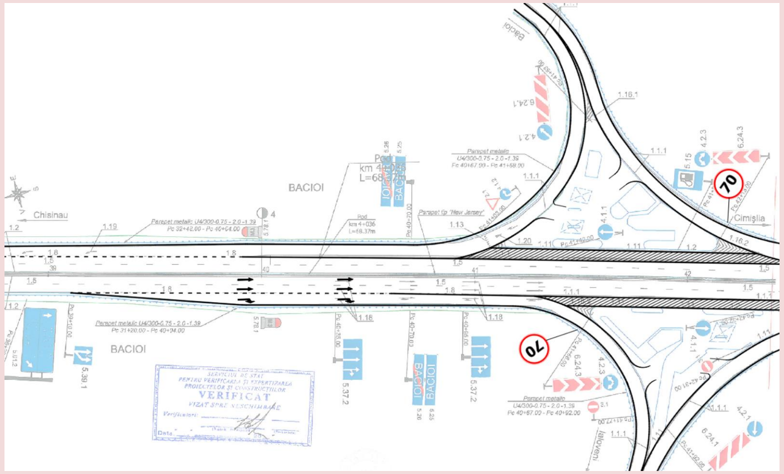
Source: https://www.highwaycodeuk.co.uk/

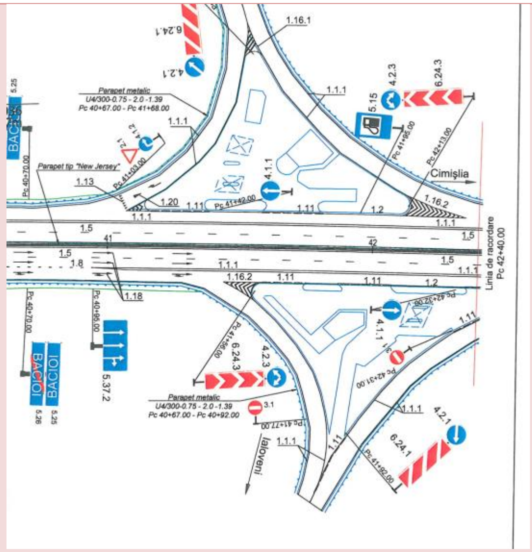
5.10. Detailed recommendations:

LOT 1: Airport Interchange – Porumbrei (34.4 km)

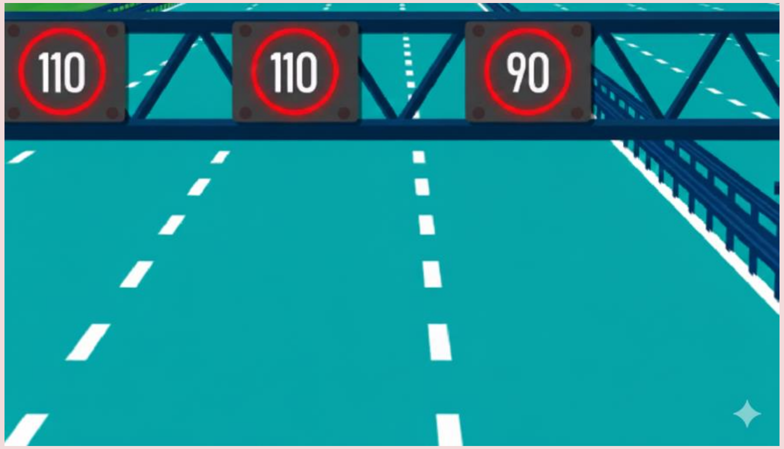
Item	Location	Deficiency	Ranking (H/M/L)	Recommendation
1.	PC 9+60 PC 343+00	On a multi-lane road with a high design speed, no deceleration lane is planned for entry into the proposed fuel station. As a result, road users traveling at higher speeds may be required to brake abruptly in order to access the station, which can lead to traffic conflicts and an increased risk of collisions due to significant speed differentials. 	H	A deceleration lane should be designed to facilitate safe access to the fuel station. This would allow road users to reduce speed safely and outside the main traffic flow before completing the turning manoeuvre into the station.  *(see enlarged in Annex C)*  *(see enlarged in Annex C)*
2.	PC 12+50	The widening of the carriageway is unclear and lacks any supplementary road markings. This may confuse drivers when the road begins to widen,	L	The widening should be appropriately marked, particularly if the area is intended for stopping places or a bus stop, to ensure that drivers clearly understand the purpose of the widened section and to maintain safe and

		potentially creating an unintended opportunity for overtaking or leading to unpredictable driving behaviour within the acceleration lane. 		orderly traffic flow.
3.	PC 13+10 – 15+30 PC 31+20 – 40+04 PC 48+86 – 59+32 PC 66+82 – 72+22 PC 71+94 – 82+90 PC 93+52 – 95+67 PC 93+52 – 96+50 PC 125+22 – 126+92 PC 124+88 – 162+28 PC 162+88 PC 170+10 PC 185+68 PC 186+70 PC 193+51 PC 200+09 PC 203+10 PC 246+80 PC 286+50 PC 310+12 PC 323+90	Straight ends of safety barriers are unsafe because a head-on collision with them is likely to result in serious consequences for the road user's health. Such design solutions should be replaced with safer, impact-absorbing terminal ends or different layout of barriers. 	M	Lower the ends of the barrier, rotate them away from driving direction and carriageway, dig them into the ground. The design of turned off the road, lowered to the ground level and dig into the ground barriers ensures less severe consequences in terms of accidents. Also, this design of barriers can help the vehicle get back on the road instead of overturns or crashes to surroundings. 

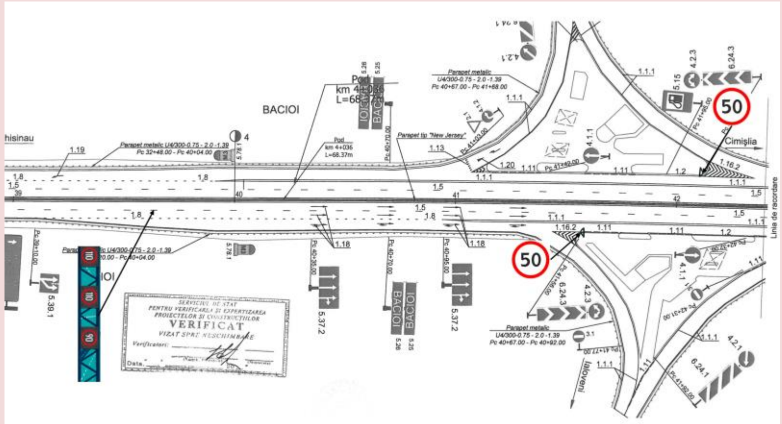
				
4.	PC 42+00	In the intersection area, the number of lanes increases to three in one direction. This widening is intended to create a dedicated lane for access to service facilities; however, no additional lane markings or speed-limiting measures are provided for this lane. As a result, all lanes permit travel at the same speed, and vehicles may both enter the service facilities and re-enter the main carriageway from this lane. This situation creates significant speed differentials and increases the potential for traffic conflicts.	H	The issue may be addressed through several recommended measures. 1. Option 1: To reduce speed differentials, it is recommended to introduce speed-limiting signs (e.g., 70 km/h) on the deceleration lane and to ensure that entry into service facilities occurs from this lane, while exit is directed into the acceleration lane. This approach eliminates the need to add an additional through-traffic lane on the highway and helps prevent excessive speed variation and driver confusion.  *(see enlarged in Annex C)* 2. Option 2: advance warning signs should be placed before the

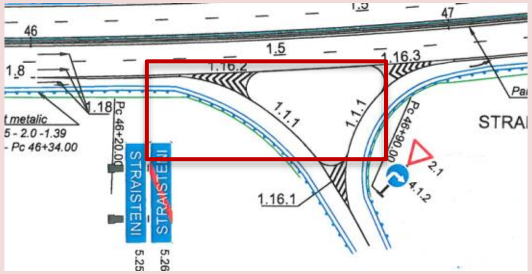
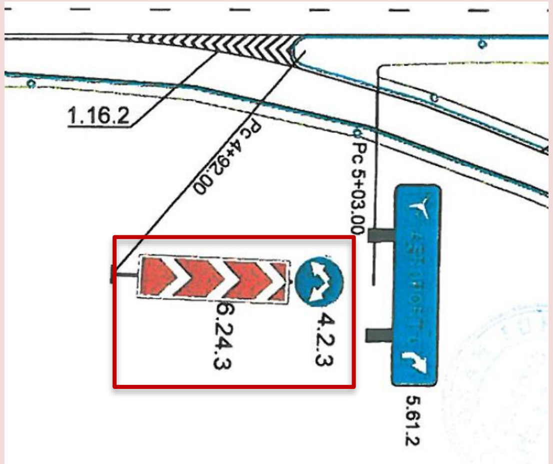


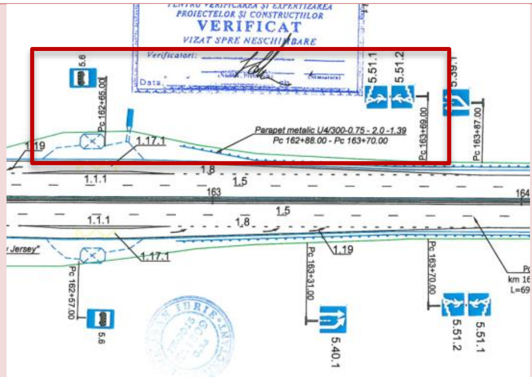
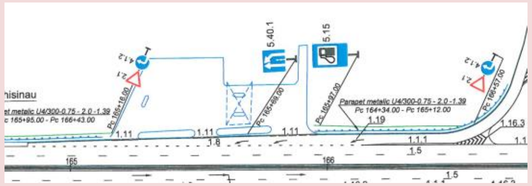
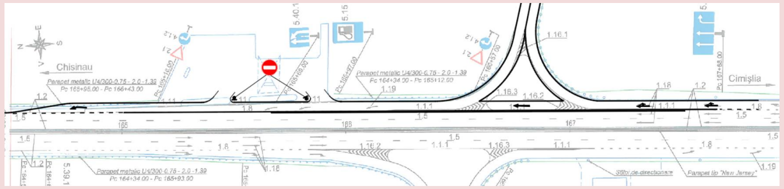
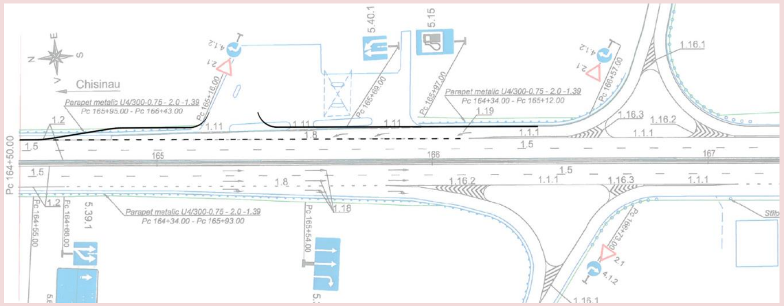
intersection to inform drivers about upcoming speed differences between the lanes. The deceleration lane should initially be limited to 70 km/h, with a subsequent reduction to 50 km/h to ensure safe access to the service facilities.

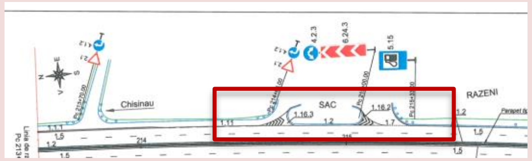
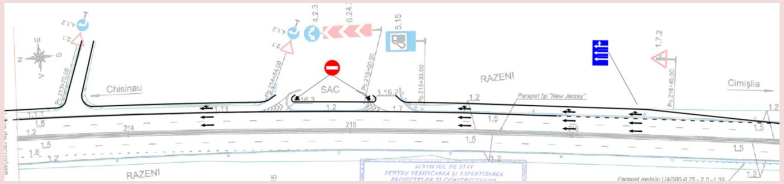


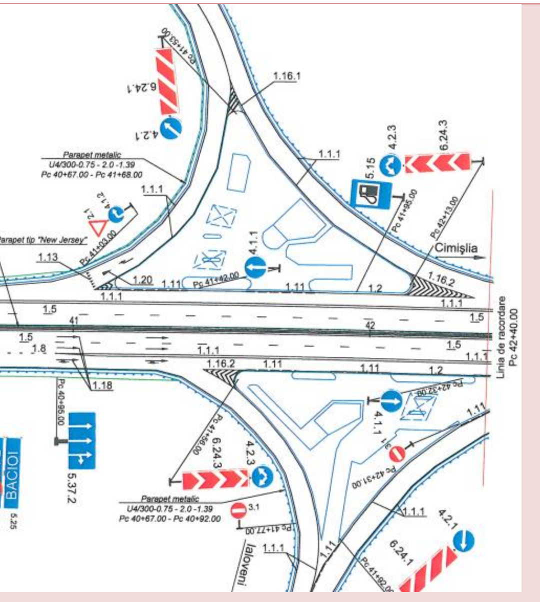
Preliminary gantry scheme with signs generated with Gemini AI



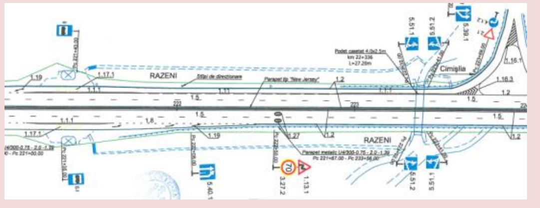
5.	PC 46+30 PC 48+50 PC 58+20 PC 150+50 PC 157+40 PC 166+15 PC 167+00 PC 181+00 PC 211+30 PC 224+00 PC 237+00 PC 237+65 PC 317+50	It is unclear whether the proposed traffic islands are raised or marked only with horizontal road markings, and road markings 4.2.3 and 6.24.3 are not provided on the islands.  	L	It is recommended to construct the islands as raised structures in order to physically prevent drivers from crossing over them. Appropriate road signs indicating the separation of traffic directions should also be installed. 
6.	PC 163+69	An underground pedestrian underpass is planned near a bus stop, but the project does not indicate what pedestrian infrastructure is intended to provide access to this underpass. Without a designated pedestrian connection, there is a significant risk that pedestrians may attempt to cross the high-speed roadway at surface level, creating a dangerous situation.	L	Pedestrian infrastructure leading to the planned underground underpass should be designed and clearly shown in the project to ensure safe and direct access for pedestrians.

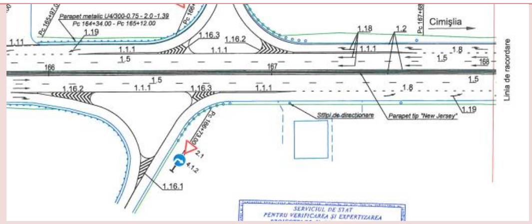
				
7.	PC 165+97	When approaching at high speed, the available distance may be insufficient for vehicles to decelerate safely in order to enter the fuel station, particularly because the station access point intersects with the acceleration lane used by traffic entering from the side road. These two conflicting traffic streams, combined with speed reduction on the main carriageway, may significantly increase the risk of traffic incidents. 	M	1. Option 1: Provide an additional dedicated access lane leading to the fuel station so that vehicles travelling on the main carriageway are not impeded by those slowing down to enter the station.  2. Option 2: Establish a single combined entry and exit point by extending the acceleration and deceleration lane, allowing road users leaving the fuel station to merge safely into traffic and reducing conflict points. 

8.	PC 215+00	On a multi-lane road with a high design speed, no deceleration lane is planned for entry into the proposed fuel station. As a result, road users traveling at higher speeds may be required to brake abruptly in order to access the station, which can lead to traffic conflicts and an increased risk of collisions due to significant speed differentials. 	H	A deceleration lane should be designed to facilitate safe access to the fuel station. This would allow road users to reduce speed safely and outside the main traffic flow before completing the turning manoeuvre into the station. 
9.	PC 41+00	As the M3 road is planned to function as a high-speed arterial route, it is not suitable for agricultural machinery and other slow-moving farm vehicles. Due to the significant differential in operating speeds between general traffic (passenger cars and heavy goods vehicles) and agricultural equipment, permitting such vehicles to use the M3 corridor would increase the risk of rear-end collisions, unsafe overtaking maneuvers, and traffic flow disruptions. Therefore, from a road safety and traffic management perspective, it is advisable to restrict access for agricultural vehicles on this route.	L	Accordingly, appropriate regulatory road signs prohibiting access for tractors and other agricultural vehicles should be installed at the main intersections and access ramps leading to the M3 road. 

				
10.	~PC 54+00 ~PC 93+00 ~PC 97+00 ~PC 129+00 ~PC 144+00 ~PC 199+00 ~PC 302+00 ~PC 316+00	Along the newly designed highway sections, there is a lack of safety barriers that would physically restrict access to and from certain access roads. The absence of physical control measures enables abrupt entry onto and exit from the main carriageway. Such uncontrolled movements—particularly at high operating speeds typical of a highway environment—significantly increase the risk of severe traffic collisions, including high-energy side-impact and rear-end crashes, which may result in fatal outcomes. From a road safety engineering standpoint, this constitutes a critical infrastructure deficiency.	H	It is recommended to install safety barriers at selected locations, taking into account the actual site conditions, in order to physically restrict access to and from specific access roads. Alternative access arrangements to these locations should be planned via adjacent areas or the local road network to ensure controlled and safe traffic circulation. This matter is discussed in greater detail in Section 4.6 of this report.

		 *The location of the picket may differ slightly from the project due to the inaccuracy of the trajectory when displaying it on Google Earth.*		
11.	PC 221+43 – PC 234+41	Several issues have been identified at this location that may negatively affect vulnerable road users. 1. The bus stops are being designed in the same location as they are currently, which is at a considerable distance from the pedestrian crossing. 2. The pedestrian crossing remains in the same location and is likely to retain the same configuration. At present, motor vehicles also pass through this tunnel, which makes pedestrian traffic safety questionable.	L	1. Assess the feasibility of relocating the bus stops closer to the grade-separated pedestrian crossing (tunnel). In any case, it is essential to ensure convenient, continuous, and safe pedestrian infrastructure providing direct access to and from the bus stops. 2. Restrict vehicle access through the currently used tunnel by installing appropriate traffic signage and implementing additional physical separation measures (e.g., bollards or barriers) to enhance pedestrian safety.

		 		
12.	PC 168+00	There is currently a frequently used café located along the M3 corridor; however, the project does not define how access to the café from the M3 will be modified. Retaining the existing direct access arrangement may create traffic conflict points and increase the risk of road accidents, particularly given the high-speed nature of the corridor and potential turning maneuvers across traffic streams.		It is recommended to reorganize access to the café via a secondary road and an alternative local street network. Parking facilities should be relocated from the area directly in front of the café to a position behind the building (as indicated in orange in the referenced illustration), thereby minimizing direct interaction with through traffic on the M3. Access back to the M3 should be integrated into the currently designed acceleration lane, or the acceleration lane should be extended as necessary to ensure safe merging conditions. This approach would reduce direct conflict points, improve operational safety, and maintain the functional integrity of the M3 as a high-speed arterial route.

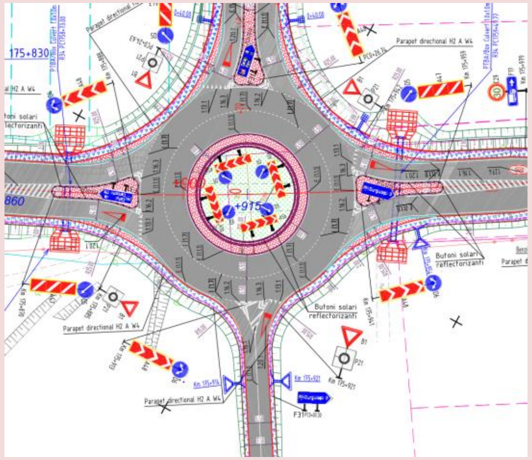
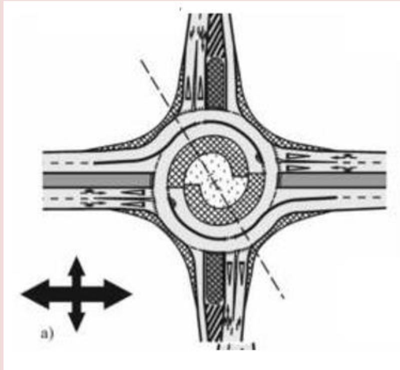
				
13.	~PC 317+00	Currently, buses and other road users drop off pedestrians near the intersection adjacent to the M3 road. Pedestrians, seeking to shorten their route, cross the M3 road at unauthorized locations, climb over safety barriers, or bypass them entirely. Given the higher operating speeds and the transit function of the M3 corridor, this behavior creates serious conflict points between vehicles and pedestrians and significantly		1. One potential solution is to redirect pedestrian movements to the existing dedicated bus stop located within the settlement, approximately 450–500 meters from the M3 road in one direction. In this case, pedestrians would need to walk no more than an additional one kilometer, but the unsafe crossing of the M3 road would be eliminated. To support this arrangement, appropriate informational and warning traffic signs should be installed on the M3 road indicating that the official pedestrian drop-off platform is located approximately 500 meters ahead. Stopping and parking should be restricted

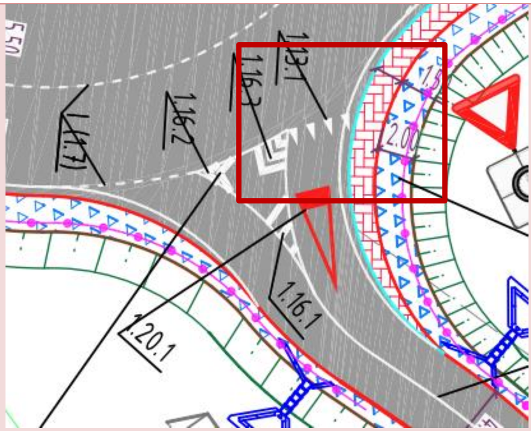
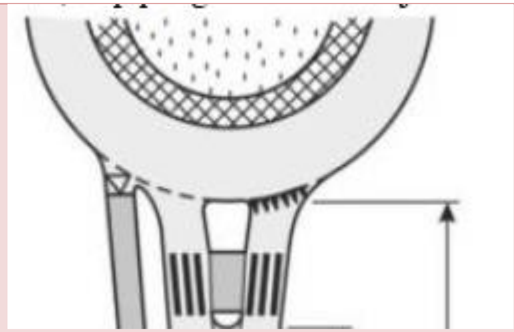
		increases the risk of severe or fatal crashes. The present situation is not consistent with Safe System principles and represents a substantial road safety concern.		along the hazardous section near the intersection, and physical measures such as continuous guardrails or pedestrian fencing should be strengthened to prevent access to the carriageway. Coordination and communication with bus operators and local residents would be necessary to ensure compliance with the revised drop-off arrangement. This option involves relatively low investment costs, can be implemented quickly, and focuses primarily on traffic management and behavioral change.  An alternative solution would be to construct a dedicated bus stop physically separated from the M3 carriageway. However, to ensure pedestrian safety, this option would require the installation of a grade-separated pedestrian crossing, either an overpass or an underpass. Direct access to the M3 carriageway would need to be

				physically restricted through guardrails, fencing, or channelization measures, ensuring that pedestrians are guided exclusively toward the safe crossing facility. Although this option requires higher capital investment, it provides a long-term engineering solution appropriate for a high-speed road environment and aligns more comprehensively with Safe System design principles.

Table 5-1: Lot 1 Recommendations

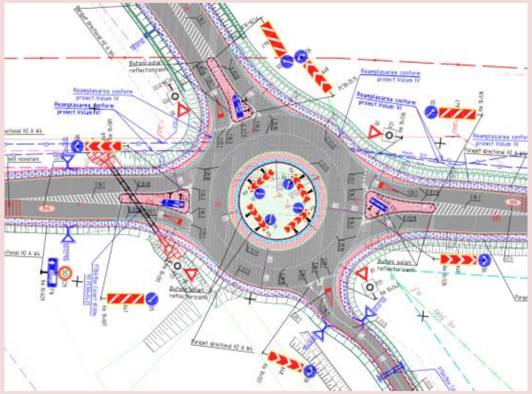
LOT 4: Giurgiulești Ring Road

Item	Location	Deficiency	Ranking (H/M/L)	Recommendation
▪	PC 00+00	1. The proposed design includes a two-lane roundabout, which may be confusing and unsafe for drivers. Vehicles entering the second lane within the roundabout are required to perform a lane-change maneuver in order to exit, increasing the likelihood of conflict points and unsafe interactions.  2. The 1.13 marking at the intersection is applied incorrectly.	H	1. The roundabout should be designed with clearly defined directional lanes that allow drivers to follow a single lane throughout the roundabout and exit without performing lane changes. Such a layout is known as a *turbo-roundabout*, which minimizes conflicts and improves safety.  *Example of turbo-roundabout layout* 2. Correct the alignment and placement of marking 1.13 so that it follows the geometry of the inner carriageway, ensuring consistent and clear stop-line visibility.

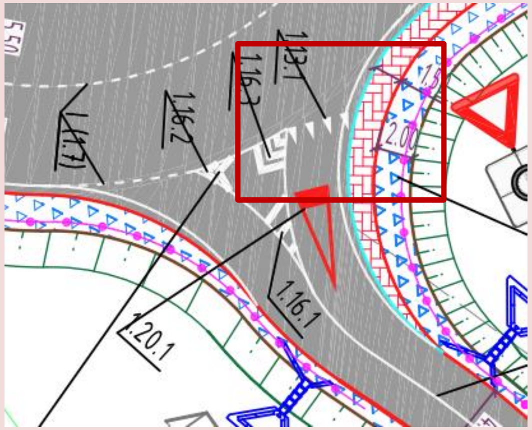
		 3. The support structure of a proposed road sign extends into the carriageway, creating a potential obstacle for vehicles.  		  *Example of 1.13 marking in roundabouts (Lithuania)* 3. Road signs should be positioned so that they do not interfere with traffic operations within the intersection area, ensuring that no columns or other support structures obstruct the carriageway. 4. If the roundabout is replaced with a turbo roundabout, it is recommended to install road signs before the entry that inform drivers which lane they must choose based on their intended direction of travel. Since lane changes are not possible within a turbo roundabout, drivers should perform the necessary lane change before entering and select the correct lane in advance.

				 *Example of road sign for orientation in roundabouts (Lithuania)* 5. Use appropriately sized and separated directional segments within the roundabout to ensure clarity and visibility.  *Example of directional segments (Lithuania)*  *Example of road sign for orientation in roundabouts (Lithuania)*
▪	PC 39+00	4. The proposed design includes a two-lane roundabout, which may be confusing and unsafe for drivers. Vehicles	H	1. The roundabout should be designed with clearly defined directional lanes that allow drivers to follow a single lane throughout the roundabout and exit without

entering the second lane within the roundabout are required to perform a lane-change maneuver in order to exit, increasing the likelihood of conflict points and unsafe interactions.

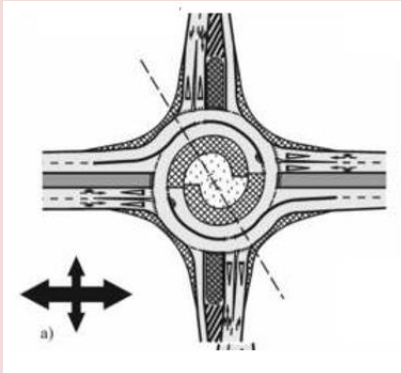


5. The 1.13 marking at the intersection is applied incorrectly.



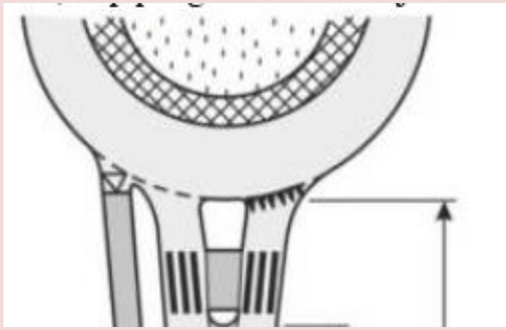
6. It is unclear why the newly designed road alignment becomes significantly curved immediately before the intersection. Such an unnecessary deviation may confuse drivers and negatively affect traffic safety.

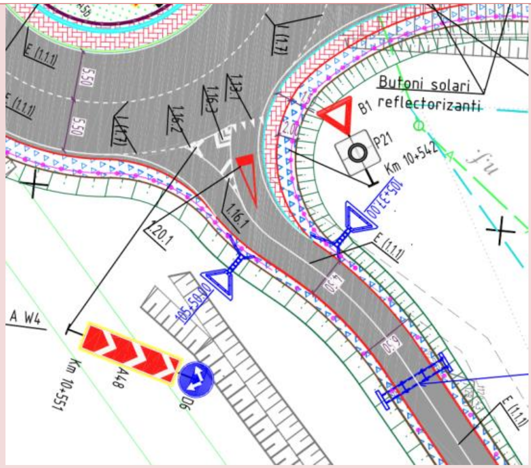
performing lane changes. Such a layout is known as a *turbo-roundabout*, which minimizes conflicts and improves safety.



Example of turbo-roundabout layout

2. Correct the alignment and placement of marking 1.13 so that it follows the geometry of the inner carriageway, ensuring consistent and clear stop-line visibility.



		 		 *Example of 1.13 marking in roundabouts (Lithuania)* 3. A smooth and direct approach to the roundabout should be provided, avoiding unnecessary curvature of the carriageway to ensure predictable and safe vehicle movement. 4. If the roundabout is replaced with a turbo roundabout, it is recommended to install road signs before the entry that inform drivers which lane they must choose based on their intended direction of travel. Since lane changes are not possible within a turbo roundabout, drivers should perform the necessary lane change before entering and select the correct lane in advance.  *Example of road sign for orientation in roundabouts (Lithuania)* 5. Use appropriately sized and separated directional segments within the roundabout to ensure clarity and visibility.

				 *Example of directional segments (Lithuania)*  *Example of road sign for orientation in roundabouts (Lithuania)*
▪	PC 4+00 PC 5+80 PC 9+20 PC 10+80 PC 18+20 PC 19+70 PC	At the intersection, the horizontal road marking 1.13 on the minor road is curved. As a result, drivers are prompted to stop at varying distances from the intersection — in some parts farther from the junction, and in others directly at the crossing point. This inconsistency may cause uncertainty about the correct stopping position and reduce intersection safety.	L	It is recommended to extend the 1.13 stop line marking consistently up to the intersection edge so that all drivers stop at the same location — directly at the junction — regardless of their intended direction of travel. This will ensure uniform driver behavior and improved safety at the intersection.

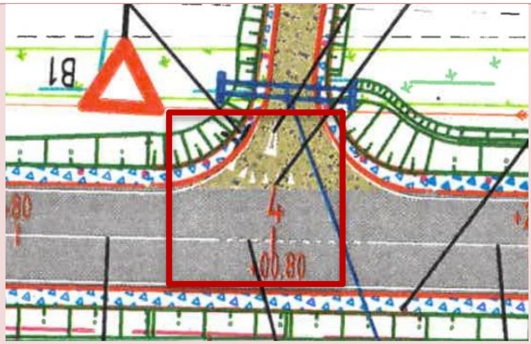
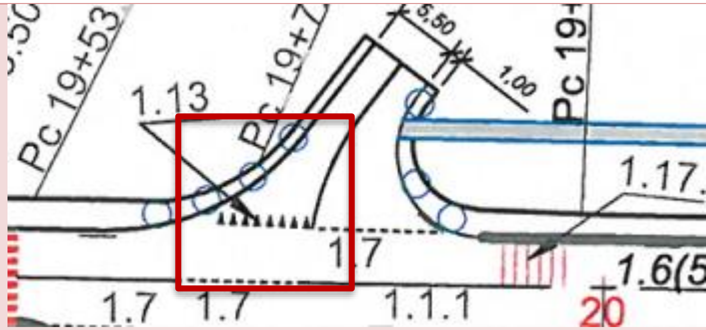
	27+10 PC 32+40 PC 35+70			

Table 5-2: Lot 4 Recommendations

5.11. General recommendations for remaining Lot 2, Lot 3, Lot 4 (partly)

At this stage, the detailed design documentation for the remaining project sections—Lot 3 (Cimișlia–Comrat, 12 km), Lot 2 (Porumbrei–Cimișlia, 19 km, involving rehabilitation and widening from 2 to 4 lanes—Category A)—has not yet been completed. Consequently, a full safety assessment cannot be performed. However, based on recurrent issues identified during the audit of previous lots, it is evident that several design shortcomings tend to reappear across different project sections. These aspects can and should be addressed proactively when preparing the designs for Lots 2, 3, and 4 to ensure consistency, safety, and long-term operational functionality of the upgraded network.

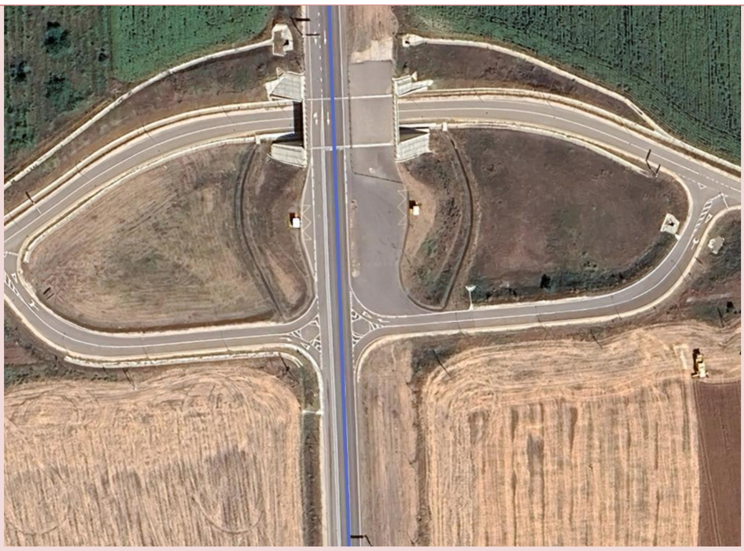
Given that Lot 2 involves significant geometric upgrades (widening to 4 lanes, Category A), it is essential that this lot maintain the same transport-organisation logic already applied in Lot 1. Consistency throughout the corridor will significantly improve predictability for drivers and reduce the risk of operational and safety conflicts.

Key recommendations for Lot 2

3. **Maintain a Unified Traffic Management Concept Across Lots.**

- Ensure that all new intersections are designed with appropriate acceleration and deceleration lanes, maintaining consistent geometries for safe merging and diverging. Below is a table and a photograph of the actual location where acceleration and deceleration lanes would be required.

KM	Photograph of the site*	Note
	LOT 2	
0 KM		The existing intersection with the M6 requires minor realignment to ensure it intersects at a proper 90-degree angle and to accommodate the provision of dedicated acceleration and deceleration lanes.
~1 KM		Keep the same traffic organization as it is currently after the reconstruction to 2+2 road.

~4.7 KM		The existing infrastructure connecting the M3 to the surrounding suburbs is adequate and is expected to remain in place following the reconstruction. However, there is a need to provide dedicated acceleration and deceleration lanes at this intersection to facilitate safe turning movements.
~11.6 KM		This intersection is expected to remain largely unchanged; however, the provision of dedicated acceleration and deceleration lanes will be required. As a result, the existing bus stop will need to be relocated.

*Photographs are taken from Google Earth

Table 5-3: Key recommendations Lot 2

At-grade (same-level) crossings must be avoided along these high-speed segments. Instead, all connections should be managed using grade-separated interchanges, in line with Category A requirements.

KM	Photograph of the site*	Note
LOT 2		
0 KM		A grade-separated intersection crossing the M6 is currently present at this location. If the M6 is widened to four traffic lanes, it will be necessary to retain the existing or a similar grade-separated traffic arrangement at this site.
~4.7 KM		A grade-separated intersection crossing the M6 is currently present at this location. If the M6 is widened to four traffic lanes, it will be necessary to retain the existing or a similar grade-separated traffic arrangement at this site.
~11.6 KM		A grade-separated intersection crossing the M6 is currently present at this location. If the M6 is widened to four traffic lanes, it will be necessary to retain the existing or a similar grade-separated traffic arrangement at this site.

*Photographs are taken from Google Earth

Table 5-4: Grade-separated interchanges

- No additional grade-separated crossings are identified, as Lot 2 of the M3 currently passes through uninhabited areas, and there is no need to construct crossings that do not serve or connect settlements. However, this situation should be monitored prior to detailed design to determine whether any pedestrian movement patterns emerge from these uninhabited areas.

- Apply uniform signage, barrier types, drainage solutions, markings, and safety features to maintain seamless driver experience. This means that Lot 2 must be coordinated with the existing M3 roadway and with Lot 1 in order to maintain overall network continuity. Opposing traffic flows must be separated either safety barriers, as in the Lot 1 design.

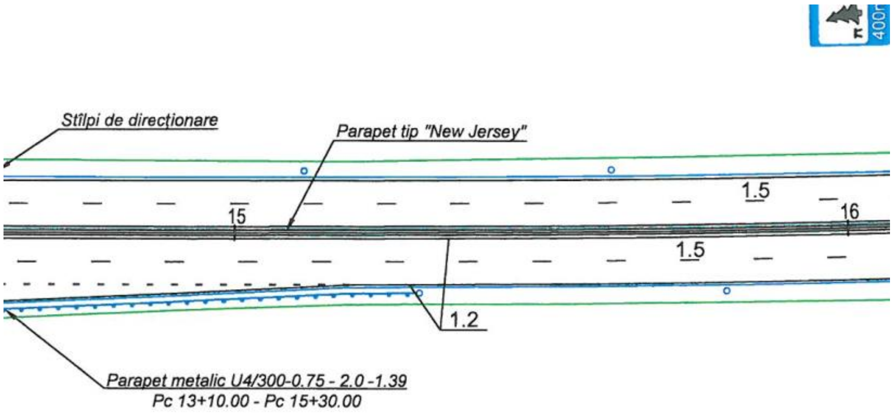


Figure 5-25. Designed road cross section for Lot 1 of M3

Source: M3 Execution project, volume 2, drawings, road works, part V, road signalling and markings

4. Improve Roadside and Median Safety Features

- Review and upgrade the barrier layout to ensure compliance with modern containment-level standards.
- Introduce forgiving roadsides wherever possible by eliminating fixed obstacles and improving clear zones.
- Ensure consistent use of median barriers suitable for high-speed, high-volume traffic.

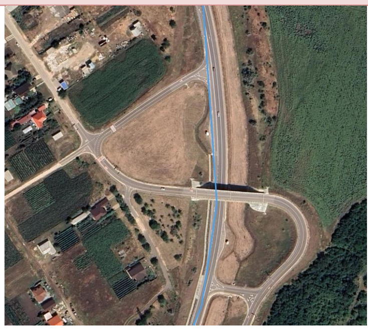
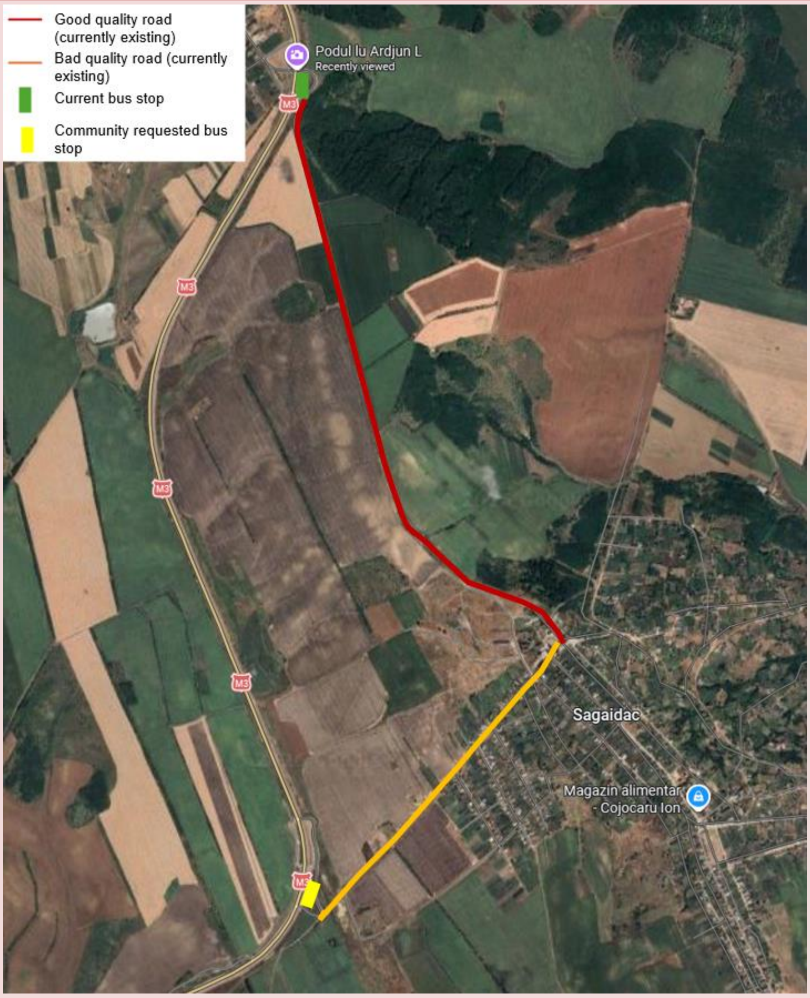
5. Implement Intelligent Transport Systems (ITS), Where Feasible

- If the national road administration already operates an ITS platform or plans ITS deployment, consider installing:
- Variable message signs (VMS) to communicate real-time information (speed limits, weather, congestion, incidents).
- Traffic monitoring equipment to enhance overall corridor management.
- Speed harmonisation systems, particularly in areas with changing geometric conditions.

These measures would ensure drivers always receive the most relevant safety and operational information, enhancing situational awareness and reducing crash risk.

6. Ensure Safe and Continuous Infrastructure for Vulnerable Road Users (VRUs).

- Although the segment is designed primarily as a high-speed corridor, the presence of residential areas, agricultural lands, and local access roads requires safe accommodation of pedestrians, cyclists, and other VRUs.
- Prohibit direct pedestrian crossings on the mainline and implement grade-separated VRU crossings such as pedestrian underpasses or overpasses.

KM	Photograph of the site*	Note
	LOT 2	
1 KM	  	A pedestrian path is currently provided at this location and must be retained to ensure a safe crossing of the M3 road for vulnerable road users. However, the existing water drainage system creates constraints that make crossing the bridge difficult for persons with disabilities.
~4.6 KM		Currently, pedestrians must walk approximately 3 km to reach the nearest bus stop, and there is no dedicated pedestrian infrastructure along this route. There is a shorter alternative route, marked in orange, which would provide more direct access. However, this road is currently in poor condition, difficult to pass, and practically unused. Despite its present state, if upgraded and provided with appropriate stopping facilities, it could significantly reduce walking distances and improve pedestrian access to public transport. At approximately KM 1, a pedestrian crossing is already in place, providing a formal crossing opportunity. In contrast, at

		approximately KM 4.6, although there is a grade-separated interchange, it lacks adequate pedestrian infrastructure to allow safe crossing to the opposite side of the M3 road. Without dedicated pedestrian facilities at this location, safe connectivity across the corridor remains insufficient.

*Photographs are taken from Google Earth and Consultant

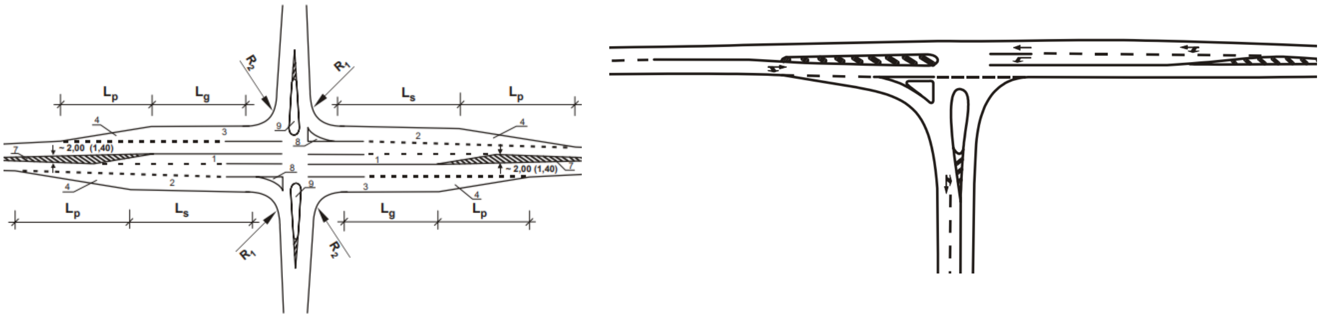
Table 5-5: Safe crossing for VRU

7. Provide safe access paths, lighting, and fencing to guide VRUs toward designated crossing points.

- Introduce service roads or parallel access roads to separate local traffic and non-motorised users from the high-speed mainline.

Key recommendations for Lot 3

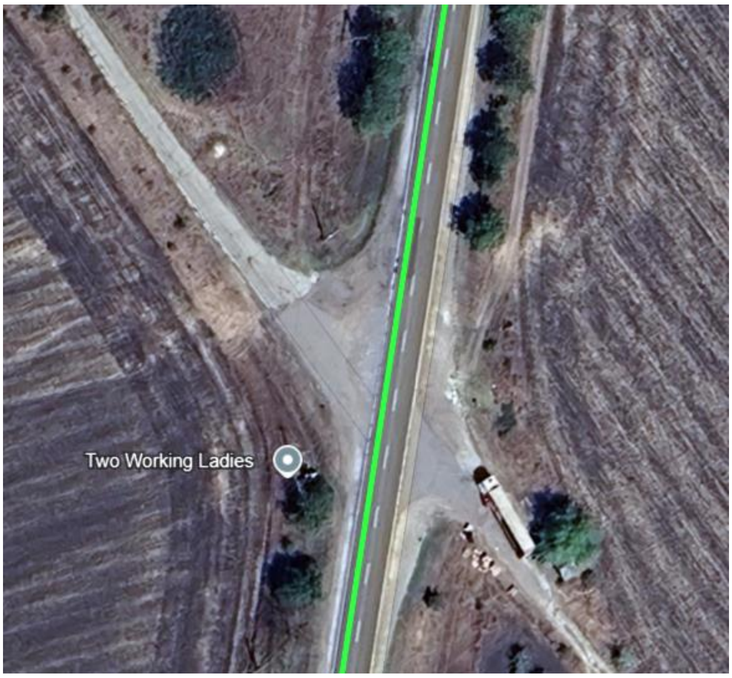
There is no indication that Lot 3 will be reconstructed as a four-lane roadway; therefore, the existing infrastructure is expected to be retained and potentially upgraded rather than fully redeveloped. The provision of acceleration and deceleration lanes may be applied depending on traffic volumes on the main road and on intersecting side roads. Below are several examples of intersection layouts both with and without dedicated acceleration and deceleration lanes. Intersections—whether three-leg or four-leg—must be designed to operate safely and to provide clear, legible infrastructure for all road users. Accordingly, intersections should be clearly delineated, with appropriate pavement markings and raised traffic islands to facilitate safe left-turn movements.

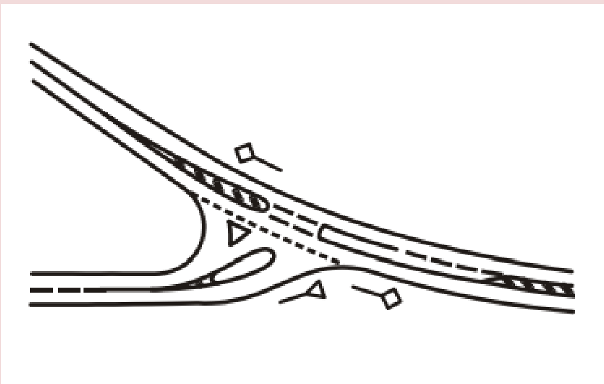


a) b)

Figure 5-26. Example of intersection design a) with acceleration and deceleration lanes b) without acceleration and deceleration

Source: The Consultant

KM	Photograph of the site*	Note
	LOT 3	
2.5 KM		This intersection will need to be reconfigured as a safe three-leg or four-leg intersection. As one approach leg is currently not connected, its inclusion should be assessed in the context of any planned future development in the area. If no such development is anticipated, there is no requirement to retain this leg, and the intersection may be designed as a safe three-leg configuration.
6.1 KM		This intersection serves as one of the access points to Ciucur Mangir village; therefore, a safe left-turn movement must be provided. Accordingly, the intersection should be reconfigured as a safe three-leg intersection.

7.3 KM		This is the main intersection along Ciucur Mangir village and must be redeveloped as a safe four-leg intersection, providing connections to both sides of the village along the M3 road.
9.0 KM	 	The geometry of this intersection is currently suboptimal. It is recommended to realign the intersection to achieve a safe 90-degree connection to the M3 road, incorporating necessary road safety elements such as traffic islands to ensure safe left-turn movements.

*Photographs are taken from Google Earth and Consultant

Table 5-6: Intersections Lot 3

Key recommendations for Lot 4 (bypass)

Lot 4 represents a different operational context, as it is intended to function as a bypass and a key interface between regional roads and major border-oriented traffic flows. Its role as a connector to the border crossing points with Romania, Ukraine, and potentially port facilities significantly affects the design requirements.

1. Design Safe and High-Capacity Roundabouts

- All roundabouts on the bypass must be designed according to international best practice for heavy-vehicle–dominated corridors, with adequate radii, entry curvature, lane configurations, and truck-friendly aprons.

- Ensure consistent deflection to reduce approach speeds without compromising flow.
- Integrate high-visibility signage and markings supporting clear navigation, especially for heavy traffic.

2. Ensure the Bypass Supports Continuous and Uninterrupted Traffic Flow

- The bypass must prioritise smooth, conflict-free movement of transit and freight traffic.
- Avoid introducing unnecessary access points, side connections, or geometric inconsistencies that could create bottlenecks or conflict zones.
- Evaluate the need for dedicated freight lanes or additional shoulders to accommodate vehicle breakdowns without impacting flow.

3. Provide Infrastructure Compatible With All Vehicle Types

- Ensure adequate lane widths, shoulder widths, and pavement strength to support intensive heavy-goods vehicle (HGV) use.
- Consider providing HGV waiting zones or buffer areas, particularly near intersections with access to border-crossing routes.

4. Maintain High Safety Standards Across the Bypass

- Install consistent barriers, lighting, and signing tailored to a high-volume bypass.
- Ensure safe design of any VRU crossings, particularly near settlement boundaries.
- Apply modern drainage and erosion-control measures to maintain long-term infrastructure integrity.

Giurgiulești functions as a major border crossing point between Romania and Ukraine and serves as a critical node for international freight transport. A substantial concentration of heavy goods vehicles (HGVs) gathers in this area on a daily basis. However, there are currently no designated or purpose-built parking or staging areas to accommodate this demand. As a result, long queues of freight vehicles regularly form along the main corridor connecting Romania and Ukraine. This situation significantly reduces traffic operability, creates unstable flow conditions, and generates challenging and potentially unsafe driving environments for both freight and passenger vehicles.

Considering that the existing M3 alignment is planned to be modified and Giurgiulești will be bypassed—thereby removing heavy transit traffic from the urban core—it is strongly recommended to integrate dedicated HGV parking and staging facilities into the new transport framework. These facilities should include both short-term and long-term parking areas designed to manage pre-border waiting flows efficiently. In addition to basic parking capacity, supporting infrastructure should be provided, such as rest areas, food services, sanitary facilities (WC and showers), and other amenities necessary to meet driver welfare and regulatory rest requirements.

Furthermore, in the medium to long term, the introduction of more advanced traffic management solutions should be considered in order to prevent uncontrolled queue formation at customs checkpoints. For example, a digital call-forward or time-slot-based system could be implemented, whereby freight vehicles are individually summoned to the customs post according to a managed schedule. Such an approach would improve throughput efficiency, enhance safety, reduce roadside congestion, and create a more predictable and controlled freight movement system in the border area.

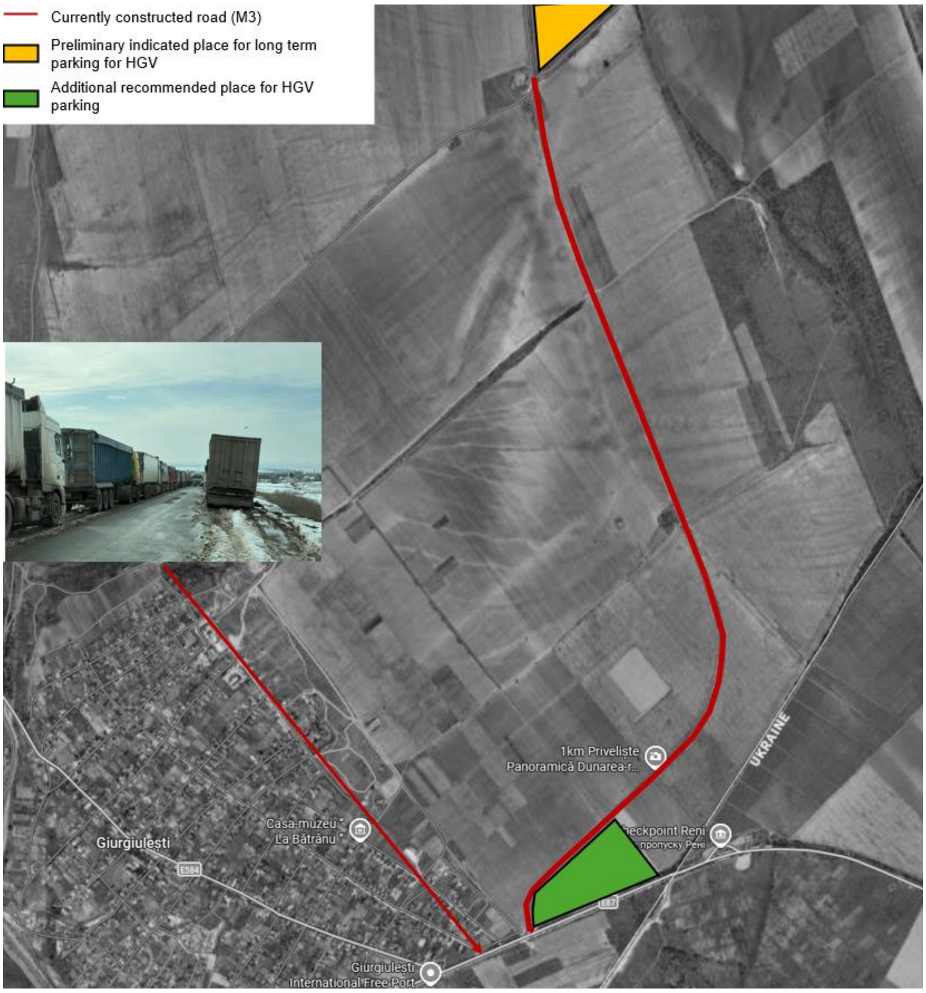


Figure 5-27. Preliminary parking places around Giurgulesti

Source: The Consultant

Annex A – Road Safety Severity Ranking scheme

Based on the developed Road Safety Audit (RSA) Manual, the risk rating for identified issues has been determined using a standardized assessment matrix. The rating combines the Likelihood of an incident occurring with the Severity of its potential consequences. This structured approach ensures consistency and clarity in evaluating road safety risks. The table below outlines the rating framework used:

Current situation			
Risk of road accident	**There are fatalities or serious injuries**	**Only slightly injured persons**	**No persons killed or injured**
	Degree of importance		
High (H)	**High (H)**	**High (H)**	**Medium (M)**
Medium (M)	**High (H)**	**Medium (M)**	**Low (L)**
Low (L)	**Medium (M)**	**Low (L)**	**Low (L)**

Annex B – Road Safety Audit checklist

Based on the Road Safety Audit (RSA) Manual, the following checklist was followed to ensure a comprehensive and systematic approach during the audit process. This checklist aligns with best practices and covers critical aspects of road design and operation that may impact safety for all road users:

Requirements of different road users

- Is the designed road intended for the involved traffic users
- Has the need for parking been taken into account?
- Have all classes of pedestrians that could be seriously affected by this Project been considered? (For example, schoolchildren, the elderly, etc.)
- Has the need to stop drivers been considered?
- Are the necessary conditions for pedestrians and cyclists provided?
- Are roadsides safe if there are lanes for cyclists on the roadway?
- Have the needs of riders and horse-drawn vehicles been taken into account, including the use of verges?
- Can underpasses be used by cyclists?
- Have the needs of truck drivers been taken into account, including turning radii and lane widths?
- Have public transport needs been taken into account?
- Have the needs of public transport users been taken into account?
- Have public transport manoeuvring needs been taken into account?
- Are public transport stops safely located?
- Have the transport needs of operational services been taken into account?
- Is safety ensured during the operation of the machines of the maintenance service

Traffic Conditions

- Do the design solutions match the anticipated traffic intensity?
- Are significant traffic generating facilities located at a sufficient distance from intersections to avoid safety issues?
- Will there be security issues in the future if:
  - Upgrade
  - Adding an additional roadway
  - Geometric changes at intersections
- Are the design solutions appropriate for the design traffic volume and characteristics (including the effects of large and heavy vehicles, cyclists and pedestrians)?
- Will the road be able to safely handle an unexpected or significant increase in traffic?
- Will the road safely handle unexpected changes in traffic?
- Has the need for parking been taken into account?
- Was lighting considered in the Project?

Visibility

- Will sight distance be ensured:
  - At intersections
  - At the exit to the adjacent territories
- Is the visibility distance sufficient:

  - At intersections (If not, what are the implications?)
  - At the entrance and exit
  - At emergency vehicle access points
- Will drivers be able to see pedestrians (and vice versa) given the terrain?
- Does the landscape interfere with visibility now and after the Project implementation?
- Is visibility provided on vertical and horizontal curves?
- Does visibility interfere with:
  - Fences or barriers
  - Furnishings
  - Parking lots
  - Signs
  - Elements of landscape design
  - Bridge piers
  - Parked cars in emergency areas or on the side of the road
  - Queue of cars
  - Small architectural forms
- Are railroad crossings, bridges and other hazards visible?
- Are other local features obstructing visibility?
- Are there obstructions from above (e.g. road or rail overpasses, signboards, overhanging trees) that obstruct visibility on vertical curves?
- Is there clearance for oversized vehicles?
- Is visibility sufficient for:
  - Pedestrian and bicycle crossings
  - Access roads, railway crossings
- Was the minimum visibility triangle ensured:
  - On transitional-high-speed lanes
  - At intersections
  - At roundabouts
  - In other conflict points
- Is the stopping distance ensured in all cases?
- Is there an adequate stopping distance on slopes?

Design Principles

- Does the estimated speed match the number and type of intersections?
- Does the lane width match the prospective intensity?
- Are separate lanes required for turning vehicles? Are transitional lanes required?
- Have detours or alternate routes been provided to ensure that existing areas are not cut off from transport links while the work is being carried out?
- Have appropriate design standards been used?
- Does the plan and profile meet regulatory requirements?
- Is the design speed correct for:
  - Designing horizontal and vertical curves

    - Definitions of visibility
    - Designing transitional speed lanes
- Do the horizontal and vertical curves match correctly?
- Are the vertical curves correct?
- Are the horizontal curves compliant?
- Are the applied curves appropriate for the functional purpose of the road?
- Are lane widths, shoulders, medians and other dimensions appropriate for the purpose of the road?
- Does the width of the traffic lanes and the carriageway correspond to:
    - Radii of curves
    - Traffic intensity
    - Dimensions of vehicles
    - Accepted speed
    - A combination of speed and intensity
- Do the design standards meet all the characteristics of the road?
- Are the applicable standards appropriate for the purpose of the road?
- Is the geometric transition from the road to the bridge safe?

Intersections

- Are there any potential problems at the junction with existing roads?
- Are all intersection parameters (eg distance, type, location, etc.) appropriate for the Project as a whole?
- Is the crossing frequency appropriate (neither too high nor too low):
    - For secure access
    - To avoid additional load on neighbouring roads
    - For emergency vehicle access
- Have any physical limitations, visibility limitations that could affect the choice or spacing of intersections been considered?
- Are all planned crossings necessary?
- Can unnecessary intersections be eliminated? Can traffic safety be improved by changes to the surrounding road network?
- Will the angle of the intersecting roads and visibility conditions be sufficient for the safety of all road users?
- Have the level crossings been identified and properly designed?
- Can all entrances be safely used?
- Have provisions been made for the safe access and movement of ambulances and other emergency services?
- Is there visibility at the intersection?
- Is the standard adopted for visibility, speed and unusual combinations of traffic volumes and compositions?
- Do intersections allow all vehicles to pass?
- Do the curvature radii at intersections allow all vehicles to turn?
- Are there horizontal curve radii for long vehicles?
- Are there any unusual elements at the intersections that could affect traffic safety?
- Are pedestrian barriers provided where necessary? (for example, to direct pedestrians or prevent parking)
- Have safety islands been provided where necessary?
- Is parking near an intersection safe or should steps be taken to prohibit it?

- Is there a safety hazard due to parked vehicles?
- Will the intersection and its functions be perceived correctly?
- Are the speeds at the intersection safe?
- Is there anything in the design of the intersection that misleads the driver?
- Are safety islands secure in all possible respects?
- Is there sufficient vertical clearance for structures? (e.g. power lines, shop sheds)
- Are traffic light phases applied correctly?
- Is there enough time for vehicular and pedestrian traffic?
- Will traffic lights be visible? (e.g. not obstructed by trees, poles, signs or large vehicles)
- Are traffic signals from other directions misleading?
- Are traffic lights increased if they can be affected by sunrise/sunset?
- Do the vertical and horizontal curves make it possible to see the traffic signal from the end of the line?
- Will approaching drivers see pedestrians?
- Are there partially or fully controlled turn phases where needed?
- Are there redundant traffic lights?
- Are road markings at intersections properly designed?
- Were appropriate pedestrian phases provided at traffic lights?
- Is the design of the central island safe at roundabouts?
- Is the radius and design of the central island appropriate for the vehicles used?
- Can pedestrians be seen in time by drivers at roundabouts?
- Can pedestrians tell if vehicles are turning? (no obstruction in line of sight)
- Are roundabout markings properly designed?
- Is the lighting correct?
- Are intersections long enough to accommodate a queue of turning cars?
- Are all exits to the surrounding areas safe?
- Can pedestrians cross safely through:
    - Intersections
    - Regulated and unregulated pedestrian crossings
    - Security islands
    - Bridges
    - Other places
- Are pedestrians prevented from crossing the road in dangerous places?
- Are the signs associated with pedestrians appropriate and adequate?
- Are the widths and slopes of walkways, walkways, etc. safe?
- Is the pavement of footpaths, crossings, etc. safe?
- Have curbs been installed for each crossing?
- Is the lighting at the crossings satisfactory?
- Is there a maximum use of transitions?
- Is it possible to abandon the design of the intersection at this location?
- Have the needs of cyclists been taken into account:
    - At intersections

  - On high-speed sections of roads
  - On cycling routes and crossings
  - At the exit from the main roads
- Are cycle/pedestrian paths (including sections on bridges) safe and signposted?
- Is priority clearly defined at all intersections?

Speed

- Would any sudden change in speed be safe?
- Is the speed limit, if any, appropriate for the proposed road?
- Is the posted or proposed speed limit consistent with the design speed?
- Have appropriate measures been taken to ensure safety where sudden changes in speed are required?
- Will drivers be able to track the road correctly at the set speed?

Obstructions and Installations

- Is the surrounding area free from physical obstructions or vegetation that could affect road safety? (e.g. isolated large trees, wooded areas, steep or rocky bluffs that limit design options)
- Has the safety at the location of the environmental protection facilities been considered? (e.g. noise barriers)
- Are there measures to prevent animals from entering the road?
- Was the issue of unstable territories considered? (e.g. subsidence of mines)
- Has the impact of distractions (e.g. scenic views) been taken into account?
- Will there be safety when roadside vegetation grows?
- Is the vegetation dangerous for vehicles on the possible sections of the emergency exit from the road?
- Are the dimensions for utilities provided?
- Is there a safe distance to utilities and do they interfere with visibility?
- Will there be glare problems for drivers during sunrise and sunset?
- Are there other obstacles on the road that could pose a safety hazard?
- Have measures been taken to remove, relocate or shield all obstructions?
- Are barriers in hazardous areas provided where necessary?
- Are barriers safe for all road users?
- Are the end sections of the barrier fence safe? Are dampeners used?
- Are barriers required in all cases?
- Are bridge guards and culvert end walls safe with respect to:
  - Visibility
  - Ease of recognition
  - Proximity to traffic
  - Potential for harm or damage
  - Designations and markings
  - Interfacing with a barrier fence
- Is there tree planting where vehicles can get off the road?

Weather Conditions and Drainage

- Are slopes, curves and general design approaches appropriate for likely weather or environmental aspects of the area? (e.g. fog-prone areas, snow-covered areas, etc.)
- Will the road be safe when it is wet or foggy?

- Has the possibility of flooding/flooding been considered?
- Are culvert heads and outlets safe?
- Are slopes safe?
- Will the new road have appropriate drainage?
- Do the slopes of the road and intersection design allow for appropriate drainage?
- Will there be water stagnation on the pavement and shoulders?
- Will there be road flooding near the intersection of watercourses and other water bodies?
- Is there enough space between storm drains to avoid flooding?
- Is stormwater design safe for cyclists?
- Will there be appropriate drainage on footpaths and sidewalks?
- Did the design take into account data on local climatic conditions and features (e.g. areas of frequent fog, etc.)?
- Will there be security in different seasons of the year? (For example, shadows in summer, slippery surfaces in spring, etc.)

Motorways with centre median

- Does the barrier design allow emergency vehicles to stop and turn without unnecessarily disrupting traffic?
- Is there an emergency stop option?
- Are there safe breaks in the median? (i.e. frequency, visibility)
- If the number of carriageways changes further down the road, are drivers adequately informed about this?
- Is it safe to cross from one carriageway to two and vice versa?
- Is the dividing strip wide enough to accommodate lighting poles?

Artificial lighting

- Do the advertising lights and traffic lights on the next road interfere with drivers?
- Are anti-dazzle screens used?
- Is adequate lighting provided when needed?
- Are there any objects that interfere with the lighting? (e.g. trees or bridges)
- Are lighting poles located in safe places?
- Should safety supports be provided?
- If special lighting conditions are required, is this provided?
- Is the lighting designed correctly?
- Are difficult and dangerous places adequately lit?
- Are there patches of shade on the road? Alternating light and shadow?

Horizontal and vertical markings

- Are all traffic control functions designed to avoid creating unsafe conditions?
- Are signs and markings applied correctly on curve sections?
- Are there conditions for overtaking?
- Is the character size correct?
- Are the signs visible in all places?
- Is it easy to understand the signs?
- Are the signs appropriate for the needs of the driver?
- Are all important features of the road marked?

- Is the construction of signs safe?
- Are safety sign supports used?
- Is it possible to reduce the number of characters?
- Do the signs on the new road match those on the adjacent section of the road (or do previous signs need to be updated)?
- Does the markup comply with the standards?
- Are there places where markup can be misleading or misinterpreted?
- Is there a solid marking line where necessary?
- Are spot reflective elements provided, if necessary?
- Are warning signs, recommended speed signs, or direction of turn signs used on horizontal curves?
- Do the markings on the new road match the markings on the adjacent section of the road (or do the previous markings need to be updated)?
- Are 'Direction of Turn' signs correctly applied where appropriate?
- Will markings and signs be visible at night?
- Will markings and signs be visible in wet weather?
- Has the need for structural markings and noise bands been considered?
- Have high and low driver eye positions been considered?
- Are safety bollards used?
- Do the locations of traffic controllers and other service devices pose a safety hazard?
- Will signs and markings be visible in all conditions, including day/night, rain, fog, etc.?

Miscellaneous

- Is it safe to connect old and new road sections?
- If an existing road has a lower category than a new road, is there a clear and unambiguous warning about this?
- Is it safe to cross when the road environment changes (e.g. from urban to rural areas; from a lighted area to a dark area, etc.)?
- Will the road be perceived unambiguously by drivers in any situation?

Parking

- Are there sufficient parking spaces in special places to avoid road parking and the associated risks?
- Are parking lots conveniently located?
- Is there enough parking space for all-round visibility and distance from the intersection?
- Is there room for large vehicles to turn around in safe areas?

Additional RSA checklist focusing on motorways

- Do the function and intended use of the road match?
- Have the effects of the construction Project on the surrounding road network been taken into account?
- Are the characteristics of the traffic composition taken into account?
- Corresponds the design speed to the road category?
- Have the design speeds of the connection ramps been selected correctly?
- Has the safest of the standard cross-sections been selected and is construction site traffic routing possible?
- Does the expansion standard correspond to the adjacent route sections?
- Is the transition area to the adjacent road section formed correctly?

- Is the end of the Project area outside critical areas, e.g. crest, incline, curve, poor visibility or distraction?
- Has the spatial alignment been taken into account?
- Has it been avoided that the minimum dimensions of location and longitudinal profile meet?
- Is the visibility sufficient?
- Have the number, spacing and formation of the nodes been adequately chosen?
- Is the timely recognizability of the nodes and the node elements guaranteed?
- Is the sequence of the node elements understandable?
- Can exiting, acceleration and interweaving lanes be designed appropriately?
- Is the distance to adjacent nodes sufficient?

If no general Project is audited, the points of the RSA – general Project must also be included:

- If available, have the RSA results of the previous RSA phase been taken into account?
- Are the cross-sectional dimensions appropriate for the function of the road?
- Are the cross-falls and slopes sufficient?
- Is the new road sufficiently drained?
- Are the hard shoulders stable (stability under load)?
- Are the tree plantings and other side obstacles inaccessible for skidding vehicles?
- Have measures been taken to exclude the hit (fall) of materials from the side of the slopes (the device of holding devices (structures) to prevent the fall of stones, rocks, sliding of the embankment slopes)?
- Have suitable measures been taken against falling material (e.g. falling rocks) at the incision slopes?
- Is the stopping distance view obstructed?
- Is operational maintenance safely possible?
- Are the designs coordinated in terms of position and height (spatial alignment)?
- Are deficits in the spatial alignment effectively prevented by the choice of design elements?
- Is the design and equipment of the selected junction appropriate for the function of the use of the road and the intersecting roads?
- Can the radii of the ramps be recognized in time by drivers?
- Has the construction standard and, if applicable, the transition area to the adjacent road section been adapted?
- Are the lane widths and curve width extensions sufficient?
- Are the exiting, acceleration and interlacing strips adequately designed?
- Is the junction sufficiently drained?
- Are the visibility conditions guaranteed at the junctions and are the required viewing distance areas freely visible?
- Are there enough parking spaces for cars, trucks and buses?
- Is the traffic routing in ancillary facilities appropriate?
- Are pedestrian facilities at ancillary facilities designed safely?
- Have arrangements been made for safe access for rescue service vehicles / operations services / fire brigade?
- Are fixed obstacles avoidable, set up at a sufficient distance or secured?
- Will planting growth lead to future safety problems?
- Are guard rails or concrete guard walls sufficiently and correctly arranged?
- Is fixed lighting at nodes / ancillary facilities required and, if necessary, designed appropriately?
- Are anti-glare devices required?

- Is the view obstructed by e.g. protective fences?
- Is the arrangement of wild life fences necessary?
- Is the line marking clear?
- Are speed limits accordingly planned (start, end, location, installation locations)?
- Are overtaking bans for trucks, buses, etc. necessary and appropriately arranged?
- Are the locations of the emergency telephones effectively arranged?

Additional RSA checklist focusing on Rural roads

- Have the RSA results of the previous RSA phase been taken into account?
- Do the function and intended use of the road match?
- Are the characteristics of the traffic composition taken into account?
- Does the design speed correspond to the road category?
- Does the proposed road standard correspond to the adjacent route sections?
- Is the transition from an urban to a rural road or from an illuminated to an unlit road section safely designed?
- Has the safest one of the standard cross-sections been chosen?
- Are the lane widths and curve width extensions sufficient?
- Are the waiting areas, especially on pedestrian islands, sufficient for waiting pedestrians and cyclists?
- Are the cross-falls / slopes sufficient?
- Is the road sufficiently drained?
- Are the hard shoulders stable (stability under load)?
- Have the needs of pedestrians and cyclists been taken into account?
- Is the passage created safely when cycle paths end on a roadway?
- Is there a sufficient separation between lanes for motorised transport and paths for cyclists and pedestrians?
- Is it possible to guide pedestrians and cyclists on the existing network?
- Is the pedestrian / cyclist infrastructure at in the nodes coordinated with the desired paths?
- Is the right of way clearly defined at areas where cyclists encounter motorized traffic?
- Are pedestrian crossings designed in such a way that bundled use is guaranteed and the road is not crossed at other points?
- Are pedestrian crossings required?
- Have the interests of pedestrians and cyclists at traffic signals been taken into account?
- Are the curbs at the crossing points for pedestrians and cyclists lowered?
- Are parking spaces (car, truck, busses) necessary and sufficiently dimensioned to prevent parking on the road?
- Are the tree plantings inaccessible by skidding vehicles?
- Have suitable measures been taken against falling material (e.g. falling rocks) for incised slopes?
- Are unavoidable bottlenecks designed safely?
- Is the stopping distance view ensured and not obstructed by e.g. barriers, vegetation?
- Are fixed obstacles avoidable, placed at a sufficient distance or secured?
- Can road service vehicles be parked safely?
- Is the end of the Project area outside critical areas, e.g. crest, incline, curve, poor visibility or distraction?
- Are the designs coordinated in terms of position and height (spatial alignment)?
- Are deficits in the spatial alignment effectively prevented by the choice of design elements?

- Has it been avoided that the minimum dimensions of location and longitudinal profile meet?
- Is the spatial alignment sufficient?
- Are the critical changes correctly arranged on roads construction type 2 + 1 spatially?
- Are lane reductions properly designed?
- Are property driveways required and are they designed safely?
- Are the entrances and exits of ancillary facilities planned in adequate places?
- Are traffic islands or narrow lanes required at city entrances?
- Are there enough opportunities to overtake safely (overtaking viewing distance / overtaking lanes)?
- Are design speeds of junction and adjacent road sections coordinated?
- Is the node necessary and is the distance between adjacent nodes adequate?
- Are there access roads and paths that can be combined?
- Is the design and equipment of the selected junction appropriate for the safety of the road and the intersecting roads?
- Is the traffic routing clear and understandable?
- Are exiting, acceleration lanes and interlacing areas necessary and safe?
- Is the intersection sufficiently drained?
- Are traffic signals / permanent speed monitoring necessary?
- Are the visibility distance in the junctions guaranteed and are the required visibility areas freely visible?
- Are passive protective devices provided at the required points?
- Will planting growth lead to future safety problems?
- Is the line marking clear and recognizable?
- Are there special arrangements for groups with disabilities, e.g. blind at traffic signals required?
- Is fixed lighting on lanes, at nodes / ancillary facilities required and, if necessary, designed appropriately?
- Are anti-glare devices required?
- Is the arrangement of wild life fences necessary?
- Is the view obstructed by e.g. wild life or snow fences, road equipment, parking vehicles, traffic signs, planting?
- Is suitable road equipment (e.g. snow fences) necessary or intended due to special weather conditions?
- Is it necessary to develop active safety measures at railway crossings (automatic traffic signaling, sound signals, barriers, automatic barriers on pedestrian paths and / or various combinations of these devices) and are they provided for in the Project?
- Is the recognizability of railroad crossings guaranteed?
- Are visibility conditions of railroad crossings guaranteed?
- Are overtaking bans and speed restrictions planned at railroad crossings?
- Are public transport stops outside of critical areas? Are the concerns of public transport taken into account?

Additional RSA checklist focusing on Urban Roads

- Are the characteristics of the traffic composition taken into account?
- Are the property entrances designed safely?
- Are speed restrictions necessary and accordingly arranged?
- Has the construction standard and, if applicable, the transition area been adapted to the adjacent routes?
- Are lane constrictions required or are they designed safely?
- Are the lane widths and curve width extensions sufficient?

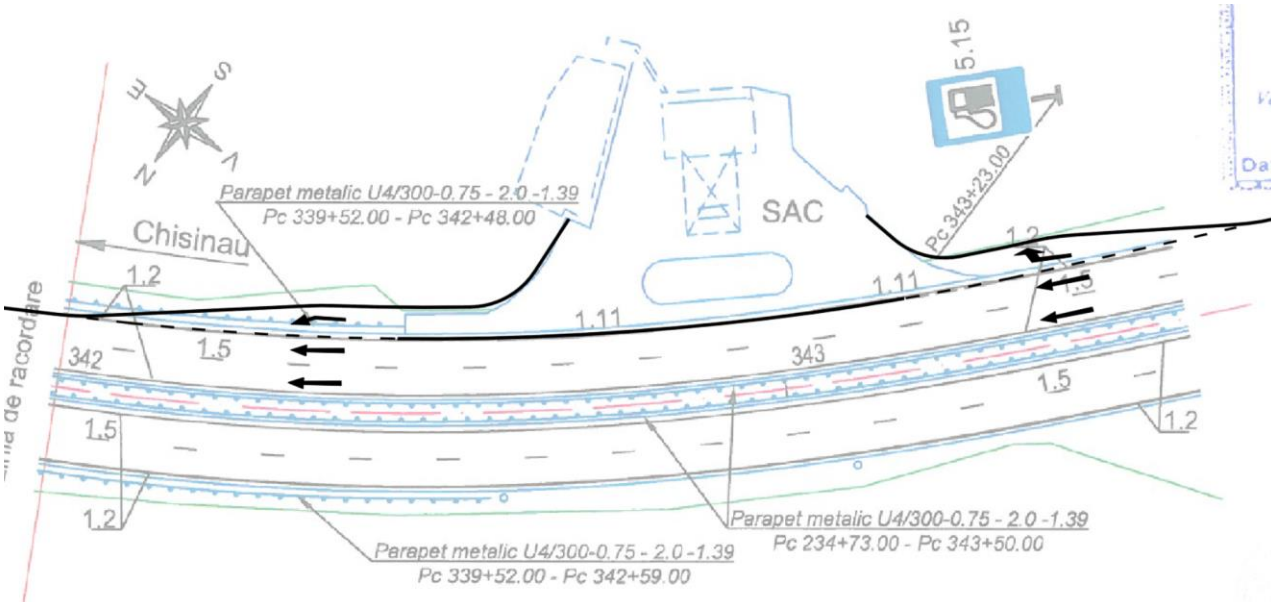
- Have provisions been made for safety?
- Have provisions been made for safe access for rescue service vehicles / operations services / fire brigade?
- Have suitable measures been taken to ensure that the maximum permissible speeds are observed?
- Have the needs of local public transport and its users been taken into account?
- Have the needs of pedestrians been taken into account?
- Have the interests of the cyclists been taken into account (e.g. separate cycling ways)?
- Are the waiting areas on the pedestrian islands large and wide enough for cyclists crossing or waiting pedestrians to stand there?
- Are the parking spaces arranged in such a way that the parking process is safe?
- Is the road sufficiently drained?
- Are pavements, pedestrian islands or narrow lanes necessary?
- Are the pedestrian islands clearly visible and functional?
- Have the dimensions of the speed-reducing measures been observed?
- Are the cross-falls sufficient?
- Is the line marking clear and recognizable?
- Are there no parking areas required?
- Have the RSA results of the previous RSA phase been taken into account?
- Has the construction standard and, if applicable, the transition area to the adjacent road section been adapted?
- Is the transition from an urban to a rural road or from an illuminated to an unlit road (town entrance) appropriate?
- If the beginning / end of the expansion is outside critical areas, e.g. hill top, downhill gradient, curve, poor visibility or distraction?
- Are the lane widths and curve width extensions sufficient?
- Is the stopping view distance guaranteed on the entire route?
- Is the view obstructed by e.g. protective fences, boundary fences, road equipment, poles, bridge railings, parking facilities, traffic signs, landscaping / planting, bridge abutments, buildings?
- Is the design and equipment of the selected junction appropriate for the function of the road and the intersecting roads (intersection, junction, roundabout, traffic signals, etc.)?
- Is the size of the junction sufficient for all vehicle movements (tow curves)?
- Are the turning lanes / areas in front of traffic signals necessary for vehicle traffic turning off and are they sufficiently dimensioned?
- Are the required viewing area distances at intersections for all road users freely visible?
- Is there coordination with other (exiting) traffic signals in the route or in the network?
- Are the green times sufficient for cyclists and pedestrians?
- Can pedestrians cross the road at once? Is the green time sufficient?
- Are longer and / or additional green phases planned for road users with reduced mobility?
- Have cyclists been signalled separately? Are the signalling devices correctly arranged for the cyclists?
- Is the right of way clearly defined in places where cyclists meet or where cyclists meet motorized traffic?
- Is the signage / road marking coordinated, free of contradictions and legible?
- Is the pedestrian / cyclist guidance at junctions coordinated with the actual traffic relation and clearly signposted?

- Do the signs obstruct the view of driveways or intersecting roads?
- Are special arrangements at traffic signals required for special groups or facilities (including hospitals), e.g. for young, older citizens, the sick, disabled, deaf or blind?
- Are separate green phases required for pedestrians and cyclists? Can pedestrians cross the road at once? Is the green time sufficient?
- Are longer and / or additional green phases planned for road users with reduced mobility?
- Is there a need for high-intensity signals and / or contrast blinds if the signals are likely to be affected by sunrise / sunset sunlight?
- Have the correct locations been chosen for the signals (additional signals, overhead signals, etc.)?
- Is lighting of special situations (crossing points, changes in the cross-section of the road, etc.) necessary and, if necessary, designed appropriately?
- Are the public transport stops designed in such a way that they can be safely reached by passengers?
- Are pedestrian crossings required at public transport stops?
- Is the cycle traffic routing in the bus stop area safe?
- Are pedestrian crossings required at crossings?
- Does the location of the pedestrian crossings correspond to the desired paths of pedestrian traffic?

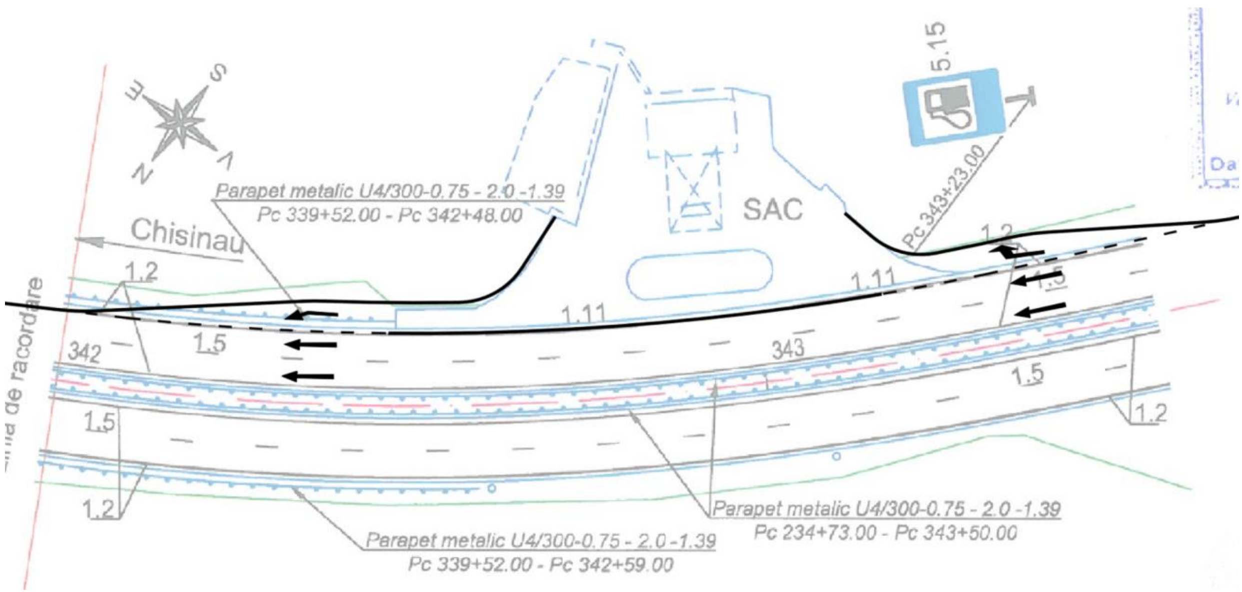
Annex C – Recommended schemes (enlarged)

LOT 1: Airport Interchange - Porumbei

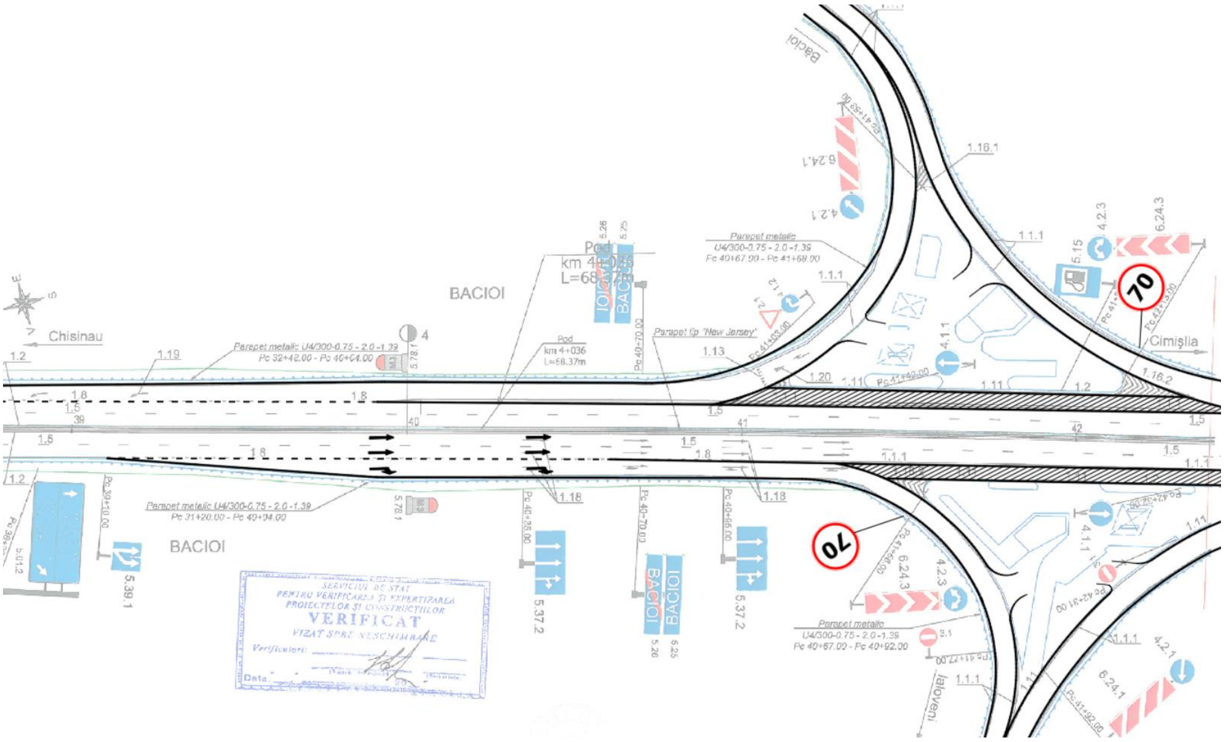
PC 9+60



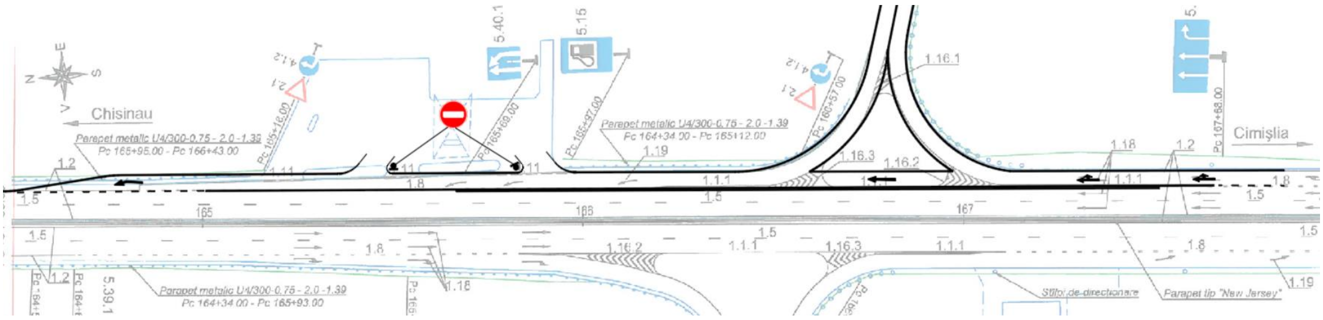
PC 343+00



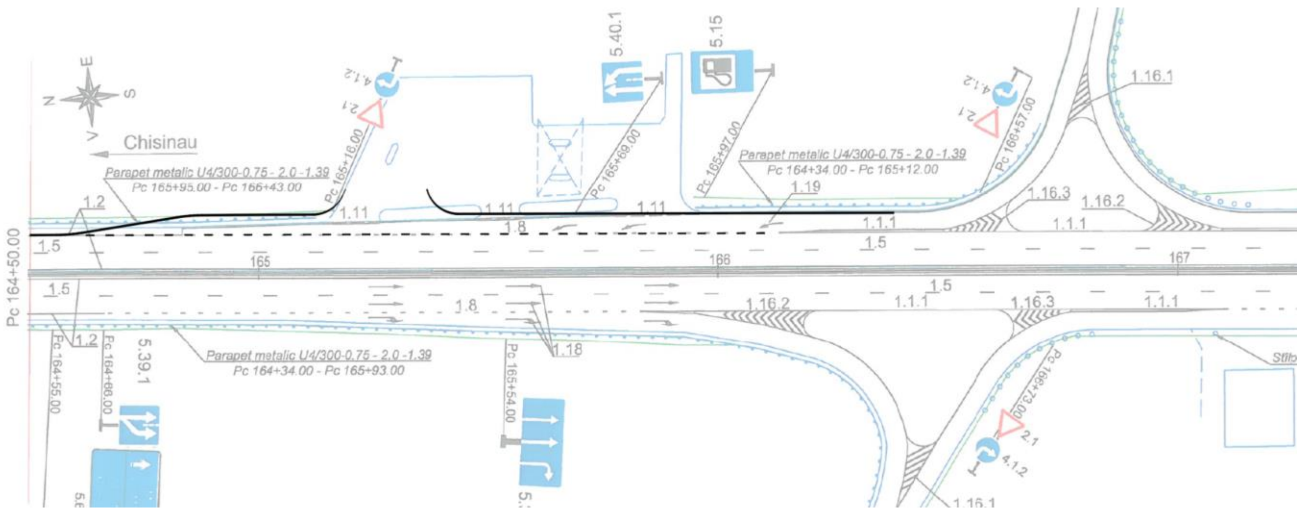
PC 42+00



PC 165+97 Option No. 1



PC 165+97 Option No. 2



PC 215+00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