Scientific Journal of Silesian University of Technology. Series Transport
Zeszyty Naukowe Politechniki Śląskiej. Seria Transport

Volume 130 **2026**

p-ISSN: 0209-3324

e-ISSN: 2450-1549

DOI: https://doi.org/10.20858/sjsutst.2026.130.3

Journal homepage: http://sjsutst.polsl.pl

Article citation information:
Beqaj, B., Gjipalaj, J., Marko, O., Shkurta, E. Environmental considerations of road infrastructure construction in a coastal city. *Scientific Journal of Silesian University of Technology. Series Transport*. 2026, **130**, 53-64. ISSN: 0209-3324.
DOI: https://doi.org/10.20858/sjsutst.2026.130.3

Blerina BEQAJ[1], Joana GJIPALAJ[2], Oltion MARKO[3], Enkeleda SHKURTA[4]

ENVIRONMENTAL CONSIDERATIONS OF ROAD INFRASTRUCTURE CONSTRUCTION IN A COASTAL CITY

Summary. Cities near the coastline are the most important coastal tourism cities in Albania, which are experiencing a fourfold increase in population in the summer season, with an ever-increasing trend. Such a high tourist frequency in the summer season brings an extremely heavy traffic situation, especially at city entrances and exits. Environmental impact assessment represents the importance of implementing infrastructure projects, starting this analysis at the study and design stage of roads. The environmental impact assessment procedure focuses on describing the project, identifying the main negative impacts on the environment, and designing mitigation measures to minimize these negative impacts as much as possible, with the aim of maintaining the balance between them to achieve sustainable development of the area. Studies on environmental issues present the implementation of infrastructure development projects and the economic benefit from their implementation, always

[1]Department of Environmental Engineering, Faculty of Civil Engineering, Polytechnic University of Tirana, Street "Muhamet Gjollesha", Nr: 54, Tirana, Albania. Email: blerina.beqaj@fin.edu.al. ORCID: https://orcid.org/0000-0002-6251-1784
[2]Department of Environmental Engineering, Faculty of Civil Engineering, Polytechnic University of Tirana, Street "Muhamet Gjollesha", Nr: 54, Tirana, Albania. Email: joana.gjipalaj@fin.edu.al. ORCID: https://orcid.org/0000-0002-1553-756X
[3]Department of Environmental Engineering, Faculty of Civil Engineering, Polytechnic University of Tirana, Street "Muhamet Gjollesha", Nr: 54, Tirana, Albania. Email: oltion.marko@fin.edu.al. ORCID: https://orcid.org/0000-0003-2734-8296
[4]National Environmental Agency, Street "Sami Frasheri", Nr: 4, Tirana, Albania Email: enkeleda.shkurta@akm.gov.al. ORCID: https://orcid.org/0009-0000-2142-1486

protecting the environment and taking into account the "Principle of Sustainable Development". This study shows the importance of developing road infrastructure projects well-focused on environmental protection. Road construction projects usually cause environmental pollution, impacts on habitats, changes in water flow patterns, and these projects must be developed taking into account environmental, social and economic impacts.

Keywords: environmental consideration, road infrastructure, road construction, environmental concerns, environmental protection

1. INTRODUCTION

A natural and untouched environment is an essential basis for daily life and, consequently, the health, well-being, and economy of a country. Due to the need to ensure human comfort, it often becomes necessary to protect natural resources with the aim of using them sustainably; to protect viable ecosystems and maintain a high degree of biological diversity; to protect the climate as much as possible, and finally, to adapt to its changes to an acceptable extent. Road construction infrastructure produces significant adverse effects on the environment and human health due to the discharge into the atmosphere of pollutants during the accomplishment of the various construction processes and the operation of diesel-powered equipment [1-4]. Road construction significantly impacts the environment, being one of the most energy-intensive sectors and a major contributor to CO_2 emissions [5].

The process of road construction heavily relies on natural resources, including soil, stone, lime, cement, and asphalt, to meet material requirements. Previous studies have shown that the use of conventional asphalt methods for road construction can result in large carbon emissions and high energy consumption, which is incompatible with the principles of sustainable development and environmental protection at the construction site [6], [7]. Such projects cannot be separated from various environmental and social impacts as they often result in significant changes to ecosystems, including habitat reduction, pollution, and impacts on water flows [8].

The assessment of environmental impact presents the importance of implementing infrastructure projects, starting this analysis at the study and design stage of roads. The environmental impact assessment procedure focuses on describing the project, identifying the main negative impacts on the environment, and designing mitigation measures to minimize these negative impacts as much as possible, with the aim of maintaining the balance between them to achieve sustainable development of the area. Although road construction is an essential aspect in the development of an area, there is limited awareness of the environmental impacts resulting from the implementation of these projects [9].

The impacts of road infrastructure development on ecosystems can be numerous, including habitat destruction, disruption of aquatic ecosystems, and increased pollution. Road construction often has a direct impact on habitat fragmentation and changes in wildlife migration patterns [10]. More importantly, these changes can disrupt the balance of ecosystems that have existed for centuries, affecting not only flora and fauna but also water and soil resources. Road infrastructure development from a social perspective has significant impacts on local communities, as its construction can trigger socio-economic changes, including changes in employment structures and community dynamics. These developments can bring new economic opportunities but often also have negative consequences, such as community displacement and increased cost of living [11].

Environmental sustainability is considered an important issue that should be included in the planning and implementation process of road infrastructure projects [12].

Various studies emphasize the importance of an approach to sustainable development that takes into account environmental and social impacts from the beginning of an infrastructure project; and this step not only protects ecosystems but also ensures the well-being of local communities [13]. Mitigation measures are necessary to reduce the negative impacts of such projects, which include the development of green infrastructure, empowerment of local communities, and environmental sustainability.

Cities near the coastline are the most important coastal tourist cities in Albania, which are experiencing a fourfold increase in population during the summer season. High tourist frequency in the summer season brings an extremely heavy traffic situation, especially at the city entrances and exits [14]. The existing road systems, both within and around the city, are insufficient to accommodate this flow. Heavy traffic, especially at the entrance of the coastal city, has become common during the tourist season.

2. MATERIALS AND METHODS

To predict environmental impacts, the following steps should be taken into consideration:
- analysis of the project implementation, project location, and road length;
- the existing environmental and social conditions of the area expected to be affected by the development project;
- information and consultation with other interested parties.

The methodology for drafting the environmental impact assessment is based on the recognition of:
- full compliance of the project with relevant laws and regulations;
- assessment of the socio-economic impacts on the community and the health of the residents themselves;
- assessment of long-term or permanent impacts on ecological systems, local natural resources, as well as those representing national or regional interest;
- assessment regarding the negative social impacts on a part of the local community directly affected by the development of the road infrastructure construction project.

The impact assessment methodology also takes into account the analysis of the implementation of the proposed project in relation to: equipment, machinery, auxiliary materials, the method of project implementation, time, deadlines, and the team necessary for its implementation.

The purpose of the study is to draft a conceptual and implementation project for the construction of a new road segment connecting Qafe-Gjashta with the national road, leaving open the possibility of further development towards the connection with the Kardhiq-Delvine-Saranda road and the Coastal road (Figure 1). Study aims:
- designing a traffic flow scheme that would enable easy vehicle circulation in the area;
- designing the road axis to enable the most suitable traffic scheme for users;
- designing connections with the capillary infrastructure of other city roads to guarantee traffic flow towards the city;
- creating a comfortable infrastructure for the movement of vehicles in this tourist area;
- creating a modern infrastructure for the movement and safety of pedestrians.

From repeated observations of the main entrances to the city, especially in the summer season, it has been found that almost all the main entrances have significant difficulties in traffic.

In order to eliminate this congestion, the solution is to create a new entry point towards the coastal city. The new entrance is proposed to be located in the northern part of the city and directly connected to the road axis [8].

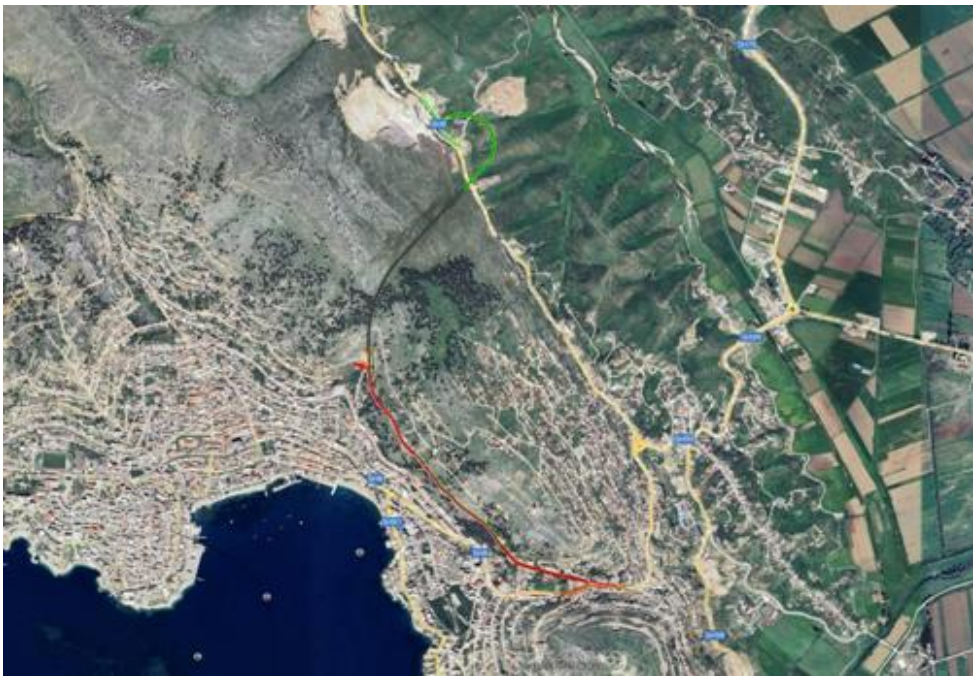

Fig. 1. Proposed road route of the project

3. RESULTS AND DISCUSSIONS

The road axis to be built is approximately 3.0 km long, and 750 m is represented by a tunnel. The road will pass through difficult terrain, with steep slopes, and with geometric limitations due to the presence of buildings on both sides of the road. During field inspections, sporadic underground and aboveground infrastructure elements have been identified, which will be treated with care in later phases. The cross-section will consist of two 3.5 m wide roadways, 2 m of parking pathway and 2 m wide ditch, as well as sidewalks on both sides of the road, each 2 m wide. Project environmental impacts have been assessed in relation to the state of the environment in the project implementation site, with reference to the technical road construction project. Technological processes are those of the construction phase, carried out by construction firms, and generally consist of the following:

- demolition of concrete structures;
- cleaning the site and removing all inert waste;
- selecting the area where the machinery will be located;
- elevation of the construction site;
- excavating and filling the caisson;
- construction of the road layers (body);
- construction of asphalt layers;

- construction of sidewalks;
- hydro technical works (hydrants, sewage, etc.);
- works for the electrical network;
- application of paint;
- road signs and protection.

The raw materials used are mainly concrete mortar, monolithic concrete structures, stabilizers for the road body, sand, gravel, bitumen for asphalt layers, and two-component paint. The following potential negative impacts on the environment will be highlighted:

- social impact,
- impact on waste generation,
- impact on road traffic,
- impact on air quality,
- impact on noise,
- impact on biodiversity,
- impact on water resources,
- impact on working environments and human health,
- visual impact,
- impact on land,
- impact on cultural and archaeological heritage.

Each impact has been assessed using the criteria in the table below. To provide a relative illustration of the magnitude of the impact, it is useful to assign numerical or relative descriptors of the intensity of the impact and the sensitivity of the receptor for each potential impact. Each criterion has been assessed according to a numerical scale (Table 1).

Tab. 1

Environmental impact assessment criteria

	Classification	**Description**
1	The extension	Assessment of the area of occurrence/influence of the impact on the environment. If the impact occurs locally, in a limited area (within a radius of 2 km from the project area); at the local level (within a radius of 5 km); regional (at the district, national or international level).
2	Continuity/duration	Assessment of the duration of the impact on the environment, if the impact will be temporary (<1 year); short-term (1-5 years); medium-term (5-10 years); long-term (>10 years); or permanent.
3	Social context/sensitivity or potential for conflict between actors	Assessment of impacts for sensitive receptors in terms of ecological, social sensitivity and aspects such as rare and endangered species, sensitive ecological and endangered environments, architecture, social or cultural environment, high potential for conflicts of interest and different stakeholders. The sensitivity classification is presented as follows: *High sensitivity:* Displacement of entire communities, destruction of world heritage or important cultural sites, large-scale conflict of interest groups, etc.

		Average sensitivity: Displacement of several families, moderate level of concern to stakeholders. *Low sensitivity:* No relocations are necessary; there is no potential for stakeholder conflict.
4	Compliance with legal requirements and regulatory framework	Impact assessment on national and international legal requirements. *High:* Major violations of regulatory requirements that could result in criminal prosecution or significant delays in project approval. *Medium:* Potential violations of specific regulatory framework boundaries that could result in non-compliance. *Low*: No violations of specific regulatory framework boundaries are anticipated.
5	Overall impact assessment (Significance)	Using a combination of the above criteria, the overall significance of the impact is categorized as: very large, substantial, moderate, small and negligible.

3.1. Environmental impacts

Social impacts

Positive social impacts:

- Improvement of existing roads and infrastructure for residential areas and residents;
- Traffic relief due to the improvement of existing roads and infrastructure;
- Noise reduction and stress reduction as a result of traffic improvement.

Negative social impacts: During the construction phase:

- Temporary blockage of various road segments;
- Increased traffic during works in various segments;

Waste generation

The construction phase is accompanied by excavation processes. This project will generate around 70150 m^3 of soil, part of which will be reused for filling, while the rest will be removed. Inert waste from excavation processes will be removed to their disposal areas, previously approved by the Municipality of Saranda. Meanwhile, during the construction phase, inert waste as well as urban waste will be generated from the human activity of workers working on the road construction. Contractors must separate, at source, inert waste from other waste generated from the construction phase (excavations, soil). Determining the route and timing of heavy trucks transporting waste is important, with the aim of avoiding residential areas or other sensitive human receptors as much as possible. All waste must be disposed of in approved landfills under agreements with the waste disposal site manager, approved by the municipality. Hazardous waste, such as paints, adhesives, and various chemicals, should be managed by a contractor certified by the National Environmental Agency. Supervising engineers should ensure that contractors do not illegally dump waste in areas other than those approved for waste disposal.

Impact on road traffic

During the construction phase, due to the narrowing of roads during the works, there is expected to be an impact on road traffic. During the operational phase, no impacts on road

traffic are expected as the works are carried out precisely with the aim of improving infrastructure and easing traffic.

Impact on air quality

Air pollution resulting from construction works, such as dust emissions, will increase especially when working with equipment in processes with "dry" materials. This impact will be local and only during the construction phase. There will potentially be a moderate increase in the level of PM_{10} and $PM_{2.5}$ in the air. This amount of dust will mainly affect the air quality in the vicinity of the construction site. There may be emissions of gases from fuel combustion by machinery and equipment operating on the construction site (CO_2, SO_2, NO_x, VOC gases emitted from the combustion of fuels).

Noise impact

The noise impact during the construction phase is temporary and local. Noise sources can be numerous and can be caused by construction works from equipment, such as generators, and machinery, such as excavators, transport trucks, etc. The noise impact will be felt in the area where the works are carried out and in the vicinity of the nearby facilities, especially on roads that may be located near various institutions or near citizens' homes.

Impact on biodiversity

Vegetation cover near the project area consists mainly of ornamental trees and shrubs, typical of urban areas. These species are planted by the local administration for ornamental purposes. During the implementation of the project, vegetation cover will not be affected by the works. The impact may come through the rise of dust in various possible cases during the work.

Impact on water resources

During the construction phase, there will be no direct pollution of water sources. There may be a potential increase in solids in areas where rainwater is discharged and consequently in surface waters, as a result of the leaching of excavated soil surfaces (during periods of rainfall). There is no negative impact during the operational phase of the roads.

Impact on working environments and human health

In order to prevent the negative impacts of construction activities on health and the environment, from the failure to implement occupational safety regulations, and from the failure to take safety precautions, the construction company must implement an occupational health and safety management system. This system is defined for construction activities according to the relevant legislation. No negative impact is expected after the completion of the construction processes.

Visual impact and landscape

During the construction phase of this project, there are expected to be both temporary and permanent changes to the landscape. Some general negative impacts are:

- visual changes to the location where the works will be carried out;
- visual changes from the installation of construction equipment and machinery, which will be used and installed temporarily during the construction phase.

During the construction phase, temporary damage will negatively affect the landscape (e.g., the presence of piles of soil, aggregates or construction materials).

The visual impact will be temporary, and after the completion of each segment, the area will be rehabilitated immediately. At the end of the road construction activity, the impact on the landscape will be positive and permanent.

Impact on the soil surface

There may be contamination of the soil surface due to leaks, accidental spills of hydrocarbons, lubricants from equipment, and machinery operating on site during the construction phase. No impact on soil quality is expected after completion of construction processes.

Impact on cultural and archaeological heritage

The areas through which the project passes and where the works will be carried out are close to two archaeological sites. Construction works will be carried out with the utmost care to ensure that these areas of known archaeological value are not affected.

3.2. Discharges of wastewater, gases, dust, noise, vibrations and waste generated

During the 3-year construction period, emissions to the environment are of a temporary and relatively short-term nature. Expected emissions to the environment are estimated as follows:

- soil from the excavation process;
- generation of polluted water from the employee's activity operating on the site;
- gas emissions from the combustion of fuel from vehicles operating on the site;
- inert waste from the road construction process;
- urban waste from the human activity of the company operating on the site;
- PM10, PM2.5, TS PM emissions;
- noise emissions.

3.2.1. Soil and inert materials generated from excavations

Inert waste from excavation processes / soils will be deposited in the landfill and then reused for various fillings. It has been estimated that insignificant amounts of inert will be generated, as well as soil will be generated from excavation processes.

3.3. Discharges of urban wastewater and urban waste from employees' activity involved in the project

Many workers will be hired to build the road. Under these conditions, there will be discharges into the environment from the human activity of the employees involved in the project. Urban waste generated by the employees will be collected and managed by the company that manages the collection and transport of urban waste in the Municipality of Saranda, according to the relevant contractual agreements. Wastes will be removed within the day, so as not to hinder further work and not pollute the environment. Urban wastewater will be managed through licensed subcontractors for the collection and treatment of urban wastewater (mini portable toilets). The amount of waste generated by human activity is considered insignificant in reference to the urban waste generated by the residents of Saranda. Since the employees involved in the project will be mainly residents of the area, urban waste is part of the same matrix, location, waste dump and disposal site as if they were carrying out another activity within the Saranda area.

3.4. Assessment of the significance of negative environmental impacts

The nature of impacts can be categorized in terms of:
Direction - Positive or negative
Duration - Long-term or short-term
Location - Direct or indirect
Magnitude - Large or small
Extent - Widespread or local
Significance - Large or small

Tab. 2
Methodology for assessing the significance of potential negative impacts on the environment

Category	Description
Low	The impact is temporary, slightly damaging natural values, both in quality and quantity (volume). Once the action that causes it is completed, it no longer has any effects on the environment.
Medium	The impact is temporary, but in the absence of control and management measures, it may cause long-term impacts on natural values. The alienated area is not restored to its original state, but occupies an acceptable ratio with the total area of the project, and only the construction area of the facility is alienated. The impact does not represent discharges of pollutants into the environment.
Considerable	The impact is permanent and extends beyond the affected area (displacement, pollution, noise, and air emissions). The impact compromises the rates of emissions into the environment and the rates of environmental use.
Reversible	The effect ends when the cause is stopped and the affected environment regains its natural state.
Partially Reversible	The effect continues partially even after the cessation of the cause that causes it. (Continues the negative effect on the environment partially)
Irreversible	The consequences of the impact are irreversible (continue to have a negative effect on the environment) even after the action causing the impact ends.

To identify the impacts associated with the construction of the proposed road infrastructure, an impact matrix has been raised, which presents the main project activities against relevant environmental factors. This matrix is presented in Table 3.

4. CONCLUSIONS AND RECOMMENDATIONS

From the review of all environmental impacts for the road infrastructure construction project, the following was concluded.

The identified potential environmental impacts have been assessed and addressed according to the required legal standards, methodology and recommendations.

Project implementation with the foreseen mitigation measures guarantees not only the achievement of the objectives but also environmental performance in full compliance with the laws in force, regarding the level of emissions into the environment and its protection.

Tab. 3

Environmental impact matrix in the construction phase

	Activity/ Impact	Direction		Duration			Magnitude			Extension		Importance		
		Positive	Negative	Long term	Medium term	Short term	High	Medium	Small	Wide	Local	High	Medium	Small
A	**Transport of materials to the facility**													
	Dust emissions during loading, transportation of materials		x			x		x			x	x		
	Emissions from material transport vehicles		x			x		x			x	x		
	Traffic congestion from vehicle traffic		x			x		x			x	x		
B	**Road construction works**													
	Noise, vibrations		x			x		x			x	x		
	Dust		x			x		x			x	x		
	Gas emissions from machinery operating in the facility		x			x			x		x		x	
	Visual appearance		x			x			x		x		x	
	Soil generation from excavations		x			x			x		x			x
	Urban waste generation from the company's human activity		x			x			x		x			x
	Generation of inert waste from construction (construction waste)		x			x			x		x			x
	Generation of urban wastewater from the company's human activity		x			x			x		x			x

Soil contamination due to mechanical failures in the project area		x		x		x		x		x
Impact on existing vegetation during the construction phase		x		x		x		x		x
Job creation	x			x		x		x		x
Urban area development	x		x		x		x		x	
Visual appearance of the area after improvement and/or construction	x		x		x		x		x	

No significant impacts are identified that would affect the quality of the environment from the implementation of the project.

From the analysis of the content of this study, the implementation of this project will not have significant negative impacts on the environment surrounding the project areas during its construction phase, while after the construction phase, there will be an improvement in road standards, consequently reducing traffic.

During the construction phase, it is recommended to fence off temporary areas where work is being carried out and to place warning signs regarding the risks to passersby and workers; to carry out occasional wetting of surfaces where there is the presence of materials that cause dust on the city streets.

As a result of the implementation of the project, no significant environmental, social and human health impacts will be incurred.

It is recommended to maintain green areas and to plant native decorative plants in artificial conditions, to increase in every case that is possible the green coefficient.

The use of generators must be avoided as much as possible, and noise must be reduced in the late hours.

The impact on archaeological areas near the project should be avoided as much as possible during construction works.

Awareness-raising advertisements should be placed for employees and citizens for a clean environment.

The construction company must take into account the legal framework for the environment and its changes.

By placing special containers for the collection of urban waste and including them in the existing scheme for the collection and disposal of urban waste, the problem of evacuating waste to the location settled by the municipality, as well as to other areas of the municipality's territory, is solved.

The cleanliness of the area's environment will be constantly maintained to guarantee a cultured environment within the project area.

It is recommended to build green areas where necessary, with decorative trees and shrubs, and to landscape the spaces around roads.

References

1. Faber P., F. Drewnick, S. Borrmann. 2015. "Aerosol particle and trace gas emissions from earthworks, road construction, and asphalt paving in Germany: Emission factors and influence on local air quality". *Atmospheric Environment* 122: 662-671. ISSN: 1352-2310. DOI: 10.1016/j.atmosenv.2015.10.036.
2. Font A., et al. 2014. "Degradation in urban air quality from construction activity and increased traffic arising from a road widening scheme". *Science of the Total Environment* 497-498: 123-132. ISSN: 0048-9697. DOI: 10.1016/j.scitotenv.2014.07.060.
3. Fu M., et al. 2012. "Characteristics of typical non-road machinery emissions in China by using portable emission measurement system". *Science of The Total Environment* 437: 255-261. ISSN: 0048-9697. DOI: 10.1016/j.scitotenv.2012.07.095.
4. Torén K., B. Järvholm. 2014. "Effect of occupational exposure to vapors, gases, dusts, and fumes on COPD mortality risk among Swedish construction workers: a longitudinal cohort study". *Chest* 145(5): 992-997. DOI: 10.1378/chest.13-1429. PMID: 24264472.
5. Giunta M. 2020. "Assessment of the environmental impact of road construction: Modelling and prediction of fine particulate matter emissions". *Build. Environ* 176: 106865.
6. Zheng Z., X. Gao, J. Wang, X. Ji. 2019. "Prediction Model for Energy Consumption and Carbon Emission of Asphalt Surface Construction". *International Conference on Advances in Civil Engineering, Energy Resources and Environment Engineering* 330: 1-9.
7. Plati C. 2019. "Sustainability factors in pavement materials, design, and preservation strategies: A literature review". *Construction and Building Materials* 211: 539-55.
8. Jones R., J. Llewellyn. 2019. "Improving infrastructure". *National Institute Economic Review* 250(1): R61-R68. DOI: 10.1177/002795011925000119.
9. Aryan Y., D.A. Kumar, Sh.A. Mohan. 2024. "Assessment of environmental impacts and reduction opportunities for road infrastructures in India". *Transportation Research Part D: Transport and Environment* 128: 104106.
10. Chen Z., Y. Li, Y. Liu, X. Liu. 2021. "Does rural residential land expansion pattern lead to different impacts on the eco-environment? A case study of loess hilly and gully region, China". *Habitat International* 117: 102436. DOI: 10.1016/j.habitatint.2021.102436.
11. Fernandez L., R. Acheampong. 2019. "Social impacts of road infrastructure development". *Journal of Social Change* 31(4): 210-229.
12. Kuncoro E., R.N. Wurarah, I.E. Erari. 2024. "The impact of road infrastructure development on ecosystems and communities". *Social, Ecology, Economy for Sustainable Development Goals Journal* 1(2): 78-90. DOI: 10.61511/seesdgj.v1i2.2024.336.
13. Ruggerio C.A. 2021. "Sustainability and sustainable development: A review of principles and definitions". *Science of the Total Environment* 786: 147481. DOI: 10.1016/j.scitotenv.2021.147481.
14. *Report on Strategic Environmental Assessment for the Local General Plan of Saranda Municipality*. 2017.

Received 07.10.2025; accepted in revised form 14.02.2026

Scientific Journal of Silesian University of Technology. Series Transport is licensed under a Creative Commons Attribution 4.0 International License