Green and resilient transport: Azerbaijan
1. Introduction

1.1. Background and context of the project

Enhancing the quality of the infrastructure along the Asian Highway network is a significant opportunity to raise the overall sustainability of the road transport sector. Improving substandard roads enhances the seamlessness of national and international road transport, which can lead to more optimal use of road freight vehicles, and reduce greenhouse gas emissions and the environmental impact. Similarly, as the technology advances, including new designs and construction methods, the construction, maintenance and upgrading of Asian highways creates an opportunity to transition to low-carbon road design, thereby reducing the road infrastructure’s negative footprint on the environment. Furthermore, better quality roads help build higher resilience to extreme weather disruptions caused by climate change.

In this context, the Transport Division of the Economic and Social Commission for Asia and the Pacific (ESCAP) is undertaking a study project on supporting the polices on green and resilient transport infrastructure along the Asian Highway network. The objective of the project is to strengthen sustainable regional transport connectivity by collecting and disseminating best practices pertaining to the development of low-carbon and resilient road infrastructure along the Asian Highway network.

Within the scope of the project’s activities, a series of subregional and national capacity-building workshops is being organized to disseminate the study findings and best practices. These workshops will contribute towards human resource development and the transfer of technical knowledge to the focal countries.

One of the workshops will focus on Azerbaijan and is being co-hosted by the Ministry of Digital Development and Transport of Azerbaijan.

1.2. Objective and scope of the desktop review

The objective of this desktop review is to analyse the transport sector and road infrastructure, its resiliency and sustainability in Azerbaijan, identify the gaps and challenges in the existing transportation and road infrastructure sections, and provide recommendations to address these issues.

The scope of the desktop review includes a thorough analysis of the transport system and road infrastructure, and policies, plans and regulations to identify the relevant laws, regulation and policies.
related to it. The review covers a wide range of areas, including, but not limited to, passenger and freight transportation, road infrastructure and resilient infrastructure projects.

For the review, the socioeconomic and environmental factors that may affect the transportation and connectivity sector, such as population growth, urbanization and climate change, is also being considered.

Overall, the desktop review will provide a comprehensive assessment of the current state of transportation and road infrastructure in Azerbaijan, and identify the areas that require targeted actions to achieve sustainable mobility and resilient road infrastructure.

1.3. Methodology

For this desktop review, a systematic approach is taken to gather and analyze data from various sources in order to offer thorough insight into the current state of transportation and road infrastructure in Azerbaijan. The goal of this is to pinpoint areas needing specific attention and provide recommendations for enhancing existing policies and strategies.

The initial step in the methodology involves collecting relevant data in the sustainable transport and road infrastructure sectors from national strategy documents, regulations, policies and plans related to passenger and freight transportation, and road infrastructure. The data are sourced from secondary sources and relevant national institutions, organizations and stakeholders that have a close partnership with the Ministry of Digital Development and Transport of Azerbaijan. Official government publications, academic research, news articles and reports from international organizations, such as the Asian Development Bank (ADB), the United Nations and the World Bank, are used as data sources.

After data collection, the subsequent step is data analysis. This involves applying qualitative data analysis techniques to identify the strengths and weaknesses of the transportation and road infrastructure system in Azerbaijan. The effectiveness of the system is assessed, and the analysis aims to identify gaps, challenges and opportunities for improvement in the transportation system.

Qualitative data analysis techniques are applied to gain a deeper understanding of transportation and connectivity policies and strategies in Azerbaijan. This includes coding and categorizing data, identifying themes and interpreting findings. As part of the analysis, a comparative analysis of policies and strategies of Azerbaijan with those of other countries and regions that have successfully implemented sustainable mobility and smart connectivity policies is conducted.

The methodology takes a rigorous and systematic approach and considers the perspectives of relevant stakeholders. The review provides a comprehensive understanding of the current state of
transportation and road infrastructure in Azerbaijan, identifies areas requiring targeted actions and offers recommendations for improving existing policies and strategies. This approach aims to facilitate the country’s transition towards sustainable mobility and smart connectivity.

2. Country context

2.1. Country profile

Azerbaijan, positioned in the South Caucasus region of Eurasia, spans an area of 86,600 square kilometres. Its geographical location at the convergence of Europe and Asia renders it a distinctive crossroads of significant civilizations, fostering a rich blend of cultures, languages and religions. The country’s landscape varies from level lowlands along the Caspian Sea to elevated mountain ranges, such as the Greater Caucasus, where some of the region’s highest peaks are located.

Azerbaijan has gained renown for its substantial natural wealth, notably its extensive reservoirs of oil and natural gas, which have been significant contributors to country’s economy over an extended period. In addition to being a leading global producer of oil, Azerbaijan also boasts significant reserves of metals and minerals and a flourishing agricultural industry. Despite the economic benefits, the pursuit and extraction of these resources have presented environmental issues. To tackle these challenges, the Government has initiated a number of measures, including the implementation of environmental regulations and investments in renewable energy alternatives.

The population of Azerbaijan is approximately 10 million. As of 2020, approximately 57 per cent of the total population, according to the World Bank, resides in urban areas (World Bank, 2018b). This points to a notable degree of urbanization in the country, reflecting an increasing trend of people migrating to urban centres in pursuit of improved economic prospects and enhanced access to essential services, such as health care and education.

Baku, the capital of and largest city in Azerbaijan functions as the country’s political, economic and cultural hubs. In 2021, the population of Baku was approximately 2.3 million, comprising nearly 25 per cent of the total population of Azerbaijan. Other significant cities in the country are Ganja, Sumgayit and Lankaran.

The swift urbanization in Azerbaijan is posing several challenges, necessitating improvements in infrastructure and services, such as housing, transportation and health care. Over the past few years, the Government of Azerbaijan has invested substantially in urban development and infrastructure, including in such activities as the construction of new roads, public transportation systems and affordable housing projects.
Azerbaijan recorded an average annual growth rate of 3.7 per cent between 2011 and 2020. In 2020, the country's gross domestic product (GDP) was $44.9 billion and capita GDP was $4,485. The economy heavily relies on the oil and gas sector, which accounts for approximately 70 per cent of exports and more than 40 per cent of GDP. Accordingly, the Government is actively pursuing economic diversification to decrease the country’s reliance on oil and gas. Recent endeavours have focused on cultivating non-oil sectors, such as agriculture, tourism and technology.

The primary source of greenhouse gas emissions in Azerbaijan stems from the energy sector, primarily sourced from the burning of fossil fuels to generate electricity and for transportation. The International Energy Agency (IEA) reported that in 2019, the country's total carbon dioxide (CO₂) emissions related to energy reached 35.9 million tons, with the energy sector contributing 85 per cent of the overall emissions (IEA, 2021).

Regarding per capita emissions, the individual carbon footprint of Azerbaijan was calculated at 3.4 metric tons per person in 2020, which falls below the global average of 4.8 metric tons per person (World Bank, 2023). Nevertheless, it's important to highlight that the country's emissions have been on the rise in recent years, driven primarily by the expansion of the oil and gas sector and the consequent surge in energy consumption.

To tackle this concern, Azerbaijan has initiated measures to mitigate greenhouse gas emissions and enhance energy efficiency. The Government has introduced various policies and initiatives that focus on advancing renewable energy, promoting energy efficiency and decreasing emissions. In 2019, Azerbaijan formally endorsed the Paris Agreement, pledging to decrease its greenhouse emissions by 35 per cent, measured against 1990 levels, by 2030.

Furthermore, Azerbaijan has set a goal to raise the proportion of renewable energy in its overall energy mix to 30 per cent by 2030, a significant increase from the current level of 17 per cent. Progress has already been achieved in this regard, marked by the establishment of numerous wind and solar power facilities, along with the adoption of energy-efficient practices in buildings and in industrial settings.

Apart from its abundant natural resources, Azerbaijan has emerged as a frontrunner in technology and innovation within the region, focusing heavily on nurturing human talent and updating infrastructure. The technological domain in the country has expanded appreciably recently, marked by the emergence of numerous start-ups and technology firms specializing in areas, such as fintech, e-commerce and artificial intelligence.

As per the United Nations Development Programme (UNDP), Azerbaijan has achieved noteworthy advancements in human development in recent decades. In the most recent Human Development Index
report, Azerbaijan secured the ninety-first position out of 189 countries, boasting an Index value of 0.745, which placed it within the high human development category (UNDP, 2023). The results highlight substantial strides made in enhancing life expectancy, expanding educational access and alleviating poverty. Nevertheless, considerable disparities persist between the urban and rural areas of the country and persistent challenges remain in terms of gender equality and income disparity.

Azerbaijan has a well-established transportation system, encompassing roads, railways, air travel, and maritime routes, all of which play pivotal roles in the country’s economy and societal functions. As of 2018, Azerbaijan has a comprehensive road network that spans 40,568 km, of which approximately 55 per cent of it are paved roads (State Statistical Committee of the Republic of Azerbaijan, 2023). The railway infrastructure extends more than 2,918 km, and key ports are in Baku and Sumgait. Serving as the primary airport, Heydar Aliyev International Airport in Baku facilitates direct flights to numerous international destinations.

The subsequent section provides a more in-depth review of the transportation landscape of Azerbaijan, covering its evolution and the Government’s endeavours to enhance the country’s transport infrastructure and services.

2.2. Transport sector profile

Azerbaijan boasts a robust transportation system, which is critical to its economic and societal functions. Over time, substantial initiatives have been made to enhance the country’s transport infrastructure and services. These endeavours involved the construction of new roads, railways, airports and seaports, with a focus on bolstering connectivity within the country and with neighbouring countries. The overarching goal of these initiatives is to enhance the efficiency of the transportation sector.

Drawing inspiration from successful international models in developing a sustainable transportation network, the Government of Azerbaijan has integrated the enhancement of transport infrastructure into it State programmes. The initial State Program on Poverty Reduction and Economic Development in the Republic of Azerbaijan for 2003–2005, which was intended to address socioeconomic issues, prominently featured initiatives aimed at improving of highway infrastructure. It also addressed concerns, such as air-quality monitoring, insufficient infrastructure in rural areas, financial challenges and regulatory framework issues within the transportation sector.

To comprehensively grasp the consequences of enlarging transportation infrastructure, it is crucial to consider the changes in volumes of CO₂ emissions originating from the sector, as depicted in figure 1.
The expansion of the country’s transportation sector has led to a notable surge in oil consumption by the sector, with the volume of it tripling over the past two decades, as illustrated in figure 2.
The second State Program for Poverty Reduction and Sustainable Development in Azerbaijan, spanning from 2008 to 2015, strictly focused on the transportation sector. Concerning transportation, the programme predominantly targeted issues associated with carbon emissions from motorized vehicles, which represent 61 per cent of total emissions. It also addressed the substantial rise in the number of registered cars between 1995 and 2007, the ageing vehicle fleet, deficient maintenance practices and suboptimal fuel efficiency.

Beyond domestic initiatives aimed at advancing the transportation sector, the Government of Azerbaijan has received support from ADB to formulate a strategy to enhance regulations and investments in the industry. An ADB assessment of its country strategy and programme for Azerbaijan recognized transportation as being a strategically significant domain, which made the Government's appeal for assistance a legitimate rationale for ADB funding.

The Government of Azerbaijan has introduced five-year State programmes, commencing in 2019, with the objective of enhancing the transportation sector. Among these initiatives is the State Program on Road Safety for 2019–2023, which delineates goals and priorities for enhancing mobility safety in the country. This involves the establishment of a smart transportation management system grounded in global practices, the introduction of environmentally friendly vehicles, the development of infrastructure for electric mobility and the establishment of dedicated cycling and rapid bus lanes.

Under the State Program for Socio-Economic Development for 2019—2023, the transportation sector is considered as one of the rapidly expanding industries in the country and emphasis is placed on the construction of new highways connecting Baku with its surrounding areas. Notably, however, this programme has not focused very much on the needs and demands of the transportation sector.

Government entities are in talks with industry representatives from transportation organizations within the country to draft a unified transportation plan. This initiative is intended to enhance coordination and facilitate smooth integration into the national development plan.

In the 2022 Sustainable Development Report, Azerbaijan held the fiftieth position out of 163 countries in terms of progress in realizing the 17 Sustainable Development Goals, as illustrated in figure 3 (Sachs and others, 2022). To date, the Government has yet to formally express its endorsement for the growth of the transportation sector, which could contribute towards establishing a comprehensive mobility system rather than merely enhancing performance in specific domains.
3. Transportation sector in focus/breakdown of transport system in the country

This chapter provides a comprehensive overview of the transport system of Azerbaijan, focusing in particular on passenger and freight transport. It begins with a discussion on the country’s transportation infrastructure, covering essential modes of transport, such as road, rail, air and sea. Subsequently, a thorough analysis is conducted on the passenger transport system, categorizing it into sections that address nationwide transport and urban mobility. Furthermore, a detailed examination of the challenges encountered by the transport system is provided.

Moreover, integrated into the chapter is a summary of the country’s crucial freight transport industry, which plays a pivotal role in the country’s economy. Insights into the principal modes of freight transport, including road, rail and sea transport, is provided and the opportunities and challenges faced by this sector are examined. Ultimately, the chapter concludes with a summary of the critical issues that require attention to achieve sustainable progress of transportation system of Azerbaijan.
3.1. Passenger transport

3.1.1. Country level

Azerbaijan has a thoroughly developed transportation system, encompassing air, rail, road, maritime and pipeline networks. Functioning as a pivotal logistics hub, the country has the most direct route connecting Europe to Central Asia, the Middle East, and the Far East. Notably, Azerbaijan hosts crucial transportation corridors, including the Transport Corridor Europe–Caucasus–Asia (TRACECA), and plays a vital role in the International North–South Transport Corridor and rail routes linking the Black Sea and Caspian Sea.

As reported by the State Statistic Committee of the Republic of Azerbaijan, the annual average passenger conveyance in the transportation sector has consistently exceeded 12 billion since 1990. The annual growth trends in passenger transportation in the country are visualized in figure 4.

Figure 4. Conveyance of passengers in transport sectors in Azerbaijan, 1,000 passengers


Figure 4 shows that road transport is the primary mode of passenger transportation within Azerbaijan. It’s noteworthy that trams and trolleybuses were part of the country’s transportation system during the Soviet Era, but their operations were discontinued. Trams were limited to the capital city, Baku, and were phased out in 2004. Trolleybuses operated in major cities, such as Baku, Ganja, Mingachevir, Nakchivan and Sumgait, but were gradually discontinued between 2004 and
While there have been recent government discussions about reinstating trams in Baku, no concrete plans have been put into action yet.

Moreover, the notable decline in the number of passengers transported in 2020 and 2021 can be attributed to the impact of the COVID-19 pandemic and the quarantine measures enforced in Azerbaijan during that period. Unfortunately, however, the State Statistic Committee of the Republic of Azerbaijan has not provided updated figures for 2022, posing a challenge in analysing the post-pandemic growth trend.

Figure 4 reveals that railway transportation holds a comparatively modest share in passenger conveyance in Azerbaijan. This implies that the country's railway system might not adequately cater to the population's needs. Possible reasons for this discrepancy could be attributed to lack of modernization, infrequent train schedules or limited connectivity to other modes of transportation.

Conversely, road transport commands a substantial share in passenger transportation in Azerbaijan, underscoring the population's heavy dependence on this mode of conveyance. Out of the total 12 billion passengers transported in 2021, a staggering 11 billion were conveyed by road transport. Reliance on road transport can be attributed to such factors as convenience, flexibility in route options and the absence of viable alternative, but the extensive dependence on road transport also comes with drawbacks, including heightened traffic congestion, elevated air pollution and an increased risk of road accidents.

It's important to highlight that the limited share of railway transport has played a role in the excessive dependence on road transport. The lack of diversity in transportation modes could potentially have detrimental effects on the country's transportation infrastructure in the long term, and may also limit the available options for transportation among the population.

In the subsequent analysis, the distribution of capital investment in the country's transport sector across diverse modes of transportation is scrutinized. Examining the allocation of resources and investment priorities among different transportation modes offers valuable insights into the development and maintenance of the country's transportation infrastructure.

Unfortunately, the latest data on capital investment in urban transport in Azerbaijan are not accessible. Such information would enable greater comprehension of the Government's priorities regarding urban transportation across various modes. Based on available data, the distribution of capital investment in the broader transport sector in Azerbaijan, spanning railway, road, air and water transport, is elucidated in figure 5.
Figure 5 clearly shows that the Government of Azerbaijan has made substantial investments in land transportation since 2000. Notably, a considerable portion of capital investment has been allocated to the road sector. In contrast, the railway sector has received the least amount of investment, averaging 6.3 million Azerbaijani manat (AZN) annually between 2000 and 2021. This trend is significant as it can profoundly affect the country's transportation infrastructure and overall economic development. Despite the pivotal role railways can play in connecting remote areas and facilitating trade, insufficient investment in this mode of transport may result in inefficiencies and transportation bottlenecks. It is imperative that the Government of Azerbaijan re-evaluate its investment priorities in the transportation sector to ensure an equitable distribution of resources among different modes of transport. This strategic realignment can enhance the overall efficiency and sustainability of the transportation system, thereby fostering the country's economic growth and development.

The upcoming section contains a concise overview of the primary transportation modes accessible in Azerbaijan, accompanied by a detailed description of the key transportation operators that function within the country's borders.

**Air Transport**

Aviation holds a pivotal role in the country’s passenger and cargo transportation systems, particularly owing to its landlocked geographical position. Its aviation sector is widely regarded as one of the most robust within the Central Asia Regional Economic Cooperation (CAREC) region. Azerbaijan
is equipped with six passenger airports, namely Baku, Nakhchivan, Ganja, Lankaran, Gabal and Zaqatala, all of which hold international status. However, only the Baku, Nakhchivan, and Ganja airports are fully operational and offer scheduled passenger services through commercial airlines. In addition to these international airports, Azerbaijan has two domestic commercial airlines, AZAL and its subsidiary Buta Airways, both of which make substantial contributions to the country’s air transportation industry, as they are the only local providers for air transport.

The Baku International Airport, named after former president Heydar Aliyev, is the busiest airport in the Caucasus region, with a capacity to accommodate up to 1,600 passengers per hour. It is equipped with two asphalt concrete runways, one is a 4,000-metre-long asphalt concrete runway and the other is 3,200-metre-long asphalt concrete runway, enabling it to handle large aircraft. Furthermore, the Ganja International Airport and Nakchivan International Airport were renovated and upgraded in 2004 and 2006, respectively.

Water Transport

Water transportation plays a crucial role in the economic and security dimensions of Azerbaijan, primarily because of its direct maritime links with other countries that have coastlines on the Caspian Sea, namely, the Islamic Republic of Iran, the Russian Federation and Turkmenistan. Moreover, Azerbaijan has connectivity to the Black Sea through the Volga-Don Canal and access to the Baltic Sea via the Baltic-Don Canal. While water transport is integral for cargo transportation, it is not commonly used for passenger transport in the region.

The Baku International Sea Port is the largest port on the Caspian Sea, characterized by limited depth, owing to its proximity to the shore. The size of vessels navigating the Caspian Sea are averaging approximately 6,000 tons. In 2019, the Port of Baku website reported that approximately 45,000 passengers used the port (Port of Baku, 2018).

Rail Transport

The railway network in Azerbaijan has its historical roots in the Transcaucasus Railway, which was established during the era of the Russian Empire and is now referred to as the Caucasus Transit Corridor (CTC). Its primary purpose was to facilitate the transportation of oil from Baku on the Caspian Sea to Poti, Georgia on the Black Sea, enabling further shipment to Novorossik, the Black Sea port of the Russian Federation. The main railway line connecting Baku, Tbilisi and Poti via the Azerbaijani cities of Yevlakh, Ganja and Tovuz was constructed between 1865 and 1883. Azerbaijan features two
other significant railway lines – one extends north from Baku via Yalama, Azerbaijan to the Russian Federation border, and the other extends south from Baku via Osmanli Junction to Astara, situated on the border with the Islamic Republic of Iran.

Following the dissolution of the Soviet Union in 1991, Azerbaijan regained its independence, leading to the establishment of Azerbaijan Railways for the autonomous management and maintenance of the country's railway network. The Azerbaijani railway system is electrified with 3 kV DC and operates on a broad gauge of 1,520 mm. The entire network spans 4,285 km, of which 60 per cent of it is electrified and 38 per cent of it is double-tracked, encompassing the Caucasus Transit Corridor and the northern line to the Russian Federation via Yalama. As of 2019, the network is recording utilization of 6.02 million train-km per year, with freight trains constituting 70 per cent of the usage and passenger trains accounting for the remaining 30 per cent.

Azerbaijan Railways operates as a State-owned joint-stock company responsible for overseeing and maintaining railway infrastructure and managing passenger and freight services. It is answerable to the Cabinet of Ministers and is organized into three primary departments: freight transportation; passenger transportation; and infrastructure. The company has 19,000 employees.

Azerbaijan Railways operates a fleet comprised of 59 electric locomotives, 36 diesel mainline locomotives (including 10 new ones), 80 diesel shunting locomotives and 4,193 freight wagons, of which 3,101 are new, and nine electric multiple units for passenger transport. It has been actively modernizing its rolling stock, in particular to replace outdated equipment inherited from the Soviet Union. In 2014, Azerbaijan Railways engaged Alstom to supply 40 new freight locomotives and 10 new passenger electric locomotives. In addition, it has partnered with Stadler Rail to acquire 20 new passenger coaches with gauge-changing bogeys for international traffic to Georgia. For regional passenger services, Azerbaijan Railways has added nine new double-deck Stadler electric multiple units to its fleet and plans to expand it to 19 units. To build its freight capacity, Azerbaijan Railways entered into a lease agreement for more than 10 GE Type TE33A diesel locomotives in 2015. Between 2015 and 2016, it introduced 3,101 new freight wagons of various types into service (CAREC, 2021).

From 1990 to the present, there has been a significant 83 per cent decrease in the number of passengers using the railways for travel. Moreover, the railway's share of total passenger transport has dwindled from 11.5 per cent in 1990 to a mere 1.4 per cent as of 2018. Additionally, the distance covered by rail travel has contracted to only a quarter of the distance covered in 1990.

The annual freight and passenger turnover of Azerbaijan Railways is relatively modest when compared to most other CAREC member countries. The small modal share of railways within overall
transport market of Azerbaijan contributes to this, and it also reflects limitations in railway’s, commercial practices to optimize revenues.

In comparison to other railways of CAREC members countries, the annual turnover of Azerbaijan Railways for freight and passenger services is relatively modest. This can be attributed to the limited share that railways hold in the country’s transportation market and the constraints in its commercial practices that could otherwise enhance revenue.

**Road Transport**

The Azerbaijan State Agency for Automobile Roads is tasked with the supervision and upkeep of the country’s extensive road network, which covers a total distance of 19,176 kilometres. Among these roads, 4,789 kilometres are classified as national highways and 4,387 kilometers are designated as local roads. In 2019, the road infrastructure facilitated the transportation of 155 million tons of goods and had 1.8 billion passengers. Notably, the Azerbaijan State Agency for Automobile Roads managed the successful completion of 54 projects related to road construction and reconstruction in 2019. This encompassed five projects of national significance, 39 intervillage roads and 10 settlement roads in Baku. Furthermore, for 2020, the Agency outlined plans for the construction and refurbishment of 893.2 kilometers of roads, targeting 29 cities and districts across Azerbaijan. This initiative included addressing road infrastructure in 12 districts within Baku (ITF, 2020).

The Azerbaijan road transport sector operates under full privatization, with corporate entities and private individuals actively participating in the transportation of passengers and goods. Approximately 40 trucking companies from European and Asian countries engage in the international transport of goods through Azerbaijan. Additionally, passenger bus services connect various cities in Georgia, the Islamic Republic of Iran and Türkiye. The Baku International Bus Station Complex, located at the capital’s entrance, oversees international passenger traffic.

The road sector in Azerbaijan is facing numerous challenges that must be dealt with to enhance efficiency and safety. A key concern involves the modernization of road maintenance and asset management, requiring institutional and financial reforms. Additionally, there is a pressing need to enhance road protection measures and enforce effective axle load controls to ensure the durability of roads and enable them to withstand heavy traffic loads. Addressing these issues is crucial for the overall improvement of the road infrastructure in Azerbaijan.

Another crucial area of concern in Azerbaijan is road safety; the country is grappling with a notable surge in road accidents, which causes substantial socioeconomic damage. In response to this
issue, the State Program of Azerbaijan Republic on Road Safety for 2019–2023 was established. This initiative has focused on diminishing the frequency of road accidents and elevating road safety standards. Moreover, it has advocated the adoption of environmentally friendly vehicles, while urging the incorporation of environmental and biodiversity preservation criteria in the planning, construction, repair and reconstruction of motorways. The overarching goal of the programme is to enhance road safety and mitigate the adverse impacts of road accidents in Azerbaijan.

To attain these objectives, the programme has advocate the adoption of fuel quality in line with Euro-4, Euro-5, Euro-6, and other standards, promoting the use of cleaner vehicles. Furthermore, it has incorporated initiatives to develop suitable infrastructure that encourages the adoption of electric vehicles. This dual approach not only is aimed at enhancing air quality, but it also has actively contributed towards the reduction of carbon emissions, aligning with broader environmental sustainability goals.

3.1.2. Urban transport and mobility

Urban transportation plays a pivotal role in the burgeoning economy of Azerbaijan by serving as a catalyst for economic development. It is essential to prioritize the reduction of carbon emissions and ensure that the measures taken are in harmony with the broader objectives of delivering accessible, high-quality, and environmentally sound transportation services to achieve overall sustainability in the country’s transport sector. As of 2019, some 53 per cent the country’s population resides in urban areas – 2.2 million people (23 per cent of the total population) reside in Baku. Apart from Baku, only two other cities, Sumgayit and Ganja, have populations that exceed 300,000.

The urban population has been steadily growing at a rate of 1.6 per cent annually over the past decade. Urban transportation expanded an estimated 5 per cent from 2009 to 2018. In 2018, out of the 2 billion passenger boardings, 77 per cent of them were attributed to urban transport movements, with 20 per cent for suburban and 3 per cent for interurban travel. Within urban transport, 80 per cent of the boardings were on buses, 15 per cent on the metro and 5 per cent in taxis. Notably, bus boardings increased by 5.38 per cent, taxi boardings by 6.88 per cent and metro boardings by 1.27 per cent in 2018.

In terms of vehicles, the country had 1.37 million registered vehicles in 2018; eighty-four per cent of them were classified as cars and 95 per cent as private passenger cars (State Statistic Committee of the Republic of Azerbaijan, 2023).
From 2009 to 2021, the average annual growth in vehicle registrations in Azerbaijan was approximately 4.45 per cent, as reported by the State Statistic Committee of the Republic of Azerbaijan in 2023. The political and economic shifts following the Soviet era have contributed to an increase in car ownership; in 2018, it was estimated that were 119 vehicles per 1,000 people (State Statistic Committee of the Republic of Azerbaijan, 2020). This figure, however, is significantly lower than the car ownership rate observed in the European Union during the same year, which was 610 motor vehicles per 1,000 inhabitants (ACEA 2018).

As already noted, Baku holds a significant position in Azerbaijan, playing a pivotal role in the country economy, culture and politics. A concerted effort is being made to transform Baku into a major tourist destination and economic hub, which has resulted in substantial investment in various facilities and projects (Valiyev, 2013). The city’s importance has grown due to the aspiration for elevated living standards, the necessity to address the needs of internally displaced persons and the trend of rural-to-urban migration, resulting in increased population densities in Baku and its suburbs. Reports indicate that average salaries in Baku are three to five times higher than those in rural areas (State Statistic Committee of the Republic of Azerbaijan, 2017). Projections suggest that the population of Baku will reach 3.8 million by 2030 (ITF, 2020). The city has immense socioeconomic significance for Azerbaijan, contributing to 71 per cent of GDP in 2011 (Valiyev, 2013). Baku and the surrounding Absheron economic region collectively account for 92 per cent of the national industrial output.

Public transport in Baku consists of the metro, buses and taxis. The Baku Metro, inaugurated on 6 November 1967, has undergone extensive development and now comprises 25 stations, one power depot and three lines, totaling 36.6 kilometres, and accommodates approximately 650,000 trips per working day (Baku Metro CJSC, 2022). This rapid transport system has classic Soviet metro characteristics, including exceptionally deep central stations. It operates on a track gauge of 1.52 metres and uses third rail electrification at 825 VDC. With a total of 228 trains, the metro is managed by Baku Metro CJSC, a State-owned entity, which was reformed by a Presidential Decree in 2014.

Baku boasts an extensive and expansive bus network. As of 2022, the Baku metropolitan area is served by a comprehensive bus network featuring 176 bus lines and 27 operators (one of which is State-owned). This network covers a route length of 5,119 kilometres and operates with approximately 2,005 buses (figure 7). On a daily basis, the buses transport 1.624 million passengers. Notably, Bakubus carries 220,000 passengers, while another operator named Khaliq Faiqoglu transports between 120,000 and 150,000 passengers daily. The latter also provides transport services
to an additional 150,000 people in the perimeter; the remaining passengers are handled by various smaller bus operators.

Figure 6. Baku metropolitan Bus Route Network, 2022.

Source: Baku Transport Agency internal report issued in 2022.

The bus fares in Baku are considered unsustainable, as a single ride costs 0.4 manat (approximately $0.23). This amount is insufficient to cover operational expenses and basic maintenance, let alone support funding, fleet renovation and the delivery of high-quality services. Users face limited access to information, as the previously reliable Intelligent Transport Management portal is no longer available. Furthermore, many displays at bus stations, which once provided real-time information to passengers, have fallen into disrepair. This situation brings forward the challenges of affordability and accessibility of public transportation in Baku.

In Baku, there are approximately 8,000 licensed taxis out of a total fleet of 20,000-25,000 taxis. The majority of taxis are privately owned, either by taxi firms that subrent vehicles to individual drivers or by independent owner-operators. Only a few taxi companies have taximeters installed in their vehicles, and these are seldom used. Pricing for rides with individual independent drivers is typically negotiable between the driver and the passenger.

To enhance the quality and safety of taxi services, proper regulation and control are essential. A comprehensive approach is needed encompassing technological and financial aspects to improve
vehicle and driver technical requirements. Additionally, effective oversight is critical to ensure that permits and taxes are properly managed by fiscal services. This regulatory framework is vital for creating a more organized and reliable taxi system in Baku.

As of 2021, efforts have been ongoing to establish suitable infrastructure for the organization of taxi activities in Baku. Specifically, parking lots for 96 taxi spaces were set up at 19 different points. The initiatives have resulted in a notable reduction in the number of roadside taxi ranks and a relative improvement in traffic congestion on these roads. Additionally, 8,577 Badges of Distinction were issued for taxi activities, indicating a regulatory and recognition measure in the taxi sector. These steps contribute towards creating a more organized and efficient environment for taxi services in Baku.

In addition to traditional taxis, the rapid growth of app-based private car services is notable, driven by their convenience, flexibility and comfort. However, this trend has brought about various challenges, including traffic issues, safety concerns and environmental problems. The surge in app-based private car usage has been associated with increased road accidents, congestion, a scarcity of parking spaces, energy inefficiency and air pollution. These challenges underscore the importance of addressing the impact of evolving transportation trends on traffic management, safety regulations and environmental sustainability in urban areas.

In Baku, the introduction of app-based transportation services, such as Uber and Bolt, has provided users with a new and convenient means of transportation by streamlining the reservation process. Despite the convenience, one of the significant challenges associated with these app-based transportation systems is the inefficiency and unreliability concerning the vehicles, drivers and overall safety of passenger transportation. Addressing these concerns is crucial to enhance the overall effectiveness and reliability of app-based transportation services in the city.

3.2. Freight transport

Azerbaijan acknowledges the pivotal role of logistics and trade in job creation, value addition and profitability across diverse industries. The country is strategically aiming to integrate into global and regional value chains by offering value-added services aligned with international best practices. This strategic approach is expected to yield substantial returns from transit trading. Leveraging its advantageous geographical location along the East-West, North-West, and North-South corridors, Azerbaijan is positioning itself to facilitate transit trade and import-export operations. Several infrastructure projects, including new ports and railways, have already been completed to support these goals.
To unlock the full potential of these assets, Azerbaijan envisions the creation of intermodal and multimodal logistics infrastructure. This initiative aims to not only maximize the efficiency of transportation networks, but also to boost private sector involvement in logistics, thereby increasing overall trade volume. The decline in oil prices in 2014 prompted a strategic shift towards developing the non-oil sector, with a particular emphasis on the transportation component. In December 2016, the Strategic Roadmap for Development of Logistics and Trade in the Republic of Azerbaijan was introduced to foster the growth of the non-oil sector, with a specific focus on advancing the transport sector. Azerbaijan remains steadfast in its commitment to diversifying the economy and realizing the full potential of its logistics assets.

The Strategic Roadmap for the Development of Logistics and Trade in the Republic of Azerbaijan was formulated as an integral component of a comprehensive strategy aimed at building an economy that is competitive, diverse, inclusive and sustainable. Covering short, medium, and long-term perspectives, the road map delineates objectives for the development of logistics and trade in Azerbaijan, with a strategic horizon extending to 2020, 2025 and beyond. The priorities identified for this sector have been meticulously selected to guarantee the attainment of the outlined objectives and targets. This strategic road map serves as a guide for the systematic and coordinated advancement of logistics and trade, aligning with broader economic development goals.

Under the road map, ambitious projections have been set, namely a 605 million manat increase in the country’s real GDP and the creation of 18,900 new jobs by 2020 through the implementation of its proposed measures. The estimated cost for these initiatives was 3,160,000,000 manats and the funding of it was expected to come from the Government and the private sector. To date, however, the Government has not provided any reports or updates on progress towards achieving these goals. The absence of such information makes it difficult to assess the effectiveness of the road map and evaluate the extent to which its objectives have been realized. Access to regular updates and reports would provide valuable insights into the impact and success of the initiatives outlined in the road map.

The Strategic Roadmap for the Development of Logistics and Trade in the Republic of Azerbaijan highlights that freight services of Azerbaijan have accounted for approximately 10 per cent of its total service exports in recent years; this can be compared with varying figures reported by other countries of between 8 and 52 per cent for their respective freight services. Rail transport is the

\[1\] For a copy of the road map, see https://monitoring.az/assets/upload/files/4eae769862be45d63dcd5b50b1d31844.pdf
predominant mode of international transportation within Azerbaijan, facilitating substantial volumes of import and export operations. However, the volume of transit cargo passing through Azerbaijan to intermediate destinations before reaching their final destination is comparatively low.

According to Statistic Committee of the Republic of Azerbaijan (2023), railway transportation of goods in Azerbaijan totaled 15 million tons in 2021. Within this figure, 12 million tons were attributed to imports and exports, 3 million tons to domestic cargo and 4.5 million tons to transit cargo. Notably, these numbers reflect a decrease compared to the early 2010s when 22.3 million tons of cargo were transported. This indicates a substantial decline in the volume of goods transported by railway in Azerbaijan over the past decade, as illustrated in figure 7.

![Goods transportation by Railway in Azerbaijan (thousand tons)](chart)

**Figure 7. Goods transportation by Railway in Azerbaijan (thousand tons)**

*Source: Statistic Committee of the Republic of Azerbaijan (2023).*

Even though there has been a decline in the volume of transported cargo, the revenue generated from transportation has increased compared to previous years. In 2010, the revenue was 158.3 million manats, and by 2021, it had surpassed 280 million manats. Notably, it exceeded 200 million manats in 2013 and reached 249 million manats in 2016. In comparison to 2011, the income from railway transportation increased approximately 60 per cent, as illustrated in figure 10.
Simultaneously, transit cargo transportation plays a predominant role in Azerbaijani ports. In 2021, the volume of goods imported and exported by sea amounted to 322,000 tons, while the transit cargo volume reached 4.2 million tons, constituting 77 percent of the total transit cargo. These figures have declined significantly, by 56 per cent, compared to the early 2010s (figure 9).

The bulk of goods transported by sea are coal, refined petroleum products, coke, mineral products, agricultural commodities and crude oils, but the volume of container shipments via railways
and ports has remained relatively low. In contrast to previous years, particularly in the early 2010s, revenue from offshore transportation has increased notably, rising by 66.5 per cent from 105.4 million manats in 2011 to 175.6 million manats in 2021.

As mentioned earlier, road transport is the primary mode for passenger and goods transportation. In 2021, a total of 112 million tons of goods were transported by road. The volume of transported goods between 2010 and 2019 increased significantly, by 55.4 per cent, to 155 million and 99 million tons respectively in passenger and goods transportation. However, as a consequence of the closure of land borders during the COVID-19 pandemic, the quantity of goods transported by road declined to 112 million tons in 2021, a decrease of 27.5 per cent (figure 10).

![Goods transportation by land transport in Azerbaijan, thousand tons](image)

**Figure 10.** Goods transportation by land transport in Azerbaijan (thousand tons)

*Source: Statistic Committee of the Republic of Azerbaijan (2023).*

In 2021, the revenue derived from the transportation of goods via land transport reached 642 million manats. Concurrently, the expenses associated with transporting goods through land transport for the same year amounted to 194 million manats. Consequently, the revenue generated from land transport in 2021 surpassed the corresponding expenses by 448 million manats. This indicates that the transportation of goods via land transport was profitable in 2021.

Air transport has grown substantially in Azerbaijan in recent years, particularly for freight. The volume of cargo transported by air has surged, rising from 40,000 tons in 2010 to 557,000 tons in 2021. The majority of this cargo is transported internationally, namely 99.6 per cent of all shipments. In contrast, only 2,000 tons of goods were domestically transported by air in 2021 (figure 11).
In 2021, the air transport sector generated a profit of 408 million manats, primarily attributed to revenue from international cargo transportation. This international cargo revenue constituted 83.5 per cent of the total revenue from air transport, amounting to 3.2 billion manats (figure 12).

Azerbaijan is leveraging multiple international transport corridors to foster sustainable and diversified economic development, which positions the country as a key regional transit hub. The South-West Transport Corridor is a prominent example, linking India, the Persian Gulf, the Islamic
Republic of Iran, Azerbaijan, Georgia, Ukraine and Europe. This corridor is designed to streamline the transportation of goods between the European Union and India, offering a more efficient route that reduces transit times by avoiding lengthy detours. By using the South-West Transport Corridor, cargo transportation between these regions can be accomplished within seven days, a significant improvement compared to the alternative route, which typically takes around 35-37 days.

The East-West Transportation Corridor establishes a connection between China, Kazakhstan, the Caspian Sea, Azerbaijan, Georgia, Türkiye and Europe. This corridor aims to enhance cargo transportation between China and Türkiye, and with European Union countries in both directions. The management and development of the transport corridor are overseen by a consortium comprising various companies, including China Railways, KTZ Express, the Caspian Sea Shipping Company, Azerbaijan Railways Express and Trans-Caucasus Terminal Companies. An essential feature of this corridor is the Nomad Express trains, which moves cargo from China to Europe in approximately 10-12 days. Cargo can be transported to Europe via two routes: through the Georgian ports of Poti and Batumi, or on the Baku-Tbilisi-Kars railway, operational since 2017. The commissioning of the Baku-Tbilisi-Kars project has significantly reduced transportation costs, making it a more efficient method to increase transit supplies. The Middle Corridor, also known as the Trans-Caspian International Transport Route, is another vital international transport corridor designed to transport cargo between China and Türkiye, and European Union countries in both directions.

The North-South Transport Corridor is a crucial international transport route, linking the Baltic Sea, the Russian Federation, Azerbaijan, the Islamic Republic of Iran and India. Primarily used for transportation from India and the Persian Gulf region to Western Europe, the Baltic, Scandinavian countries and the Russian Federation, the corridor offers substantial advantages in terms of transit distance and time. It takes only 20-25 days to complete the transit, making it a more efficient option compared to other routes. The development of the North-South Corridor involves connecting the railways of Azerbaijan and the Republic of Iran; the construction of the Astara-Rasht railway marks the next stage of the project. Once completed, the railways of Scandinavian countries, the Russian Federation, Azerbaijan and the Islamic Republic of Iran will form a unified network, facilitating seamless transportation from the North to the Islamic Republic of Iran. The ongoing development of this corridor is anticipated to significantly boost transit supplies in the region.

3.3. Summary and key issues

In recent years, the Government of Azerbaijan has implemented various strategies to enhance transportation infrastructure for both passenger and freight transport. The country's active
participation in several international transport corridors has played a significant role in improving its railway and road systems. Despite these efforts, the transport industry in Azerbaijan still faces several obstacles that demand attention.

A major challenge for the country’s transport sector is the lack of a comprehensive national transport strategy that encompasses all modes of transportation. A national strategy would offer a coordinated approach to transport development, ensuring alignment between government priorities and actions taken by key stakeholders in the sector. The absence of such a strategy poses a risk of fragmentation and inconsistency in the sector, potentially resulting in the inefficient use of resources and missed opportunities for development.

While certain transport subsectors have developed individual strategic plans, these plans often have limited scope and may not comprehensively address broader challenges facing the transport sector as a whole. The absence of an overarching transport sector plan makes it challenging to ensure alignment among these subsector plans and their contribution to a common goal. Furthermore, the lack of a national strategy complicates the evaluation of progress towards achieving national targets and the assessment of the effectiveness of policies and programmes.

Moreover, the absence of a comprehensive national transport strategy poses a challenge to Azerbaijan in fulfilling its nationally determined contributions related to transport. Without a clear strategy for the transport sector, it is difficult to ascertain whether Azerbaijan is on track to meet its nationally determined contributions targets related to transportation.

Addressing the absence of a comprehensive national transport strategy covering all modes of transportation in Azerbaijan is a crucial challenge that demands attention. The development of such a strategy would offer a coordinated approach to transport development, ensuring alignment with subsector plans and supporting progress toward national targets and commitments related to transport.

In addition to the absence of a comprehensive national transport strategy, Azerbaijan is grappling with significant road safety challenges, exemplified by the 2,600 road accidents and 759 fatalities recorded in 2016. The lack of a national strategy, challenges in enforcing regulations, interruptions in funding for road safety programmes, insufficient research and data for analysis, inadequate public education and awareness on road safety are among the major factors contributing to this problem. To tackle these issues, the Government has introduced the State Program of Azerbaijan Republic on Road Safety for 2019–2023, which will be explored further in this paper.
The above description highlights that Azerbaijan contends with a variety of challenges related to urban mobility, which affects the quality of life for its citizens and the country’s economic and environmental sustainability. One of the most notable challenges is the insufficient public transport infrastructure in numerous urban areas. While Baku boasts a relatively well-developed public transport system, including buses and a metro, other cities and towns in Azerbaijan lack or have limited public transport options. The resulting reliance on private cars or taxis for transportation places a burden on citizens, leading to traffic congestion and air pollution.

When scrutinizing the urban mobility issues in Baku, numerous immediate problems require attention. The lack of a comprehensive approach and institutional fragmentation within the city’s urban mobility system has persisted as an ongoing issue for years, impeding its development. Another primary challenge in Baku is the inadequate integration between different modes of transportation. The limited intermodal connections between public transport modes result in commuters experiencing long wait times or having to cover substantial distances on foot to switch between different modes of transport. This diminishes the attractiveness of urban mobility for users and is a significant barrier to its effectiveness.

Enhancing the attractiveness of urban mobility in Baku necessitates the establishment of a well-developed public transport system. Despite income growth often being correlated with an increase in car ownership, a growing number of citizens opt for cars due to the perceived unattractiveness of public transport alternatives. Consequently, the provision of high-quality public transport is vital for sustainable development. Improving the quality of non-car alternatives is not only essential to encourage people to choose alternatives to cars, but also to elevate the quality and reduce the cost of services, benefiting a broader demographic, particularly those without private vehicles.

The scarcity or absence of data in the transport sector in Azerbaijan stands out as another significant challenge to the sector’s overall development. The shortage of updated data and research for analytical purposes makes it difficult for policymakers and stakeholders to make informed decisions. Specifically, the lack of data on traffic volume, detailed passenger and freight movements, and road safety statistics poses a challenge in developing effective strategies to address issues such as traffic congestion and road safety.

Furthermore, the scarcity of data makes it challenging to monitor the progress and impact of policies and programmes implemented in the transport sector. For example, the absence of reliable data on public transport ridership hinders the assessment of the effectiveness of public transport services and impedes informed decision-making regarding investments and improvements. The
underutilization of the Intelligent Transport System Center in Baku, established in 2014 to enhance traffic management and safety through advanced technologies, results from the lack of integration with other transport-related institutions in Azerbaijan. This has prevented the accumulation of significant data that could be used to formulate comprehensive transport policies and strategies.

As an illustration, the Intelligent Transport System Center holds the potential to gather and analyse data from diverse sources, including traffic cameras and sensors, to furnish real-time information on traffic conditions and incidents. However, by not sharing this information with other transport-related institutions and stakeholders, its utility is restricted. The lack of integration of the Intelligent Transport System Center with other institutions also implies that the centre is not fully used to its full capacity and customized to local needs, which is required to enhance the overall efficiency and safety of the transport sector.

In addition to the aforementioned issues, the railway sector in Azerbaijan faces challenges, despite its crucial role in the country's transport infrastructure. A significant challenge is the outdated infrastructure, which limits the capacity and efficiency of the railway system. For instance, the primary railway line connecting Baku and the Georgian border is a single-track line with limited electrification, causing delays and impeding the movement of trains. Furthermore, insufficient investment in modernization and maintenance has led to a high incidence of technical failures, further hampering the efficiency of the railway sector.

Another challenge in the railway sector is the insufficient integration between the railway system and other modes of transport, such as road and sea transport. Notably, the railway system has limited connections with the country's ports, restricting the possibilities for multimodal transport and international trade. This lack of integration further contributes towards the underutilization of the railway system, as many shippers and passengers opt for road transport, considering it more convenient.

Moreover, the railway sector grapples with challenges pertaining to governance and institutional capacity. Notably, the sector heavily relies on state subsidies and lacks an independent regulatory body to ensure fair competition and the quality of services. This situation has led to inefficiencies and constrained private sector participation in the railway industry.

In summary, the transport sector of Azerbaijan is facing a diverse set of challenges that impede its development and prevents it from becoming more efficient. These challenges encompass the absence of a national transport strategy, institutional fragmentation, shortcomings in urban mobility, data scarcity, underutilization of the Intelligent Transport System Center in Baku and issues
within the railway sector, such as outdated infrastructure, inadequate integration and governance and institutional capacity concerns. Tackling these challenges requires substantial investment in infrastructure modernization, capacity-building and institutional reform. Additionally, adopting integrated and comprehensive transport strategies that encompass all modes of transport is crucial for overcoming these obstacles and fostering the sector's sustainable development.

4. Road infrastructure construction

4.1. National standards and parameters

Road infrastructure in Azerbaijan has a rich history, evolving from ancient trade routes to modern highways. The geographical significance of Azerbaijan as a crossroads connecting Europe, the Middle East, and Asia is evident by its historical trade centres, including those along the Great Silk Road. Archaeologists suggest that modern highways often follow ancient trade routes, emphasizing the country's historical importance in regional commerce.

The nineteenth century marked the beginning of road development, particularly around the Baku governorate, driven by the transportation needs of the booming oil industry. The first highway, constructed in 1850 near Abdalyar, laid the foundation for further road development. By the early twentieth century, cars were introduced in Azerbaijan, prompting the establishment of the first road construction organization in 1918.

In the years following the independence of Azerbaijan in 1918, significant progress was made in road development, including gravel and hard-surface roads. However, road infrastructure faced challenges during the Soviet era, as the country focused on oil exports and limited attention was given to comprehensive road construction.

World War II and its aftermath led to extensive rehabilitation efforts, with the construction of key roads, such as the Baku-Aghstafa-Kazakh-Georgia border road. The strategic importance of Azerbaijan in supplying the Union of Soviet Socialists Republics with oil underscored the need for a well-connected road network.

During post-World War II, Azerbaijan transitioned to modern tar and asphalt-concrete roads, marking a shift towards improved road quality. In the 1970s to 1990s, rapid development occurs, resulting in a 1.2-fold increase in road length and advancements in road maintenance. By 1980, all State roads had asphalt-concrete pavement.
In the years following independence in 1991, Azerbaijan faced economic challenges, affecting road construction. However, significant reforms, including the establishment of the State Road Fund in 1994, rejuvenated the road industry. The accession to the European Agreement in 1996 and the international recognition of the E-70 highway highlighted the country’s commitment to modernizing its road network.

In recent years Azerbaijan has prioritized road infrastructure, leading to the country ranking first in road infrastructure quality among the members of the Commonwealth Independent States and twenty-seventh globally. Over the period 2003–2021 numerous overpasses, tunnels, pedestrian crossings, and thousands of kilometers of inter-rural highways were constructed.

As of 2023, the length of technical class I highways has increased significantly in comparison to previous decades, reflecting the country’s commitment to modernizing its road infrastructure. The country continues to implement comprehensive programmes for the socioeconomic development of regions, focusing on road construction and renovation as a key aspect of its modernization efforts. In the pursuit of sustained socioeconomic development, Azerbaijan has steadfastly adhered to a series of national programmes aimed at fortifying the country's long-term progress. This commitment to strategic initiatives has led to a radical transformation since the successful implementation of the 2004 road map. Over the years, Azerbaijan has adopted and executed three distinct national programmes, each contributing to the enhancement of development factors and the bolstering of resilience against potential threats.

The initial programme, spanning from 2004 to 2008 and titled "Socio-Economic Development of the Republic of Azerbaijan," set the stage for sustainable development strategies within non-oil industries. Its primary objectives were to advance social infrastructure, improve services and elevate living standards through increased employment opportunities.

Following the triumph of the first programme, Azerbaijan embarked on its second national initiative in 2009, extending until 2013. This programme, sharing the same title as its predecessor, aimed to further accelerate progress within the non-oil sector, diversify the economy and foster balanced regional development. The successful implementation of this programme led to marked improvements in various socioeconomic indicators, reflecting the resilience and sustainability of the country's developmental efforts.

The third programme, titled "Socio-Economic Development of the Republic of Azerbaijan" and implemented from 2014 to 2018, marked a continuation of the country’s commitment to progress. Notable innovations in this programme included an accelerated pace of policy reforms and the
construction of comprehensive development strategies. A tangible measure of success emerged in the form of more than 1,800 newly opened facilities across various districts and population centres during this period, representing a 40 per cent increase since the 2004–2013 period.

These cumulative advancements have significantly contributed to the long-term sustainable socioeconomic development, fostering a threefold growth in the overall GDP and a 2.8 times increase in the non-energy sector since 2004. Currency reserves have surged 24 times, reaching approximately $45 billion in 2019.

Moreover, the focus on regional development programmes has manifested in substantial progress within critical sectors, such as transportation infrastructure. Large-scale investments have led to extensive renovations in vehicle fleets, bridge construction and the development of new highways, contributing to a threefold growth in economic development.

In tandem with these national programmes, Azerbaijan has taken a proactive approach to road infrastructure development. The key indicators of roads and road facilities as of 2022 are as follows:

Table 1. Key indicators of roads and road facilities by the end of 2022

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Total</th>
<th>Republic importance</th>
<th>Local importance</th>
<th>including: City</th>
<th>Area</th>
<th>Municipal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put into operation during the year:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of new motorways</td>
<td>km</td>
<td>41.5</td>
<td>-</td>
<td>-</td>
<td>18.7</td>
<td>-</td>
</tr>
<tr>
<td>Number of new bridges</td>
<td>unit</td>
<td>30</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Length of new bridges</td>
<td>running m</td>
<td>258.0</td>
<td>-</td>
<td>93.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Length of new motorways, total</td>
<td>km</td>
<td>78, 48.7</td>
<td>4 806.9</td>
<td>14 109.1</td>
<td>9 429.4</td>
<td>13 545.2</td>
</tr>
</tbody>
</table>

Including according to the type of road surface:

|          | km          |                    |                  |                 |            |           |           |
|----------|-------------|--------------------|------------------|-----------------|------------|-----------|
| Hard pavement       | km          | 52 388.8           | 4 800.9          | 14 039.1        | 8 213.5    | 531.2     | 24 804.1  |
| Concrete            | km          | 141.8              | 107.0            | 4.0             | -          | -         | 30.8      |
| Asphalt-concrete    | km          | 19 221.4           | 4 567.9          | 7 534.3         | 5 270.7    | 200.3     | 1 648.2   |
| Black surface       | km          | 1 621.2            | 90.0             | 888.8           | 383.4      | -         | 259.0     |
| Gravel              | km          | 31 404.4           | 36.0             | 5 612.0         | 2 559.4    | 330.9     | 22 866.1  |
| Earth road          | km          | 25 959.9           | 6.0              | 70.0            | 1 215.9    | 13 014.0  | 11 654.0  |

According to the level of motorways:

<p>|          | km          |                    |                  |                 |            |           |           |
|----------|-------------|--------------------|------------------|-----------------|------------|-----------|
| I degree | km          | 1 063.5            | 910.0            | 28.0            | 116.8      | -         | 8.7       |
| II degree| km          | 4 512.9            | 1 184.1          | 68.0            | 394.3      | 16.4      | 2 850.1   |
| III degree| km        | 7 683.2            | 2 686.8          | 2 472.6         | 1 875.3    | 30.2      | 618.3     |
| IV degree | km         | 28 568.8           | 26.0             | 10 437.3        | 4 366.3    | 1 321.6   | 12 417.6  |</p>
<table>
<thead>
<tr>
<th>V degree</th>
<th>km</th>
<th>36 520.3</th>
<th>-</th>
<th>1 103.2</th>
<th>2 676.7</th>
<th>12 177.0</th>
<th>20 563.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of motorways</td>
<td>unit</td>
<td>17 876</td>
<td>104</td>
<td>1 510</td>
<td>3 815</td>
<td>2 092</td>
<td>10 355</td>
</tr>
<tr>
<td>Length of &quot;E&quot; index motorways</td>
<td>km</td>
<td>1 212.0</td>
<td>1 212.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Bridges, total**

<table>
<thead>
<tr>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
</tr>
<tr>
<td>reinforced concrete bridges:</td>
</tr>
<tr>
<td>Number</td>
</tr>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Stone bridges:</td>
</tr>
<tr>
<td>Number</td>
</tr>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Metal bridges:</td>
</tr>
<tr>
<td>Number</td>
</tr>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Wooden bridges:</td>
</tr>
<tr>
<td>Number</td>
</tr>
<tr>
<td>Length</td>
</tr>
</tbody>
</table>

**Length of repaired motorways during the year**

| km | 1,040.3 | 0.6 | 104.7 | 246.9 | 32.0 | 656.1 |

*Source: Statistic Committee of the Republic of Azerbaijan (2023).*

The principal governmental authority tasked with the oversight of road infrastructure in Azerbaijan is the State Agency for Automobile Roads, which was established in 2017 as a public entity. The primary responsibility of the Agency is to manage the country’s highway and secondary road network, encompassing key local roads. Directly accountable to the President and Cabinet of Ministers, it assumes a central role in coordinating major road construction projects and delegates maintenance activities to regional entities. Notably, the Government reinstated the Road Fund in 2007, designating it as the account within the state budget responsible for consolidating revenue generated from road user charges. These collected funds are then allocated for routine and periodic maintenance activities on the primary road network. The 2020 annual state budget anticipate that the Road Fund would amass approximately $190 million to support ongoing road infrastructure initiatives.

The primary legal framework concerning highways in Azerbaijan is governed by the Law of the Republic of Azerbaijan on Highways. This legislation sets forth the fundamental principles pertaining to the legal, technical, economic and organizational aspects of the design, construction, utilization, maintenance, protection and development of highways in the country, along with related engineering
structures. Additionally, it outlines the management of the road economy and regulates the key relationships that arise among entities involved in road-related activities. This law applies to all highways in Azerbaijan, irrespective of ownership, users or significance.

The legislation places a premium on adapting highways to various conditions, from vehicular parameters to meteorological influences. Special permits for large and heavy vehicles, contingent on compliance with load and technical limits, underscore a strategic approach to ensure the structural resilience of roads. Notably, the legislation emphasizes the restoration funds requirement, establishing a financial mechanism to fortify highways against potential damage.

Ensuring the safety of highway users is paramount, with provisions for temporary restrictions during mass events. The decision-making authority, the State Agency of Azerbaijan Automobile Roads, consults with relevant executive bodies, highlighting a dynamic response system to evolving situations. Public safety is further underscored by mandatory communication of restrictions and their durations, a crucial aspect in enhancing resilience during emergencies.

Environmental considerations are interwoven into the legislation, mandating positive environmental expert opinions before the application of new technologies in highway construction. This proactive stance aligns with the broader goal of resilient infrastructure, recognizing the need to harmonize technological advancements with ecological safeguards.

Economic principles play a pivotal role in bolstering highway resilience. Competitive bidding for project execution ensures efficiency, and financing from diverse sources, including state and local budgets, loans and donations, creates a robust financial foundation. This multifaceted funding strategy promotes flexibility, a key attribute in building resilience against economic uncertainties.

Entrepreneurship along highways is governed with an eye on resilience, as activities that may impede traffic or harm the environment may be restricted. These measures, coupled with the delineation of rights for highway users, contribute to the overall resilience of the road network. Additionally, the legislation provides for the accountability of road management bodies and users, establishing a framework for addressing damages and disputes, a crucial element in maintaining resilient highway operations.

The legal framework outlined in the document "Rules for the design, construction, reconstruction and repair of highways," sanctioned by the Cabinet of Ministers of the Republic of Azerbaijan on 7 February 2000, is a crucial standardization measure for the country’s road infrastructure. These regulations emphasize meticulous planning and execution to ensure smooth and consistent vehicular flow. Parameters, such as the plan, longitudinal profile and various geometric
attributes, including the width of the carriageway and shoulders, curve radii, and artificial structure dimensions, are all carefully dictated by the standards to maintain road integrity and safety.

According to these rules motorways are divided into technical grades in accordance with table 2, depending on traffic intensity, public economic and administrative importance.

Table 2. Division of motorways according to technical grades

<table>
<thead>
<tr>
<th>Functional designation</th>
<th>Grade</th>
<th>Personal car</th>
<th>vehicle</th>
<th>Motorways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway</td>
<td>Ia</td>
<td>More than 14 000</td>
<td>More than 7 000</td>
<td>Highways of national importance (including for international connections)</td>
</tr>
<tr>
<td>Fast highways</td>
<td>Ib</td>
<td>More than 14 000</td>
<td>More than 7 000</td>
<td>Highways of national importance (not assigned to grade Ia)</td>
</tr>
<tr>
<td>Ordinary ways</td>
<td>Ic</td>
<td>More than 14 000</td>
<td>More than 7 000</td>
<td>Highways of national importance (not assigned to grade Ib)</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>From 6 000 up to 14000</td>
<td>From 3 000 up to 7 000</td>
<td>Highways of national importance (not classified as class I)</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>From 2 000 up to 6 000</td>
<td>From 1 000 up to 3 000</td>
<td>Highways of national importance (not classified as grade II), roads of local importance</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>from 200 - until 2000</td>
<td>from 100 - up to 1000</td>
<td>Highways of local importance (not class III)</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>Up to 200</td>
<td>Up to 100</td>
<td>Highways of local importance (not class IV)</td>
</tr>
</tbody>
</table>


Environmental considerations are paramount within this legislative framework. Accordingly, a comprehensive assessment of a road's ecological impact during construction and operation phases is necessary. The legislation advocates environmentally conscious project solutions based on the goal to minimize the ecological footprint of road infrastructure. To this end, the regulations stipulate the strategic planting of trees and shrubs along highways and the creation of green belts. This afforestation initiative not only enhances the aesthetics of the landscape, but it also plays a crucial role in reducing harmful atmospheric pollutants, which supports a commitment to sustainable practices.

Moreover, the legislation encourages sustainable construction practices by endorsing the use of industrial waste within construction zones and promoting the use of recycled asphalt concrete. These measures not only contribute to the conservation of raw material resources but they also align with broader environmental goals by reducing energy consumption associated with traditional materials. The legal provisions, therefore, underscore a holistic approach that prioritizes road safety, environmental harmony and sustainability in the development and maintenance of the country's highway infrastructure.

In recent years, the Government has recognized the expensive nature of road construction and maintenance and have taken steps to explore sustainable funding models. Traditionally, countries have resorted to significant borrowing for infrastructure projects, leading to substantial national debt. However, recently the country started to venture into using toll roads as a viable solution.

Despite the legislation allowing for the construction of toll roads, Azerbaijan had not use approach until the recent Cabinet of Ministers Resolution No. 309, dated 5 September 2023. Under the resolution, a new 129-kilometre section of the state border highway M-1 Baku-Guba-Russian Federation is designated as a toll road – a strategic move to generate funds for the maintenance and development of critical infrastructure.

The M-1 Baku-Guba-Russian Federation state border highway, integral to the "North-South" international transport corridor, is expected to play a pivotal role in strengthening transport infrastructure of Azerbaijan. The toll road designation is envisioned to expand opportunities for participation in transit transportation, reduce delivery times for goods in transit and provide an additional impetus to regional tourism.

The Tariff Council, following the resolution, has determined fares for the toll road, ranging from 0.093 manat ($0.05) to 0.194 manat ($0.11) per kilometre for various vehicle categories. These
tolls, accompanied by proposals made by the State Agency of Azerbaijan Automobile Roads for weekly, monthly and annual tariffs, align with international practices.

The decision to introduce tolls on this section of the road, effective from 20 October 2023, marks a significant departure from previous approaches. As the country ventures into toll roads, it anticipates not only sustainable funding for infrastructure development, but also potential benefits, such as shorter travel distances, higher speed limits, and overall time and fuel savings for users.

In essence, the integration of toll roads into the country’s infrastructure strategy reflects a pragmatic approach to address the financial challenges associated with road construction and maintenance. As Azerbaijan strives for continued economic growth and development, the development of resilient infrastructure, including toll roads, is seen as a critical component. This strategic move aligns with the broader vision of fostering sustainable economic growth, increasing competitiveness, generating employment and alleviating poverty through strategic investments in infrastructure.

4.2. Green and resilient road infrastructure development, challenges and current status

Regrettably, the availability of data on resilient road infrastructure development in Azerbaijan is lacking among secondary sources. The pursuit of green and resilient road infrastructure development is a critical aspect of sustainable urban planning and transportation systems. However, the absence of comprehensive information on the challenges and current status in this domain poses a significant hurdle in understanding the intricacies of this crucial aspect of infrastructure. In the absence of readily accessible data, it is imperative to explore and analyse the existing knowledge and perspectives on green and resilient road infrastructure to shed light on the challenges and the present state of development in this vital sector. This exploration will help in gaining a better understanding of the complexities involved and lay the groundwork for future endeavours in enhancing the resilience and sustainability of road infrastructure.

The scarcity of data on resilient road infrastructure development poses a notable challenge, particularly in assessing the ongoing projects along the Asian Highway network in Azerbaijan. The Asian Highway network plays a pivotal role in regional connectivity and economic development, making it crucial to have comprehensive insights into the resilience initiatives undertaken. Resilience initiatives, in this context, refer to measures and strategies implemented to enhance the ability of the road infrastructure to withstand and recover from various challenges and disruptions. These initiatives may include incorporating climate-resilient design features, utilizing durable and
sustainable materials, implementing effective maintenance and repair strategies and adopting innovative technologies to enhance the overall robustness and adaptability of the road network. The aim is to ensure that the infrastructure can withstand natural disasters, climate changes and other unforeseen events while, continuing to contribute to regional connectivity and economic growth.

In the 2020 policy analysis conducted by the International Transport Forum (ITF), several primary issues in the road sector of Azerbaijan were identified. Among them are the need for the modernization of road maintenance and asset management, enhancement of road protection and axle load control, improvement in the financial sustainability of the road sector, adoption of national technical and design standards based on global best practices, elevation of road safety standards and the implementation of road user information systems. Road safety is a significant concern within the country’s transportation sector. The State Program of the Azerbaijan Republic on Road Safety for the period 2019–2023 is designed to address these issues comprehensively. This programme aims to enhance road safety, reduce the incidence of road accidents and minimize the socioeconomic impact resulting from preventable road casualties. Emphasizing environmental considerations, the programme advocates the use of environmentally friendly vehicles and the incorporation of environmental and biodiversity preservation requirements into the planning, construction, repair, and reconstruction of highways. Additionally, the programme encourages the adoption of high-quality fuel standards, such as Euro-4, Euro-5 and Euro-6, to promote cleaner vehicles. The development of Infrastructure to support the use of electric vehicles is also a notable component of the programme.

In the early 2000s, the Government of Azerbaijan initiated a significant highway reconstruction programme that mainly focused on enhancing key corridors. Substantial improvement were made in the East-West corridor through upgrades to the M2 Baku-Alat-Gazakh-Georgian border highway and the M4 Baku-Shamakhi-Yevlakh highway. Simultaneously, efforts were directed towards the North-South corridor, which involved the enhancement of the M1 Baku-Guba-Russian border highway and the M3 Alat-Astara-Republic of Iran border highway. The comprehensive programme also included rehabilitation projects for other major highways categorized as M roads. The ambitious goal was to complete the reconstruction and rehabilitation of all M category roads by 2021. Although the upgrading of the main highways is nearing completion, the focus on reconstructing lower road networks, particularly tertiary or local roads (Y roads), remains an ongoing priority (World Bank, 2021).

On 20 May 2021, the World Bank Board of Directors approved a new $65 million loan for the Azerbaijan to finance the Regional Connectivity and Development Project. The objective of the project is to provide safe, efficient and climate-resilient transport connectivity to enhance market accessibility
along the Salyan-Bilasuvar road in the southern part of the country. Approximately 250,000 people residing along this route were expected to benefit from upgraded road infrastructure, leading to improved economic opportunities and easier access to essential service facilities.

The project has played a crucial role in supporting the national development priorities of Azerbaijan. With the backing of the World Bank, the country has committed to ensuring equitable distribution of development benefits across all regions, fostering inclusive and sustainable communities, unlocking the full potential of rural areas, and enhancing people's skills.

Financing for the project was allocated to three key areas. First, investments were made in roads and ancillary agricultural and logistics infrastructure to enhance connectivity and market accessibility with the objective to maximize the socioeconomic development impact of the upgraded roads. Second, the project supported financial sustainability and efficiency within the road sector by providing technical assistance for developing road network management systems and studying options for the introduction of user charges and prevention of vehicle overloading. Third, the project backed the design and arrangement of roadside logistics and market facilities, along with the provision of skills training to local entrepreneurs, to enhance income-generating opportunities for local communities. The project addressed climate vulnerabilities through, for example, raised road embankments and the use of appropriate road materials. Additionally, it created job opportunities during the construction of the roads and the operation of roadside facilities, which has contributed to the post-COVID-19 recovery.

In the "I State Program on the Great Return to the territories freed from occupation of the Republic of Azerbaijan," as per the Decree of the President of the Republic of Azerbaijan dated November 2022, a holistic approach to environmental considerations is evident. The target indicators of this programme pertaining to environmental issues are encapsulated under the theme of "Balanced environmental development," with specific subtargets focusing on various aspects. These include ensuring environmental protection, effective utilization of natural resources, expanding the implementation of renewable energy sources and promoting the concepts of "Smart City," "Smart Village," and "Green Energy Zone."

The State Program underscores the priority direction of improving the ecological environment in the areas and the application of environmentally friendly technologies. Key areas of emphasis encompass the restoration of forest stock, flora and fauna, the adoption of energy-efficient and environmentally friendly technologies, prudent use of water resources and the establishment of
modern infrastructure for solid household waste management. These initiatives are core priorities within the broader framework of the programme.

Within the context of creating a "green energy" zone, the programme places a strong emphasis on incorporating "green technologies" and maximizing the potential of "green energy" in every phase of the electric energy value chain. The design of buildings and other structures in these areas takes into account the installation of various renewable energy sources based on the potential of the region. Additionally, the programme is committed to establishing the necessary infrastructure to facilitate the use of environmentally friendly vehicles.

The effective utilization of the economic and geographical potential of these areas is envisioned to align with modern urban planning principles, prioritizing environmental protection and ecological balance. Importantly, the new road infrastructure developed within the programme adheres to environmentally friendly solutions, reflecting a comprehensive commitment to sustainable and green development.

After reviewing the secondary source data available, it is evident that developing resilient road infrastructure in Azerbaijan faces significant challenges, with the foremost issue being the limited availability of relevant data. The absence of comprehensive and up-to-date information impedes a thorough understanding of the existing state and challenges within the road infrastructure sector. Without a robust data set, it is very difficult to formulate effective strategies and initiatives to enhance resilience in this vital aspect of transportation.

Another critical challenge pertains to the standards for road infrastructure, particularly the need for updates that align with contemporary environmental considerations. Outdated standards may not sufficiently address the evolving environmental challenges faced by road infrastructure projects. As sustainable practices and green technologies become increasingly important in modern urban planning, road infrastructure standards must be regularly updated to incorporate the latest advancements and align with global best practices in environmental preservation.

The lack of updated standards poses a potential obstacle to the integration of environmentally friendly solutions into road construction and maintenance. This includes considerations, such as the use of eco-friendly materials, adherence to energy-efficient technologies and the incorporation of measures to minimize the ecological footprint of road projects. Ensuring that road infrastructure aligns with current environmental standards is crucial for the overall sustainability and resilience of the transportation network in Azerbaijan.
In summary, the primary challenges in resilient road infrastructure development in Azerbaijan revolve around the limited availability of data and the need for updated standards, particularly those concerning environmental aspects. Addressing these challenges is essential to foster sustainable, resilient and environmentally conscious road infrastructure in the country.

4.3. Summary and key issues

The information provided in this chapter covers the historical development and current status of road infrastructure of Azerbaijan, highlighting the country’s strategic importance as a crossroads connecting Europe, the Middle East and Asia. The narrative spans from ancient trade routes to modern highways, with significant developments during the nineteenth century, the post-independence era, and recent years, positioning Azerbaijan as a leader in road infrastructure quality among Commonwealth of Independent States countries.


Key indicators of roads and road facilities as of 2022 show that substantial progress in this sector has been made. Notable, the focus has been on various types of road surfaces, motorway degrees and bridge constructions. The Government’s commitment to strategic initiatives has led to a radical transformation in road infrastructure, which, in turn, has contribute to economic growth and development.

Azerbaijan faces challenges in the transportation sector, such as outdated standards and limited data availability for resilient road infrastructure development. Efforts have been made to explore sustainable funding models, including the recent introduction of toll roads to generate funds for infrastructure maintenance and development.

**Key Issues:**

Limited data availability: The scarcity of comprehensive and up-to-date data poses a significant challenge in understanding the current state and challenges within the country’s road infrastructure sector. This data gap hinders effective planning and strategy formulation.

Outdated standards: The need for updated standards in road infrastructure, especially concerning environmental considerations, is crucial. Outdated standards may not address evolving environmental challenges and hinder the integration of sustainable practices and green technologies.
Sustainable funding models: The Government has explored toll roads as a sustainable funding model, however, the transportation sector's expensive nature necessitates continuous efforts to identify and implement effective funding models for infrastructure projects.

In conclusion, the road infrastructure of Azerbaijan has undergone significant development, but addressing data gaps and updating standards are crucial to foster sustainable, resilient and environmentally conscious road infrastructure.

5. Conclusion

The examination undertaken in Azerbaijan as part of the project has provided valuable insights into the current state of the country's transportation sector, shedding light on critical issues, such as the absence of a comprehensive and unified strategy for sustainable transport. Moreover, it has identified challenges, such as the unregulated surge in private car ownership, safety concerns and issues related to air quality. However, amid these challenges, notable opportunities exist to reshape the transport system into a sustainable, well-connected, and efficient network.

Furthermore, the analysis of the prevailing standards in road infrastructure and the assessment of ongoing projects aimed at environmentally friendly road development have brought to light significant issues. One prominent challenge is the limited availability of comprehensive and up-to-date data, which impedes being able to understand the current state and obstacles within the country's road infrastructure sector. This data scarcity is a barrier to effective planning and strategy formulation. Another concern pertains to outdated standards, particularly in relation to environmental considerations. The imperative for updated standards becomes apparent, as they play a crucial role in addressing evolving environmental challenges and facilitating the integration of sustainable practices and green technologies.

Additionally, the review underscores the importance of sustainable funding models for infrastructure projects in the transportation sector. While the government has explored toll roads as a potential sustainable funding model, the inherently expensive nature of the transportation sector necessitates continuous efforts to identify and implement effective funding mechanisms. Recognition of challenges and opportunities within the transport and road infrastructure domains provides a foundation for strategic interventions and policy measures to enhance sustainability and resilience of the country’s transportation landscape.


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