ROAD MAINTENANCE FINANCING AND COST RECOVERY OPTIONS

THE FUTURE OF ROAD USER REVENUES IN DEVELOPING ASIA AND THE PACIFIC

Serge Cartier van Dissel and Michael Anyala

NO. 100

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Road Maintenance Financing and Cost Recovery Options: The Future of Road User Revenues in Developing Asia and the Pacific

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Notes:
In this publication, "$" refers to United States dollars.
ADB placed its regular assistance to Afghanistan on hold effective 15 August 2021.

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This paper on *Road Maintenance Financing and Cost Recovery Options* is the first in a series of three, presenting the findings of a study on the Future of Road User Revenues in Developing Asia and the Pacific. It was developed as part of the Asian Development Bank's (ADB) technical assistance initiative, Improving Infrastructure Sustainability through Better Asset Management. This initiative aims to enhance asset management maturity and operations across infrastructure sectors in ADB's developing member countries (DMCs) by providing knowledge and technical support for project preparation and capacity development.

The paper was initiated and led by Michael Anyala, senior transport specialist (Road Asset Management) at ADB, with guidance from James Leather, director of the Transport Sector Office, and administrative support from Diana Marie Hernandez-Louis and Wendy Nazal Montealto.

The publication was prepared by Serge Cartier van Dissel, a road management consultant for ADB, and Michael Anyala, based on an initial report by Dornier Consulting International GmbH. We extend our gratitude to those individuals who collected and analyzed data throughout this study. Special thanks to Henry Kerali, Alexandra Spernol, and Ian Greenwood for their support and review of the publication.

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ABBREVIATIONS

$	–	United States dollar
€	–	euro
AC	–	asphalt concrete
ADB	–	Asian Development Bank
ADT	–	average daily traffic
AMP	–	annual maintenance plan
ARMP	–	annual road maintenance plan
BDT	–	Bangladesh taka
BEV	–	battery electric vehicle
BAN	–	Bangladesh
BRTA	–	Bangladesh Road Transport Authority
BRV	–	base calculated value (базовой расчетной величине)
CAREC	–	Central Asia Regional Economic Cooperation
CBD	–	completely built-up
CIF	–	cost, insurance, and freight
CKD	–	completely knocked down
COVID-19	–	coronavirus disease
CR	–	Committee for Roads
CRRN	–	Core Rural Road Network
DBST	–	double bituminous surface treatment
DDH	–	Road Maintenance Department (Департамент Дорожного Хозяйства – ДДХ)
DGRBFPC	–	Directorate General of Roads, Bridges, and Flood Prevention and Control
DMC	–	developing member country
DOLI	–	Department of Local Infrastructure
DOR	–	Department of Roads
DOTM	–	Department of Transport Management
DRIMS	–	Dynamic Response Intelligent Monitoring System
EAEU	–	Eurasian Economic Union
FCEV	–	fuel cell electric vehicle
FRMR	–	Fund for Repair and Maintenance of Roads
FY	–	financial year
GDCE	–	General Department of Customs and Excise
GDP	–	gross domestic product
HDM-4	–	Highway Development and Management System
HEV	–	hybrid electric vehicle
HS	–	harmonized system
ICE	–	internal combustion engine
IMF	–	International Monetary Fund
IRI	–	International Roughness Index
JDCF	–	Japan Debt Cancellation Fund
KGS	–	Kyrgyz som
KGZ	–	Kyrgyz Republic
CAM	–	Cambodia
KHR	–	Cambodia riel
LGED	–	Local Government Engineering Department
LTMIS	–	Land Transport Management Information System

MON	–	Mongolia
MNT	–	Mongolian togrog
MPWT	–	Ministry of Public Works and Transport
MRD	–	Ministry of Rural Development
MRTD	–	Ministry of Road and Transport Development
MTC	–	Ministry of Transport and Communications
MVIL	–	Motor Vehicles Insurance Limited
NBR	–	National Board of Revenue
NHA	–	National Highway Authority
NHMP	–	National Highway Motor Police
NEP	–	Nepal
NPR	–	Nepal rupee
OEC	–	Observatory of Economic Complexity
OSCE	–	Organization for Security and Co-operation in Europe
PAK	–	Pakistan
PCU	–	passenger car unit
PGK	–	Papua New Guinea kina
PHEV	–	plugin hybrid electric vehicle
PKR	–	Pakistan rupee
PNG	–	Papua New Guinea
PWD	–	Public Works Department
RBN	–	Road Board Nepal
RHD	–	Roads and Highways Department
RIMS	–	Road Inventory Management System
RMA	–	Road Maintenance Account
RRF	–	Republican Road Fund
RTDC	–	Road and Transport Development Centre
SDI	–	Surface Distress Index
SRN	–	strategic road network
SUE	–	state unitary enterprise
TIM	–	Timor-Leste
TOE	–	ton of oil equivalent
UNDP	–	United Nations Development Program
UNESCAP	–	United Nations Economic and Social Commission for Asia and the Pacific
US	–	United States
UZB	–	Uzbekistan
UZS	–	Uzbekistan sum
VAT	–	value-added tax
VAN	–	Vanuatu
VUV	–	Vanuatu vatu
WHO	–	World Health Organization

I. INTRODUCTION

This publication on *Road Maintenance Financing and Cost Recovery Options* forms the first of three publications that together present the results and recommendations of a study on the *Future of Road User Revenues in Developing Asia and the Pacific*. It was developed as part of the Asian Development Bank's (ADB) technical assistance on *Improving Infrastructure Sustainability through Better Asset Management*, which aims to enhance asset management maturity and operations across infrastructure sectors in ADB developing member countries (DMCs) through knowledge and technical support for project preparation and capacity development to DMCs.

To meet increasing demand and support achieving the Sustainable Development Goals, ADB estimates the costs of transport infrastructure requirements in Asia and the Pacific region to be more than $550 billion a year. In addition to funding this significant transport infrastructure gap, ADB estimates that the region also requires a similar amount for maintenance of existing transport infrastructure and tackling externalities, including greenhouse gas emissions air quality and road safety. A lack of adequate and reliable funding for the road sector, and especially for road maintenance, forms a serious risk to the sustainability of the road networks in the DMCs and the sustainability of past road investments by DMC governments and development partners.

This study focuses on financial sustainability, specifically the revenues collected from road users. Collection of revenue from road users in emerging economies in Asia and the Pacific typically has two main purposes: (i) to charge road users for the costs they impose on the administration and maintenance of roads, and on other users in terms of congestion, pollution and other negative externalities associated with road use; and (ii) to raise general revenue for governments. The focus of this assignment is on the road use aspect, although this will necessarily look at the wider collection of road user revenues, even where these are not allocated to the road sector.

One of the most important road user revenues is the tax or levy applied to fuel. This exists in almost all countries, either as a general revenue source or as a dedicated revenue for road maintenance. This road user revenue has important advantages in terms of the low collection costs and the fact that revenues increase as traffic volumes and related fuel consumption increase. At the same time, a fuel tax introduces incentives to move toward more efficient and cleaner vehicles, reducing the significant negative impacts of internal combustion engines on air pollution.

Traffic-related air pollution poses a severe global public health threat, demanding immediate action. The Asia and Pacific region bears the highest global burden, with 81% of air pollution deaths linked to fine particulate matter (PM2.5). Diesel-powered vehicles are major contributors, responsible for 72% of the road-related disease burden from PM2.5 and ground-level ozone pollution.[1] To mitigate these impacts, transitioning to cleaner engines and electric vehicles, such as hybrid electric vehicles (HEV), plugin hybrid electric vehicles (PHEV), battery electric vehicles (BEV), and fuel cell electric vehicles (FCEV), is essential.

As the uptake of electric vehicles and other forms of low-carbon vehicles increases, taxes and levies on fossil fuels as a source of road user revenues will increasingly decline leaving a growing hole in transport and government budgets in general. To address the resulting funding gap, countries will need to implement alternative road user revenue systems that will continue to incentivize the uptake of zero or low-emission vehicles and mobility. These new road user revenue systems should not be negatively

[1] Asian Transport Outlook, 2024.

impacted by the transition away from fossil fuel vehicles, ensuring a more sustainable source of funding for road maintenance in the future. In the context of this ongoing transition and the need for a new system of road user revenues to replace the traditional fuel taxes and levies, this study produced the following three publications:

(i) ***Road Maintenance Financing and Cost Recovery Options***: This first publication examines the current approaches to collecting road user revenues in 10 countries across Asia and the Pacific. It discusses the road networks, vehicle fleets, maintenance needs, and current budget allocations to road maintenance. Additionally, it analyzes the road user revenues that are collected and the degree to which these are allocated to the road subsector, identifying which revenues are likely to be affected by the transition to electric and low-carbon vehicles. The publication highlights patterns and important characteristics that influence the speed of this transition and the likely impact on the level of road user revenues. These findings feed into subsequent publications.

(ii) ***Technology Options for Road User Revenue Systems***: This second publication provides a comprehensive review of existing and emerging technologies and systems that could be applied to the collection of road user revenues. It covers various types of road user revenues and highlights technologies that can minimize collection costs. Additionally, it assesses the suitability of these technologies in different contexts considering factors such as road standards, traffic volumes, and vehicle fleet composition. This publication identifies the most suitable technologies for collecting road user revenues, ensuring key benefits like ease of collection, usage-based payment, and incentives for the decarbonization of road transport are maintained.

(iii) ***Mapping the Future of Road User Revenues in Developing Asia and the Pacific***: This third and final publication looks at the next 25 years up to 2050, focusing on the anticipated shift to electric and low-carbon vehicles across the 10 countries. It examines the potential impact of this transition on current road user revenues and explores alternative revenue systems that could be implemented to counteract the expected decline in revenues related to fossil fuel consumption. These systems aim to sustain or improve revenue levels while promoting the decarbonization of road transport. The publication provides a roadmap for the gradual adoption of these alternative road user revenue systems in the ten sample countries, providing a framework that can be adapted for use in other countries.

II. COUNTRY SELECTION

For this study, 10 countries were selected from the 40 developing member countries of the ADB. The selection aimed to represent all five ADB regions and included a mix of large and small countries, small island developing states, countries with extensive and limited road networks, those with and without domestic vehicle production capacity, and countries with diverse vehicle fleets, road funds, and road user revenue systems. These aspects all have an impact on the road maintenance needs as well as the potential revenues from road users and the impact of the transition to electric vehicles on those revenues. The selected countries are: Bangladesh, Cambodia, Kyrgyz Republic, Mongolia, Nepal, Papua New Guinea, Pakistan, Timor-Leste, Uzbekistan, and Vanuatu. The main characteristics of these countries are shown in Table 1.

Table 1: Country Characteristics

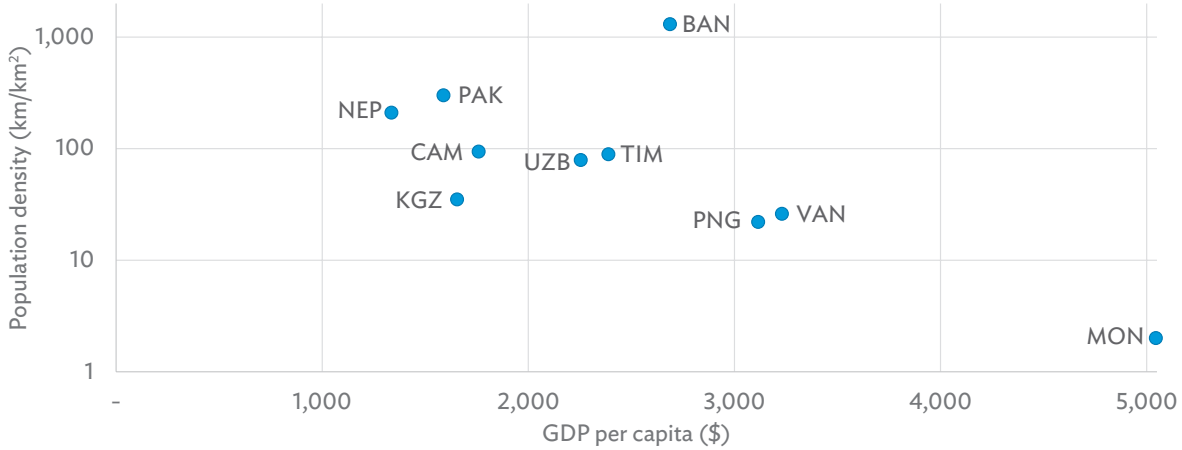
Characteristic	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Land area ('000 km²)	130.2	176.5	191.8	1,557.5	143.4	770.9	452.9	14.9	440.7	12.2
Population (million)	171.2	16.8	7.0	3.4	30.5	235.8	10.1	1.3	35.6	0.3
Population density (#/km²)	1,301	94	35	2	210	300	22	89	79	26
GDP ($ billion)	460.2	29.5	11.5	17.1	40.8	374.7	31.6	3.2	80.4	1.1
GDP per capita ($)	2,688	1,760	1,655	5,046	1,337	1,589	3,116	2,389	2,255	3,231

BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: World Bank. World Bank Open Data. https://data.worldbank.org (accessed 1 October 2024).

Mongolia, the largest country in terms of land area among the ten, has a relatively small population, resulting in the lowest population density. Although Vanuatu and Timor-Leste are the two smallest countries by land size, they also have relatively low population densities and a comparatively high GDP per capita. Despite having a much larger land area than Vanuatu, Papua New Guinea also has a much larger population with both countries exhibiting similar population density and GDP per capita. Uzbekistan and Timor-Leste share similar GDP per capita and population density. However, Uzbekistan stands out with a land area that is 30 times larger, a population 27 times greater, and a GDP 25 times higher than Timor-Leste. Although Cambodia and Kyrgyz Republic have similar land areas, Cambodia's population is approximately 2.5 times larger, as is its GDP. This results in a significantly higher population density for Cambodia, while both countries maintain a comparable GDP per capita. Pakistan and Bangladesh have the two largest populations, which is also reflected in their GDPs. However, Bangladesh has a significantly higher population density, four times that of Pakistan, and a GDP per capita that is 1.7 times higher than Pakistan's. Nepal has the lowest GDP per capita of these ten countries, with a population density between Uzbekistan and Pakistan. The population density and the GDP per capita of the ten countries are shown in Figure 1 (note that the population density is on a logarithmic scale).

Figure 1: Population Density and GDP per Capita by Country



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Source: Consultant's processing of collected data.

III. ROAD NETWORK

A. Road Management Levels

The management of road networks varies by country. In Bangladesh and Cambodia, local authorities have limited involvement, with central entities overseeing the entire network. In Bangladesh, the Roads and Highways Department manages higher-level roads comprising national highways, regional highways, and *zilla* (district) roads. Meanwhile, the Local Government Engineering Department manages lower-level roads, such as *upazila* (subdistrict) roads, union roads, and village roads. In Cambodia, the Ministry of Public Works and Transport is responsible for higher-level roads, and the Ministry for Rural Development oversees lower-level roads. Both countries exhibit significant deconcentration, with local offices of national entities managing different parts of the road network, particularly lower-level roads. These offices collaborate with local authorities to identify needs and set priorities.

In the remaining eight countries, road management responsibilities are more decentralized. Typically, the responsibility for lower-level roads falls to local (municipal) authorities. However, in Nepal, Pakistan, and Uzbekistan, regional authorities (provincial, state, and regional governments, respectively) also play a significant role. In Uzbekistan, regions are formally responsible for all internal roads, though in practice, district and city/town governments are also involved. Generally, regional and local governments oversee the majority of the road network. This decentralization significantly impacts road financing, as regional and local governments often lack the revenue-generating capacity of national governments and rely heavily on national transfers. The involvement of numerous regional and local governments complicates the planning and prioritization of needs, making it challenging to ensure the efficient and effective use of available funding.

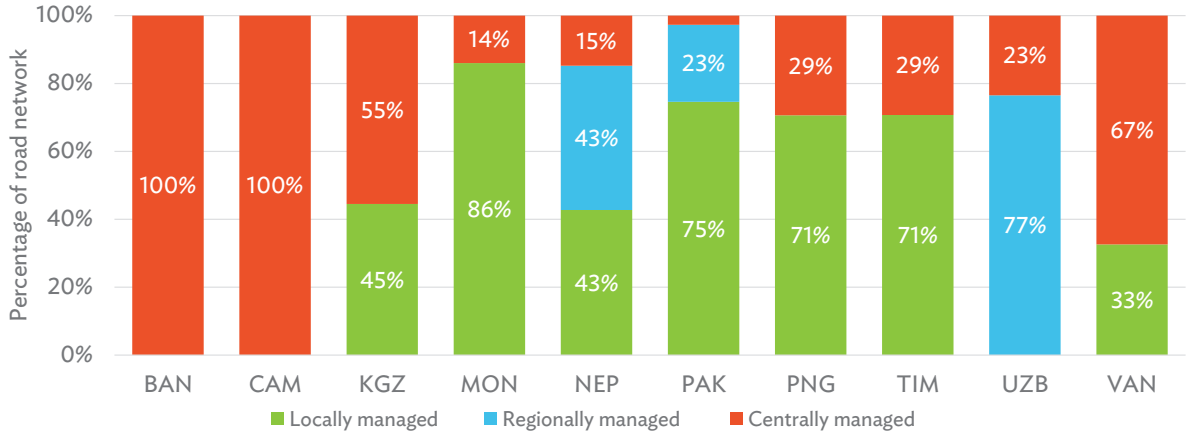
Table 2: Road Lengths by Management Level
(km)

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Centrally managed	395,231	67,714	18,942	15,820	11,179	13,570	8,738	2,198	42,695	2,037
Regionally managed	-	-	-	-	32,229	113,580	-	-	139,305	-
Locally managed	-	-	15,190	97,261	32,388	373,525	21,000	5,307	-	986
Total	**395,231**	**67,714**	**34,132**	**113,081**	**75,796**	**500,675**	**29,738**	**7,505**	**182,000**	**3,023**

BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, km = kilometer, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

Figure 2: Management Level of the Road Network



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Source: Consultant's processing of collected data.

B. Road Surface

In each of the ten sample countries, most of the road network remains unpaved. The percentage of paved roads ranges from a minimum of 10%–11% in Vanuatu, Mongolia and Papua New Guinea to a maximum of 40%–48% in Pakistan, Bangladesh and Uzbekistan. The paved roads tend to be concentrated in the higher-level national road network and in and around urban areas. Paved roads generally provide a higher, all-weather access standard, but also have higher maintenance needs. The percentage of paved roads therefore has an important effect on the road maintenance needs. It also provides an indication of the expected investments in road improvements with the aim to gradually pave an increasing portion of the road network, leading to a likely increase in future maintenance needs.

Table 3: Paved and Unpaved Road Lengths

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Paved (km)	176,422	13,199	9,874	11,220	11,383	201,855	3,320	2,784	87,122	198
Unpaved (km)	218,809	54,515	24,258	101,833	64,412	298,895	26,418	4,721	95,071	1,838
Total	**395,231**	**67,714**	**34,132**	**113,053**	**75,796**	**500,750**	**29,738**	**7,505**	**182,000**	**2,037**
Percentage paved (%)	45%	19%	29%	10%	15%	40%	11%	37%	48%	10%

BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, km = kilometer, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

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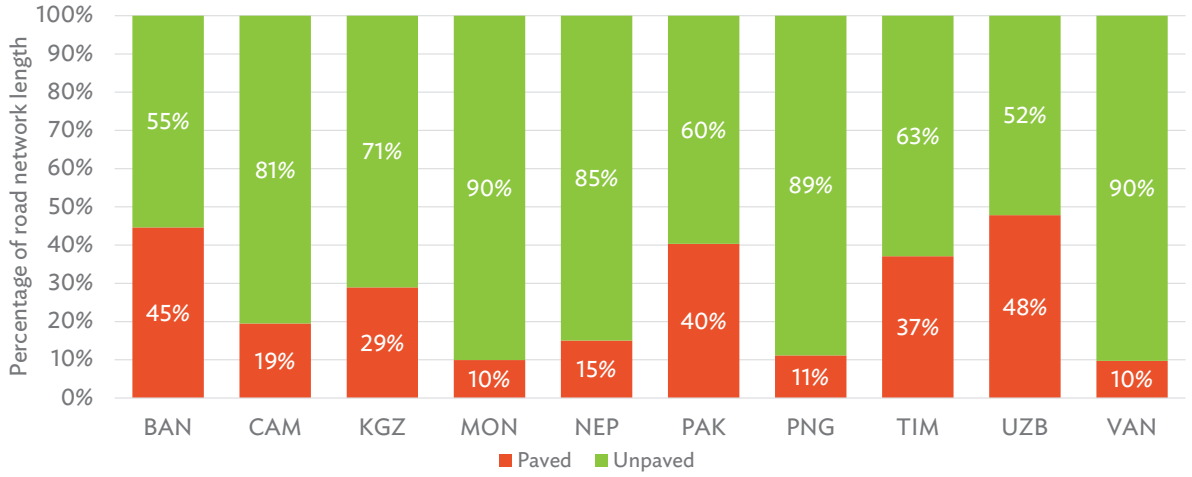

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Source: Consultant's processing of collected data.

C. Road Density

Road density can be defined in various ways, with the most common method being the measurement of road length per unit of land surface area (km per 100 km^2). This metric provides an indication of the accessibility to different regions within a country. While this allows for comparisons between countries, it does not account for population density. Countries with higher population densities typically require more roads to ensure adequate access and capacity. For instance, Bangladesh, with its high population density, has a road density of 304 km per 100 km^2. In contrast, Mongolia, with its low population density, has a road density of only 7 km per 100 km^2.

A second definition of road density based on population size (km per 10,000 people) is therefore often used. This has the reverse effect as the size of the country is not taken into account. In a country like Bangladesh with its high population density, this definition results in a low road density of only 23 km per 10,000 people, while in a country like Mongolia with its low population density, it results in a high road density of 333 km per 10,000 people.

This publication introduces a third definition of road density based on gross domestic product (GDP). Specifically, it measures road density as the length of roads per $20 billion GDP to align the values with other road density definitions. This method considers population size, which directly impacts GDP, and to a lesser extent, country size, which also influences GDP. Consequently, the differences in road density values between countries are reduced. Additionally, this definition provides insight into a country's ability to maintain its road network and the extent to which the road network size may limit economic growth.

Table 4: Road Densities

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Road density by area (km/100 km^2)	303.6	38.4	17.8	7.3	52.9	65.0	6.6	50.4	41.3	16.7
Road density by population (km/10,000 people)	23.1	40.3	48.8	332.5	24.9	21.2	29.4	57.7	51.1	67.9
Road density by GDP (km/$20 billion GDP)	42.9	114.8	148.4	330.6	92.9	66.8	47.1	117.3	113.2	92.6

BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, km = kilometer, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

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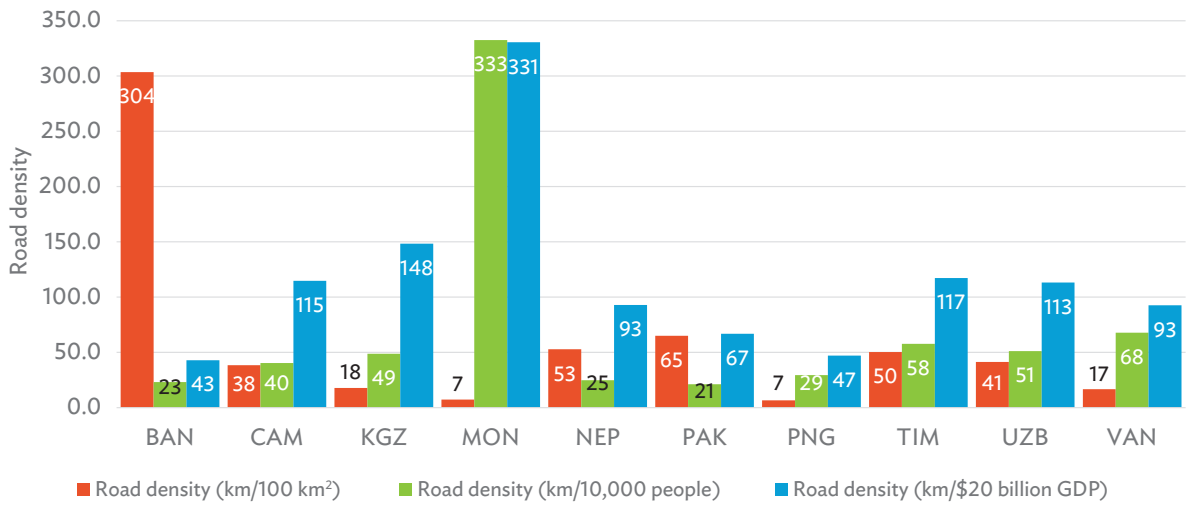

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Source: Consultant's processing of collected data.

Where the road length per GDP is small, it means that the road network size is likely to form a limitation for the growth of the economy, as transport costs become high as a result of poor access, high congestion, or both. Bangladesh is an example of this, where the road density based on area may be high, but the road density based on population is low, resulting in limited access and heavy congestion. The fact that the majority of these roads are unpaved further exacerbates the situation. This is even better visualized by looking at the road density for paved roads only. Here, Bangladesh continues to score low in terms of road length per GDP despite its extensive network of 176,000 km of paved roads, but countries like Papua New Guinea and Vanuatu score even lower.

Where the road length per GDP is high, there is a risk that the country cannot afford to maintain its extensive road network. Mongolia is a prime example of this challenge. Because of the large size of the country, it is forced to construct an extensive road network. However, the small population size means that the GDP remains limited and that the country will have difficulties maintaining its road network. At the moment, most of the road network consists of earthen tracks across the steppes that receive little to no maintenance, and if the track becomes poor, vehicles simply move to a different alignment. As these roads are improved to a gravel or paved surface, this approach is no longer applicable, and the

roads will need to be regularly maintained to ensure the benefits of higher road standards continue to be achieved. The length of paved roads per GDP is currently still in an acceptable range in Mongolia, but as the unpaved roads are improved to a paved standard, this will increase the maintenance costs and will ultimately lead to a significant problem regarding the financing of the road maintenance needs in light of the size of the GDP.

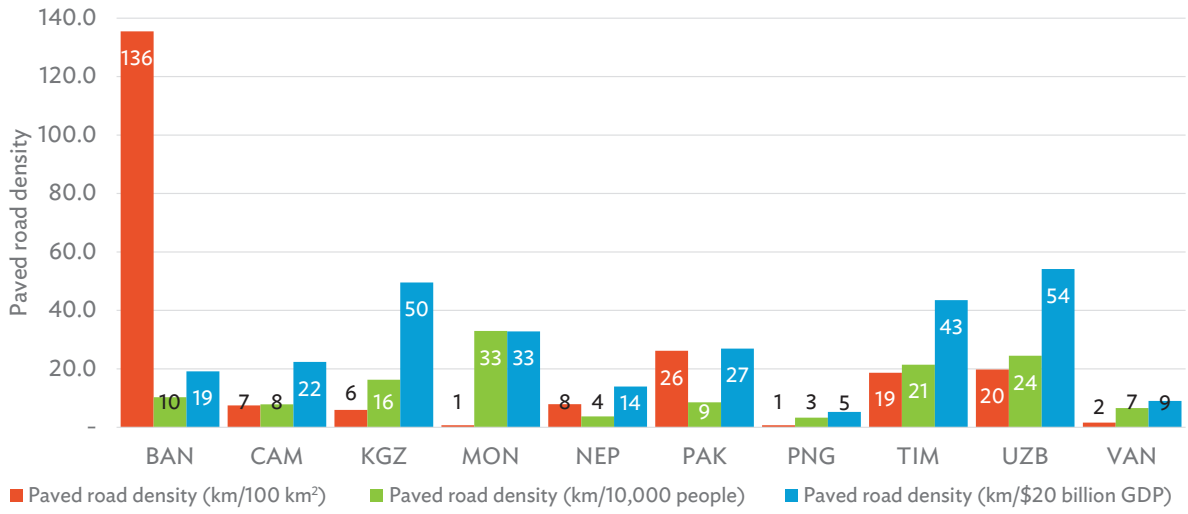
Table 5: Paved Road Densities

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Paved road density by area (km/100 km^2)	135.5	7.5	5.9	0.7	7.9	26.2	0.7	18.7	19.8	1.6
Paved road density by population (km/10,000 people)	10.3	7.9	16.3	33.0	3.7	8.6	3.3	21.4	24.5	6.6
Paved road density by GDP (km/$20 billion GDP)	19.2	22.4	49.5	32.8	14.0	26.9	5.3	43.5	54.2	9.0

BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, km = kilometer, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

Figure 5: Paved Road Densities



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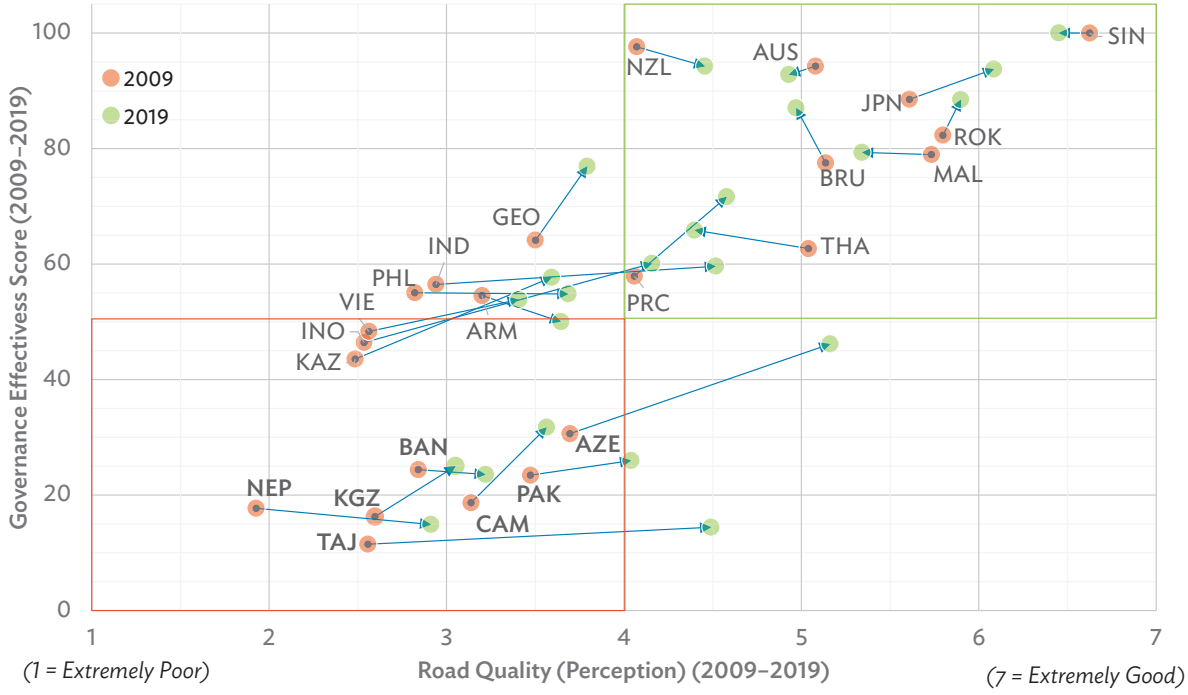
Source: Consultant's processing of collected data.

When examining the length of paved roads relative to GDP, a different set of countries emerges at the top. Uzbekistan and Kyrgyz Republic have inherited extensive paved road networks from the Soviet era, but they struggle to maintain these roads, especially the lower-level ones, which are often in poor condition. Timor-Leste faces a similar challenge with its large, paved road network inherited from Indonesian annexation, also struggling with maintenance. This issue is expected to persist in the near future, even with road improvements, as the GDP of these countries is not large enough to finance the upkeep of such extensive networks. Therefore, the development of road networks, particularly paved ones, should align with GDP growth to ensure sustainability. This publication focuses on the current road network and maintenance needs, while the third publication in this series will address future needs, including anticipated improvements and potential expansions.

D. Road Quality and Governance Effectiveness

Establishing a robust governance mechanism is crucial for delivering high-quality road infrastructure as illustrated in Figure 6. It ensures that road investment priorities align with government policies and that roads are constructed to standards, maintained adequately, and timely, considering lifecycle costs for cost-effectiveness. This approach guarantees value for money for taxpayers. Over the decade from 2009 to 2019, improvements in road quality and governance effectiveness in Nepal, Cambodia, Pakistan, Kyrgyz Republic, and Bangladesh have been modest.

Figure 6: Road Quality and Governance Effectiveness



ARM = Armenia, AUS = Australia, AZE = Azerbaijan, BAN = Bangladesh, BRU = Brunei Darussalam, CAM = Cambodia, GEO = Georgia, IND = India, INO = Indonesia, JPN = Japan, KAZ = Kazakhstan, KGZ = Kyrgyz Republic, MAL = Malaysia, NEP = Nepal, NZL = New Zealand, PAK = Pakistan, PHI = Philippines, PRC = People's Republic of China, ROK = Republic of Korea, SIN = Singapore, THA = Thailand, TAJ = Tajikistan, VIE = Viet Nam.

Source: Authors' analysis of data from the Asian Transport Observatory.

IV. MAINTENANCE NEEDS AND BUDGET ALLOCATIONS

Although this study focuses on road user revenues, these revenues are compared to the maintenance needs of the road networks utilized by road users. Since these revenues are collected specifically from road users, it is important that they are partly used for the benefit of those road users, specifically for the maintenance of the road networks and where possible for the further improvement of those road networks. This chapter therefore presents the estimated road maintenance needs of the ten sample countries, as well as the budgets currently being allocated toward road maintenance. This will later be compared to the actual road user revenues to determine if the "user pays" concept is actually achieved and if road users generate sufficient revenue to finance the estimated road maintenance needs.

A. Road Maintenance Needs

Road maintenance needs in the ten sample countries have been determined based on road network analyses, for instance using the Highway Design and Management software (HDM-4) to determine maintenance needs and priorities based on collected road inventory, condition and traffic data. Where such analyses were not available, government estimates were used, or a simple estimation was made based on unit rates for different maintenance types and road standards, multiplying these by the relevant road lengths.

The annual road maintenance requirements for extensive road networks are naturally greater than those for smaller networks, as illustrated in Table 6. Even when examining the needs on a per-kilometer basis, significant disparities between countries are evident. In some instances, these differences arise from varying road standards. For example, in Pakistan, the extensive network of expressways and highways, coupled with a high percentage of paved roads, leads to increased average costs per kilometer. In other countries, factors such as terrain and climate contribute to higher average costs, as seen in Nepal and Papua New Guinea. Additionally, small countries, particularly island states like Timor-Leste and Vanuatu, experience relatively high average costs due to their inability to leverage economies of scale and high costs related to the import of materials.

Table 6: Maintenance Needs

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Needs ($ million)	2,233	166	126	120	495	3,472	195	41	431	12
Needs ($/km)	5,650	2,451	3,680	1,064	6,536	6,933	6,557	5,516	2,368	5,892
GDP ($ million)	460,200	29,500	11,500	17,100	40,800	374,700	31,600	3,200	80,400	1,100
Needs/GDP (%)	0.5%	0.6%	1.1%	0.7%	1.2%	0.9%	0.6%	1.3%	0.5%	1.1%

BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, km = kilometer, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

Of particular interest is the comparison of the estimated maintenance needs to the GDP of the country concerned. As mentioned in Chapter 3, a relatively small road network can limit the growth of the economy, while a relatively large road network can put an unaffordable strain on the economy to finance the maintenance of that network. The estimated maintenance needs as a percentage of the GDP of a country is a suitable means of reflecting this. As can be seen in Table 7, the maintenance needs range from 0.5% of GDP in Bangladesh and Uzbekistan, to as much as 1.3% of GDP in Timor-Leste, with road maintenance needs forming 0.9% of GDP on average.

In Bangladesh the low percentage of maintenance needs to GDP is an indication that the size and standard of the road network are likely limiting economic growth, and the country could afford to maintain a larger road network. Contrarily, in Timor-Leste, for example, the current size and standard of the road network is already beyond the capacity of the country to maintain. Similar challenges for the financing of road maintenance exist in Kyrgyz Republic, Nepal, and Vanuatu. In Mongolia this does not yet appear to be an issue, but here the estimation of needs assumes little to no maintenance being carried out in the large portion of unpaved roads (90% of the network, but only 27% of the estimated needs). Maintenance needs in Mongolia are likely to increase rapidly as the international and state road networks are paved, easily reaching 1.0% of GDP. The same may be the case for other countries with low percentages of paved roads, where maintenance needs will increase significantly as more roads are paved. Specifically, Nepal and Vanuatu face this challenge, as their maintenance needs as a percentage of GDP are already high. The appropriate level for road maintenance needs as a percentage of GDP is not easily defined, as this depends on multiple factors. However, it would appear that these countries should aim to have their road maintenance needs in the range of 0.7%–0.9% of GDP to ensure that road maintenance remains affordable, while avoiding the limited road network size and standards becoming a barrier to economic growth.

B. Road Maintenance Budget Allocations

Budget allocations to road maintenance fall short of estimated maintenance needs in all ten sample countries. This deficit increases for lower-level roads, especially where these are managed and financed by regional or local governments. As can be seen in Table 7 and Figure 7, the budget allocations to road maintenance form less than half the estimated needs, exceeding this only in Cambodia (54%) and Uzbekistan (86%). In the other eight countries, the budget allocation ranges from a minimum of 17%–18% in Kyrgyz Republic and Nepal, to 44% in Pakistan and Timor-Leste.

When examining the budget allocation for road maintenance as a percentage of GDP, most countries fall within the range of 0.2% to 0.4%, with an average of 0.3%. Mongolia's notably low allocation of 0.1% is due to the minimal maintenance of its largely unpaved road network, reflected in the average budget allocation per kilometer of just $186. As a greater portion of the road network in Mongolia is paved, it is likely to require significantly higher budget allocations as a percentage of GDP due to its large land area and the large size of the road network. Applying the next lowest budget allocation per kilometer of $1,128/km for Kyrgyz Republic would increase the budget requirement in Mongolia to 0.7% of GDP. Timor-Leste has the highest percentage of GDP going to road maintenance (0.6%). This has two causes, namely the pressure exerted by different development partners to provide suitable funding to maintain the roads that were recently improved with their support, as well as the combination of steep terrain, high rainfall and loose soils that regularly lead to damage and the need for regular emergency maintenance to reinstate access.

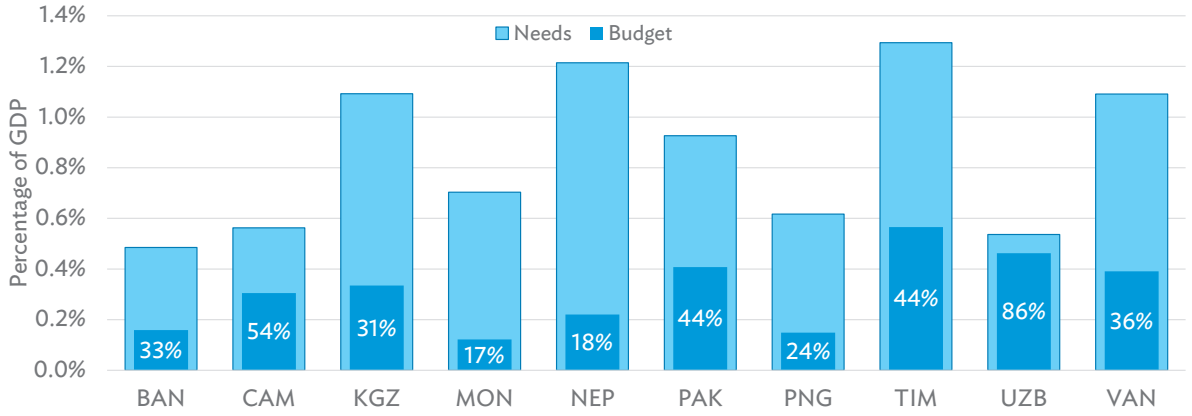
Table 7: Maintenance Budgets

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Budget ($ million)	730	90	39	21	90	1,527	47	18	372	4
Budget/needs (%)	33%	54%	31%	17%	18%	44%	24%	44%	86%	36%
Budget ($/km)	1,847	1,329	1,128	184	1,186	3,049	1,580	2,412	1,681	2,111
GDP ($ million)	460,200	29,500	11,500	17,100	40,800	374,700	31,600	3,200	80,400	1,100
Budget/GDP (%)	0.2%	0.3%	0.3%	0.1%	0.2%	0.4%	0.1%	0.6%	0.5%	0.4%

BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, km = kilometer, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

Figure 7: Maintenance Needs and Budgets as Percentage of GDP



BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

C. Road Funds

Six of the 10 sample countries formally have road funds in place, although these are generally not operating in accordance with their design (in Papua New Guinea the road fund is not yet operational). These road funds finance only certain parts of the road network or provide only limited funding for lower-level roads. The presence of a road fund does not necessarily lead to higher allocations to road maintenance and a greater coverage of maintenance needs (Table 8 and Figure 8). In the end, the level of funding that a road fund can provide depends on the road user revenues earmarked or allocated to it by the government, in the same way that allocations from the General Budget depend on the annual budgets approved by the government. This similarity is even more evident given that the actual allocations to road funds often continue to depend on political priorities rather than on the automatic earmarking of road user revenues. The benefits of the road fund should therefore be sought more in the stability and predictability of road maintenance funding and in the processes put in place to use the available funding in an efficient and effective manner.

Table 8: Maintenance Budget Allocations in Relation to the Presence of a Road Fund

Surface Type	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Budget/needs (%)	33%	54%	31%	17%	18%	44%	24%	44%	86%	36%
Road Fund	No	No*	Yes	Yes	Yes	Yes	Yes**	No	Yes	No

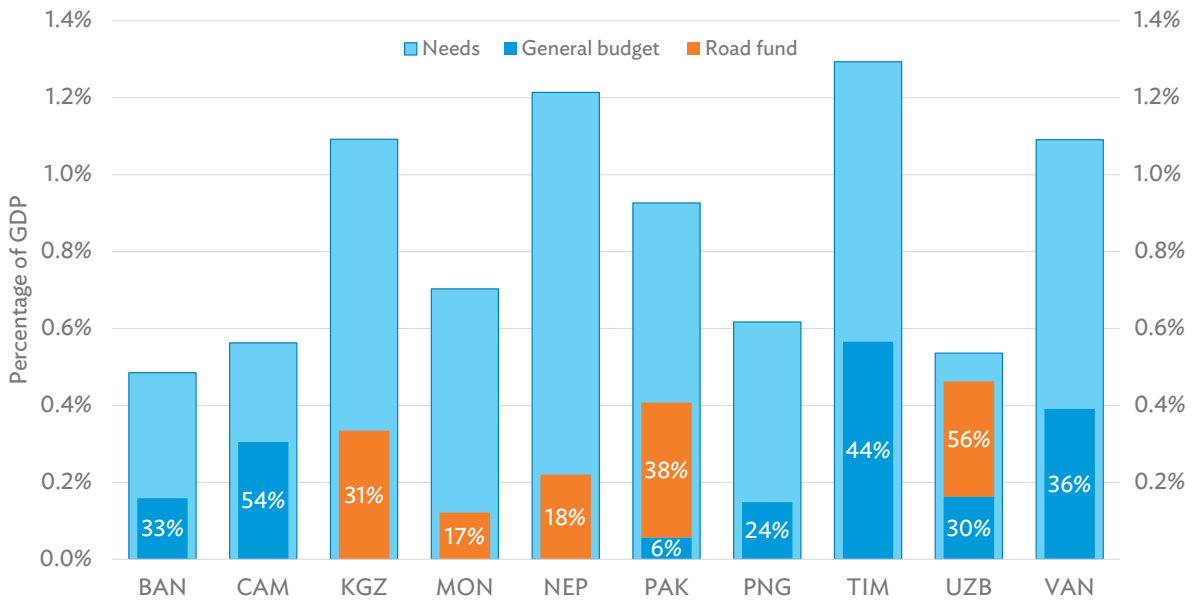
BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

* Although there is no road fund, there used to be one and some of the earmarked revenues remain.

** Although a road fund is formally in place, it is not yet operational, and funding is dependent on allocations from the General Budget.

Source: Consultant's processing of collected data.

Figure 8: Funding from General Budget and from Road Fund



BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

V. VEHICLE FLEET

The size and makeup of the vehicle fleet have an important influence on road maintenance financing and cost recovery options. First, the vehicle fleet and, more precisely, the traffic volumes and loading have an effect on the deterioration of the road network and the need for road maintenance. Second, several road user revenues are collected from vehicle owners and operators, and the size and makeup of the vehicle fleet therefore determines how much revenue can potentially be collected. Third, this study looks at the gradual transition from internal combustion engine vehicles to electric and other low-carbon vehicles, and the influence this has on road user revenues, which is strongly influenced by the type of vehicles that make up the vehicle fleet and the number of vehicles that are newly registered each year. This chapter therefore looks at the size and makeup of the vehicle fleets in the ten sample countries and the estimated growth rates of these vehicle fleets, while also looking at the current percentage of electric vehicles and the targets or expectations for future growth in the number of electric vehicles.

A. Vehicle Fleet Sizes

The numbers of registered vehicles in the 10 sample countries are presented in Table 9 and Figure 9, distinguishing between three main categories of vehicles: (i) two- and three-wheelers (e.g., motorcycles, tempos, rickshaws), (ii) light-duty vehicles (e.g., passenger cars, pickups, microbuses), and (iii) other vehicles (e.g., buses, trucks, tractors). It must be noted here that a number of countries (Bangladesh, Cambodia, Nepal, Pakistan, and Uzbekistan) only record the number of vehicles newly registered each year

(e.g., based on excise tax records), and their vehicle registration numbers are the consolidation of the different annual registration numbers without taking account of the vehicles that are decommissioned and no longer form part of the vehicle fleet. These vehicle numbers therefore result in an overestimation of the size of the vehicle fleet and related growth rates. In other countries (Papua New Guinea, Timor-Leste), data on registered vehicles is not readily available or vehicle registration systems are currently being introduced, limiting the availability of reliable data. This also affects the availability of reliable historic vehicle registration data, making it difficult to accurately estimate vehicle fleet sizes and growth rates.

Table 9: Number of Registered Vehicles by Type

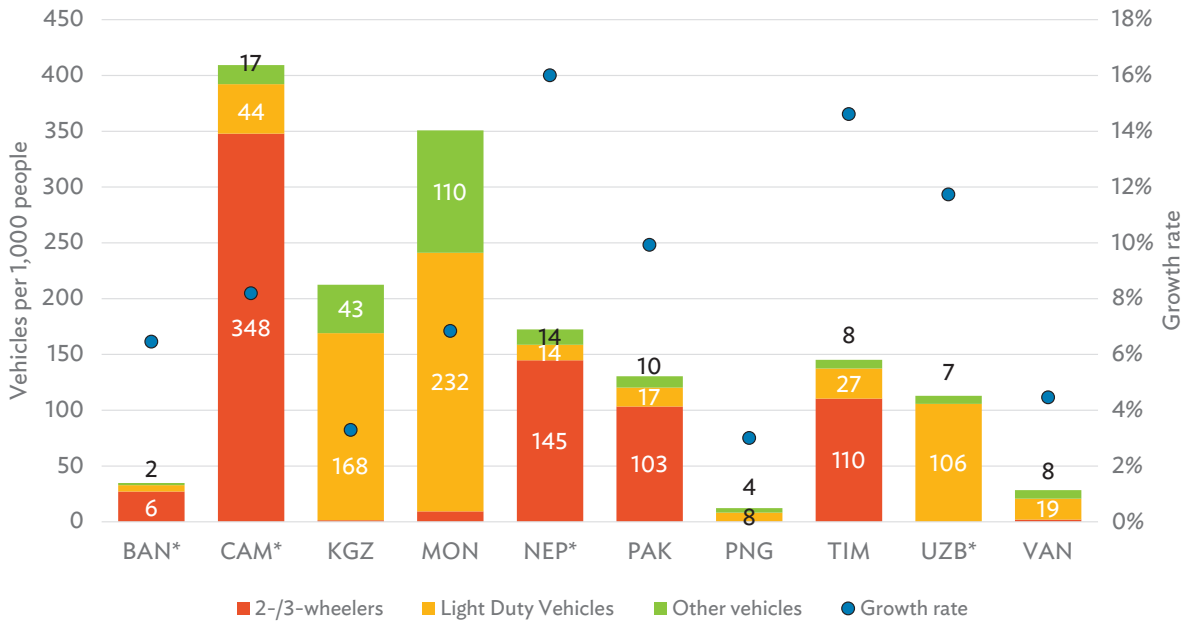
Vehicle Type	BAN* 2023	CAM* 2022	KGZ 2023	MON 2022	NEP* 2022	PAK* 2020	PNG 2023	TIM 2022	UZB* 2023	VAN 2020
2- and 3-wheelers ('000)	4,657	437	10	32	4,415	24,359	2	144	-	1
Light Duty Vehicles ('000)	953	69	1,173	788	424	4,005	81	35	3,760	6
Other vehicles ('000)	343	14	304	373	421	2,393	41	10	262	2
Total	**5,953**	**521**	**1,487**	**1,193**	**5,260**	**30,758**	**124**	**189**	**4,021**	**9**

BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

* The registered vehicle numbers in these countries do not take into account decommissioned vehicles that are no longer in operation and therefore represent an overestimation of the vehicle fleet size.

Source: Consultant's processing of collected data.

Figure 9: Number of Vehicles per 1,000 People



BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

* The registered vehicle numbers in these countries do not take account vehicles that are no longer in operation and therefore represent an overestimation of the vehicle fleet size and growth rate.

Source: Consultant's processing of collected data.

B. Two- and Three-Wheelers

On examining Table 9 and Figure 8, it immediately becomes evident that five of the ten sample countries (Bangladesh, Cambodia, Nepal, Pakistan, and Timor-Leste) have high numbers of 2- and 3-wheelers that make up an average of 80% of the vehicle fleet, while the other five sample countries (Kyrgyz Republic, Mongolia, Papua New Guinea, Uzbekistan, and Vanuatu) have small numbers of 2- and 3-wheelers that make up an average of only 2% of the vehicle fleet. For Kyrgyz Republic, Uzbekistan, and Mongolia, the harsh winters are a likely reason for the limited number of 2- and 3-wheelers. For Papua New Guinea and Vanuatu, the reason is not immediately evident, although the heavy rainfall and the relatively high GDP per capita are likely influencing factors.

The presence of large numbers of 2- and 3-wheelers in some countries has several consequences for this study. First, 2- and 3-wheelers are light and do not cause significant damage to a road network, although they can cause congestion. Because they are so light, they use less fuel and generate lower road user revenues (either related to fuel consumption or to vehicle ownership and operation) than vehicles with four or more wheels. Nevertheless, the large numbers of these vehicles can still result in up to half the total road transport fuel consumption and can generate significant road user revenues (e.g., nearly half the total revenue from vehicle import duties and taxes in Bangladesh). Another important aspect of 2- and 3-wheelers is that they are relatively easy to transition to electric propulsion. Their lifespan is shorter and their replacement by new electric versions is therefore much faster than for other vehicles. There are also inexpensive conversion kits available to replace the internal combustion engine with an electric engine for existing motorcycles. The speed with which these vehicles will transition to electric propulsion is therefore likely to be much greater than for other vehicles.

C. Vehicle Ownership Rate

One key measure of vehicle ownership rate is the number of vehicles per 1,000 people. Naturally, the number of vehicles increases with a country's population size. However, significant differences exist when comparing vehicle ownership rate by population across countries. Table 10 and Figure 8 show that Cambodia and Mongolia have the highest vehicle ownership rates, with 409 and 351 vehicles per 1,000 people, respectively. This equates to one vehicle for every 2 to 3 people. In Mongolia, this high ownership rate is due to a relatively high GDP per capita and a strong reliance on vehicles because of the vast distances and harsh winters. Conversely, Cambodia's high vehicle ownership rate stems from the prevalence of inexpensive 2- and 3-wheelers and substantial GDP growth, which has doubled in the past decade. When considering vehicles with four or more wheels per 1,000 people, Cambodia's ranking drops significantly. Here, Central Asian countries dominate due to their large distances and severe winters, which make 2- and 3-wheelers less practical and encourage the purchase of used (second-hand) cars.

Table 10: Number of Vehicles per 1,000 People

Vehicle Type	BAN* 2023	CAM* 2022	KGZ 2023	MON 2022	NEP* 2022	PAK 2020	PNG 2023	TIM 2022	UZB 2023	VAN 2020
2- and 3-wheelers	27	348	1	9	145	103	0	110	0	2
Light Duty Vehicles	6	44	168	232	14	17	8	27	106	19
Other vehicles	2	17	43	110	14	10	4	8	7	8
Total	**35**	**409**	**212**	**351**	**172**	**130**	**12**	**145**	**113**	**28**
4 or more wheels	8	61	211	341	28	27	12	35	113	26

BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

* The registered vehicle numbers in these countries do not take into account vehicles no longer in operation and therefore represent an overestimation of the vehicle fleet size.

Source: Consultant's processing of collected data.

D. New Versus Used Vehicles

The sample countries also show a variation in the registration of used and new vehicles. Most of the sample countries show high percentages of used cars being imported. The main exception is Uzbekistan, which has an important domestic vehicle manufacturing industry and where new vehicles are more common, partly as a result of financial incentives for purchasing domestically produced vehicles.[2] Bangladesh and Pakistan also have important domestic vehicle manufacturing industries, although imports of second-hand vehicles are still significant.

In the majority of sample countries, electric vehicles therefore need to compete with second-hand internal combustion engine vehicles. The second-hand market for electric vehicles is not yet strong, and those second-hand electric vehicles that are available are often first-generation vehicles with limited ranges and poor batteries. However, it is expected that second-hand electric vehicles will become more easily available over the coming 5–10 years. As there will also be a demand for second-hand electric vehicles in more developed countries, that demand will first need to be filled before they become available in large numbers in developing countries. This effect will delay the transition to electric vehicles in those countries with large numbers of imported second-hand vehicles.

In Uzbekistan, with its new domestically produced vehicles, the transition speed will be largely dependent on the introduction of domestically produced electric vehicles although the recent reduction of import duties will also result in increased numbers of imported electric vehicles. This domestic production is now starting and will likely have a large effect on the availability of electric vehicles. At the same time, the import of used (second-hand) vehicles in Uzbekistan is being opened up with the duties and taxes on imported vehicles being reduced, making it easier to import new and used electric vehicles from other countries.

The dependence on second-hand vehicle imports and the domestic vehicle manufacturing industry means that there is a lag in the availability of electric vehicles compared to more developed countries. This means that the high transition speeds to electric vehicles obtained through financial incentives in some countries like the Netherlands and Norway, will only be achievable in the sample countries after a certain number of years as the availability of electric vehicles first needs to be improved. The very low fuel prices in some countries also form an obstacle for the transition to electric vehicles.

E. Vehicle Fleet Growth

Growth rates for registered vehicles are presented in Table 11 and shown in Figure 8. These have been calculated based on historic data on vehicle registrations for the past few years. It must be noted, however, that for some countries the vehicle registrations do not take into account decommissioned vehicles, and that the vehicle fleet size and especially the growth rates could result in overestimations. For these countries (Bangladesh, Cambodia, Nepal, Pakistan and Uzbekistan), the actual growth rates are likely to be around 50%–60% of the calculated growth rates, bringing them more in line with the growth rates in the other sample countries. The only exception is Timor-Leste where vehicle registration is updated annually at the municipal level, but that still has a high growth rate. However, Timor-Leste just introduced a new system of vehicle registration, making the calculated growth rate less reliable. At the same time, the GDP growth in Timor-Leste is high, almost tripling over the past decade. A high vehicle fleet growth rate is therefore understandable, especially considering that most of the growth is with 2- and 3-wheelers.

[2] This situation may change because of the recent reduction of the import duty on vehicles imported into Uzbekistan.

Table 11: Vehicle Fleet Size and Growth Rates

Metrics	BAN* 2023	CAM* 2022	KGZ 2023	MON 2022	NEP* 2022	PAK* 2020	PNG 2023	TIM 2022	UZB* 2023	VAN 2020
Registered vehicles ('000)	5,953	6,877	1,487	1,193	5,260	30,758	124	189	4,022	9
Growth rate (%)	6%	8%	3%	7%	16%	10%	3%	15%	12%	4%

BAN = Bangladesh, KGZ = Kyrgyz Republic, CAM = Cambodia, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

* The registered vehicle numbers in these countries do not take into account vehicles that are no longer in operation and therefore represent an overestimation of the vehicle fleet size and growth rate.

Source: Consultant's processing of collected data.

The vehicle fleet growth rate is an important factor in estimating the future transition speed to electric vehicles. The higher the growth rate or, more specifically, the higher the portion of the vehicle fleet that is renewed each year through newly registered vehicles, the faster the transition to electric vehicles can potentially take place. In developed countries with vehicle fleet growth rates of around 1%, replacement rates will likely be around 5% (assuming existing vehicles are replaced every 20 years), implying that each year around 6% of the vehicle fleet will be renewed. If 20% of all newly registered vehicles would be electric, this would allow 1.2% of the vehicle fleet to transition to electric each year. Getting to 20% of the total vehicle fleet being electric will therefore take as long as 17 years. However, developing countries tend to have much higher vehicle fleet growth rates of around 5%–6%. In addition, their replacement rates are also often higher, as they tend to import second-hand vehicles with a shorter remaining lifespan. Assuming a replacement rate of 10% (existing vehicles are replaced every 10 years), the renewal rate would be in the order of 15%. Using a similar scenario where 20% of all newly registered vehicles are electric, this would allow 3% of the vehicle fleet to transition to electric each year. Getting to 20% of the total vehicle fleet being electric will then only take up to 7 years instead of 17. The vehicle fleet growth rate therefore has a significant effect on the transition speed for electrifying the vehicle fleet, increasing the effect of financial and other incentives for electrification, even where these result in a similar percentage of newly registered vehicles being electric. This will be further elaborated in the modeling of the transition speed for the ten sample countries in the third publication prepared under this study.

F. Electric Vehicles

In the sample countries, only a small percentage of the vehicle fleet currently consists of electric vehicles or other low-carbon vehicles. In half the sample countries this is 0.1% of the vehicle fleet or less. Uzbekistan is seeing a rapid increase in the number of electric vehicles as a result of the recently introduced domestic manufacturing capacity, as well as the reduction of rates for importing vehicles and the construction of charging stations. The higher percentage in Timor-Leste only involves electric motorcycles that are less dependent on charging stations and electric cars are not yet present in the country. In Nepal, the significantly higher percentage mainly involves electric 3-wheeler tempos and e-rickshaws that are used for urban public transport. The electric tempos were first introduced more than a decade ago to address the pollution in Kathmandu Valley by two-stroke internal combustion tempos, while the e-rickshaws are more recent and include vehicles manufactured in Nepal as well as imported from the People's Republic of China. Bangladesh also reportedly has a large number of such electric 3-wheelers, but these are not formally registered as legislation did not allow the registration of electric vehicles until recently.

Table 12: Number of Electric and Hybrid Vehicles

Metrics	BAN* 2023	CAM 2023	KGZ 2022	MON 2023	NEP 2022	PAK 2020	PNG 2023	TIM 2022	UZB 2023	VAN 2020
Number	8,366	1,335	1,097	378,253	150,000	25,000	3	1,504	24,500	N/A
Percentage	0.1%	0.1%	0.1%	31.7%	2.9%	0.1%	0.0%	0.8%	0.6%	N/A

BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

* Bangladesh reportedly has a large number of electric 3-wheelers, but these are not registered and do not form part of the registered vehicle fleet.

Source: Consultant's processing of collected data.

The most impressive case is that of Mongolia, where nearly one-third of the vehicle fleet involves hybrid vehicles. These are mainly second-hand Toyota Priuses that are used privately and as taxis, especially in Ulaanbaatar. The question is to which degree these vehicles drive on electric power given their age, but in any case, they are likely to have a lower fuel consumption than other internal combustion vehicles of the same age. This is mainly the result of financial incentives that are applicable to both battery electric vehicles and hybrid electric vehicles. The preference for hybrids makes sense given the limited availability of charging infrastructure and the large distances in Mongolia. This also shows the effect that financial incentives can have if sufficient vehicles are available and there are no major barriers to their operation.

Financial incentives form an important means of stimulating the transition to electric vehicles. Most of the 10 sample countries have introduced financial incentives for them, with the only exception being Timor-Leste which has not yet introduced incentives. These incentives generally involve a reduction of the rates applied to the taxes or duties for importing or purchasing a vehicle. In a few cases, it also involves reductions to the annual costs of operating such vehicles. The objective in both cases is to make the purchase of electric vehicles more attractive compared to internal combustion vehicles. An overview of the financial incentives in the ten sample countries is provided in Table 13.

Table 13: Financial Incentives for Electric Vehicles

Country	Road User Revenue	Financial Incentive
Bangladesh	Supplementary duty on vehicles	Rate set at zero for electric motorcycles and buses, rate reduced by 0%–95% for electric cars, rate unchanged for electric 3-wheelers.
Cambodia	Special tax on vehicles	Rate reduced by 0%–80% for electric motorcycles, by 50%–80% for electric cars, and by 75% for electric buses.
Kyrgyz Republic	Vehicle registration fee	Rate set at zero for battery electric vehicles and reduced by 50% for hybrid electric vehicles.
	Vehicle customs duty	Rate reduced by 40%–45% for electric vehicles from outside the EAEU.
Mongolia	Vehicle excise tax	Rate reduced by 50%–100% for electric vehicles.
Nepal	Vehicle customs duty	Rate reduced by 67% for electric 3-wheelers, by 25%–87% for electric cars, by 67% for electric minibuses, by 95% for electric buses and by 67%–75% for electric trucks. No reduction for hybrid electric vehicles.
	Vehicle excise duty	Rate reduced by 85%–90% for electric 3-wheelers, by 0%–40% for hybrid electric cars, by 30%–50% for battery electric cars, and 80%–90% for electric pickups and small trucks. No reduction for electric (mini)buses.
	Vehicle road construction and maintenance duty	Rate reduced by 33%–50% for electric motorcycles, by 33% for electric 3-wheelers, and by 37%–50% for electric cars.
	Annual vehicle tax	Rate reduced by 66%–90% for electric motorcycles and 55% for electric cars.

continued on next page

Table 13 *continued*

Country	Road User Revenue	Financial Incentive
Pakistan	Vehicle customs duty	Rate reduced by 50% for electric 2- and 3-wheelers, by 98% for electric cars, by 95% for electric buses, and by 95%–98% for electric trucks. No reduction for hybrid electric vehicles.
Papua New Guinea	Vehicle excise tax	Rate set at zero for battery electric vehicles. No reduction for hybrid vehicles.
Timor-Leste	N/A	No financial incentives for electric vehicles.
Uzbekistan	Vehicle customs duty	Rate set at zero for battery electric vehicles.
Vanuatu	Vehicle import duties	Set at zero for battery and hybrid electric vehicles.

Source: Consultant's processing of collected data.

Despite these financial incentives, there are a number of barriers to the introduction of electric vehicles. The first of these is their limited availability and affordability in the ten sample countries. This is slowly improving, especially with relatively inexpensive vehicles from the People's Republic of China. Domestic production in Uzbekistan and Nepal is also boosting availability. In most countries, however, the dependency on used vehicles and the lack of used electric vehicles together with the comparatively high price of new ones and low cost of fuel, means they are not yet readily available at competitive prices. In these countries their introduction will likely be delayed until good-quality used electric vehicles become available.

The lack of charging infrastructure is also proving to be an important factor affecting the speed of transition to electric vehicles. In all ten sample countries, the availability of charging infrastructure is limited, making it difficult to operate electric vehicles. Uzbekistan appears to be the most advanced in the construction of charging stations. Home-based charging is not a suitable option for the majority of people who do not have easy access to an electric plug for their vehicle. Until sufficient charging stations become available, the operation of electric vehicles will be problematic and will be largely limited to 2- and 3-wheelers and public transport vehicles. The availability of charging infrastructure is especially important for the operation of electric vehicles over larger distances between cities, and even more so in countries with used electric vehicles that have a more limited range.

A final barrier for a high transition speed is the lack of capacity of the electricity network for charging large numbers of vehicles. The capacity of the network to generate and transmit sufficient electricity to charge large numbers of vehicles is already proving to be a problem in developed countries, and this will be even more evident in developing countries. Many of the ten sample countries already face issues generating and transmitting sufficient electricity, and this will only become worse with the significantly increased demand for electric vehicles.

In short, there are several reasons that explain the current low adoption rates of electric vehicles, and that are likely to limit the transition speed in the years to come. Until electric vehicles become readily available at prices comparable to their internal combustion counterparts, and sufficient charging stations and charging capacity are created in the countries, the financial incentives for electrification of the vehicle fleet are likely to have less impact than in developed countries where these barriers are less evident.

VI. ROAD USER REVENUES

This chapter looks at the cost recovery options that exist for financing road maintenance. Internationally there is wide acceptance of the "user pays" concept for financing road maintenance, where road users are required to pay for the maintenance of the road network, as well as compensate for the congestion, pollution and other negative externalities associated with road use. Although this concept is widely accepted and road users provide significant revenue to the national and local governments, this revenue is not always used for road maintenance. As this chapter will demonstrate, most of the ten sample countries collect a lot more revenue from road users than is required to cover the road maintenance needs, and certainly a lot more than is allocated to road maintenance. Before looking at the actual levels of road user revenues collected, however, this chapter will first describe the different types of road user revenues that exist.

A. Types of Road User Revenues

Road user revenues refer to revenues from taxes, levies, duties, fees, and fines that are charged to road users in relation to their use of the road network. This includes two main types of road user revenues: access revenues and usage revenues.

(i) **Access revenues**. Access revenues are paid by road users in exchange for unlimited access to the road network, with fixed rates regardless of the degree of usage. No distinction is made between road users who make more use of the road and cause more damage and road users who make less use of the road. These access revenues are often applied to vehicles and paid by the vehicle owner. The rates will depend on the type of vehicle, with higher rates for heavier vehicles that do more damage or cause more pollution, and lower rates for vehicles that cause less damage and pollution (e.g., electric vehicles). These access revenues can be one-time revenues that are generally paid on the purchase or import of the vehicle (e.g., customs duty, excise tax, sales tax, first-time registration fee). The access revenues can also be periodic revenues paid on an annual or multiannual basis (e.g., annual vehicle registration fees and vehicle technical inspection fees). Some access revenues are paid in exchange for access to the entire network, while others only provide access to certain roads (e.g., vignette).

(ii) **Usage revenues**. Usage revenues are paid by road users according to the degree of usage of the road network. Road users who make more use of the road and thus cause more damage to the road are required to pay more than road users who make less use of the road. These usage revenues are generally applied to the vehicle operator, who is not necessarily the vehicle owner. The most common of these are fuel taxes that are applied to each liter of fuel (e.g., fuel excise tax, fuel levy, fuel customs duty, fuel sales tax). The greater the distance driven, the greater the fuel consumption and thus the greater fuel taxes paid. Another common type of usage revenue is tolling, where the amount to be paid by the road user depends on the distance traveled and the number of trips (and often also the type of vehicle). Usage revenues are not commonly applied to vehicles, although many countries have been contemplating the introduction of distance charging based on annual odometer readings or other verification of traveled distances. Usage revenues are by definition periodic revenues, as they are periodically collected based on the usage of the vehicle or road network.

Apart from this distinction between access and usage revenues, the road user revenues can also be distinguished based on the source of the revenue. This includes three main types: energy-based revenues, vehicle-based revenues and road-based revenues.

(iii) **Energy-based revenues**. The energy-based revenues look at the energy used for propulsion. In most cases, this involves internal combustion engines, and the energy source consists of carbon-based petroleum products or natural gas products. The most common of these energy-based revenues are the traditional fuel taxes (e.g., fuel excise tax, fuel levy, fuel customs duty, fuel sales tax). With the transition to hybrid and electric vehicles or other non-carbon fuels, these revenues will be directly impacted. The transition to electricity as the energy source allows revenues to be collected from electricity usage (e.g., electricity tax, sales tax) in the same way as has been done for petroleum and gas consumption. However, with electricity it is much harder to distinguish between usage in the road sector and other sectors, complicating the introduction of differentiated charges. Additionally, electric vehicle powertrains are significantly more efficient at converting energy into motion than internal combustion engines. As a result, the revenues from electricity tend to be much lower than from fossil fuels.

(iv) **Vehicle-based revenues**. Vehicle-based revenues are applied in different forms. The most common are one-time revenues that are collected when the vehicle is imported or purchased and registered for the first time. This may involve an excise tax, a customs duty, a sales tax or a first-time vehicle registration fee. Often several different revenues are collected at the same time and these costs can easily exceed the cost of the vehicle itself. These revenues are generally collected from both new vehicles produced domestically as well as from new and used vehicles imported into the country. Some revenues may be collected when the vehicle is sold again within the same country (e.g., vehicle ownership registration fee), although those are less common. Apart from such one-time revenues, there are several periodic revenues collected from vehicles. This may include annual vehicle registration fees or so-called road taxes[3] but also includes vehicle technical inspection fees and driving license fees. These are often paid on an annual or multiannual basis by vehicle owners. Traffic fines and fees for oversized/overweight vehicles are also considered vehicle-based revenues, as they are dependent on the vehicle and its use (usage revenues). Specific mention must also be given to distance charging which is also a vehicle-based revenue. This has similar benefits as the energy-based revenues in that it is a usage revenue, although it faces challenges regarding the measurement of the distance traveled.

(v) **Road-based revenues**. Road-based revenues are applied to specific roads and are collected from road users who choose to make use of those roads. Although the rates generally depend on the type of vehicle, they are treated as a separate category since they are only collected for certain roads or areas. The most common example of this is tolling, which is paid only for certain road sections or tunnels/bridges according to the frequency of use and the distance traveled (usage revenue). Vignettes also form a road-based revenue, although they provide unlimited access (access revenue). Other road-based revenues include fees for the transit of vehicles from other countries. Also included here are the fees paid for the usage of the right-of-way for service stations and advertising. Although these are not paid directly by road users, they are targeted at road users who pay them indirectly through the services and goods they purchase. These are also specific to certain roads.

[3] Despite being called road taxes, these are generally vehicle-based charges of which the revenue is earmarked for the road sector.

Table 14: Types of Road User Revenues

Type of Charge	Access Revenues	Usage Revenues
Energy-based charges		(i) Customs duty or excise tax on fuel (ii) VAT or sales tax on fuel/electricity (iii) Fuel tax/levy (iv) Electricity tax/levy
Vehicle-based charges	**One-time** (i) Customs duty or excise tax on vehicles (ii) VAT or sales tax on vehicles (iii) Ownership registration fee/tax	
	Periodic (i) Annual registration fee (ii) Annual vehicle tax/road tax (iii) Vehicle technical inspection fee (iv) Driver license fee (v) Heavy vehicle fee	**Periodic** (i) Vehicle distance charging (ii) Traffic fines (iii) Overweight/oversized permit fees
Road-based charges	(i) Vignette (ii) Right-of-way usage fees	(i) Tolling (ii) Foreign vehicle transit fees

Source: Consultant's processing of collected data.

An overview of the different road user revenues is provided in Table 14, distinguishing between energy-based, vehicle-based and road-based revenues, as well as between usage revenues and access revenues. It may be clear from the table that energy-based revenues tend to be usage revenues, while vehicle-based revenues tend to be access revenues and road-based can be either. Colors have been added to the different groups of road user revenues, and these colors will be repeated in subsequent charts to distinguish the different types of road user revenues. In the case of vehicle-based revenues, a further distinction has been made between one-time revenues and periodic revenues.

Table 14 also shows that some similar taxes and duties are applied to energy-based revenues and vehicle-based revenues. The most common of these are the customs tax or duty, the excise tax or duty and the sales tax. It is therefore important to understand the differences between these three commonly applied taxes and duties.

(i) **Customs duty**. The customs duty is levied on the import of goods into the country and is paid by the receiver of those goods. Specific goods have their own customs duty rates. It is generally collected by the customs agency. It is only applicable to goods that are imported into the country and is not applicable to domestically produced goods. If a country has a strong domestic oil production or vehicle manufacturing industry, the customs duty will provide less revenue.

(ii) **Excise tax**. The excise tax is levied on the manufacture, sale or consumption of goods and is paid by the manufacturer or seller of those goods. Specific goods have their own excise tax rates. In some countries, it is only applied to domestically produced goods (to compensate for the lack of customs duty on those goods), while in other countries it is applied to both domestically produced and imported goods. It is generally collected by the tax revenue agency, although for imported goods it is often collected by the customs agency together with the customs duty.

(iii) **Sales tax**. The sales tax or value-added tax is levied on the sale of goods and paid by the consumers of those goods. It is generally collected by the tax revenue agency from the points of sale. Most countries have a fixed sales tax rate that is applied to all goods, sometimes with two or three categories of rates. Because it is a flat rate applied across a wide range of goods, the revenue is often not regarded as road user revenue. In this document, it has been included as a road user revenue in the consideration that the sales tax on fuel and vehicles is paid specifically by road users. In the case of sales tax on fuel, this revenue will also be directly impacted by the transition to electric vehicles.

Apart from these three most common forms of taxes and duties, there are several variations of taxes, duties and levies that are applied to fuel and vehicles. However, these are specific to each country and are discussed in more detail in the country case studies that are included in the appendices to this publication.

B. Levels of Road User Revenues

Information on the specific road user revenues collected in the ten sample countries can be found in the country case studies at the end of this publication. Table 15 presents an overview of the revenues collected annually in each of the ten countries, distinguishing between the different categories of road user revenues as presented in Section 6.1 and Table 15. In Figure 9, the road user revenues are compared to the GDP of the countries concerned to account for the differences in size and population of each country.

The data clearly show the dominance of energy-based revenues.[4] This mainly involves fuel taxes, duties and levies applied to carbon-based fuels. On average, the energy-based revenues from fuel taxes and duties make up more than 60% of the total road user revenues, forming as much as 75%–80% in Pakistan, Papua New Guinea, and Timor-Leste. In Pakistan, the energy-based revenues make up 1.5% of GDP, while in Papua New Guinea and Timor-Leste, they form only 0.3%–0.5% of GDP, and the high score is only because of the lack of other road user revenues. Only in Cambodia, Nepal, and Uzbekistan does the fuel-based revenue drop below 50% of total revenue, with the lowest percentage in Cambodia (38%). But in each of these countries, the energy-based revenues still provide more than 1.0% of GDP (2.2% in Cambodia) and the low score is mainly due to the importance of other road user revenues. On average, energy-based revenues make up 1.1% of GDP, dropping below 1.0% only in Bangladesh, Papua New Guinea, and Timor-Leste where the total road user revenues form only 0.5%–0.8% of GDP. This shows the high dependency on fuel-based revenues. These revenues are not just important for road maintenance, but also as a general revenue for the government as a whole.

Table 15: Levels of Road User Revenues by Country
($ million/year)

Road User Revenues	BAN	CAM	KGZ	MON	NEP	PAK	PNG	TIM	UZB	VAN
Energy-based (usage)	1,856	660	148	266	574	5,680	144	11	827	14
Vehicle-based (one-time)	984	935	98	129	526	828	15	4	1,066	6
Vehicle-based (periodic)	506	100	13	4	121	162	20	-	32	2
Vehicle-based (usage)	-	-	2	-	-	17	-	-	-	-
Road-based (access)	-	-	-	-	-	12	-	-		-
Road-based (usage)	108	40	1	3	3	198	-	-	20	-
Total	**3,454**	**1,735**	**261**	**402**	**1,224**	**6,897**	**179**	**15**	**1,945**	**21**
% GDP	0.8%	5.9%	2.3%	2.4%	3.0%	1.8%	0.6%	0.5%	2.4%	1.9%
% Maintenance needs	155%	1,045%	208%	335%	247%	199%	92%	36%	451%	173%

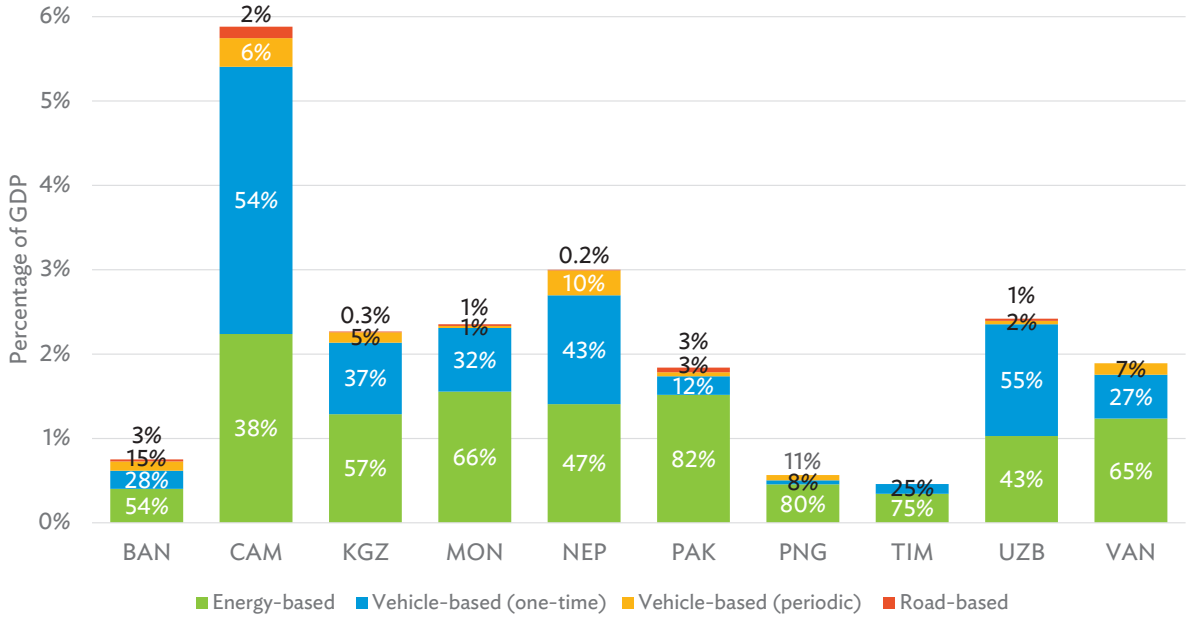
BAN = Bangladesh, CAM = Cambodia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Note: The year for which revenue data was collected or estimated varies by country and by revenue source. The exact years are indicated in the country case studies further on in this document.

Source: Consultant's processing of collected data.

[4] This publication only looks at energy use in the road subsector and does not energy usage for other transport subsectors or other sectors.

Figure 10: Road User Revenues by Country



BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

The one-time vehicle-based revenues form the second most important source of road user revenues. These revenues are collected on the first registration of imported and domestically produced vehicles. These make up 32% of the total road user revenues on average, although there is greater variation between the different countries. Extremes are found in Cambodia, Nepal, and Uzbekistan, where these one-time revenues provide 43%–55% of total road user revenues, forming between 1.3% and 3.2% of GDP. In Pakistan and Papua New Guinea, these revenues are far less important and form only 8%–12% of total revenue, providing less than 0.2% of GDP. On average, the one-time vehicle-based revenues comprise 0.9% of GDP, but this is mainly the result of the high revenue in Cambodia (3.2% of GDP), and in half the countries this revenue forms less than 0.5% of GDP. Apart from Pakistan and Papua New Guinea, this includes Bangladesh, Timor-Leste, and Vanuatu where these revenues form less than 30% of total road user revenues.

Periodic vehicle-based revenues only form 6% of total road user revenues on average, reaching more than 10% only in Bangladesh, Nepal, and Papua New Guinea. In all ten sample countries, the revenues make up only 0.3% of GDP or less. In eight of the ten countries, this revenue includes an annual road tax, (motor) vehicle tax or vehicle registration fee, which all function in more or less the same way. Only in Uzbekistan is there a specific fee for heavy vehicles. In Timor-Leste, no periodic vehicle-based revenue is currently being collected. The low score of these revenues is explained by the fact that the revenue collection often forms a challenge, requiring an up-to-date database on vehicle ownership and owner addresses, as well as more stringent enforcement. As such, these revenues are less easy to apply than the one-time vehicle-based revenues that are collected at the point of import or sale.

Road-based revenues form a small portion of total road user revenues, averaging just over 1% of total road user revenues and less than 0.03% of GDP. In six of the ten countries, this involves toll collection in roads, bridges and tunnels. Although tolling is generally seen as an important road user revenue, the revenue levels are often low in developing countries due to low traffic volumes and high collection

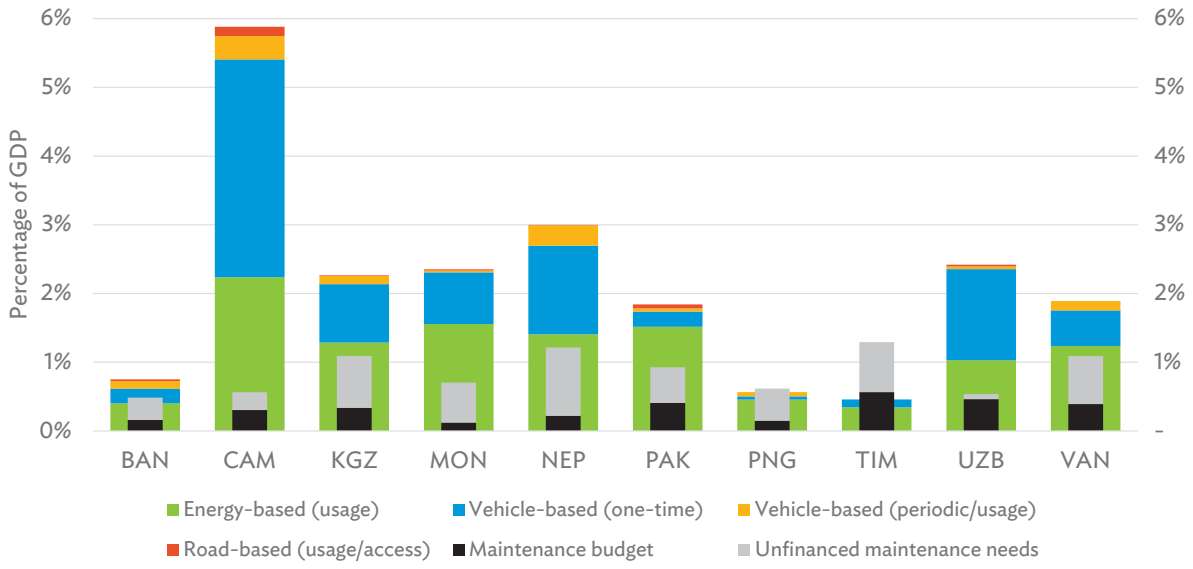
costs. The main benefit of tolling is seen in the fact that the revenue is more easily earmarked for road maintenance since the collection is often carried out by the road agency (and in some cases by the concessionaire responsible for the road). In Pakistan, besides tolling, revenue is also collected from right-of-way usage fees. In Uzbekistan, road-based revenue comes from the fees paid by foreign vehicle operators to make use of the road network. In Papua New Guinea, Timor-Leste, and Vanuatu there is no collection of road-based revenues.

On average across all ten countries, the total road user revenues make up 2.1% of GDP. This appears to be an appropriate revenue level, as it allows the road maintenance needs to be covered that form 0.9% of GDP on average ("user pays" principle), while also providing some general revenue to the government (considering that some road user revenues may be considered to be more general taxes or duties). In six of the ten countries (Kyrgyz Republic, Mongolia, Nepal, Pakistan, Uzbekistan, and Vanuatu) we see that the road user revenues are around this value, ranging from 1.8% to 3% of GDP. The other four countries are outliers.

Most striking is Cambodia, where road user revenues make up 5.9% of GDP. Especially the one-time vehicle-based revenues appear to be high here, and then more specifically the special tax on vehicles that comprises 27% of total revenues. Although this implies that sufficient revenue is being collected to cover the road maintenance costs as well as provide revenue to the General Budget, it also suggests that road users are excessively burdened and contribute a disproportionate amount to government revenues. This can limit economic growth in sectors that are highly dependent on road transport. The other outliers are Bangladesh, Papua New Guinea, and Timor-Leste, where the road user revenues are between 0.5% and 0.8% of GDP. Here the revenues are likely to be insufficient or barely sufficient to cover the road maintenance costs. This is made more visible by comparing the revenue levels to the road maintenance needs and budgets as described in Chapter 4, the results of which are shown in Figure 10.

In the six countries with road user revenues around 2% of GDP (Kyrgyz Republic, Mongolia, Nepal, Pakistan, Uzbekistan, and Vanuatu), we see that the road maintenance needs are between 40% and 60% of total road user revenues. In Mongolia the road maintenance needs are 30% of the road user revenues, as the needs are currently relatively low since most of the network is unpaved and receives little to no maintenance. This percentage will rapidly increase as a greater portion of the road network is paved. In Uzbekistan, road maintenance needs are only 22% of the road user revenues, as the rural road maintenance needs only include the core rural road network. If the non-core rural roads are also included, this percentage will also go up. In all six cases, there is sufficient revenue to cover the needs, and the main challenge is ensuring that a significant portion of this revenue is actually allocated to road maintenance. In these six countries, the budget allocations to road maintenance form only 5%–20% of collected road user revenues. Especially Mongolia and Nepal have low allocations for road maintenance and low coverage of maintenance needs.

Figure 11: Road User Revenues and Road Maintenance Needs and Budgets by Country



BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

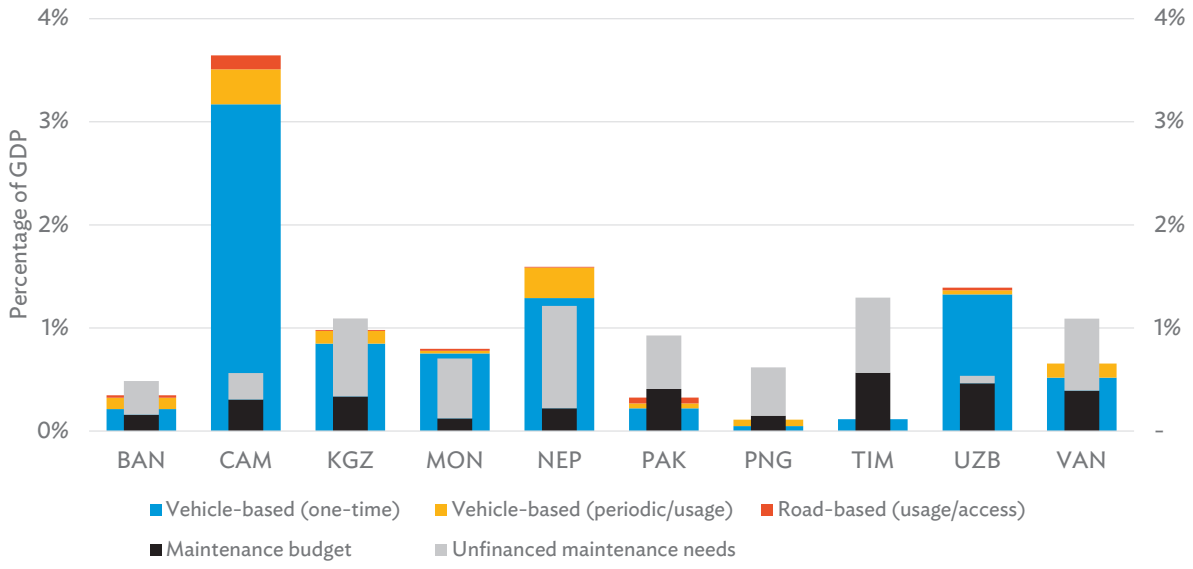
Cambodia is clearly an exception due to its extremely high road user revenues that are over ten times the road maintenance needs. It is likely that the road maintenance needs are underestimated here, but even with higher estimated needs, the road user revenues would be many times higher. As mentioned earlier, this puts a disproportionate burden on road users and can limit economic growth in sectors that are highly dependent on road transport.

In Bangladesh, road maintenance needs are 65% of road user revenues. Although the revenues can easily cover the needs, there is a risk that this will not be the case in the future as more roads are paved and road maintenance needs increase. Here the road user revenues should be increased from the current 0.8% of GDP to a level closer to 2.0% of GDP to ensure adequate coverage of road maintenance needs while also providing revenue to the General Budget. In Papua New Guinea, the road user revenues are actually slightly below the maintenance needs, implying that the "user pays" principle is not being effectively applied. Actual budget allocations to road maintenance are only 24% of the maintenance needs, meaning that the budget allocations can still be easily covered by road user revenues. Here too, road user revenue levels need to be increased significantly to cover road maintenance needs. Timor-Leste has the worst scenario, with road user revenues covering only 36% of maintenance needs. Here, even the budget allocations to road maintenance are higher than the road user revenues, implying that the government is allocating non-road user revenues to road maintenance (revenues from oil production). In Timor-Leste, there is an urgent need to increase the road user revenue levels by increasing rates or introducing complementary revenue sources.

The transition to electric vehicles and the decarbonization of road transport will only exacerbate the situation of road maintenance financing. The high dependence on fuel-based road user revenues means that the revenue levels will be directly affected by this transition as less fuel is consumed. This effect will not be immediate, and the speed with which it takes place will vary from one country to the next (the third publication in this study will look specifically at this aspect). However, it will be clear that all ten sample countries will be affected sooner or later. To visualize this effect, the fuel-based road user

revenues have been removed in Figure 11. Some other road user revenues may also be affected by the transition to electric vehicles, especially where lower rates are applied to electric vehicles. However, it is expected that these lower rates will be adjusted as the percentage of electric vehicles in the vehicle fleet and new vehicle registrations increase.

Figure 12: Road User Revenues Excluding Fuel-Based Revenues



BAN = Bangladesh, CAM = Cambodia, GDP = gross domestic product, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, PNG = Papua New Guinea, TIM = Timor-Leste, UZB = Uzbekistan, VAN = Vanuatu.

Source: Consultant's processing of collected data.

With the removal of the fuel-based road user revenues, Figure 11 provides a disturbing picture where in seven of the ten countries the road maintenance needs exceed the road user revenues. Only in Cambodia and Uzbekistan do the road user revenues continue to form more than double the road maintenance needs, mainly as a result of the high vehicle-based road user revenues. In Nepal the road user revenues also continue to exceed the road maintenance needs, but only barely. As more roads are paved, the maintenance needs will increase and quickly exceed the road user revenues. The future situation may not be as dire as depicted here, as increased vehicle numbers will lead to increased vehicle-based revenues. However, these increased vehicle numbers will also require a greater road length and will lead to increased road maintenance needs. The gradual reduction of fuel-based revenues will therefore have significant consequences for the overall revenues of the government, and specifically on the budget allocations to road maintenance. Although the majority of road user revenues is currently not spent on road maintenance, any loss of revenue is likely to disproportionately affect road maintenance financing.

To address this issue, the levels of other road user revenues need to be increased. This can be achieved by increasing the rates of existing vehicle-based and road-based revenues, but it can also be achieved by introducing new road user revenues (e.g., road distance charging). The second publication in this study will look at possible alternatives to fuel-based revenues, describing the advantages and disadvantages of application in the ten sample countries. The third publication in this study will subsequently take the most promising alternative road user revenues, and model how these are best introduced in each of the ten sample countries, describing how fuel-based revenues are likely to be affected over time given the expected transition speeds to electric vehicles in each country, and how this can be compensated through the alternative road user revenues.

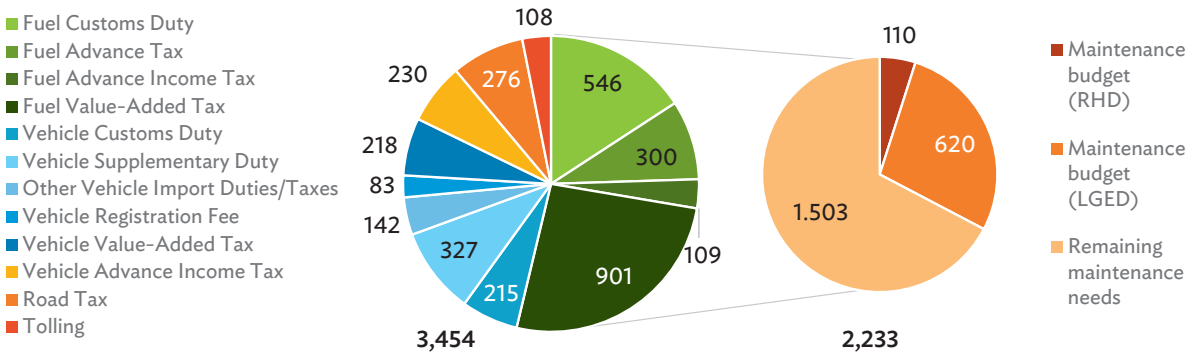
VII. POTENTIAL IMPACT OF EV TRANSITION ON REVENUES

This final chapter provides a more detailed overview of the situation in each of the 10 sample countries regarding road maintenance financing and cost recovery options. Special attention is given to the expected impact of the transition to electric vehicles on these cost-recovery options. This publication considers that the road user revenues should be at least double the road maintenance needs, allowing part of the revenues to be used for other purposes as they are currently (road improvements or for other sectors altogether). This chapter looks to which degree this is achieved currently, and how this may be affected by the loss of revenues from fossil fuel related road user revenues. Further information on each of the sample countries can be found in the country case studies in the appendices to this publication.

A. Bangladesh

Bangladesh has a large road network of 395,231 km, of which a large portion is paved (45%). The road density per area is high at 304 km per 100 km^2, although the road density per population is low at only 23 km per 1,000 people. In terms of GDP, the road density is the lowest of all ten sample countries at 43 km per $20 billion GDP. Road maintenance needs are estimated at $2,233 million per year (Figure 12), equivalent to 0.5% of GDP. The allocated road maintenance budget of $730 million covers only 33% of these needs. Road user revenues are relatively low and amount to $3,454 million, forming 1.5 times the estimated road maintenance needs and only 0.8% of GDP. Half of the road user revenues come from fuel-based revenues, involving an amount of $1,856 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues being able to cover only 72% of road maintenance needs. The revenue from the supplementary duty on vehicles will also be affected as the rate is set at zero for electric motorcycles and up to 95% lower for other electric vehicles, potentially affecting a further $327 million in revenue. Current numbers of registered electric vehicles are low, partly due to legislative obstacles hindering registration in the past (there are reportedly large numbers of unregistered electric 3-wheelers). The vehicle fleet includes large numbers of 2- and 3-wheelers (78% of registered vehicles) that will likely transition more quickly to electric. Financial incentives for the import of electric vehicles and the introduction of a domestic manufacturing capacity for electric vehicles are expected to further speed up the transition process. However, the lack of charging infrastructure and the limited capacity of the electricity network will form impediments to the transition.

Figure 13: Road User Revenues versus Maintenance Needs and Budgets in Bangladesh
($ million)



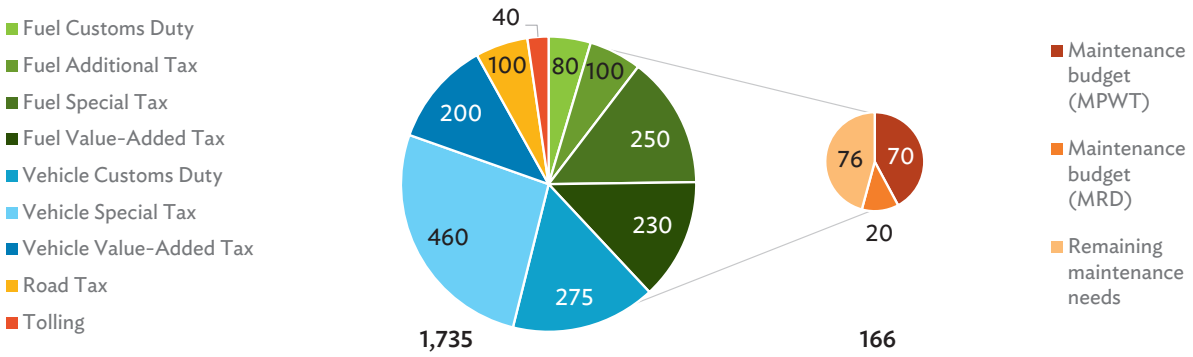
LGED = Local Government Engineering Department, RF = Road Fund, RHD = Roads and Highway Department.

Source: Consultant's processing of collected data.

B. Cambodia

Cambodia has a road network of 67,714 km, of which only a small portion is paved (19%). The road density per area averages 38 km per 100 km^2, the road density per population at 40 km per 1,000 people, and the road density per GDP at 115 km per $20 billion GDP. Road maintenance needs are estimated at $166 million per year (Figure 13), equivalent to 0.6% of GDP. The allocated road maintenance budget of $90 million covers 54% of needs. Road user revenues are extremely high and amount to $1,735 million, forming 10 times the estimated road maintenance needs and 5.9% of GDP, the highest of any of the ten sample countries. Only 38% of the road user revenues are fuel-based revenues, an amount of $660 million that will be directly affected by the transition to electric vehicles. Even with the loss of this fuel-based revenue, however, the remaining road user revenues will still be six times the estimated road maintenance needs. The revenue from the special tax on vehicles will also be affected as the rate is set to 80% lower for electric vehicles, potentially affecting a further $205 million in revenue. The current number of registered electric vehicles is low. The vehicle fleet includes large numbers of 2- and 3-wheelers (85% of registered vehicles) that will likely transition more quickly to electric. Financial incentives for the import of electric vehicles are still limited, and the lack of charging infrastructure will form an impediment to the transition.

Figure 14: Road User Revenues versus Maintenance Needs and Budgets in Cambodia
($ million)



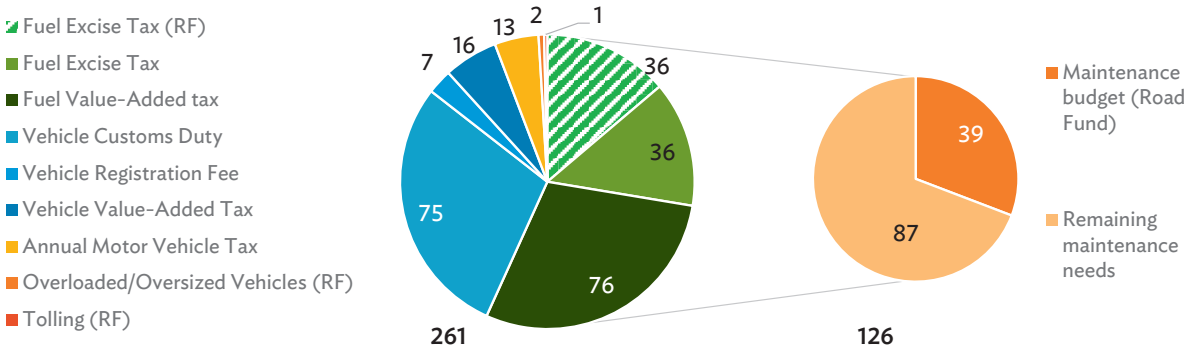
MPWT = Ministry of Public Works and Transport, MRD = Ministry of Rural Development, RF = Road Fund.
Source: Consultant's processing of collected data.

C. Kyrgyz Republic

Kyrgyz Republic has a road network of 34,132 km, of which 29% is paved. The road density per area is low at 18 km per 100 km^2, while the road density per population is 49 km per 1,000 people, and the road density per GDP at 148 km per $20 billion. Road maintenance needs are high and are estimated at $126 million per year GDP (Figure 14), equivalent to 1.1% of GDP, indicating a challenge for financing. The allocated road maintenance budget of $39 million covers only 31% of needs. Road user revenues amount to $261 million, which is two times the estimated road maintenance needs and 2.3% of GDP. Over half the road user revenues are from fuel-based revenues, involving an amount of $148 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues covering 90% of road maintenance needs. The loss of fuel-based revenue will specifically affect the Road Fund, where the fuel excise tax revenue is the main source of funding. The revenue from the customs duty on vehicles and the vehicle registration fee will also be affected as the rates are set from zero to 50% lower for electric vehicles, potentially affecting a further $38 million

in revenue. The current number of registered electric vehicles is low. The vehicle fleet includes hardly any 2- and 3-wheelers (1% of registered vehicles), and the transition from light-duty vehicles to electric will likely be slower. Financial incentives for electric vehicles are limited and fossil fuel costs are low. However, the lack of charging infrastructure and the limited capacity of the electricity network will form impediments to the transition.

Figure 15: Road User Revenues versus Maintenance Needs and Budgets in Kyrgyz Republic
($ million)

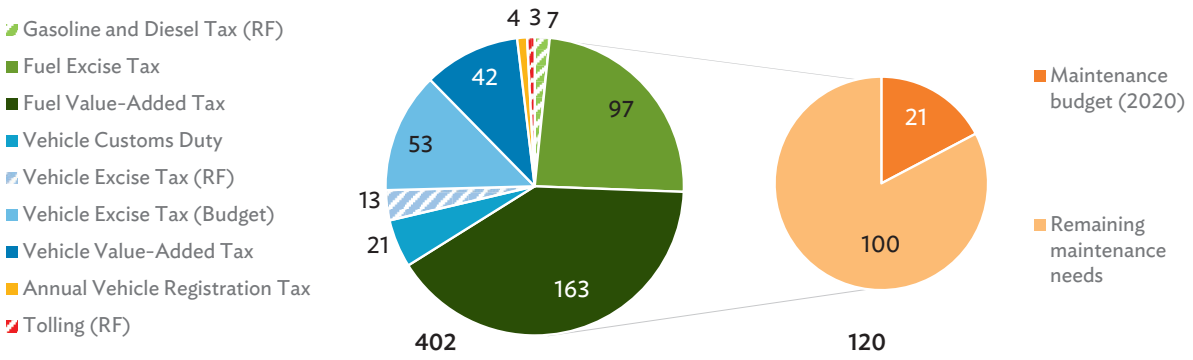


Source: Consultant's processing of collected data.

D. Mongolia

Mongolia has a road network of 113,053 km, of which only 10% is paved. Due to the large country size and the small population, the road density per area is extremely low at 7 km per 100 km^2, while the road density per population is extremely high at 333 km per 1,000 people, as is the road density per GDP at 331 km per $20 billion. Road maintenance needs are estimated to amount to $120 million per year (Figure 15), equivalent to 0.7% of GDP. However, the maintenance needs are expected to increase rapidly with the ongoing paving of the international and state roads. The allocated road maintenance budget of $21 million only covers 17% of needs, the lowest of all ten sample countries. Road user revenues are average and amount to $402 million, forming more than 3 times the estimated road maintenance needs and 2.4% of GDP. With the expected increase in road maintenance needs as a result of the paving of international and state roads, road user revenues are expected to form around two times the estimated needs. Two-thirds of the road user revenues are from fuel-based revenues, involving an amount of $266 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues barely being able to cover the road maintenance needs, especially if the needs increase as a result of ongoing paving works. This is especially relevant since the revenue from the gasoline and diesel tax is the main source of funding for the Road Fund. The revenue from the excise tax on vehicles will also be affected as the rate is set 50%–100% lower for electric vehicles, potentially affecting a further $66 million in revenue. This revenue is also partially earmarked for the State Road Fund. Current numbers of battery electric vehicles are low, but hybrid electric vehicles make up 34% of the registered vehicles, mainly involving second-hand imports from Japan. There are hardly any 2- and 3-wheelers (3% of registered vehicles), and the transition of light-duty vehicles to electric will likely be slower. Financial incentives such as lower taxes and duties on the import of hybrid and electric vehicles have proven to work well for the transition to hybrid electric vehicles, but the lack of charging infrastructure and the large distances between cities is proving to be an impediment to the transition to battery electric vehicles.

Figure 16: Road User Revenues versus Maintenance Needs and Budgets in Mongolia
($ million)

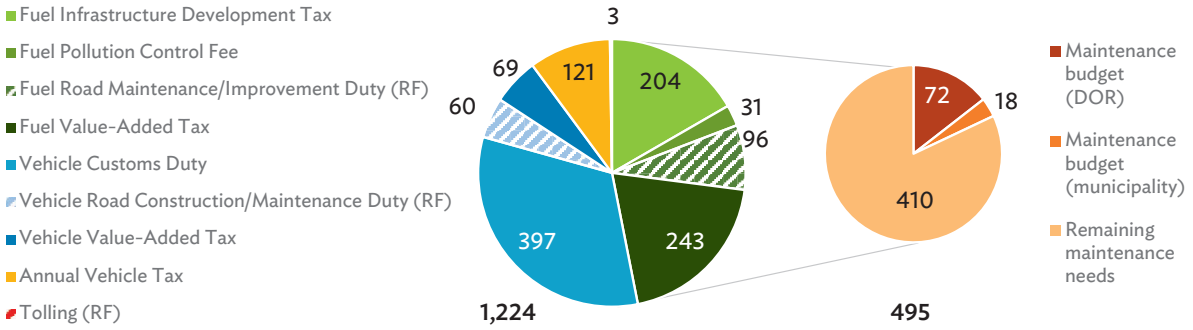


RF: Road Fund
Source: Consultant's processing of collected data.

E. Nepal

Nepal has a road network of 75,796 km, of which only 15% is paved. The average road density per area is 53 km per 100 km^2 and the road density per population is relatively low at 25 km per 1,000 people. The road density per GDP is slightly below average at 93 km per $20 billion. Road maintenance needs are high and are estimated to amount to $495 million per year, equivalent to 1.2% of GDP and indicating a challenge for financing. These needs are expected to increase further as new roads are constructed and existing roads are paved. The allocated road maintenance budget of $90 million only covers 18% of needs, only just higher than Mongolia. Road user revenues are high and amount to $1,224 million, forming 2.5 times the estimated road maintenance needs and 3% of GDP. Nearly half of the road user revenues are from fuel-based revenues, involving an amount of $574 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues barely being able to cover maintenance needs, especially if needs increase as a result of ongoing road paving and network expansion works. The loss of fuel-based revenue is especially relevant since the fuel levy on gasoline and diesel is the main source of funding for the Road Fund. The revenue from the customs duty and excise duty on vehicles as well as the vehicle road construction and maintenance duty and the annual vehicle tax will also be affected as rates are set up to 95% lower for electric vehicles, potentially affecting a further $400 million in revenue. Current numbers of registered electric 3-wheelers are relatively high in the cities, but other electric vehicles are almost nonexistent. The vehicle fleet includes large numbers of 2- and 3-wheelers (84% of registered vehicles) that will likely transition more quickly to electric. The large number of financial incentives are likely to contribute to the transition to electric vehicles. However, the lack of charging infrastructure and the limited capacity of the electricity network will form impediments to the transition.

Figure 17: Road User Revenues versus Maintenance Needs and Budgets in Nepal
($ million)

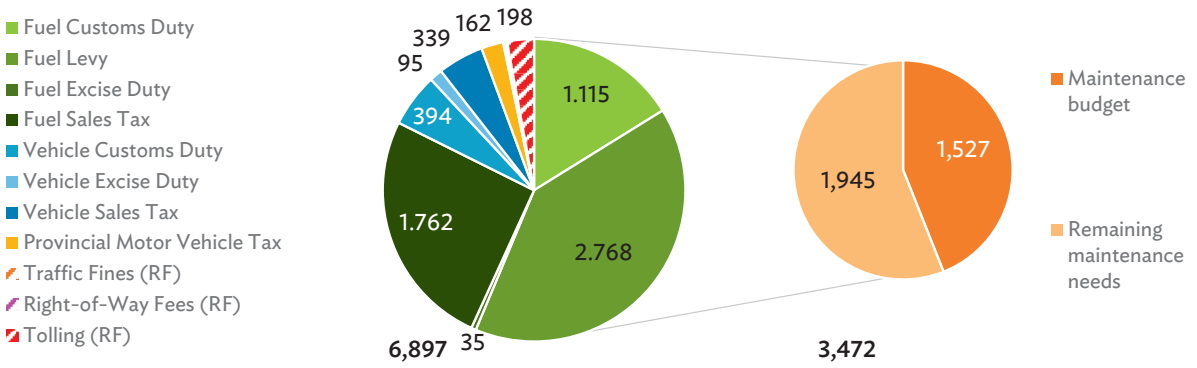


DOR = Department of Roads, RF = Road Fund
Source: Consultant's processing of collected data.

F. Pakistan

Pakistan has a very large road network of 500,750 km, of which a large portion (40%) is paved. The average road density per area is 65 km per 100 km^2, but the road density per population is relatively low at 21 km per 1,000 people, as is the road density per GDP at 67 km per $20 billion GDP. Road maintenance needs are average and are estimated to amount to $3,472 million per year, equivalent to 0.9% of GDP. The allocated road maintenance budget of $1,527 million covers 44% of needs. Road user revenues are average and amount to $6,897 million, forming two times the estimated road maintenance needs and 1.8% of GDP. Over 80% of road user revenues are from fuel-based revenues, the highest of any of the ten sample countries, involving an amount of $5,680 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues being able to cover only 35% of the road maintenance needs. The revenue from the customs duty on vehicles will also be affected as the rates are set up to 98% lower for electric vehicles, potentially affecting a further $394 million in revenue. The current number of registered electric vehicles is low. The vehicle fleet includes large numbers of 2- and 3-wheelers (79% of registered vehicles) that will likely transition more quickly to electric. Financial incentives for the import of electric vehicles and the introduction of domestic manufacturing capacity for electric vehicles are expected to further speed up the transition process. However, the lack of charging infrastructure and the limited capacity of the electricity network will form impediments to the transition.

Figure 18: Road User Revenues versus Maintenance Needs and Budgets in Pakistan
($ million)



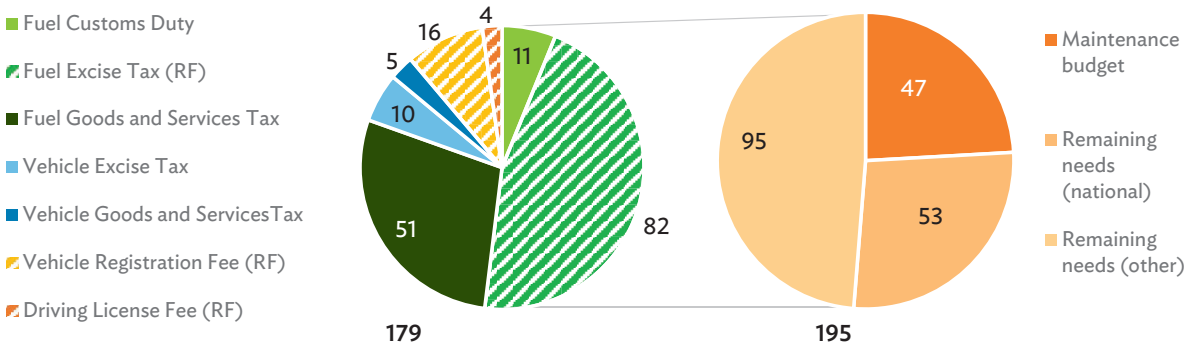
RF: Road Fund

Source: Consultant's processing of collected data.

G. Papua New Guinea

Papua New Guinea has a road network of 29,738 km, of which only 11% is paved. The road density per area is low at 7 km per 100 km^2, as are the road density per population at 29 km per 1,000 people and the road density per GDP at 47 km per $20 billion GDP. As a result of the low road densities, road maintenance needs are low and are estimated to amount to $195 million per year, equivalent to only 0.6% of GDP. The allocated road maintenance budget of $47 million covers only 24% of needs. Road user revenues are low and amount to $179 million, less than the estimated road maintenance needs and only 0.6% of GDP. Just over 80% of road user revenues are from fuel-based revenues, involving an amount of $144 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues being able to cover only 18% of the road maintenance needs. The loss of fuel-based revenue is especially relevant since the fuel excise tax revenue is the main source of funding for the Road Fund. The revenue from the excise tax on vehicles will also be affected as the rate is set at zero for battery electric vehicles, potentially affecting a further $10 million in revenue. The current number of registered electric vehicles is extremely low. There are hardly any 2- and 3-wheelers (1% of registered vehicles), and there is limited capacity to afford light-duty electric vehicles. Financial incentives for the import of electric vehicles are unlikely to have a significant impact on the transition speed as there is a high dependency on second-hand vehicles. The lack of charging infrastructure and the limited capacity of the electricity network form additional impediments to the transition.

Figure 19: Road User Revenues versus Maintenance Needs and Budgets in Papua New Guinea
($ million)



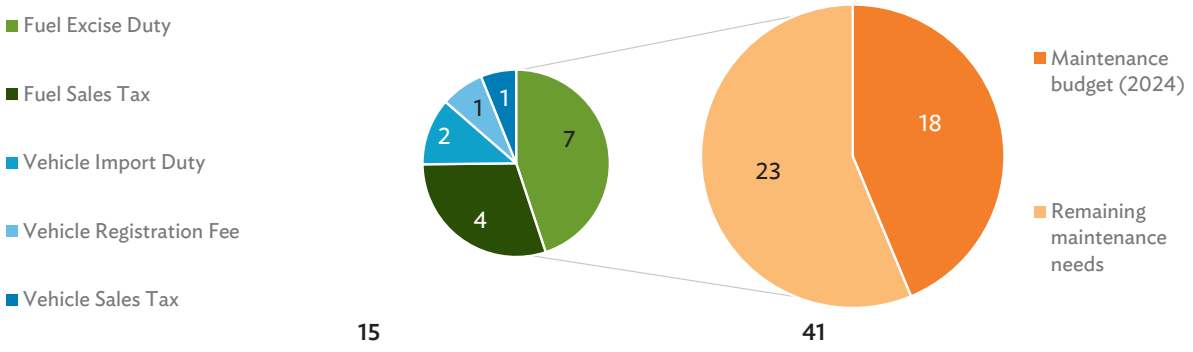
RF: Road Fund

Source: Consultant's processing of collected data.

H. Timor-Leste

Timor-Leste has a small road network of 7,505 km, of which 37% is paved. The average road density per area is at 50 km per 100 km^2, as are the road density per population at 51 km per 1,000 people and the road density per GDP at 117 km per $20 billion GDP. Road maintenance needs are high and are estimated to amount to $41 million per year, equivalent to 1.3% of GDP, the highest of any of the ten sample countries and implying a challenge for financing. The allocated road maintenance budget of $18 million covers 44% of needs. Road user revenues are extremely low and amount to only $15 million, only one-third of the estimated road maintenance needs and only 0.5% of GDP, the lowest of the ten sample countries. Over 75% of the road user revenues is from fuel-based revenues, involving an amount of $11 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues being able to cover only 9% of the road maintenance needs, the lowest of the ten sample countries. Other road user revenues are not directly affected by the transition to electric vehicles but provide little revenue. Current numbers of registered electric vehicles are relatively low, mainly involving electric motorcycles. The vehicle fleet includes large numbers of 2- and 3-wheelers (76% of registered vehicles) that will likely transition more quickly to electric. There are currently no financial incentives for the import of electric vehicles. The high dependency on second-hand cars will make it difficult to introduce electric cars. The lack of charging infrastructure and the limited capacity of the electricity network form additional impediments to the transition.

Figure 20: Road User Revenues versus Maintenance Needs and Budgets in Timor-Leste
($ million)

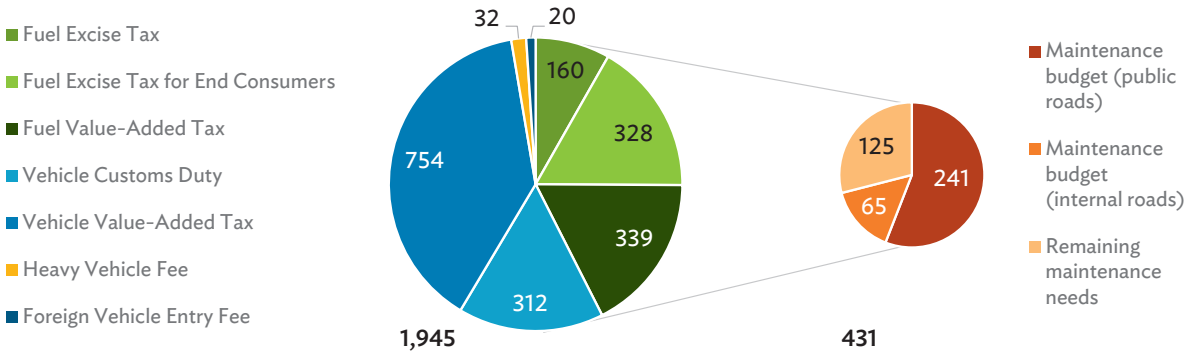


Source: Consultant's processing of collected data.

I. Uzbekistan

Uzbekistan has a large road network of 182,000 km, of which 48% is paved, the highest percentage of any of the ten sample countries. The average road density per area is 41 km per 100 km^2, as are the road density per population at 68 km per 1,000 people and the road density per GDP at 113 km per $20 billion GDP. Estimated road maintenance needs are low at $431 million per year, equivalent to 0.5% of GDP. However, this does not yet include the maintenance needs for the non-core rural roads and total maintenance needs are likely higher. The allocated road maintenance budget of $372 million covers 86% of needs, the highest percentage of the ten sample countries. Road user revenues are high and amount to $1,945 million, forming 4.5 times the estimated road maintenance needs and 2.4% of GDP. Just over 40% of road user revenues are from fuel-based revenues, involving an amount of $827 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will still result in the remaining road user revenues forming 2.5 times the estimated road maintenance needs. There is a road fund, but it is not directly financed by road user revenues and would not be directly impacted by the loss of fuel-based revenues. The revenue from the customs duty on vehicles will be affected by the transition to electric vehicles as the rate is set at zero for battery electric vehicles, potentially affecting a further $312 million in revenue. The current number of registered electric vehicles is relatively low. There are no registered 2- and 3-wheelers, and the transition of light-duty vehicles to electric will likely be slower. Financial incentives for the import of electric vehicles and the introduction of a domestic manufacturing capacity for electric vehicles are expected to speed up the transition process. There are already several charging stations in the country and there are targets to introduce many more, providing further incentives for the transition to electric vehicles.

Figure 21: Road User Revenues versus Maintenance Needs and Budgets in Uzbekistan
($ million)

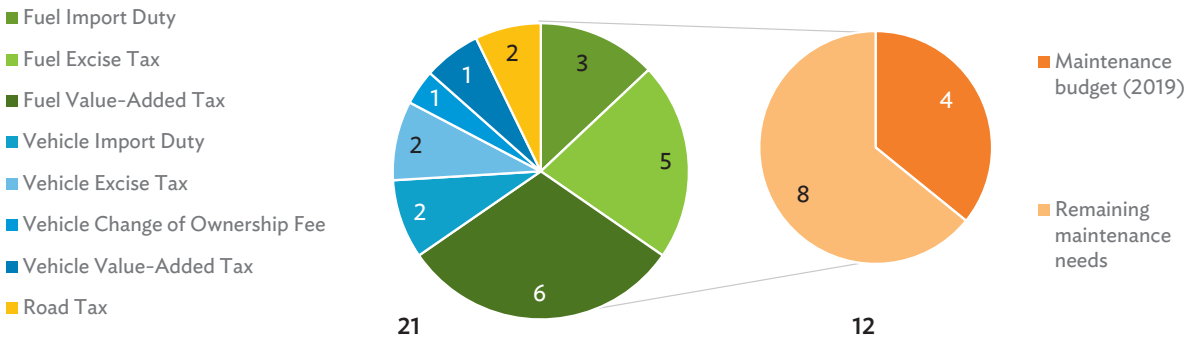


Source: Consultant's processing of collected data.

J. Vanuatu

Vanuatu has an extremely small road network of only 2,037 km, of which only 10% is paved. The road density per area is low at only 17 km per 100 km^2, while the average road density is 68 km per 1,000 people. The road density per GDP is slightly below average at 93 km per $20 billion GDP. Road maintenance needs are high and are estimated to amount to $12 million per year, equivalent to 1.1% of GDP and implying a challenge for financing. The allocated road maintenance budget of $4 million covers 36% of needs. Road user revenues are average and amount to $21 million, 1.7 times the estimated road maintenance needs and forming 1.9% of GDP. Two-thirds of the road user revenues are from fuel-based revenues, involving an amount of $14 million that will be directly affected by the transition to electric vehicles. The loss of this revenue will result in the remaining road user revenues being able to cover only 60% of the road maintenance needs. The revenue from the import duty and excise tax on vehicles will also be affected as the rates are set at zero for hybrid and battery electric vehicles, potentially affecting a further $3.6 million in revenue. Electric vehicles are all but nonexistent. There are a number of 2- and 3-wheelers (7% of registered vehicles), although this is not expected to have a significant impact on the transition to electric vehicles. Although there are financial incentives for the import of electric cars, these do not apply to electric 2- and 3-wheelers. The high dependency on second-hand cars will make it difficult to introduce electric cars. The lack of charging infrastructure forms an additional impediment to the transition.

Figure 22: Road User Revenues versus Maintenance Needs and Budgets in Vanuatu
($ million)



Source: Consultant's processing of collected data.

VIII. COUNTRY CASE STUDIES

A. Bangladesh

Bangladesh is located in South Asia with a land area of 130,200 km^2 and a population of 171.2 million people, resulting in a high population density of 1,301 persons per km^2. According to the World Bank, the GDP was $460.2 billion in 2022 (US$ current), resulting in a medium GDP per capita of $2,688. Bangladesh is predominantly flat and is centered around the delta of the Ganges River. The climate is tropical, with a heavy monsoon season from June to October.

1. Road network

Bangladesh has an extensive road network of more than 395,000 km, resulting in an extremely high road density of more than 300 km per 100 square kilometers. There are nearly 22,500 km of national highways, regional highways and *zilla* (district) roads that are managed by the Roads and Highways Department (RHD) under the Ministry of Road Transport and Bridges. Although the length of the RHD road network has not increased significantly in the past years, the standard and the width of different important road segments have been improved including widening to 4, 6, or 8 lanes. This RHD road network is complemented by 372,755 km of *upazila* roads, union roads and village roads (A+B) that are managed through the Local Government Engineering Directorate (LGED) under the Ministry of Local Government, Rural Development and Cooperatives, in coordination with local governments.[5]

Table BAN1: Road Lengths by Class and Surface Type
(km)

Road Class	Paved	Unpaved	Total
National highway	3,929	62	3,991
Regional highway	4,651	247	4,898
Zilla road	11,493	2,095	13,588
Subtotal RHD	**20,072**	**2,404**	**22,476**
Upazila road	34,131	2,581	36,712
Union road	32,863	9,017	41,880
Village road A	52,813	80,868	133,681
Village road B	36,543	123,939	160,482
Subtotal LGED	**156,349**	**216,405**	**372,755**
Total	**176,422**	**218,809**	**395,231**

Source: Government of Bangladesh, Roads and Highways Department, Highway Development and Management. 2023. *Maintenance and Rehabilitation Needs Report 2022–2023*. Local Government Engineering Department (LGED) Road and Market Database.

The roads managed by RHD are mostly paved. According to RHD data, this generally involves a bituminous surface, with only short sections of concrete or concrete blocks. There are, however, more than 600 km of RHD roads with herringbone brick surfaces, and a similar length with earthen surfaces. There are also approximately 3,500 km of RHD roads that have not yet been surveyed. A roughness survey of the paved RHD roads carried out in 2021–2022 covered a total length of 20,000 km (89% of the total RHD network). This included 98% of national highways, 95% of regional highways and

[5] *Upazilas* are the second lowest tier of regional administration in Bangladesh.

85% of *zilla* roads. The survey collected roughness data and found 76% of the paved roads to be in good condition and 13% in fair condition. A further 6% were in poor condition, 2% in bad condition and the remaining 2% in bad condition. The percentage of the road network in the different condition categories is similar for the different road classes, although *zilla* roads are in slightly worse condition. However, different definitions of the condition categories are used for different road classes.

Table BAN2: RHD Road Conditions by Road Class
(km)

Road Class	Good	Fair	Poor	Bad	Very Bad	Total
National highway	2,979	675	170	62	43	3,929
Regional highway	3,761	532	188	75	94	4,651
Zilla road	8,564	1,482	770	356	321	11,493
Total	**15,305**	**2,690**	**1,128**	**493**	**457**	**20,072**
Percentage	76%	13%	6%	2%	2%	100%

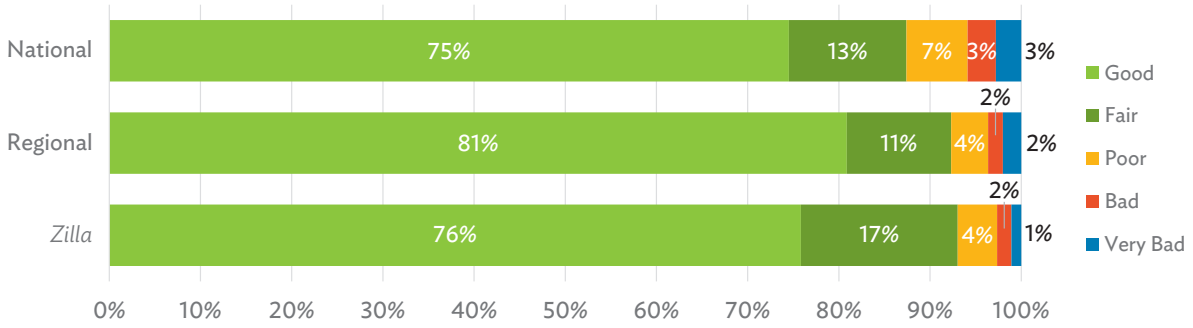
National highways: Good (IRI<4), Fair (4<IRI<6), Poor (6<IRI<8), Bad (8<IRI<10), Bad (IRI>10)

Regional highways: Good (IRI<5), Fair (5<IRI<7), Poor (7<IRI<9), Bad (9<IRI<11), Bad (IRI>11)

Zilla roads: Good (IRI<6), Fair (6<IRI<8), Poor (9<IRI<10), Bad (10<IRI<12), Bad (IRI>12)

Source: Government of Bangladesh, Roads and Highways Department, Highway Development and Management. 2023. *Maintenance and Rehabilitation Needs Report 2022–2023.*

Figure BAN1: RHD Road Conditions by Road Class



National highways: Good (IRI<4), Fair (4<IRI<6), Poor (6<IRI<8), Bad (8<IRI<10), Bad (IRI>10)

Regional highways: Good (IRI<5), Fair (5<IRI<7), Poor (7<IRI<9), Bad (9<IRI<11), Bad (IRI>11)

Zilla roads: Good (IRI<6), Fair (6<IRI<8), Poor (9<IRI<10), Bad (10<IRI<12), Bad (IRI>12)

Source: Government of Bangladesh, Roads and Highways Department, Highway Development and Management. 2023. *Maintenance and Rehabilitation Needs Report 2022–2023.*

The roads managed by LGED are mostly unpaved earthen roads (58%). This is especially the case for the lower-level village A and B roads, where respectively 60% and 77% of the length is unpaved. For the *upazila* roads, only 7% is unpaved and for the union roads this is 22%. The majority of paved roads have a bituminous surface, but there are significant lengths of road with a herringbone brick surface or a water-bound macadam surface.

2. Road maintenance needs and budget

The RHD Maintenance and Rehabilitation Needs Report 2022–2023 presents the results of an unconstrained HDM-4 program analysis for paved roads. This identifies the need for BDT149.9

($1,454 million) in maintenance and repair works for the period 2022/23–2026/27. This includes BDT47.5 billion ($461 million) for 28,329 km of routine maintenance and BDT82.7 billion ($802 million) for 14,785 km of periodic maintenance, resulting in average annual maintenance needs of $253 million. This translates to $11,250/km on average. This is based on the first five years of an unconstrained HDM-4 program analysis, in which HDM-4 tends to put all the backlog maintenance in the first few years. As a result, the estimated needs are higher than the actual long-term needs that are not reflected in the Maintenance and Rehabilitation Needs Report.

Table BAN3: RHD Maintenance and Repair Needs 2022–2023 to 2026–2027

Maintenance/ Repair Type	National Highways		Regional Highways		*Zilla* Roads		Total	
	Budget (BDT million)	**Length** (km)	**Budget** (BDT million)	**Length** (km)	**Budget** (BDT million)	**Length** (km)	**Budget** (BDT million)	**Length** (km)
Routine	4,079	1,510	12,900	6,450	30,551	20,369	**47,529**	**28,329**
Periodic	23,297	2,396	23,756	4,545	35,614	7,844	**82,667**	**14,785**
Rehabilitation	8,183	158	1,950	58	4,150	265	**14,284**	**481**
Reconstruction	3,077	48	249	6	2,085	87	**5,411**	**141**
Total	**38,633**		**38,855**		**72,398**		**149,886**	

Source: Government of Bangladesh, Roads and Highways Department, Highway Development and Management. 2023. *Maintenance and Rehabilitation Needs Report 2022–2023.*

According to the Ministry of Finance, a total of BDT11.4 billion was allocated to RHD in 2022–2023 for repair and maintenance, and the budget allocation for 2023–2024 was set at BDT12.0 million, equivalent to $110 million, and projected to increase further to BDT14.1 billion by 2025–2026. The current budget provides 43% of the estimated maintenance needs for the RHD network.

LGED in their Asset Management Plan (Roads) prepared in 2021 identified a need for BDT147.2 billion ($1,769 million) for the maintenance of their road network for the five-year period from 2020–2021 to 2024–2025. The average annual maintenance need amounts to BDT29.4 billion, equivalent to $354 million. This is equivalent to approximately $950/km on average, which can be considered low, forming only 0.1% of GDP. An LGED report on Developing a Framework Regarding Involvement of Local Government Institutions presents an estimation of maintenance needs of BDT204.1 billion for 2021–2022, equivalent to $1,980 million. This translates to $5,300/km and 0.4% of GDP, which seems a more realistic estimate. Currently, many of the LGED roads are not in a maintainable condition, and these maintenance needs are likely an overestimation for the short-term.

Table BAN4: LGED Maintenance Needs 2020–2021 to 2024–2025

Road Class	**Budget** (BDT million)	**Length** (km)
Upazila roads	63,500	24,900
Union roads	48,000	18,900
Village roads	35,700	11,400
Total	**147,200**	**55,200**

Source: Government of Bangladesh, Ministry of Local Government, Rural Development, and Cooperatives, LGED. 2021. *Asset Management Plan (Road).*

The LGED report on Developing a Framework Regarding Involvement of Local Government Institutions shows an allocation of BDT25.8 billion ($306 million) from the government in 2021–2022, as well as an additional BDT26.5 billion ($314 million) from the Japan Debt Cancellation Fund (JDCF) and other

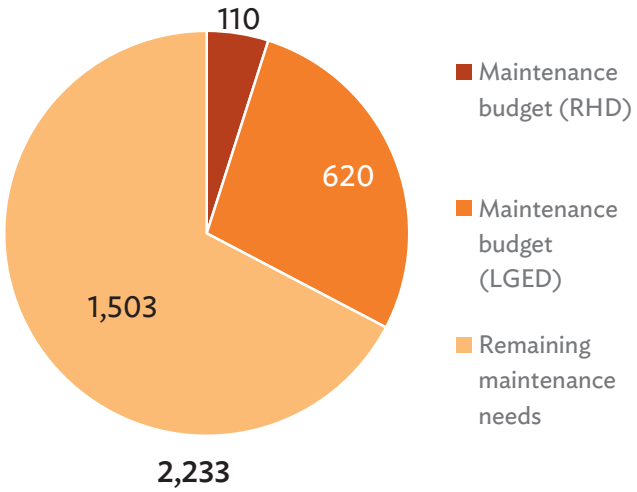
development partner projects. Together, this results in an allocation of $620 million forming 31% of the identified funding needs for the roads managed by LGED.

Table BAN5: LGED Maintenance Budgets 2017–2018 to 2021–2022
(BDT million)

Year	Maintenance Need	Budget Allocation			Maintenance Expenditure				
		GOB	JDCF + DPs	Total	Routine (Off-Pavement)	Routine (On-Pavement)	Periodic	Emergency	Total
2017/18	168,890	17,300	9,630	26,930	421	46	26,183	283	26,932
2018/19	184,860	18,000	14,950	32,950	424	76	32,250	200	32,950
2019/20	209,050	17,670	21,350	39,020	623	113	38,029	250	39,015
2020/21	195,140	22,760	22,690	45,450	1,190	190	43,770	300	45,450
2021/22	204,130	25,800	26,480	52,280	1,480	200	48,020	2,580	52,280

Source: Government of Bangladesh, LGED. 2023. *Developing a Framework Regarding Involvement of Upazila Parishad/Union Parishad/ Local Community/Stakeholders for Rural Road Maintenance and Road Safety Programme for Participation in Management and Funding.*

Figure BAN2: Road Maintenance Needs and Budgets in Bangladesh
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

According to the Bangladesh Road Transport Authority (BRTA), there were almost six million vehicles registered at the end of 2023. However, this number is based on the new registrations each year and does not take into account vehicles that are decommissioned and no longer form part of the vehicle fleet. This number should, therefore, be considered an overestimation of the actual vehicle fleet operating on the Bangladesh road network. The growth rate of registered vehicles averaged 9% per year over the period 2019–2023, reducing gradually from 13% in 2019 to 6% in 2023. The growth is higher for 2- and 3-wheelers which constitute 78% of the registered vehicles, with growth rates reducing from 16% to 7%. For light-duty vehicles, growth is also reducing slightly, from 6% to 4%, while for other vehicles the reduction is more drastic, from 8% to only 2%. It must be noted that these growth rates do not take into account vehicles

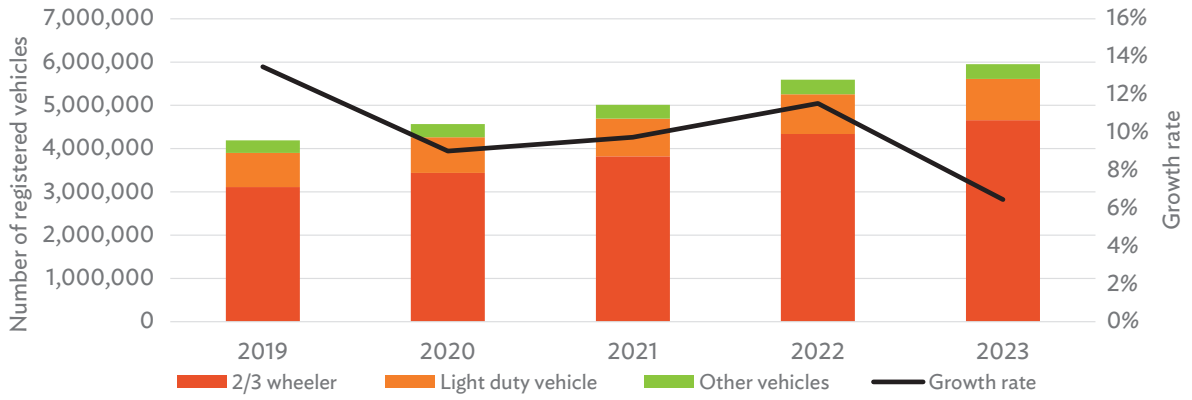
that are no longer operational and are removed from the vehicle fleet, and the actual growth rates of the vehicle fleet are likely around half these percentages. By far the majority of imported passenger cars and microbuses are second-hand, with only some 5%–10% of new vehicles imported each year.

Table BAN6: Annual Vehicle Registrations in Bangladesh

Vehicle Type	Total up to 2018	2019	2020	2021	2022	2023	Total up to 2023
Motorcycle	2,413,185	401,452	311,016	375,252	506,912	310,418	**4,318,235**
Rickshaw/tempo	265,526	30,031	16,801	9,183	7,615	9,265	**338,421**
Car, pickup, jeep, taxi	537,785	34,335	27,820	34,548	36,743	25,213	**696,444**
Micro/minibus	122,665	4,517	3,399	5,333	7,801	5,359	**149,074**
Delivery van	86,226	5,106	3,317	5,291	5,604	2,307	**107,851**
Bus	41,888	3,558	2,395	1,517	2,688	2,280	**54,326**
Truck	130,376	8,735	5,023	6,037	4,937	2,626	**157,734**
Special purpose/other	96,135	9,698	7,889	7,869	5,851	3,393	**130,835**
Total	**3,693,786**	**497,432**	**377,660**	**445,030**	**578,151**	**360,861**	**5,952,920**

Source: Government of Bangladesh, Road Transport Authority. 2024.

Figure BAN3: Vehicle Registrations in Bangladesh



Source: Government of Bangladesh, Road Transport Authority. 2024.

The Automobile Industry Development Policy 2021 set a target to convert the majority of vehicles to electric by 2030 by introducing different financial incentives and introducing charging stations. The Electric Vehicle Registration and Operation Policy 2023 sets a more conservative target of converting at least 30% of all vehicles to electric by 2030. Until recently, there was no legislation in place to register electric vehicles, and as a result, there are no official statistics on the number of electric vehicles. The Electric Motor Vehicle Registration and Operation Guideline was approved in 2023, enabling the import and registration of electric vehicles. The electric vehicle fleet is dominated by 3-wheelers, of which there are reportedly 2 million operating in Bangladesh, although most of these are not formally registered and are not included in the vehicle registration statistics. Electric passenger cars are almost nonexistent, and the focus lies on hybrid vehicles with the number of new registrations increasing from 3,296 in 2017–2018 to 8,366 in 2020–2021. The first electric vehicle manufacturing plant is being constructed in Bangladesh that aims to produce 60,000 2-wheelers, 40,000 3-wheelers and 30,000 passenger cars annually.

4. Sources of road user revenues

There is no road fund in Bangladesh, and both RHD and LGED are dependent on annual budget allocations from the General Fund. Bangladesh collects a variety of road user revenues, mainly on fuel and vehicles, with all revenues going directly to the General Fund.

a. Fuel Import Duties and Taxes

Fuel imports are subject to a set of different duties and taxes. A customs duty of 10% is charged under the Customs Act of 1969. This is applied to the import value of the fuel and is collected by Bangladesh Customs under the National Board of Revenue (NBR). Together with the customs duty, an advance income tax of 2% is also applied to the import value. A value-added tax of 15% and an advance tax of 2% is applied to the sum of the import value and the customs duty. The compounded total of these duties and taxes is 34%.

Table BAN7: Fuel Import Duty and Tax Rates in Bangladesh

Fuel Type	Customs Duty	Advance Tax	Value-Added Tax	Advance Income Tax	Total
Gasoline	10%	5%	15%	2%	34%
Diesel	10%	5%	15%	2%	34%

Source: Bangladesh Customs. Harmonised Tariff of Bangladesh Customs. https://customs.gov.bd/portal/services/tariff/index.jsf (accessed 1 October 2024).

According to the Energy Scenario of Bangladesh 2021–2022, a total of 4,259,976 metric tons of fuel was used for transport in 2020–2021, including 446,647 metric tons of gasoline and 3,813,329 metric tons of diesel. This shows the predominance of diesel in Bangladesh, constituting 90% of fuel consumption for transport. Given that the number of registered vehicles has increased by 40% since the end of 2019, fuel consumption is assumed to have increased by a similar percentage. The pump price for gasoline was BDT127 per liter in May 2024, and BDT108 per liter for diesel. Based on this data, the revenue from the different duties and taxes on fuel is estimated to amount to BDT201 billion, equivalent to $1,857 million. This includes $1,201 million from the value-added tax and advance tax, as well as $546 million from the customs duty and $109 million from the advance income tax. This revenue is deposited in the Consolidated Fund.

Table BAN8: Fuel Import Duty and Tax Rates in Bangladesh
(BDT million)

Fuel Type	Consumption 2023 (metric tons)	Import Value	Customs Duty	Advance Tax	Value-Added Tax	Advance Income Tax	Total
Gasoline	446,647	80,066	8,007	4,404	13,211	1,601	27,222
Diesel	3,813,329	512,894	51,289	28,209	84,627	10,258	174,384
Total	**4,259,976**	**592,960**	**59,296**	**32,613**	**97,838**	**11,859**	**201,606**

Source: Energy Scenario of Bangladesh 2021–22, Consultant's processing of data.

b. Vehicle Import Duties and Taxes

Vehicle imports are similarly subject to a set of different duties and taxes. A customs duty is charged on imported vehicles under the Customs Act of 1969. The customs duty is collected by Bangladesh Customs under the National Board of Revenue. The customs duty is applied as a percentage of the vehicle CIF value and is generally 25% for vehicles, with a lower percentage of 10% applied to larger buses

and trucks. Bangladesh Customs also collects a regulatory duty of 3% that is applied as a percentage of the vehicle CIF value for most imported vehicles, except large buses and trucks. Bangladesh Customs further collects a supplementary duty that is applied to most vehicles except larger trucks and buses as well as some electric vehicles. The rates depend on the type of vehicle, the engine size, and whether the vehicle is imported completely built-up (CBD) or in parts (completely knocked down) (CKD). The supplementary duty is applied to the sum of the vehicle CIF value, the customs duty and the regulatory duty. The supplementary duty is the highest of the three, and ranges from 20% to 60% for most vehicles, with high rates of 100% to 500% for vehicles with large engines or with two-stroke engines. For electric vehicles, the supplementary duty is set at zero (except 3-wheelers where the same rate is applied as for internal combustion engines). Bangladesh Customs further collects an advance tax that is a form of value-added tax. This is 5% for vehicles and is applied to the sum of the vehicle CIF value, the customs duty, the regulatory duty and the supplementary duty. Similarly, a value-added tax of 15% is applied in the same way. Lastly, Bangladesh Customs collects an advance income tax of 5% that is applied only to the CIF value of the vehicle. Bangladesh has a complicated system of rates for these duties and taxes. The rates for the most important vehicle types are shown in Table BAN9. The compounded nature of these duties and taxes means that the total of duties and taxes tends to be high. Except for larger buses and trucks and electric vehicles where the compounded total ranges from 37% to 89%, for most vehicles the compounded tax exceeds 100%, reaching more than 800% for completely built-up passenger cars with engine capacities over 3,000cc.

Table BAN9: Vehicle Import Duty and Tax Rates in Bangladesh

Vehicle Type	Characteristics	CBD/ CKD	Customs Duty	Regulatory Duty	Supple-mentary Duty	Advance Tax	Value-Added Tax	Advance Income Tax	Total
Motor-cycle	<250cc	CBD	25%	3%	60%	5%	15%	5%	**151%**
		CKD	25%	3%	20%	5%	15%	5%	**89%**
	>250cc	CBD	25%	3%	100%	5%	15%	5%	**212%**
	Two-stroke engine	CBD/ CKD	25%	3%	250%	5%	15%	5%	**443%**
	Electric	CBD/ CKD	25%	3%	-	5%	15%	5%	**59%**
3-wheeler	<1000cc	CBD/ CKD	25%	3%	20%	5%	15%	5%	**89%**
	Electric	CBD/ CKD	25%	3%	20%	5%	15%	5%	**89%**
Passenger car	<1600cc	CBU	25%	3%	45%	5%	15%	5%	**128%**
		CKD	25%	3%	20%	5%	15%	5%	**89%**
	1600cc–2000cc	CBU	25%	3%	100%	5%	15%	5%	**212%**
		CKD	25%	3%	45%	5%	15%	5%	**128%**
	2000cc–3000cc	CBU	25%	3%	250%	5%	15%	5%	**443%**
		CKD	25%	3%	150%	5%	15%	5%	**289%**
	>3000cc	CBU	25%	3%	500%	5%	15%	5%	**827%**
		CKD	25%	3%	350%	5%	15%	5%	**596%**
	Electric	CBD/ CKD	25%	3%	20%	5%	15%	5%	**89%**

continued on next page

Table BAN9 *continued*

Vehicle Type	Characteristics	CBD/ CKD	Customs Duty	Regulatory Duty	Supple-mentary Duty	Advance Tax	Value-Added Tax	Advance Income Tax	Total
Bus	<15 seats	CBD	25%	3%	30%	5%	15%	5%	**105%**
	<15 seats (electric)	CBD	25%	3%	-	5%	15%	5%	**59%**
	<15 seats	CKD	10%	-	-	5%	15%	5%	**37%**
	15–40 seats	CBD	10%	-	-	5%	15%	5%	**37%**
	>40 seats	CBD	10%	-	-	5%	15%	5%	**37%**
Truck	All	CBD	25%	3%	-	5%	15%	5%	**59%**
		CKD	10%	3%	-	5%	15%	5%	**41%**
	More than 2 axles	CBD/ CKD	10%	-	-	5%	15%	5%	**37%**

CBD = completely built-up, CKD = completely knocked down.

Source: Bangladesh Customs.

The exact revenue from the different duties and taxes is not reported separately for vehicles. However, the Bangladesh Bureau of Statistics reports the import values of vehicles by harmonized system (HS) code. Using this data for 2019–20, the estimated revenue from the different duties and taxes is shown in Table BAN10. Based on a vehicle import value of BDT73.5 billion ($884 million), the revenue from the different duties and taxes is estimated to amount to BDT75.0 billion, equivalent to $901 million. This mainly comes from passenger cars and microbuses (HS 8703) and generates 57% of the estimated revenue, with motorcycles providing an additional 20%. In terms of the types of duties and taxes, the most significant source of revenue is the supplementary duty (36%), followed by the customs duty and value-added tax (each 24%). This revenue is deposited in the Consolidated Fund.

Table BAN10: Vehicle Import Duty and Tax Revenues in Bangladesh
(BDT million)

Vehicle Type	HS code	Import value	Customs Duty	Regulatory Duty	Supple-mentary Duty	Advance Tax	Value-Added Tax	Advance Income Tax	Total
Motorcycles	8711	10,112	2,528	303	7,766	1,035	3,106	506	15,245
Car/microbus	8703	33,740	8,435	1,012	19,434	3,131	9,393	1,687	43,093
Bus	8702	3,548	355	-	-	195	585	177	1,313
Goods vehicles	8704	19,591	4,898	588	-	1,254	3,761	980	11,480
Special purpose	8705	6,551	1,638	197	-	419	1,258	328	3,839
Total		**73,542**	**17,853**	**2,100**	**27,201**	**6,035**	**18,104**	**3,677**	**74,970**

Source: Government of Bangladesh, Ministry of Planning, Bangladesh Bureau of Statistics, Statistics and Informatics Division. 2021. *Foreign Trade Statistics of Bangladesh 2019–20. Vol. II*.

c. Vehicle Registration Fee

On the first registration of a vehicle, a registration fee needs to be paid to the Bangladesh Road Transport Authority (BRTA). The registration fees for a number of common vehicles are listed in Table BAN11. According to the Ministry of Finance, BRTA collected BDT8.5 billion from registration fees in 2022–2023, equivalent to $82.5 million.

Table BAN11: Vehicle Registration Fees

Vehicle Type	Characteristics	Fee (BDT)
Motorcycle	<100cc	2,000
	>100cc	3,000
Passenger cars	<600cc	9,000
	600cc–1000cc	18,000
	1000cc–1400cc	27,000
	1400cc–2000cc	60,000
	>2000cc	120,000
Bus	<31 seats	7,000
	31–52 seats	20,000
	>52 seats	25,000
Trucks	<3.5 tons	7,000
	3.5–12.5 tons	21,000
	>12.5 tons	27,000

Source: Government of Bangladesh, Road Transport Authority. 2024.

d. Vehicle Advance Income Tax

The advance income tax is regulated by the Income Tax Ordinance of 1984. Apart from the advance income tax that is collected on the first registration of a vehicle as described earlier, the Income Tax Ordinance also stipulates that a separate advance income tax is to be applied annually to vehicle owners according to the rates defined in Table BAN12. The advance income tax is only applied to passenger cars and microbuses, with a 50% increase if a person owns more than one car. Originally the Income Tax Ordinance did not define rates for electric vehicles, and these have only been introduced recently.

Table BAN12: Annual Advance Income Tax Rates for Vehicles

Vehicle Type	Internal Combustion Engine	Electric Engine	Rate (BDT)
Car/jeep	<1300cc	<65 kW	37,500
	<1500cc	<65 kW–75 kW	25,000
	1500cc–2000cc	75 kW–100 kW	50,000
	2000cc–2500cc	100 kW–125 kW	75,000
	2500cc–3000cc	125 kW–150 kW	125,000
	3000cc–3500cc	150 kW–175 kW	150,000
	>3500cc	>175 kW	200,000
Microbus			30,000

Source: Advance Income Tax on Motor Vehicle 2023–2024, Bangladesh Gazette, 22 June 2023.

Revenue from the advance income tax on vehicles is not reported separately. Based on the official number of registered passenger cars and microbuses, together with the fact that most cars reportedly have engine capacities in the 1000cc–1500cc range, the revenue is estimated to be in the order of BDT25 billion, equivalent to $230 million. This revenue is deposited in the Consolidated Fund.

e. Road Tax (Motor Vehicle Tax)

The road tax is paid by vehicle owners and is collected by BRTA together with the advance income tax. The road tax replaced the motor vehicle tax in the financial year 2020–2021. For most vehicles, the road tax is collected annually, but in the case of motorcycles, owners can either pay for 10 years in advance or pay in 5 instalments every 2 years. The rate for motorcycles is BDT1,000 per year (BDT10,000 for 10 years or BDT2,000 every two years), while for passenger cars the rate is BDT3,500 per year. The same rate is used for electric vehicles. The road tax is collected by the BRTA together with the advance income tax for vehicles. The road tax is paid for all operational registered vehicles. When paid, a tax token is received to show that the tax is paid. According to the Ministry of Finance, BDT12.6 billion was collected by BRTA from road tax in 2022–2023, equivalent to $122.6 million. For 2023–2024 the revenue is expected to more than double to BDT30 million, equivalent to $276 million. This revenue is deposited in the Consolidated Fund.

f. Tolling

RHD collects tolls for a large number of bridges and several road sections. The toll revenue is reserved for road maintenance and does not appear to be deposited in the Consolidated Fund. According to the Ministry of Finance, BDT11.1 billion was collected from road and bridge tolls in 2022–2023, equivalent to $108 million.

5. Road user revenues

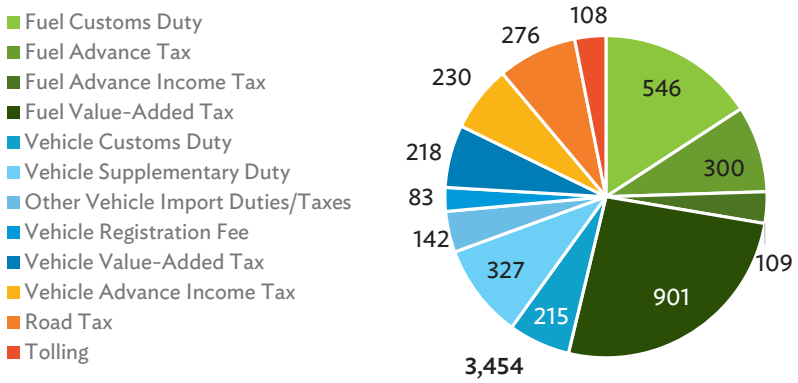
The estimated road user revenues are presented in Table BAN13. The total revenue from road users amounts to $3,454 million per year, more than 1.5 times the estimated road maintenance needs. These road user revenues constitute 0.8% of GDP, which is relatively low compared to other countries included in this study. Fuel taxes provide $1,856 million in revenues and make up over half the total revenues. Road user revenues from vehicle-based charges applied on first registration provide an additional $984 million, forming 28% of total revenues. Annual vehicle-based charges applied to vehicle owners provide $506 million or 15% of total revenues, while tolling provides the remaining $108 million, forming only 3% of total revenues. These road user revenues are not earmarked for a road fund, although the revenue from tolling is reserved for road maintenance.

Table BAN13: Road User Revenues in Bangladesh

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Fuel Customs Duty	546	16%	-	-
Fuel Advance Tax	300	9%	-	-
Fuel Value-Added Tax	901	26%	-	-
Fuel Advance Income Tax	109	3%	-	-
Vehicle Customs Duty	215	6%	-	-
Vehicle Supplementary Duty	327	9%	-	-
Vehicle Value-Added Tax	218	6%	-	-
Other Vehicle Import Duties/Taxes	142	4%		
Vehicle Registration Fee	83	2%	-	-
Vehicle Advance Income Tax	230	7%	-	-
Road Tax	276	8%	-	-
Tolling	108	3%	-	-
Total	**3,454**	**100%**	**-**	**-**

Source: Consultant's processing of data.

Figure BAN4: Road User Revenues in Bangladesh
($ million)



Source: Consultant's processing of collected data.

Revenue from carbon-based fuel taxes amounts to approximately $1,856 million per year, forming 54% of the total road user revenues. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. Another road user revenue that will be affected is the supplementary duty on imported vehicles, which is set at a lower rate or zero for electric vehicles. The total revenue from this duty is estimated to be $327 million, of which a large portion will be lost as ownership of electric vehicles increase to make up a greater portion of newly registered vehicles.

B. Cambodia

Cambodia is located in Southeast Asia with a land area of 176,500 km^2 and a population of 16.8 million people, resulting in a relatively low population density of 94 persons per km^2. According to the World Bank, the GDP was $29.5 billion in 2022 (US$ current), resulting in a low GDP per capita of $1,760. Cambodia has a low-lying central plain with mountain ranges to the north, east and south. The climate is tropical, with a monsoon climate and a rainy season from May to October.

1. Road network

Cambodia has a reported road network of 67,714 km. This includes 19,795 km of national and provincial roads that are managed by the Ministry of Public Works and Transport (MPWT) and 47,919 km of rural roads that are managed by the Ministry for Rural Development (MRD) in coordination with local governments. In addition, there are urban roads that are managed and financed directly by the subnational administrations.

Table CAM1: Road Lengths by Class and Surface Type
(km)

Road Class	Asphalt Concrete	Cement Concrete	DBST	Gravel	Earth	Total
National Road (1-digit)	1,817	8	428	-	-	2,254
National Road (2-digit)	393	87	3,448	1,233	-	5,161
Provincial Road (3-4 digit)	51	254	4,555	7,520	-	12,380
Rural Road	-	-	2,157	28,710	17,052	47,919
Total	**2,261**	**350**	**10,588**	**37,463**	**17,052**	**67,714**

DBST = Double Bituminous Surface Treatment

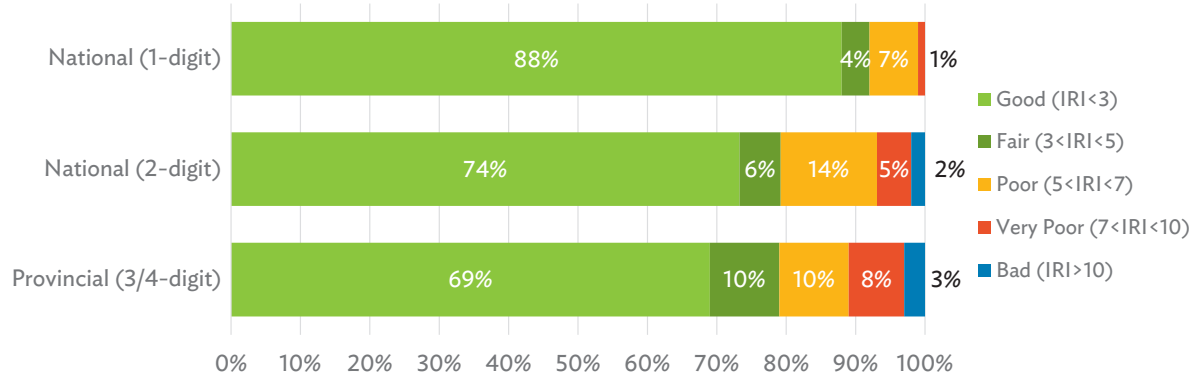
Source: Government of Cambodia. 2023. *Overview of the Transport Infrastructure Sector in the Kingdom of Cambodia (7th Edition)*. Infrastructure and Regional Integration Technical Working Group (IRITWG).

The rural road network is divided into four classes. Class T1 roads connect district towns (17% of rural road network), while class T2 roads connect district towns to communes (15% of the rural road network), class T3 roads connect communes (25% of the rural road network) and class T4 roads connect to villages and agricultural fields (43% of the rural road network).

Despite extensive recent investments in road improvements, the paved road network only makes up 19% of the total road network. In the case of national roads, this percentage is much higher with 83% paved (including 100% of 1-digit national roads), while for provincial roads the percentage of paved roads drops to 39% and only 5% for rural roads. Most paved roads (80%) have double bituminous surface treatments, with only 2,610 km of roads with asphalt concrete or cement concrete pavements.

The condition of the paved national road network is regularly inspected using a Dynamic Response Intelligent Monitoring System (DRIMS) that involves an accelerometer to measure roughness. In 2023, almost 5,000 km of paved national and provincial roads were surveyed, just under half the total length of paved roads. The data is presented annually in a *Report on International Roughness Index* (IRI), indicating for each road the roughness and condition category by 100-meter segments. The results from the 2023 survey are presented in Figure CAM1. This shows the majority of the paved road network being in good condition, with an increasing portion in fair, poor, poor and bad condition for lower class roads. It must be noted that the accuracy of the DRIMS is not high and surveys focused on the most important roads, and that as a result, it is likely that a larger portion of the paved road network is in worse condition than depicted here. Poor road conditions have significant impacts on the functionality of the road network, especially during the rainy season when the adverse effects of road damage and deterioration can lead to roads becoming impassable.

Figure CAM1: Road Conditions by Road Class



Source: Report On International Roughness Index (IRI) 2023.

2. Road maintenance needs and budget

The Transport Sector Assessment, Strategy and Road Map for Cambodia prepared by ADB in 2019 estimated that $45 million was required annually for routine maintenance of the national and provincial roads. For periodic maintenance, the document estimates that at least $25 million per year is required given the makeup of the national and provincial road networks. However, periodic maintenance is likely to require double this amount. In addition, approximately $10 million is required for emergency maintenance. The Rural Roads Policy 2021–2030 estimates that maintenance needs for the core rural road network in 2021 amount to $20 million for routine maintenance, $40 million for periodic maintenance and $6 million for emergency maintenance. The Rural Roads Policy also estimates that these rural road maintenance needs will gradually increase to $100 million as the core rural road network is upgraded to an all-season standard. This puts the current maintenance needs for the full road network at approximately $166 million, equivalent to 0.6% of GDP.

The Transport Sector Assessment, Strategy and Road Map for Cambodia also includes information on the budget allocations to road maintenance. The maintenance budget for national and provincial roads in 2017 amounted to $70 million and for rural roads the budget allocation was $20 million, resulting in a total road maintenance budget allocation of $90 million, equivalent to 0.2% of GDP.

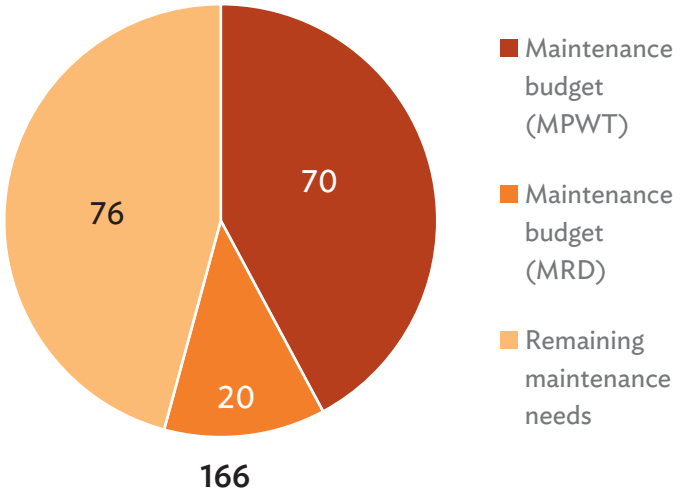
Table CAM2: Budget Allocations to Road Maintenance
($ million)

Year	Maintenance type	2014	2015	2016	2017
National and Provincial roads	Routine	23	31	31	45
	Periodic	27	13	18	15
	Emergency	13	13	14	10
	Subtotal	**63**	**57**	**63**	**70**
Rural roads	All	N/A	15	18	20
Total		**63**	**72**	**81**	**90**

Source: Asian Development Bank (ADB). 2019. *Cambodia Transport Sector Assessment, Strategy, and Road Map*.

Road maintenance in Cambodia is financed from the national budget. In 2000 the government established a Fund for Repair and Maintenance of Roads (FRMR). Initially, it was financed from loans from state-owned enterprises under MPWT, but in 2002 levies on fuel were introduced ($0.02 per liter on gasoline and $0.04 per liter on diesel). These were collected by the Customs Department on import into Cambodia, with revenues earmarked for the FRMR. The total revenue from the fuel levies was estimated to be in the order of $25 million. However, the FRMR was mainly used to finance road rehabilitation works and did not provide sustainable financing for road maintenance. The FRMR was closed in 2006 and was subsequently replaced with a line item in the national budget.

Figure CAM2: Road Maintenance Needs and Budgets in Cambodia
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

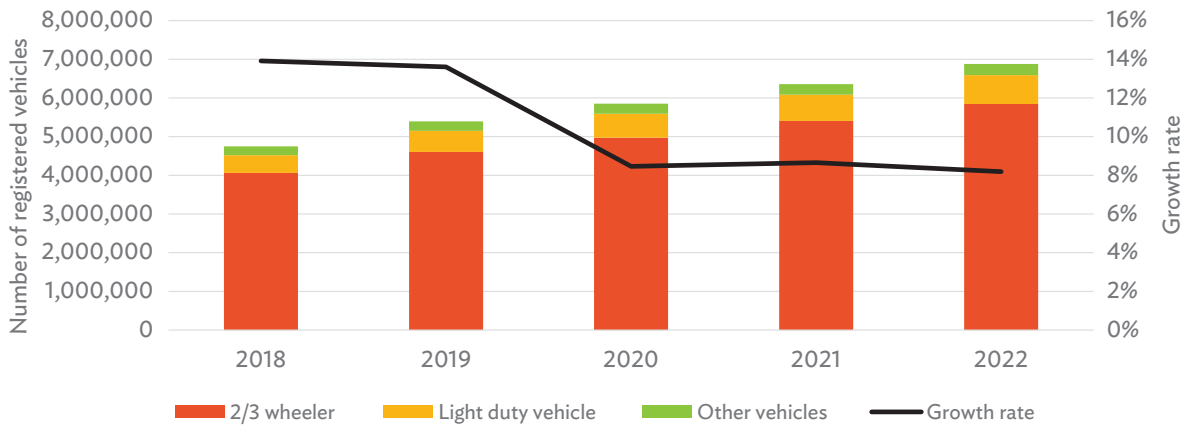
According to the Overview of the Transport Infrastructure Sector in the Kingdom of Cambodia (7th Edition), the number of vehicles registered in Cambodia from 1991 to 2022 amounted to almost 6.9 million vehicles, including over 5.8 million motorcycles, 744,755 light-duty vehicles, and 288,278 heavy vehicles. However, these vehicle numbers are based on the compounded annual registrations of vehicles when these are first admitted to the country, and therefore also include decommissioned vehicles that are no longer operational. The actual size of the operational vehicle fleet will therefore be significantly lower. In 2021, road tax was collected from only 800,000 vehicles, suggesting that the number of operational vehicles in Cambodia is much lower than the official registration numbers. The vehicle fleet is dominated by 2- and 3-wheelers which make up 84% of the registered vehicles. The growth rate of registered vehicles over the period 2018–2022 averaged 10% per year, reducing from 14% in 2018 and 2019 to 8% in later years. The growth rate is dominated by 2- and 3-wheelers which make up 85% of registered vehicles, and the growth rate is actually higher for passenger cars (10%) and lower for heavy vehicles (5%). The number of passenger cars is expected to continue to grow significantly, as only 10% of households owned a car in 2019. It must be noted that these growth rates do not take into account vehicles that are no longer operational and are removed from the vehicle fleet, and the actual growth rates of the vehicle fleet are likely about half these percentages.

Table CAM3: Vehicle Registrations in Cambodia

Vehicle Type	2018	2019	2020	2021	2022
Motorcycles	502,701	540,621	370,601	432,255	437,495
Passenger cars	67,432	89,177	70,631	60,964	68,658
Other vehicles	9,772	16,275	15,342	13,007	14,463
Total	**579,905**	**646,073**	**456,574**	**506,226**	**520,616**

Source: Government of Cambodia. 2023. *Overview of the Transport Infrastructure Sector in the Kingdom of Cambodia (7th Edition)*. Infrastructure and Regional Integration Technical Working Group (IRITWG).

Figure CAM3: Vehicle Registrations in Cambodia



Source: Government of Cambodia. 2023. *Overview of the Transport Infrastructure Sector in the Kingdom of Cambodia (7th Edition)*. Infrastructure and Regional Integration Technical Working Group (IRITWG).

The number of electric vehicles in Cambodia is still limited. In 2020 the first five electric vehicles were imported, followed by 63 in 2021, 663 in 2022 and 604 in 2023, bringing the total to 1,335. The Roadmap for the Development of an Electric Vehicle Charging Stations Network in Cambodia presents three scenarios for the transition to electric vehicles. The most conservative scenario foresees 30% of new 2-wheeler sales, 15% of new passenger cars and 1% of other vehicle sales being electric by 2050, resulting in 2.1 million electric 2wheelers (20%) and 316,000 electric cars (12%) by 2050. The most positive scenario has been calibrated to correspond with the Long-Term Strategy for Carbon Neutrality set out by the Ministry of the Environment, and foresees 90% of 2-wheeler sales, 51% of new passenger car sales and 5% of other vehicle sales being electric by 2050. This would result in 7.3 million 2-wheelers (70%) and 1.1 million cars (40%) being electric by 2050. The main incentive to achieve this has been the reduction in 2022 of the special tax on vehicle imports from the average of 50% for vehicles with internal combustion engines with an engine capacity over 1,000cc (including hybrid vehicles), to 10% for battery electric vehicles.

4. Sources of road user revenues

Cambodia used to have a Fund for Repair and Maintenance of Roads (FRMR), but this was abolished in 2006. The fuel levies that were introduced to finance the FRMR continue to be collected but now go to the General Fund. Several other road user revenues are also collected, especially from fuel and vehicle imports. All revenues go to the General Fund.

a. Fuel Customs Duty

In Cambodia, a customs duty of 15% is collected on gasoline by the General Department of Customs and Excise of Cambodia (GDCE). No customs duty is collected on diesel. According to the Statistics and Energy Balance 2020–2021, fuel consumption for transport in 2021 amounted to 1,931 kilotons, equivalent to 2.4 billion liters. All fuel is currently imported. Based on this consumption and the fuel price in Cambodia (KHR4,350 per liter for gasoline and KHR4,300 per liter for diesel), the revenue from the customs duty on fuel is estimated to be around $80 million per year.

Table CAM4: Fuel Consumption in Cambodia

Fuel Type	Tons	Conversion Factor	Liters
Gasoline	636,400	1,351	859,776,400
Diesel	1,294,500	1,192	1,543,044,000

Source: UNDP Statistics and Energy Balance 2020–2021.

b. Fuel Additional Tax

Cambodia also collects levies on fuel that were introduced in 2002 to finance the Fund for Repair and Maintenance of Roads. Although this fund has been abolished, the government continues to collect these levies as an additional tax on fuel. This amounts to $0.02 per liter on gasoline and $0.04 per liter on diesel. The Ministry of Economy and Finance reports $100 million (KHR410 billion) collected in revenue from this additional tax in 2023.

Table CAM5: Customs Duty, Special Tax, and VAT on Fuel in Cambodia

Fuel Type	Customs Duty	Additional Tax	Special Tax	VAT
Gasoline	15%	$0.02/liter	30%	10%
Diesel	-	$0.04/liter	4%	10%

Source: General Department of Customs and Excise of Cambodia.

c. Fuel Special Tax

A special tax on fuel is collected by the GDCE. The rate is set at 30% for gasoline and 4% for diesel. This rate is applied to the sum of the import value, the customs duty and the additional tax. Based on the fuel consumption presented in Table CAM4 and the current fuel prices, revenue from this additional tax is estimated to be in the order of $250 million per year.

d. Fuel Value-Added Tax

The value-added tax on fuel is collected by the General Department of Taxation. The rate is fixed at 10% and is applied to the sum of the import value, the customs duty, the additional tax and the special tax. Based on the fuel consumption presented in Table CAM4 and the current fuel prices, the revenue from this additional tax is estimated to be in the order of $230 million per year.

e. Vehicle Customs Duty

Vehicles imported into Cambodia are subject to a customs duty, which is collected by the GDCE. The customs duty is defined as a percentage of the value of the vehicle, and depends on the type of vehicle, the engine type and the engine capacity, as shown in Table CAM6. The customs duty is lower for motorcycles, trucks and buses and higher for passenger cars. For 2023, the GDCE reported a total value of vehicle imports of $1.3 billion, up from $1.0 billion in 2022. Based on the newly registered vehicles in 2022, the revenue from the customs duty on vehicles is estimated to amount to approximately $275 million.

Table CAM6: Customs Duty, Special Tax and VAT on Vehicles in Cambodia

Vehicle type	Engine type	Engine capacity	Customs duty	Special tax	VAT
Motorcycle	ICE	<50cc	15%	5%	10%
		50–250cc	15%	15%	10%
		250–800cc	15%	20%	10%
		>800cc	15%	25%	10%
	BEV	All	15%	5%	10%
Passenger car	ICE	<1,000cc (gasoline)	35%	20%	10%
		<1,000cc (diesel)	35%	50%	10%
		1,000–3,000cc	35%	50%	10%
		>3,000cc	35%	55%	10%
	BEV	All	35%	10%	10%
Trucks	All	<5 tons	15%	40%	10%
		>5 tons	15%	30%	10%
Buses	ICE	All	15%	40%	10%
	BEV	All	15%	10%	10%

BEV = Battery Electric Vehicle, cc = cubic centimeters, ICE = Internal Combustion Engine (including hybrid vehicles).

Source: Government of Cambodia. 2023. *Overview of the Transport Infrastructure Sector in the Kingdom of Cambodia (7th Edition)*. Infrastructure and Regional Integration Technical Working Group (IRITWG).

f. Vehicle Special Tax

The GDCE also collects a special tax on vehicles, which is applied to both imported and domestically produced vehicles. This ranges from 5% for small motorcycles to 55% for passenger cars with large engines, as can be seen in Table CAM6. The rates for battery electric vehicles have been reduced to 5% for electric motorcycles and 10% for other electric vehicles. Hybrid vehicles, including plugin hybrids, pay the same rate as vehicles with only an internal combustion engine. The rates are applied to the import value plus the customs duty. The revenue from the special tax on vehicles is estimated to be in the order of $460 million.

g. Vehicle Value-Added Tax

A value-added tax on vehicles is collected by the General Department of Taxation. The VAT is 10% regardless of the type of vehicle. The rate is applied to the import value plus the customs duty plus the special tax. Based on the 2023 import value of $1.3 billion, the estimated customs duty revenue of $230 million and the estimated special tax revenue of $310 million, the revenue from the VAT is estimated to be $200 million.

h. Road Tax

Cambodia has introduced a tax on means of transportation, commonly referred to as a road tax. This is an annual tax charged on the ownership of vehicles and is collected by the General Department of Taxation and paid at provincial and district branches or commercial banks. Payment is also possible using the Road Tax app, which greatly facilitates the payment and has resulted in a much higher percentage of vehicle owners paying the tax. The rates applied in the app are indicated in Table CAM7. In 2021, GDT reportedly collected $93 million in road tax revenues from nearly 800,000 vehicles. In 2022, GDT reported that revenues exceeded $100 million.

Table CAM7: Tax on Means of Transportation in Cambodia

Vehicle type	Vehicle characteristics	Tax rate (KHR)
Passenger car	<15 seats	150,000
	>15 seats	200,000
Pickup 2-door		200,000
Pickup 4-door	<1500cc	150,000
	1500cc-2000cc	200,000
	2000cc-2900cc	600,000
	2900cc-4000cc	1,600,000
	>4000cc	2,000,000
Bus	<1500cc	80,000
	1500cc-2000cc	100,000
	2000cc-2900cc	250,000
	2900cc-4000cc	600,000
	>4000cc	800,000
Truck	3t-10t	500,000
	<3t	200,000
	10t-20t	1,000,000
	>20t	2,000,000

Source: GDT Means of Transportation app.

i. Tolling

Cambodia currently collects tolls on the expressway from Phnom Penh to Sihanoukville. This 190 km, 4-lane expressway was constructed and is operated under a Build-Operate-Transfer model. The construction cost amounted to $2 billion. The toll rates are shown in Table CAM8. During the first four months of operation, revenue was reported to amount to $11 million, suggesting an annual revenue of approximately $33 million. However, a 20% discount was applied to the toll rates during the first year of operation, but since December 2023 the full toll rates have been applied. As a result, toll revenues are likely in the order of $40 million. These toll revenues serve to cover both the maintenance costs and to recover part of the initial investment. These revenues are not available to other roads.

Table CAM8: Estimated Road User Revenues in Cambodia

Category	Description	Toll rate
Type A	Motorcycles with cylinder capacity greater than or equal to 500cc	0.08 $/km
	Passenger cars up to 7 seats	
	Truck with less than 2 tons gross weight	
Type B	Medium bus from 8 to 19 seats	0.16 $/km
	Truck with 2 to 5 tons gross weight	
Type C	Large bus from 20 to 56 seats	0.24 $/km
	Truck with 5 to 10 tons gross weight	
Type D	Truck with 10 to 20 tons gross weight	0.32 $/km
Type E	Truck with more than 20 tons gross weight	0.40 $/km

Source: Ministry of Public Works and Transport, 1 November 2022.

5. Road user revenues

The estimated road user revenues are presented in Table CAM9. The total revenue from road users amounts to $1,735 million per year, over ten times the estimated road maintenance costs. Road user revenues constitute 5.9% of GDP and are far higher than any other country in this study. Fuel taxes provide $660 million in revenues and make up 38% of the total revenues. However, the majority of road user revenues comes from vehicle-based charges, including $935 million in revenues applied on first registration (54%) and an additional $100 million (6%) from the annual road tax based on vehicle ownership. The remaining $40 million (2%) comes from tolling. The current road user revenues are not earmarked for a road fund or for road maintenance, although the fuel additional tax ($100 million in 2023) was originally introduced as an earmarked revenue to finance road maintenance and is still indicated as such in the reports of the Ministry of Economy and Finance. The toll revenue ($40 million) covers the maintenance costs for the expressway from Phnom Penh to Sihanoukville and serves to cover part of the initial investment.

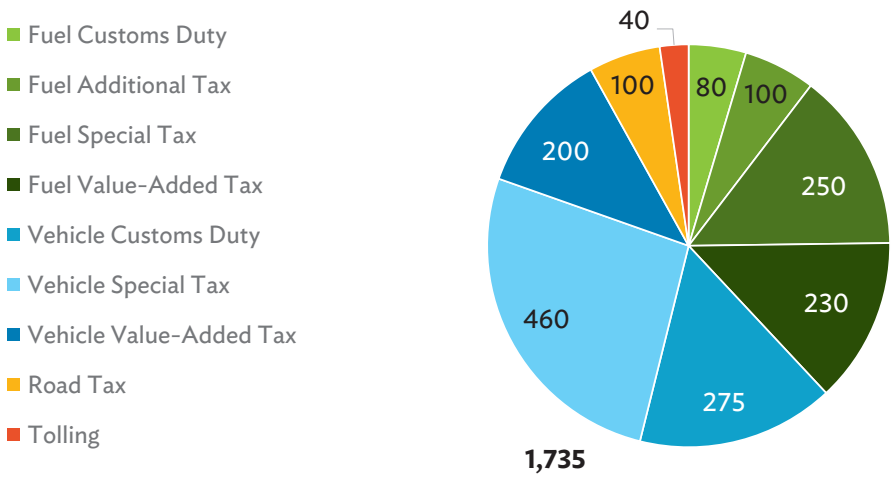
Table CAM9: Road User Revenues in Cambodia

Road User Revenue	Revenue ($ million)	%	Road Fund ($ million)	%
Fuel Customs Duty	80	5%	-	-
Fuel Additional Tax*	100	6%	-	-
Fuel Special Tax	250	14%	-	-
Fuel Value-Added Tax	230	13%	-	-
Vehicle Customs Duty	275	16%	-	-
Vehicle Special Tax	460	27%	-	-
Vehicle Value-Added Tax	200	12%	-	-
Road Tax	100	6%	-	-
Tolling	40	2%		
Total	**1,735**	**100%**	**-**	**-**

* The fuel additional tax was originally introduced as an earmarked levy for road maintenance.

Source: Consultant's processing of data.

Figure CAM4: Road User Revenues in Cambodia
($ million)



Source: Consultant's processing of collected data.

Revenue from carbon-based fuel taxes amounts to approximately $660 million per year in Cambodia, forming 38% of the total road user revenues. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. Compared to consumption in 2019 of 12 million barrels of oil equivalent in the transport sector, the Roadmap for the Development of an Electric Vehicle Charging Stations Network in Cambodia estimates that the fuel consumption will reduce by up to 2.6 million barrels of oil equivalent by 2050, based on the most progressive scenario. Based on current fuel-based revenues, this would correspond to a loss in revenue of approximately $140 million by 2050, almost the same as the estimated road maintenance needs. The revenue from the special tax on vehicles would also be affected as the rate is set significantly lower for electric vehicles, potentially affecting a further $205 million in revenue.

C. Kyrgyz Republic

Kyrgyz Republic is a landlocked country in Central Asia with a land area of 191,800 km^2 and a population of 7.0 million people, resulting in a relatively low population density of 35 persons per km^2. According to the World Bank, the GDP was $11.5 billion in 2022 (US$ current), resulting in a low GDP per capita of $1,655. Kyrgyz Republic has a mountainous terrain, with over 90% of the country covered by mountains. The climate is continental, with hot summers and cold winters.

1. Road network

Kyrgyz Republic has a reported road network of 34,132 km. This includes 18,942 km of public roads that are managed by the Ministry of Transport and Communications (MTC) and 15,190 km of roads in cities, villages and enterprises that are managed by local governments or enterprises. Policy development for the road sector falls under the responsibility of the Road Administration Department under MTC, while management of public roads is carried out by the Road Maintenance Department (DDH)[6] which is set up as a separate legal entity under MTC. DDH is supported in the management of the public road network by four oblast regional offices. All implementation of maintenance and current repair works on public roads is contracted out to the recently created state enterprises Kyrgyz Avtozhol-North and Kyrgyz Avtozhol-South. Midterm repairs (periodic maintenance) and capital repairs (rehabilitation) are outsourced on a competitive basis.

Table KGZ1: Public Roads by Class and Surface Type
(km)

Road Class	Asphalt concrete	Cement Concrete	Black Gravel	Gravel	Earth	Total
International	3,095	196	336	707	5	**4,339**
National	1,727	173	577	5,054	1,427	**8,957**
Local	1,468	119	664	3,158	237	**5,647**
Total	**6,289**	**488**	**1,578**	**8,919**	**1,668**	**18,942**

Source: Report on Strategy Analysis with HDM-4, ADB 2021.

[6] Департамент Дорожного Хозяйства (ДДХ).

The majority of public roads (80%) have a low technical standard (IV or V with 1 or 2 lanes and a maximum six meter carriageway width). Class I and II roads make up only 3% of the network. Overall, 44% of the public road network is paved. In the case of international roads, 84% is paved, while for national roads this percentage drops to only 28%. For local roads, 40% are paved, mainly in and around population centers. For roads in cities, villages and enterprises it is not clear what percentage is paved, but this is estimated to be around 10%.

Table KGZ2: Public Roads by Technical Standard

	Road category	Design traffic (vehicles)	Geometric parameters	Right-of-way (either side)	Length (km)	%
IA	Motorways	>9,000	4 lanes, 15 m width, separated carriageway	32 m	54	0.3%
IB	International and national corridors	7,000–9,000	4 lanes, 15 m width	32 m		
II	International, national and local roads	3,000–7,000	2 lanes, 7.5 m width	16 m	549	3%
III	International, national and local roads	1,000–3,000	2 lanes, 7 m width	14 m	3,197	17%
IV	National and local roads	100–1,000	2 lanes, 6 m width	13 m	7,461	40%
V	Local roads	<100	1 lane, 4.5 m width	12 m	7,561	40%

Source: Report on Strategy Analysis with HDM-4, ADB 2021.

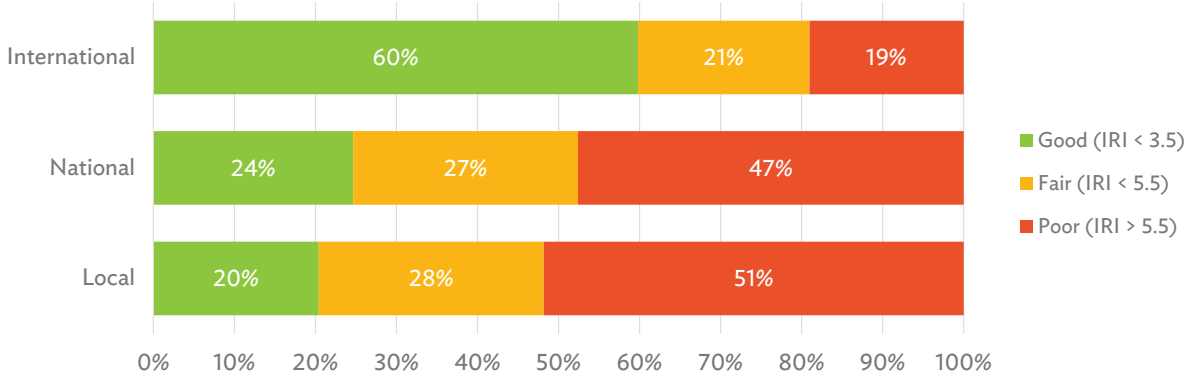
After independence, road conditions deteriorated significantly. Since 2006, large portions of the public road network have been upgraded and rehabilitated, focusing on more than 2,000 km of international roads, with over 900 km financed through development partner road projects. The percentage of international road networks in good condition increased from 21% in 2010 to 44% in 2019 and is currently 60%. National and local roads showed a slower improvement, with the percentage in good condition increasing from 20% in 2010 to 24% in 2019, but currently back down at 20%. The percentage of international roads in poor condition has decreased as a result of the large investment. For national and local roads, the percentage has increased, reflecting a lack of funding for these roads.

Table KGZ3: Public Road Conditions by Road Class

Road class	**Good** (IRI < 3.5)	**Fair** (IRI < 5.5)	**Poor** (IRI > 5.5)
International	60%	21%	19%
National	24%	27%	47%
Local	20%	28%	51%
Total	**44%**	**24%**	**32%**

Source: Report on Strategy Analysis with HDM-4, ADB 2021.

Figure KGZ1: Public Road Conditions by Road Class



Source: Report on Strategy Analysis with HDM-4, ADB 2021.

2. Road maintenance needs and budget

An HDM-4 strategy analysis carried out by ADB consultants in 2021 identified an optimal 20-year funding requirement for public road maintenance and repair of $120 million annually. The long-term maintenance and repair budget includes approximately $80 million per year for 8,100 km of paved roads and $40 million per year for 10,700 km of unpaved roads (with some unpaved roads receiving only maintenance and current repairs). An additional $1,040 million was estimated to be needed to address the backlog in maintenance and repair.

A simple unit rate analysis carried out by MTC provides a similar result. Here the road lengths are multiplied by unit costs of different maintenance needs and divided by the frequency of application in years to determine the average annual financing needs. As shown in Table KGZ4, the costs amount to just over KGS10 billion per year, equivalent to $125.6 million or 1.1% of GDP. A significant portion of this funding, around KGS5.7 billion ($67 million), is earmarked for international roads. It should be noted that this estimate and the HDM-4 estimate do not include the 15,000 km of city, village and enterprise roads.

Table KGZ4: Unit Cost Estimation of Road Maintenance Needs

Treatment Type	Frequency	Length per year (km)	Unit Cost (KGS/km)	Total Cost (KGS '000)	Total Cost ($ million)
Maintenance (5%)	every year	-	-	550,000	6.5
Routine repair	every year	18,810 km	14,000–191,000	1,850,000	21.9
Midterm repair				4,210,000	49.7
Surface treatment	5 years	600 km	1,000,000	600,000	7.1
Overlay	10 years	400 km	5,000,000	2,000,000	23.6
Black gravel course	6 years	280 km	2,500,000	700,000	8.3
Regravelling	4 years	2,270 km	400,000	910,000	10.7
Capital repair	15 years	320 km	11,000,000	3,520,000	41.6
Engineering structures	-	-		500,000	5.9
Total	**-**	-	-	**10,630,000**	**125.6**

Source: Government of Kyrgyz Republic. Ministry of Transportation and Communications of Kyrgyz Republic.

Before the COVID-19 pandemic, budget allocations from the Republican Budget for maintenance and repair were approximately $28 million per year, representing approximately 20%–25% of the identified needs. Despite a significant reduction of funding to only $10 million in 2020 as a result of the COVID-19 pandemic, budget allocations started increasing again in 2021.

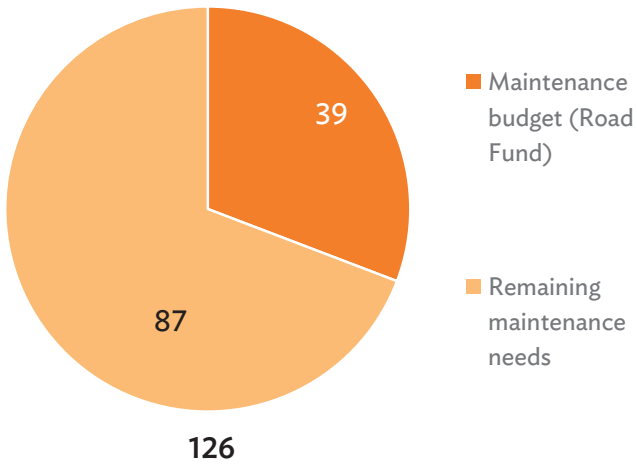
Table KGZ5: Budget Allocations to Road Maintenance from the Republican Budget

Year	2017	2018	2019	2020	2021
Budget allocation (KGS million)	1,980	1,984	1,963	721	1,558

Source: Government of Kyrgyz Republic. Ministry of Transportation and Communications.

The newly established Road Fund was expected to generate revenues of around KGS4 billion ($50 million). However, based on estimates of the main road user revenues earmarked for the Road Fund, this is likely to be in the range of $38.5 million, equivalent to 0.3% of GDP. While this represents a substantial increase from pre-COVID-19 allocations from the Republican Budget, it still falls significantly short of the identified funding requirements for road maintenance and repair. Over time, it is anticipated that additional revenues will be collected by the Road Fund through the implementation of tolling for trucks and buses on public roads. MTC estimates that this could generate an additional KGS3.5 billion (over $40 million) annually in revenue. However, it is important to note that achieving this toll revenue is uncertain, and it will likely take several years before it becomes a reliable source of funding to fully cover the maintenance and repair needs for international and national roads.

Figure KGZ2: Road Maintenance Needs and Budget in Kyrgyz Republic
($ million)

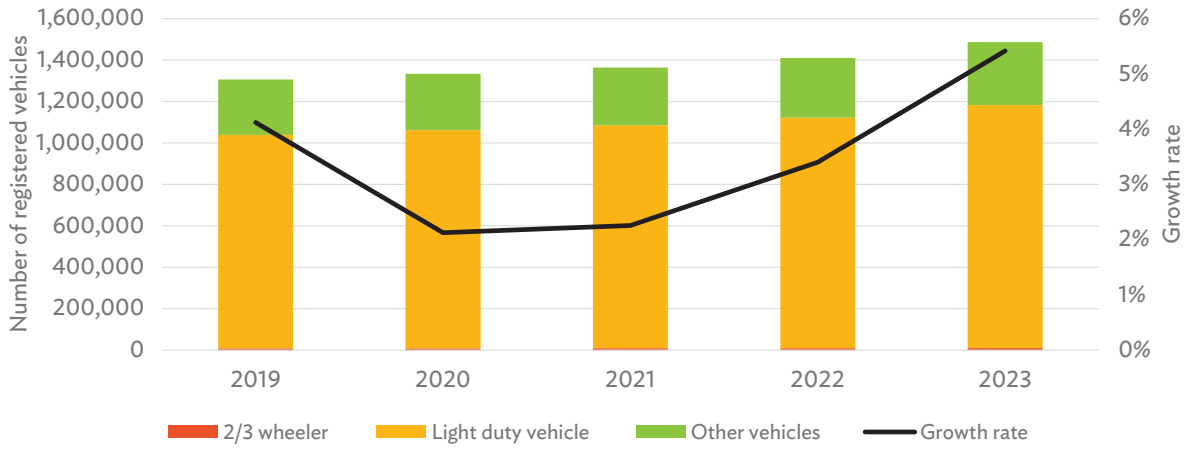


Source: Consultant's processing of collected data.

3. Vehicle fleet

The Kyrgyz vehicle fleet consisted of 1.4 million vehicles in 2019. This included approximately 9,000 motorcycles, 1 million light-duty vehicles, and 270,000 other vehicles. Although data for subsequent years is available for passenger car registrations, this is not readily available for other vehicle types. The number of passenger cars has exhibited an average annual growth rate of about 3% from 2019 to 2023, as depicted in Figure KGZ3. Assuming a similar annual growth rate for other vehicle types as for passenger cars, this would suggest that there were 1.5 million vehicles in 2023.

Figure KGZ3: Total Registered Vehicles in Kyrgyz Republic



Source: National Statistical Committee of Kyrgyz Republic.

Kyrgyz Republic does not have autonomous car or truck manufacturing capabilities. The automotive fleet is primarily comprised of second-hand vehicles sourced from various countries, with over 90% of vehicles currently more than 10 years old. In 2022, 46,745 vehicles were imported with a total value of approximately $456 million, marking a tripling of imported vehicle numbers and values compared to 2021. The significant increase in vehicle imports in 2022 is partly due to the onward shipping to the Russian Federation.

Table KGZ6: Number and Value of Imported Vehicles by Year

Year	Motorcycle	Passenger car	Bus	Truck	Other	Total	Value ($)
2021	3,579	6,900	188	3,699	133	**14,499**	128.9
2022	6,868	32,872	128	6,600	277	**46,745**	456.2

Source: National Statistical Committee of Kyrgyz Republic.

The number of electric vehicles in Kyrgyz Republic is still limited. However, the low customs duties on electric vehicles are resulting in increasing numbers of electric vehicles being imported. According to a study by the OSCE Academy in Bishkek,[7] there were 1,097 electric vehicles imported into Kyrgyz Republic between 2018 and 2022, with three-quarters imported in 2022 alone. This mainly involves new electric vehicles as second-hand electric vehicles are not widely available or have low-quality batteries. However, charging infrastructure is largely lacking in Kyrgyz Republic, limiting the usability of electric vehicles. In the OSCE study, this is quoted as the main factor limiting uptake. Large numbers of electric vehicles will likely also place a strain on the electricity network. Under a scenario of 100,000 electric vehicles, the OSCE study estimates that Kyrgyz Republic would need about 110 million–140 million kilowatt-hours of additional electricity per year. This amount of electricity is not available at present.

[7] Рынок Электромобилей в Кыргызстане: Тенденции, Препятствия И Рекомендации Для Развития, 2023.

4. Sources of road user revenues

Kyrgyz Republic collects a range of road user revenues. According to the 2022 Law on the Road Fund, the following road user revenues are earmarked for the Road Fund. In practice, however, some of these road user revenues are not yet being collected, such as the tolls and fees for the use of the right-of-way.

Table KGZ7: Road User Revenues Earmarked for the Road Fund

(i)	50% of the fuel excise tax
(ii)	Vehicle registration fee
(iii)	Tolls for passage through artificial structures on public roads
(iv)	Tolls from trucks and buses for travel on public roads
(v)	Fees for axle load and size control and fees for permits for oversized and overweight vehicles
(vi)	Fines for overweight and oversized vehicles
(vii)	Compensation for damages by heavy and oversized vehicles
(viii)	Fees for lease of land in the right-of-way of public roads

Source: Law on the Road Fund, 2022.

a. Fuel Excise Tax

The excise tax rates are defined in the 2022 Tax Code. The fuel excise tax is applied to gasoline, diesel and liquified gas. Of the fuel excise tax revenue collected, 50% is earmarked for the Road Fund where it forms the most important source of revenue. Excise tax applied to liquified gas was originally not earmarked for the Road Fund, but in February 2024 it was added through an amendment to the Road Fund Law. The tax rates were increased significantly in 2020 and for gasoline now amount to KGS10,000 per ton (equivalent to approximately $0.08 per liter), while for diesel they are much lower at KGS2,000 per ton (equivalent to approximately $0.02 per liter) and for liquified gas they are KGS5,000 per ton. The fuel excise tax for fuel imported from countries outside the Eurasian Economic Union (EAEU) is collected by the State Customs Service, while for fuel imported from inside the EAEU (which is imported duty-free) and for fuel produced domestically, the excise tax is collected by the State Tax Service. In 2021, gasoline consumption was reported to be in the order of 485,000 tons per year and diesel consumption was in the order of 475,000 tons per year. As a result, the fuel excise tax revenue from gasoline and diesel was expected to be in the order of KGS5.8 billion, equivalent to $72 million. Only 50% of this revenue is earmarked for the Road Fund, equivalent to $36 million.

Table KGZ8: Fuel Excise Tax Rates

Fuel Type	**Excise Tax** (KGS/ton)
Gasoline	10,000
Diesel	2,000
Liquified gas condensate	5,000

Source: Government of Kyrgyz Republic. 2022. *Tax Code of Kyrgyz Republic.*

b. Fuel Value-Added Tax

The value-added tax (VAT) in Kyrgyz Republic is 12%. Based on the fuel consumption in 2021 of 485,000 tons for gasoline and 475,000 tons for diesel, together with the average fuel price for 2021 of $0.61 per liter for gasoline and $0.55 per liter for diesel in that same year, the VAT revenue is estimated to amount to $76.0 million.

c. Vehicle Registration Fee

The vehicle registration fee is regulated by the Code on Non-Tax Incomes and the rules for registration and re-registration of vehicles issued through Resolution No. 407 of 2017. Collection of the vehicle registration fee is carried out by the Department for the Registration of Vehicles and Drivers under the State Registration Service. The vehicle registration fee is collected on the initial importation of the vehicle into the country (first registration) and on a change of ownership (re-registration). During the first registration, a fee equivalent to 5% of the tax value of the vehicle is enforced, while the re-registration incurs a fee of 0.3% of the tax value. The tax value itself is determined by factors including the engine power, the age of the vehicle, and the country of manufacture. Vehicles originating from member countries of the Eurasian Economic Union (EAEU) have lower tax rates, particularly in the case of new cars. Table KGZ9 shows the initial registration and re-registration fee rates for new vehicles (maximum rates) and for vehicles of 10 years or older (minimum rates). Initial registration fees range from $70 to $2,160 for cars and $125–$2,560 for trucks and buses. Electric vehicles are exempt from paying the registration fee, while hybrid vehicles pay only 50% of the fee. In 2018, the reported revenue from the registration fee amounted to KGS486 million, equivalent to $7.1 million. This revenue is earmarked for the Road Fund.

Table KGZ9: Vehicle Registration Fee Rates

Vehicle type	Engine capacity (cc)	Initial registration fee (5%) [som]				Re-registration fee (0.3%) [som]			
		New vehicle		> 10 years old		New vehicle		> 10 years old	
		Inside EAEU	Outside EAEU	Inside EAEU	Outside EAEU	Inside EAEU	Outside EAEU	Inside EAEU	Outside EAEU
Motor-cycles	< 350	7,500		2,250		450		135	
	> 350	22,500		5,000		1,350		300	
Cars	< 1,000	17,500	37,375	2,500	4,000	1,050	2,243	150	240
	1,000–2,000	19,000	48,875	3,500	5,000	1,140	2,933	210	300
	2,000–3,000	20,500	57,500	4,500	6,000	1,230	3,450	270	360
	3,000–4,000	22,000	66,125	5,500	7,000	1,320	3,968	330	420
	4,000–5,000	23,500	71,875	6,500	8,000	1,410	4,313	390	480
	> 5,000	25,000	77,625	7,500	10,000	1,500	4,658	450	600
Other vehicles (buses, trucks)	< 2,000	33,000	55,200	4,500	8,000	1,980	3,312	270	480
	2,000–3,000	35,000	63,250	5,000	9,500	2,100	3,795	300	570
	3,000–4,000	39,000	71,300	5,500	11,000	2,340	4,278	330	660
	4,000–5,000	39,000	74,750	5,500	11,750	2,340	4,485	330	705
	5,000–8,000	42,500	79,350	5,750	12,500	2,550	4,761	345	750
	8,000–10,000	46,000	87,400	6,250	14,000	2,760	5,244	375	840
	10,000–12,000	55,000	89,125	6,750	15,000	3,300	5,348	405	900
	12,000–15,000	57,500	90,275	6,850	16,000	3,450	5,417	411	960
	> 15,000	60,000	92,000	7,000	17,500	3,600	5,520	420	1,050

cc = cubic centimeter, EAEU = Eurasian Economic Union.

Source: State Registration Service.

d. Vehicle Customs Duty

The customs duty on vehicles varies based on the country of origin. For vehicles imported from within the EAEU, the import duty is set at 20% of the vehicle's value. For new or relatively new vehicles (0–3 years old) coming from outside the EAEU, the duty is either 48%–54% of the vehicle's value or €2.5–€20 per cubic centimeter (cc) of engine capacity, whichever is greater. Vehicles aged 3–5 years from outside the EAEU are charged based on engine capacity, with rates ranging from €1.5–€3.6 per cc. For vehicles older than 5 years, the duty increases to €3.0–€5.7 per cc. Electric vehicles imported from outside the EAEU have a customs duty of 29% of the vehicle's value. Based on the data for 2021, the annual revenue from these customs duties is estimated to be around €70 million (approximately $75 million). This revenue is allocated to the General Budget and is not earmarked for the Road Fund.

Table KGZ10: Vehicle Customs Duty Rates

Origin	Type of Vehicle	Customs Duty Rate
Inside EAEU	All vehicles	20% of value
Outside EAEU	Age 0–3 years	48%–54% of value or €2.5–€20.0/cc, whichever is greater
	Age 3–5 years	€1.5–€3.6/cc
	Age >5 years	€3.0–€5.7/cc
	Electric vehicles	29% of value

Source: State Customs Service of Kyrgyz Republic.

e. Vehicle Value-Added Tax

The value-added tax (VAT) in Kyrgyz Republic is 12%. Application of this tax rate to the value of imported vehicles for 2021 of $129 million, results in an estimated revenue of $15.5 million. This revenue is allocated to the General Budget.

f. Annual Motor Vehicle Tax

The rates for the motor vehicle tax depend on the vehicle type, the vehicle age and the engine power (see Table KGZ11). The annual motor tax revenues are estimated to be approximately KGS1.1 billion, equivalent to $12.6 million, assuming the vehicle fleet numbers for the year 2022 are correct, together with average engine capacities of 125cc for motorcycles, 1,500cc for passenger cars and 5,000 cc for other vehicles, and the fact that 90% of the vehicles are older than 15 years.

Table KGZ11: Motor Vehicle Tax Rates in Kyrgyz Republic

Vehicle type	Vehicle age	Tax rates (KGS per cc)	Approximate number of vehicles
2- and 3-wheelers (motorbikes, scooters, mopeds)	< 10 years	0.15	2,500
	> 10 years	0.09	22,500
Light duty vehicles (passenger cars, vans and pickup trucks based on passenger cars)	< 5 years	0.90	10,000
	5–10 years	0.75	20,000
	10–15 years	0.60	70,000
	> 15 years	0.45	900,000

continued on next page

Table KGZ11 *continued*

Vehicle type	Vehicle age	Tax rates (KGS per cc)	Approximate number of vehicles
Other vehicles (trucks, buses, minibuses)	< 5 years	0.75	2,600
	5–10 years	0.60	5,200
	10–15 years	0.45	18,200
	> 15 years	0.30	234,000

Source: https://auto.doska.kg/inform:usefull/show:autotax_calc.

g. Overloaded and Oversized Vehicles

Different road user revenues are collected from overweight and oversized vehicles. This includes a fee paid for weight and dimension control, a permit fee for vehicles with large or heavy indivisible loads, and a fine for the compensation of damages. The exact rates applied are unknown. Revenues from these three road user revenues amounted to KGS118.2 million in 2018, equivalent to $1.6 million. This revenue is earmarked for the Road Fund.

Table KGZ12: Revenues from Overweight and Oversized Vehicles (2018)

Road user revenue	**Revenue** (KGS million)
Fee for load and dimension control	77.6
Permit fee for vehicles with indivisible loads	15.3
Fine for compensation of damages	20.9

Source: Government of Kyrgyz Republic. Ministry of Transportation and Communications.

h. Tolling

Tolling on public roads is regulated in the Code on Non-Tax Income and the 2008 Decree No. 615. Presently, tolls are only collected in two major tunnels along the Bishkek–Osh road, namely the Sosnovka and Karakol tunnels. Collection is carried out by the State Directorate Bishkek-Osh, which has been merged recently into the state enterprise Kyrgyzavtozhol. Although revenue was officially earmarked for the Road Fund, in practice it remained with the State Directorate and was used for the maintenance and repair of the Bishkek–Osh road, especially its tunnels. Specific data on prevailing rates applied is unavailable. Reported revenue from the tolls in the two tunnels amounted to KGS59.4 million in 2018, equivalent to $0.9 million. This revenue is earmarked for the Road Fund.

Currently there are no tolls collected on public roads, but MTC is planning to introduce tolls for 4,400 km of public roads in the form of fees for trucks and buses that use those roads. This tolling initiative will incorporate an automated registration system equipped with a dimension scanner and dynamic scales to gauge axle and total loads. The proposed toll rate is anticipated to incrementally rise to KGS8.3/km (approximately $0.09/km). According to the decree on toll roads, toll collection will be the responsibility of Road Maintenance Department.

5. Road user revenues

The estimated road user revenues are presented in Table KGZ13. The total revenue from road users amounts to nearly $261 million per year, double the estimated road maintenance needs and equivalent to 2.3% of GDP. A large portion is from fuel tax revenues, amounting to $148 million per year and making up 57% of the road user revenues. Vehicle customs duties, registration fees, and value-added taxes make

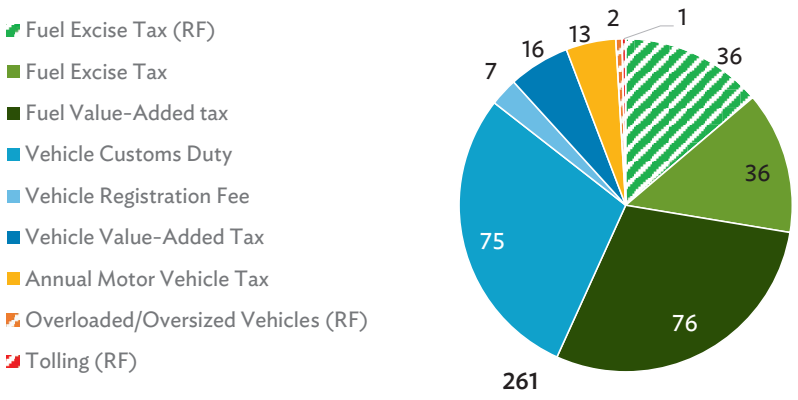
up a large portion of the revenue, providing $98 million per year or 37% of total revenue. The annual motor vehicle tax revenue is also significant and provides 5% of total revenue. Overloaded/oversized vehicles and tolling currently provide only $2.5 million or 1% of the revenue, but this may change if the tolls are expanded to other tunnels and bridges and applied to roads for trucks and buses, potentially increasing to $40 million in revenue. Of the current total revenue, only $38.5 million (15%) is officially earmarked for the Road Fund.

Table KGZ13: Road User Revenues in Kyrgyz Republic

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Fuel Excise Tax	72.0	28%	36.0	94%
Fuel Value-Added Tax	76.0	29%	-	-
Vehicle Customs Duty	75.0	3%	-	-
Vehicle Registration Fee	7.1	29%	-	-
Vehicle Value-Added Tax	15.5	6%	-	-
Annual Motor Vehicle Tax	12.6	5%	-	-
Overloaded and Oversized Vehicles	1.6	0.6%	1.6	4%
Tolling	0.9	0.3%	0.9	2%
Total	**260.7**	**100%**	**38.5**	**100%**

Source: Consultant's processing of data.

Figure KGZ4: Road User Revenues in Kyrgyz Republic
($ million)



Source: Consultant's processing of collected data.

Revenue from carbon-based fuel taxes amounts to approximately $148 million per year in Kyrgyz Republic and make up 57% of the total road user revenues. More importantly, the fuel taxes make up 94% of the current revenue of the Road Fund that provides the financing for road maintenance. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. The study by the OSCE Academy in Bishkek estimates that the introduction of 100,000 electric vehicles will reduce fuel consumption by 86,400 tons. For gasoline, this represents approximately $10 million in fuel excise tax revenue. With 50% allocated to the Road Fund, this would decrease the Road Fund revenue by $5 million, 13% of total revenue. Revenue from the vehicle registration fee and the vehicle customs duty will also reduce as the rates for electric vehicles are significantly lower or set to zero. This can affect a further $38 million in revenues, although these are not earmarked for the Road Fund.

D. Mongolia

Mongolia is a large landlocked country in Central Asia with a land area of 1,557,500 km^2 and a population of only 3.4 million people, resulting in a low population density of only two persons per km^2. According to the World Bank, the 2022 GDP (US$ current) is $17.1 billion, resulting in a relatively high GDP per capita of $5,046. The terrain combines mountains and rolling plateaus. The climate is continental, with hot summers and cold winters. The country has several areas with permafrost that are gradually being affected by climate change, causing damage to roads and other infrastructure.

1. Road network

Mongolia has a reported road network of approximately 113,000 km of which only a small portion is paved. This includes 14,921 km of international and state roads that are managed by the Ministry of Road and Transport (MRT) which is also responsible for special purpose roads. The capital city roads are managed by Ulaanbaatar Municipality, while local roads are under the responsibility of the regional (*aimag*) administration. The paved road network makes up 50% of the international and state road network, with an average of 335 km of roads being paved each year in the past seven years. Overall only 10% of the road network is paved and only 2% of local roads.

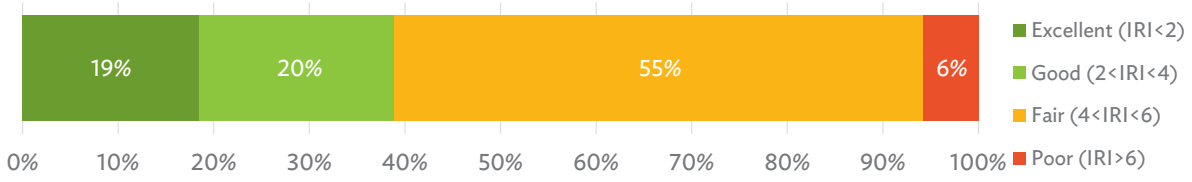
Table MON1: Road Lengths by Class and Surface Type
(km)

Road Class	Asphalt Concrete	Cement Concrete	Gravel	Earthen Improved	Earth	Total
International and State	7,477	9	906	347	6,183	**14,921**
Special purpose	855	43				**898**
Capital city	1,124	12				**1,136**
Local	1,668	32	255	393	93,749	**96,125**
Total	**11,124**	**95**	**1,161**	**740**	**99,932**	**113,081**

Source: Ministry of Roads and Transport Development 2023.

Road condition survey data collected by MRTD for 6,755 km of paved international and state roads shows that 39% is in excellent (IRI<2) or good condition (2<IRI<4), mainly as a result of recent upgrading works. A further 55% of the surveyed road length was found to be in fair condition (4<IRI<6) and the remaining 6% were in poor condition (IRI>6). The large percentage of the paved road network that is in fair condition demonstrates the urgent need for periodic maintenance. If this is not done on time, then the percentage of the paved network in poor condition could build up rapidly in the coming years, increasing the need for costly rehabilitation. The unpaved international and state roads mainly consist of earthen tracks without a fixed alignment and no maintenance is carried out except for a few structures on these roads. As these roads deteriorate, road users select a new alignment across the steppe.

Figure MON1: Road Condition of Paved International and State Roads



Source: MRTD survey data.

2. Road maintenance needs and budget

The maintenance needs were estimated by MRTD to be in the order of $50–$60 million per year for the paved international and state road network. In Table MON2, the maintenance needs are estimated by applying unit rates per kilometer per year to the different road types depending on their surface type and class. For paved international and state roads, an average of $6,000/km/year is estimated to be required, with lower amounts required for paved local roads. For gravel roads, the required funding amount is $2,000/km/year. Although earthen roads are non-engineered tracks and do not receive maintenance, some funding has been allocated for the maintenance of structures. Based on these unit rates and the road lengths, the total annual funding needs are estimated to amount to $120 million, mainly for the paved international and state roads managed by MRTD ($70 million). This amounts to 0.8% of GDP.

Table MON2: Estimated Annual Road Maintenance Funding Needs

Surface	**Responsible**	**Length** (km)	**Unit cost** ($/km/year)	**Annual cost** ($ million)
Paved	MRTD	8,809	8,000	70.5
	Ulaanbaatar	1,136	8,000	9.1
	Aimags	1,570	5,000	7.9
Gravel	MRTD	1,136	2,000	2.3
	Aimags	677	1,500	1.0
Earth	MRTD	6,101	1,000	6.1
	Aimags	93,878	250	23.5
Total		**113,307**		**120.3**

Aimag = province.

Source: Consultant's processing of collected data.

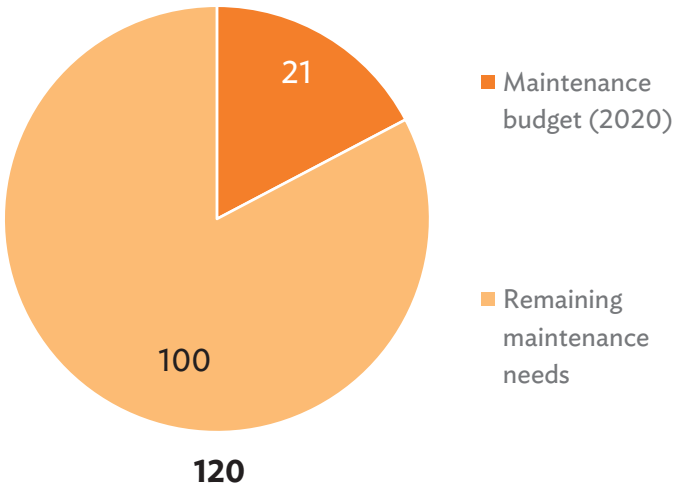
The road network is large compared to the size of the population (only just over 3 million inhabitants), complicating the financing and implementation of maintenance. This issue is further complicated by a strong concentration of the population in the capital city, Ulaanbaatar. As a result, a large portion of the local and state roads, mainly those that are unpaved, receive little to no maintenance.

Funding for maintenance of international and state roads comes from the State Road Fund and from the State Budget. The State Road Fund currently only receives funds from toll revenues, which amounted to MNT8,648 million ($3.3 million) in 2020.[8] Allocations from the State Budget amounted to MNT45,800 million ($17.5 million) in the same year. The total budget allocation to MRTD for road

[8] Source: Financial audit report 2020.

maintenance amounts to $20.8 million, equivalent to 0.1% of GDP and well below the estimated $70.5 million required for the paved international and state roads alone. Information about allocations for Ulaanbaatar Municipality and the *aimags* (provinces) are unknown.

Figure MON2: Road Maintenance Needs and Budget in Mongolia
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

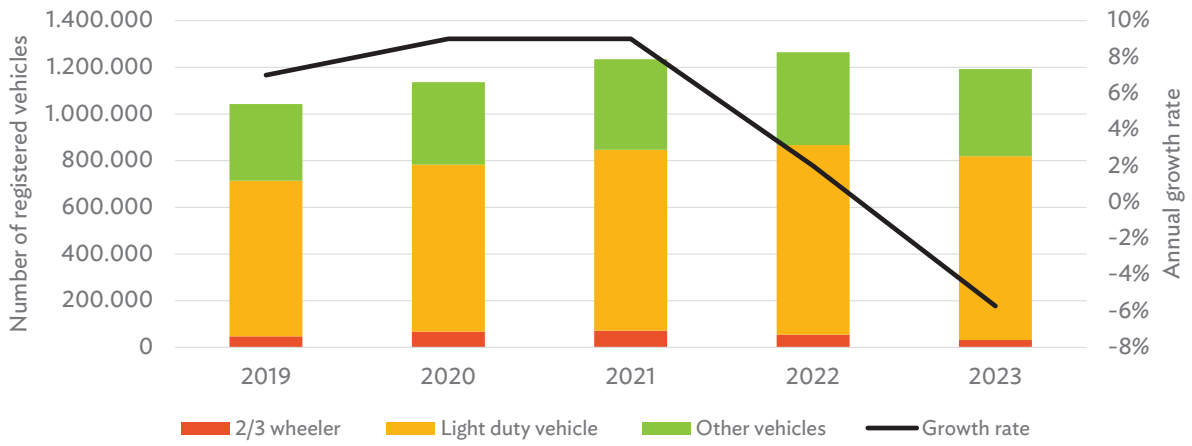
The vehicle fleet in Mongolia consisted of approximately 1.2 million vehicles in 2023 as shown in Table MON3. Two-thirds are passenger cars and one-third are buses, trucks and other vehicles. Motorcycles make up only a small portion of the vehicles (4%). Over half the vehicles are registered in Ulaanbaatar City, reflecting the concentration of the population in the capital. The vehicle fleet has exhibited an average annual growth rate of about 7% from 2019 to 2022 but showed a negative growth in 2023. Over 80% of the registered vehicles are more than 10 years old, with only 6% less than 3 years old (although this percentage is steadily increasing). Despite being a left-hand drive country, two-thirds of the registered vehicles are right-hand drive as a result of cheap second-hand imports from Japan.

Table MON3: Total Registered Vehicles in Mongolia

Vehicle type	2019	2020	2021	2022	2023
Motorcycle	46,951	67,781	71,677	54,760	31,520
Passenger car	667,375	715,309	775,171	812,263	788,038
Bus	19,535	36,084	34,073	31,832	23,356
Truck	227,525	241,268	263,852	265,661	244,867
Special purpose	20,075	20,672	20,404	18,604	14,705
Equipment	13,595	15,004	16,527	17,603	16,979
Trailer	47,972	40,616	52,997	64,169	73,055
Total	**1,043,028**	**1,136,734**	**1,234,701**	**1,264,892**	**1,192,520**
Ulaanbaatar	568,866	615,622	662,644	712,992	

Source: National Statistical Office of Mongolia.

Figure MON3: Total Registered Vehicles in Mongolia



Source: National Statistical Office of Mongolia.

On average, around 85,000 vehicles are imported each year. Three-quarters are passenger cars, mainly second-hand vehicles imported from Japan (over 90%). Trucks are mainly imported from the Republic of Korea, People's Republic of China and Japan. According to the General Department of Customs, the value of vehicle imports for 2023 amounted to $209 million, excluding vehicle parts and partly constructed vehicles. According to the Observatory of Economic Complexity, the total value of imported vehicles in 2021 amounted to $420 million. A Mongolian company (Bars Motor) has established a vehicle assembly plant in Ulaanbaatar, marking a shift toward small-scale domestic production, including the production of electric vehicles.

Table MON4: Number of Vehicles Imported to Mongolia

Vehicle type	2018	2019	2020	2021	2022
Passenger car	64,039	69,472	53,087	55,238	65,612
Bus/minibus	1,363	1,543	1,359	1,095	1,082
Truck	22,256	23,050	20,982	26,526	22,369
Total	**87,658**	**94,065**	**75,428**	**82,859**	**89,063**

Source: National Statistical Office of Mongolia.

The low vehicle excise tax rates (and earlier exemption) for hybrid and electric vehicles and the high excise rates for older vehicles with internal combustion engines has resulted in a large number of second-hand hybrid vehicles on the streets of Ulaanbaatar (mainly Toyota Prius). Hybrid vehicles currently comprise over one-third of the vehicle fleet in Mongolia, up from one-quarter of the fleet only two years ago. Hybrid vehicles have exhibited growth rates of 15% per year over the past two years. Battery electric vehicles are not yet popular, with only 1,072 registered in 2023, but the growth rates are even higher at almost 50% per year. This growth of hybrid and electric vehicles has been at the cost of vehicles with internal combustion engines, with a negative growth of gas-powered vehicles of -26% per year over the past two years, -11% for gasoline vehicles, and -2% for diesel vehicles. The uptake of electric vehicles is hampered by the fact that second-hand electric vehicles are not widely available or have low-quality batteries. Another factor hampering the uptake of electric vehicles is the lack of charging infrastructure. With the long distances in Mongolia, an internal combustion engine or hybrid vehicle is often preferred. However, in Ulaanbaatar, there are reportedly 70 charging stations with plans to add more.

Table MON5: Number of Registered Vehicles by Engine Type and by Year

Type of engine	2021	2022	2023	Annual growth
Petrol	531,652	508,277	420,128	-11%
Diesel	318,703	323,932	305,033	-2%
Gas	24,914	25,123	13,711	-26%
Hybrid	286,260	324,848	377,181	15%
Electric	485	668	1,072	49%

Source: Ministry of Roads and Transport Development.

4. Sources of road user revenues

Mongolia collects a range of road user revenues. According to the 2017 Law on Roads, the road user revenues listed in Table MON6 are earmarked for the State Road Fund. In practice, however, only the toll revenue is allocated to the State Road Fund. Other road user revenues are allocated to the State Budget, with annual budget allocations to road maintenance to complement the budget allocations from the State Road Fund. Some road user revenues are not yet being collected, such as the fees for the use of the right-of-way. International vehicle fees are rarely collected as a result of bilateral agreements exempting vehicles from neighboring countries.

Table MON6: Road User Revenues Earmarked for the State Road Fund

(ix) At least 20% of vehicle excise tax
(x) Tax on gasoline and diesel
(xi) Fees for the use of international, national, and special-purpose roads (tolls)
(xii) International vehicle fees
(xiii) Traffic fines issued on international, national, and special-purpose roads
(xiv) Fees for the use of the right-of-way in international, national, and special-purpose roads

Source: Law on Roads, 2017.

a. Gasoline and Diesel Tax

The gasoline and diesel tax is regulated by the Law on Gasoline and Diesel Tax of 1995. This law was introduced to provide earmarked road user revenues to the road fund that existed at the time. When the road fund was abolished, the law continued to exist. Although the Law on Roads that established the new State Road Fund does not identify the gasoline and diesel tax as an earmarked revenue, the Law on Gasoline and Diesel Tax continues to earmark the revenue to the road fund. The tax rates are defined in the law itself, and as a result, have remained unchanged since 1995. The 2019 Decree No. 312 links the Law on Gasoline and Diesel Tax to the State Road Fund and defines a portion of the revenue to be transferred to the State Road Fund. Where the rates were originally equivalent to about $0.04 per liter for gasoline and $0.005 per liter for diesel, because of the devaluation of the togrog, the revenue has now dropped to $0.006 per liter for gasoline and less than $0.001 per liter for diesel. Although increased consumption resulted in increased revenues, the fixed rates from 1995 meant that revenues were not able to match inflation and the devaluation of the togrog. Revenues from the gasoline and diesel tax increased by 50% in togrog terms between 2014 and 2020 but remained steady in US dollar terms. According to the United Budget for 2022, the revenue reached MNT17.1 billion in 2020, equivalent to $6.5 million. This revenue is officially earmarked for the State Road Fund, although this does not happen in practice.

Table MON7: Gasoline and Diesel Tax Rates

Fuel Type	Law on Gasoline and Diesel Tax (MNT/ton)	Decree 312 (MNT/ton)
Gasoline up to 90 octane	MNT20,350	MNT20,000
Gasoline over 90 octane	MNT25,700	
Diesel	MNT2,140	MNT2,000

Sources: 1995 Law on Gasoline and Diesel Tax, and 2019 Decree #312.

b. Fuel Excise Tax

The fuel excise tax is regulated by the 2006 Law on Special Excise Tax and subsequent amendments. The rates are defined in the law and are set at MNT15,950/MNT17,400 per ton for gasoline (about $0.005 per liter) and MNT21,750 per ton for diesel ($0.007 per liter). Although the excise tax rates on gasoline are similar to those under the Law on Gasoline and Diesel Tax, the rate of the diesel excise tax is 10 times higher, resulting in significantly higher revenues. The law also defines fuel excise tax rates depending on the border crossing point where the fuel enters the country, but it is not clear how this is applied and appears to be an amount to be paid on top of the rates listed below. According to the United Budget for 2022, the revenue from the fuel excise tax reached $96.5 million in 2020. However, the revenue from the fuel excise tax is not earmarked for the State Road Fund and remains in the State Budget.

Table MON8: Fuel Excise Tax Rates

Fuel Type	Law on Special Excise Tax (MNT/ton)
Gasoline up to 90 octane	MNT15,950
Gasoline over 90 octane	MNT17,400
Diesel	MNT21,750

Source: 2016 Law on Special Excise Tax.

c. Fuel Value-Added Tax

The value-added tax (VAT) is regulated by the Law on Value-Added Tax of 2006 and subsequent amendments. The standard VAT rate in Mongolia is 10%. However, according to the Law on Value-Added Tax, the government can set the VAT rate for gasoline and diesel between 0% and 10%. It is not clear exactly what VAT rate is applied to gasoline and diesel. According to the Ministry of Mining and Heavy Industry, Mongolia imported 729,800 tons of gasoline worth $522 million in 2023, as well as 1,347,000 tons of diesel worth $1,110 million. Assuming the value-added tax in Mongolia is set at the standard rate of 10%, the VAT revenue would be in the order of $163 million.

d. Vehicle Excise Tax

The excise tax on imported vehicles is regulated by the 2006 Law on Special Excise Tax and subsequent amendments. The rate of excise tax depends on the age of the vehicle and on the engine capacity as shown in Table MON9 for gasoline- and diesel-powered vehicles. Vehicle excise tax rates increase for older vehicles, ranging from $286 to $5,424 for new gasoline- or diesel-powered vehicles to

$3,817–$25,181 for vehicles over 10 years old. Vehicles powered by natural gas, hybrid vehicles and electric vehicles were exempted from excise tax in 2010, but this was changed in 2017 with the law now stipulating that the rate should be 0%–50% of the excise tax for other vehicles. The tax is collected by the Mongolian Customs General Administration on entry of the vehicle into the country. According to the United Budget for 2022, revenue from the vehicle excise tax has increased from MNT90.3 billion in 2014 to MNT172.3 billion in 2020, equivalent to $65.7 million. Of the total revenue collected, 20% is officially earmarked for the State Road Fund, amounting to $13.1 million (this does not happen in practice).

Table MON9: Vehicle Excise Tax
(MNT)

Engine Capacity	<3 Years Old	4–6 Years Old	7–9 Years Old	>10 Years Old
<1,500cc	750,000	1,600,000	3,350,000	10,000,000
1,500–2,500cc	2,300,000	3,200,000	5,000,000	11,700,000
2,500–3,500cc	3,050,000	4,000,000	6,700,000	13,350,000
3,500–4,500cc	6,850,750	8,000,000	10,850,000	17,500,000
>4,500cc	14,210,000	27,200,000	39,150,000	65,975,000

cc = cubic centimeter.

Source: 2006 Law on Special Excise Tax.

e. Vehicle Customs Duty

The customs duties are regulated by the Law on Customs Tariffs and Customs Duties of 2008 and subsequent amendments. The customs duty for imported vehicles is 5%. Based on the vehicle import value of $421 million in 2021, the customs duty revenue would amount to $21.0 million. This revenue is not earmarked for the State Road Fund.

f. Vehicle Value-Added Tax

The value-added tax (VAT) is regulated by the Law on Value Added Tax of 2006 and subsequent amendments. The value-added tax for vehicles is 10%, applied to imported vehicles and locally produced vehicles. In this study, the value of imported vehicles is used as the basis for estimating revenue from the VAT. Based on an import value of $421 million, the revenue would be $42.1 million. This revenue is not earmarked for the State Road Fund.

g. Vehicle Registration Tax

The vehicle registration tax is regulated by the Official Tax Law of Mongolia on Vehicles and Self-Propelled Vehicles of 1992. It is an annual vehicle tax collected by Ulaanbaatar Municipality and the *aimags* (provinces). The actual rates are defined by the Council of Representatives of the city and the *aimags*. The city and the *aimags* are also responsible for the collection of this tax. The revenue in Ulaanbaatar City was reported to amount to MNT12.7 billion in 2019, equivalent to $4.3 million. This revenue is not earmarked for the State Road Fund.

Table MON10: Annual Vehicle Registration Tax Rates
(MNT)

Type of vehicle	Ulaanbaatar city,	Darkhan-Uul, Orkhon province	Other locations
2-wheel motorcycle	2,000–6,000		1,800–5,400
3-wheel motorcycle	1,500–9,000		2,800–8,400
Passenger cars	16-132 per cm^3	16–66 per cm^3	14-60 per cm^3
Minibus up to 15 seats	35,000–105,000		28,000–84,000
Bus	52,000–156,000		40,000–120,000
Truck (depending on carrying capacity)	25,000–1,440,000		20,000–1,320,000
Special purpose vehicle	16,000–48,000		15,000–45,000
Tractors and other self-propelled tools	14,000–42,000		11,200–33,600
Small tractor	7,000–21,000		5,600–16,800
Trailer (per 1 ton of load)	5,500–16,500		5,500–16,500

Source: Official Tax Law of Mongolia on Vehicles and Self-Propelled Vehicles.

h. Tolling

Tolling is regulated by the Law on Roads, which provides MRTD with the authority to define the procedures for tolling on international, state and special-purpose roads. The 2016 Government Resolution No. 103 defines the toll rates to be applied on international, national and special-purpose roads as presented in Table MON11. For the highway to the airport, specific toll rates are defined in Government Resolution No. 82 of 2019, also presented in Table MON11. The tolling procedures are defined in the 2021 Ministerial Decree No. 106. Collection of the tolls on international, national and special purpose roads is carried out by the Road and Transport Development Center through its Toll Collection, Road Use, and Traffic Control Department (the same department that manages the State Road Fund). Toll collection costs were high, averaging over 30% in 2014–2015, and exceeding 60% in nearly half the toll stations in those years. The high toll collection costs are being addressed through the introduction of an electronic toll collection system using smart cards. However, because of the low traffic volumes on many roads in Mongolia, toll collection costs will continue to be a significant portion of the toll revenue.

Table MON11: Toll Rates

Vehicle Type	General			Ulaanbaatar–Khushig Valley Airport		
	Category	Rate (MNT)	Rate ($)	Category	Rate (MNT)	Rate ($)
Passenger vehicles	<12 seats	MNT1,000	$0.38	<8 seats	MNT2,000	$0.76
	12–24 seats	MNT2,000	$0.76	8–16 seats	MNT10,000	$3.82
	>24 seats	MNT3,000	$1.15	>16 seats	MNT20,000	$7.63
Freight vehicles	<3.5 tons, 2 axles	MNT2,000	$0.76	<3.5 tons	MNT5,000	$1.91
	3.5-18 tons, 2 axles	MNT3,000	$1.15	3.5–7.5 tons	MNT10,000	$3.82
	<18 tons, 3 axles	MNT4,000	$1.53	<7.5 tons	MNT15,000	$5.73
	18–25 tons, 3 axles	MNT5,000	$1.91	Truck and Trailer	MNT20,000	$7.63
	<25 tons, 4 axles	MNT6,000	$2.29			
	>25 tons, 4 axles	MNT10,000	$3.82			
Others	Equipment	MNT10,000	$3.82			
	Motorcycle	MNT500	$0.19	Motorcycle	MNT2,000	$0.76

Sources: 2016 Government Resolution #103, and 2019 Government Resolution No. 282.

Revenues from tolling have been gradually increasing as more toll stations are established and traffic volumes increase. Toll revenue amounted to MNT8,648 million in 2020 according to the Financial Audit Report of the State Road Fund, equivalent to $3.3 million. This revenue is collected by the Road and Transport Development Center and fully earmarked for the State Road Fund.

5. Road user revenues

The different road user revenues are presented in Table MON12. The total amount collected from these main road user revenues amounts to $402 million per year, more than triple the estimated road maintenance needs and equivalent to 2.4% of GDP. A large portion is from fuel-related tax revenues, amounting to $266 million per year (66% of total revenues). Vehicle customs duties, excise taxes and value-added taxes also form a large portion of the revenue, providing $129 million per year (32% of total revenue). Annual vehicle registration taxes and tolling provide only $8 million (2% of total revenue). Of this total revenue, only $22.90 (6%) is officially earmarked for the State Road Fund, although in practice only the $3 million in toll revenues are allocated to it (1% of total revenue).

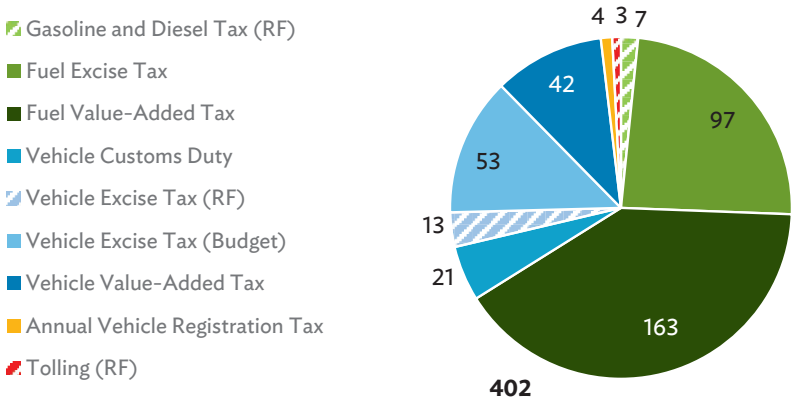
Table MON12: Road User Revenues in Mongolia

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Gasoline and Diesel Tax	7	2%	7	28%
Fuel Excise Tax	97	24%		
Fuel Value-Added Tax	163	41%		
Vehicle Excise Tax	66	16%	13	57%
Vehicle Customs Duty	21	5%		
Vehicle Value-Added Tax	42	10%		
Annual Vehicle Registration Tax	4	1%		
Tolling	3	1%	3	14%
Total	**402**	**100%**	**23**	**100%**

Source: Consultant's processing of collected data.

Carbon-based road user revenues amount to $266 million per year. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. In addition, the revenue of the vehicle excise tax will be reduced as the rates for electric and hybrid vehicles are 0%–50% of those for internal combustion engines. This can affect a further $33–$66 million in revenues. This is especially relevant since 20% of this revenue is officially earmarked for the State Road Fund.

Figure MON4: Road User Revenues in Mongolia
($ million)



Source: Consultant's processing of collected data.

E. Nepal

Nepal is a landlocked country in South Asia with a land area of 143,400 km^2 and a population of 30.5 million people, resulting in a relatively high population density of 210 persons per km^2, especially considering that a large part of the country consists of high mountain ranges and the population is concentrated in the middle and south of the country. According to the World Bank, the 2022 GDP (US$ current) is $40.8 billion, resulting in a relatively low GDP per capita of $1,337. The terrain varies from flat in the south to hills in the middle and steep mountains in the north. The mountains make it difficult to provide road access to population centers in the north, and some district capitals still lack connectivity to the main road network. The climate varies from tropical in the south to temperate in the middle and artic in the high mountains.

1. Road network

Nepal has a road network of more than 75,000 km. The main road network is commonly referred to as the strategic road network (SRN) and is managed by the Department of Roads (DOR) under the Ministry of Physical Infrastructure and Transport. It used to comprise national highways, feeder roads, the mid-hill and postal roads. However, as a result of the administrative reform in 2015 creating provinces, a number of lower-level SRN roads were transferred to these new provincial governments. As a result, the size of the SRN was reduced from 13,447 km in 2017–2018 to 11,179 km in 2019–2020. All SRN roads are now classified as national highways. The SRN is complemented by a network of provincial highways of 32,229 km managed by the provincial governments. This includes former SRN roads as well as important local roads. The remaining local road network of 32,388 km is managed by urban and rural municipalities. Both provinces and municipalities receive technical support for the management of their road networks from the Department of Local Infrastructure under the Ministry of Urban Development. The road density is high at over 50 km per 100 km^2, but many roads are little more than earthen tracks and are not passable, or only passable in 4-wheel drive vehicles during the dry season.

Table NEP1: Road Lengths by Class and Surface Type
(km)

Road Class	Blacktop	Gravel	Earthen	Total
National	6,836	1,116	3,226	**11,179**
Provincial	4,547	13,629	46,441	**32,229**
Local				**32,388**
Total	**11,383**	**14,745**	**49,667**	**75,796**

Source: Department of Roads and Department of Local Infrastructure.

Paved roads make up 61% of the national highway network, while 29% of national highways still only have an earthen surface. For the provincial and local roads, paved roads make up only 7% of the network, mainly in and around cities and towns. Over 70% of provincial and local roads have an unimproved earthen surface, and these roads are often not adequately engineered and lack basic drainage and slope protection works.

For the SRN, road condition surveys are regularly undertaken. This includes an assessment of road roughness using the International Roughness Index (IRI) and a visual assessment of the surface defects using the Surface Distress Index (SDI). According to the survey data from 2018, only 5% of the SRN was in good condition based on the SDI, and 40% was in poor condition. Based on the IRI, the percentage in good condition is even lower at 2% and the percentage in poor–bad condition was 83%. In part, this is the result of the large length of earthen roads in the SRN, but it also reflects a lack of maintenance of the paved road network.

In the case of the provincial and especially the local roads, only a portion of the network is considered functional, while an even smaller percentage can be considered to be all-seasonal. This is generally due to the lack of engineering of roads without drainage and slope protection, and which often have steep inclines without any surface improvement. This leads to rapid deterioration and results in roads becoming impassable, especially during the rainy season.

2. Road maintenance needs and budget

The Economic and Financial Analysis for the South Asia Subregional Economic Cooperation Highway Enhancement Project estimates the costs of routine maintenance to be around NPR200,000 per kilometer ($1,500/km), while the cost of periodic overlays is estimated to amount to NPR2,000 per square meter, equivalent to NPR160,000 per kilometer for an 8-meter-wide pavement ($125,000), to be carried out once every eight years on average. For gravel and earthen roads, the costs are estimated to be slightly lower. Applying these unit costs to the road network in Nepal results in the following rough estimation of annual road maintenance needs (Table NEP2). The total road maintenance needs are estimated to be in the order of $495 million per year, equivalent to 1.2% of GDP which can be a challenge for the country to finance. This includes $160 million for the paved road network and similar amounts for the gravel and earthen networks. The budget requirement for the national highways would be in the order of $120 million and for the provincial and local roads would be $375 million. It must be noted, however, that most of the provincial and especially the local road networks are currently not in a maintainable condition and would require significant improvement before they can be put under maintenance.

Table NEP2: Estimated Annual Road Maintenance Needs

Maintenance type	Blacktop	Gravel	Earthen
Routine maintenance unit cost ($/km)	1,500	1,000	1,000
Periodic maintenance unit cost ($/km)	125,000	30,000	5,000
Periodic maintenance frequency	10 years	3 years	2 years
Average maintenance unit costs ($/km/year)	14,000	11,000	3,500
Road length (km)	11,383 km	14,745 km	49,667 km
Total annual maintenance costs ($)	**159,368,300**	**162,198,960**	**173,834,920**
National highways annual maintenance costs ($)	95,710,300	12,279,960	11,291,420
Provincial/local roads annual maintenance costs ($)	63,658,000	149,919,000	162,543,500

Source: Consultant's processing of collected data.

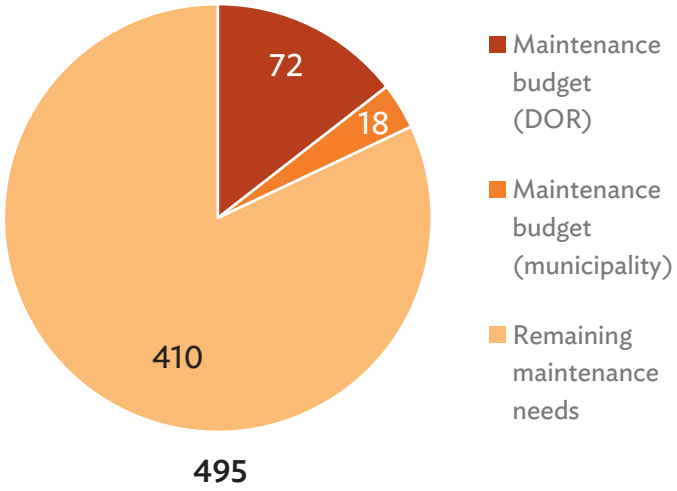
Road maintenance in Nepal is largely financed through the road fund (Roads Board Nepal) (RBN). The road agencies (DOR, provincial governments and municipal governments) prepare an Annual Road Maintenance Plan which they submit to RBN for approval, based on which they receive funding for road maintenance. RBN provides financing to DOR for the maintenance of the national highway network, and to the provincial and municipal governments for the maintenance of the provincial highway and local road networks. According to the RBN Annual Progress Report, RBN provided a total of NPR8,607 million in funding to DOR in the financial year 2022–2023 ($66 million). In addition, NPR850 million in World Bank funding for periodic maintenance was provided under the Nepal Strategic Road Connectivity and Trade Improvement Project, bringing the total maintenance funding for national highways to $72.4 million. RBN also financed NPR5,101 million in road maintenance works on national highways from previous years committed under previous budgets. For the provincial and local road networks, RBN provided NPR683 million to urban municipalities ($5.2 million) and NPR1,601 million to rural municipalities ($12.3 million), a total of $17.5 million. Here too RBN also financed NPR3,000 million in road maintenance works on national highways from previous years committed under previous budgets. The total budget allocation from RBN for 2022–2023 thus amounted to $89.9 million (including World Bank funding, but excluding liabilities from previous years), forming only 18% of estimated needs and equivalent to only 0.2% of GDP. For the national road network, this translates to approximately $6,500/km, but for the provincial and local roads, the funding only amounts to $270/km. Funding allocations to the national highway network cover 60% of estimated needs, while for the provincial and local roads, the allocations cover only 5% of estimated needs. However, it is important to stress that most provincial and local roads are currently not in a maintainable condition, and that road maintenance needs for functional provincial and local roads are likely significantly lower.

Table NEP3: Road Maintenance Funding in Nepal
(NPR)

Funding source	DOR	Urban municipalities	Rural municipalities
RBN	8,607,183,000	682,504,000	1,600,758,700
World Bank	850,000,000		
Subtotal	**9,457,183,000**	**682,504,000**	**1,600,758,700**
Liabilities from previous years	5,101,083,000	3,000,000,000	
Total	**14,558,266,000**	**5,283,262,700**	

Source: RBN Annual Progress Report FY 2079–2080 (2022–2023).

Figure NEP5: Road Maintenance Needs and Budgets in Nepal
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

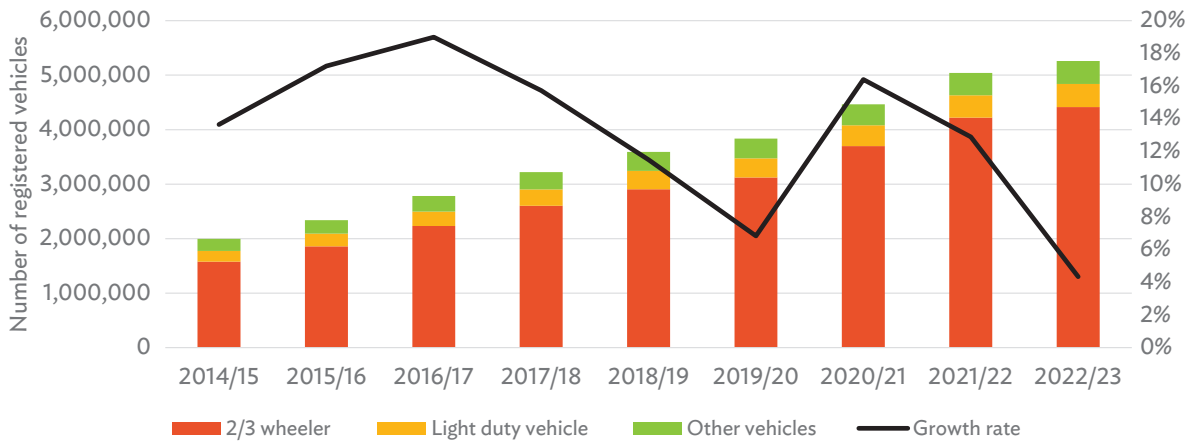
According to the Department of Transport Management (DOTM), there were 5.2 million vehicles in Nepal at the end of 2022–2023, a tripling from the 1.7 million registered vehicles a decade earlier. This shows the enormous increase in vehicle numbers resulting from the expansion and improvement of the road network, as well as the strengthening of the economy. It must be noted that DOTM only records the number of vehicles newly registered in any given year, and it does not monitor the number of vehicles that are decommissioned and removed from operation. As such, the number of registered vehicles is an overestimation of the vehicle fleet size. This also explains the extremely high growth rates that result from the registered vehicle numbers, as these do not account for the removal of vehicles from operation. Although the average growth in the number of registered vehicles between 2014 and 2019 was 16%, the actual vehicle fleet growth is likely to be around 8%–9%, which is still high. The majority of registered vehicles are motorcycles or 3-wheeler tempos (84%). The rest are made up of passenger cars and pickups (8%) and larger vehicles (8%). In 2021–2022, a total of 575,583 vehicles were newly registered, mostly motorcycles. More than half the vehicles currently registered in Nepal were registered in the five years from 2018 to 2023. However, most imports are second-hand vehicles, and most vehicles are therefore more than five years old.

Table NEP4: Total Registered Vehicles in Nepal

Vehicle type	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Motorcycle	1,567,589	1,835,028	2,189,099	2,530,722	2,813,719	3,023,390	3,580,209	4,083,488	4,266,566
3-wheeler	9,068	23,575	43,604	72,138	92,115	98,947	117,403	136,302	148,061
Car, van, pickup	193,563	226,984	258,951	293,631	326,409	341,967	370,424	400,264	412,631
Microbus	3,746	4,883	5,724	7,658	9,988	10,381	10,944	11,429	11,715
Minibus/truck	16,989	21,614	23,622	25,595	28,004	29,002	32,080	34,240	37,479
Bus	36,651	41,004	46,346	49,318	53,040	55,322	58,722	62,401	64,647
Others (heavy)	167,798	186,081	216,082	241,980	268,005	277,493	296,059	313,300	319,062
Total	**1,995,404**	**2,339,169**	**2,783,428**	**3,221,042**	**3,591,280**	**3,836,502**	**4,465,841**	**5,041,424**	**5,260,161**

Source: National Sustainable Transport Strategy for Nepal (2015–2040) and ceicdata.com.

Figure NEP6: Total Registered Vehicles in Nepal



Source: National Sustainable Transport Strategy for Nepal (2015–2040) and ceicdata.com.

The number of electric vehicles remains quite low. Electric vehicles are mainly 3-wheeler tempos and rickshaws used for urban public transport. The tempos are mainly used in the capital Kathmandu and used to have two-stroke engines that were banned in 2000 to address the air pollution issues. Approximately 85,000 tempos have been newly registered over the past 10 years, which are all understood to be electric. The domestic vehicle manufacturer Hulas, which used to make jeeps, is now producing 3-wheeler electric rickshaws. These e-rickshaws from Hulas and imported from the People's Republic of China are used mainly in urban centers in the south of the country, with some 55,000 e-rickshaws having been sold over the past 10 years. In addition, there are also some pilots ongoing with electric buses. Imports of electric passenger cars are gradually increasing, from only 200 vehicles in 2020–2021 to 1,807 vehicles in 2021/22 and 4,050 vehicles in 2022–2023. The total number of electric vehicles is estimated to be in the order of 150,000, mainly involving 3-wheelers. This is a considerable portion of the total registered vehicles.

The Assessment of Electric Mobility Targets for Nepal's 2020 Nationally Determined Contributions sets targets for the electrification of the vehicle fleet. For 2025, the target is for 25% of private vehicle sales (including 2- and 3-wheelers) and 20% of 4-wheel public transport vehicle sales to be electric vehicles, while for 2030 these targets are further increased to, respectively, 90% and 60%. These appear to be ambitious targets, especially those for 2030.

4. Sources of road user revenues

Nepal collects a range of road user revenues. According to the 2002 Road Board Nepal (RBN) Act, the following road user revenues may be allocated to RBN. In practice, only the first three sources of funding are (partially) allocated to RBN. The revenues from the fuel levy and the vehicle registration fees are collected and deposited into the Consolidated Fund, with an annual allocation to RBN. This is the main source of revenue for RBN. RBN reports an allocation of NPR6,740 million from the Ministry of Finance in 2022–2023 ($51.6 million), down from NPR6,883 million the year before ($58.3 million). This is approximately one-third of the revenues estimated to be collected from the fuel levy and the vehicle registration fees. The road user fee (toll) revenues are collected directly by RBN and do not go through the Consolidated Fund.

Table NEP5: Road User Revenues Earmarked for Road Board Nepal

(i)	Fuel levy on gasoline and diesel
(ii)	Vehicle registration fees
(iii)	Road user fees (tolls)
(iv)	Fees collected from international transit vehicles
(v)	Grants from the national government
(vi)	Grants or loans received from development partners

Source: Road Board Act, 2002.

a. Fuel Infrastructure Development Tax

An Infrastructure Development Tax of NPR10 per liter ($0.008/liter) is applied to gasoline and diesel on import into Nepal. This tax was introduced in 2017–2018 to finance a large hydropower project. The rate was increased from the original NPR5 per liter in 2020. According to the government's Consolidated Financial Statements 2021–2022, the revenue amounted to NPR24.1 billion, equivalent to $204 million. This is in line with the fuel consumption reported for 2021–2022 of 739 million liters of gasoline and 1,750 million liters of diesel. This revenue is allocated to the Consolidated Fund.

b. Fuel Road Maintenance and Improvement Duty

A Road Maintenance and Improvement Duty of NPR4 per liter for gasoline and NPR2 per liter for diesel is collected on import of the fuel into Nepal. According to the government's Consolidated Financial Statements 2021–2022, the revenue amounted to NPR11.3 billion, equivalent to $96 million. This reported revenue is 75% higher than what would be expected based on the fuel consumption reported for 2021–2022 of 739 million liters of gasoline and 1,750 million liters of diesel. This revenue is allocated to the Consolidated Fund but is officially earmarked for RBN. In practice, only a small portion is actually allocated to RBN.

c. Fuel Pollution Control Fee

A Pollution Control Fee of NPR1.50 per liter for gasoline and diesel is collected on the import of fuel into Nepal. According to the government's Consolidated Financial Statements 2021–2022, the revenue amounted to NPR3.7 billion, equivalent to $31 million. This revenue is allocated to the Consolidated Fund.

d. Fuel Value-Added Tax

The value-added tax (VAT) in Nepal is 13%. Based on the reported value of fuel consumption in 2021–2022 of NPR66.8 billion for gasoline and NPR153.7 billion for diesel, the VAT revenue is estimated to be in the order of NPR28.7 billion, equivalent to $243 million. This revenue is allocated to the Consolidated Fund.

e. Vehicle Customs Duty

The customs duty is only collected for vehicles imported into Nepal. The customs duty is applied as a percentage of the value of the vehicle and is collected by the Customs Department under the Ministry of Finance. The customs duty percentages are presented in Table NEP6. According to the Customs Department, vehicles are the largest source of customs duty revenues, forming approximately one-quarter of all customs duty revenue. According to the government's Consolidated Financial Statements for 2021–2022, the total revenue from customs duty amounted to NPR187.3 billion, suggesting a revenue

from customs duty on vehicles of NPR46.8 billion, equivalent to $397 million. This revenue is allocated to the Consolidated Fund.

Table NEP6: Vehicle Customs Duty Rates in Nepal

Vehicle type	Characteristics	ICE/HEV	BEV
3-wheeler	All	30%	10%
Passenger car	All internal combustion	80%	
	<50 kW		10%
	50 kW–100 kW		15%
	100 kW–200 kW		20%
	200 kW–300 kW		40%
	>300 kW		60%
Bus	11–14 seats	30%	10%
	>15 seats	30%	1%
Goods vehicle	Double cab pickup	40%	10%
	Other	30%	10%

BEV = Battery Electric Vehicle, ICE = Internal Combustion Engine, HEV = Hybrid Electric Vehicle, kW = kilowatt

Source: Customs Tariff 2023–2024, Department of Customs.

f. Vehicle Excise Duty

The excise duty is only applied to vehicles produced in Nepal. The rates are presented in Table NEP7. Although previously jeeps were produced by the domestic company Hulas, this company currently only produces electric rickshaw 3-wheelers. As a result, the amount collected from this road user revenue is estimated to be negligible. This is not taken into account in the rest of this document.

Table NEP7: Vehicle Excise Duty Rates in Nepal

Vehicle type	Characteristics	Gasoline	Diesel	HEV/PHEV	BEV
Motorcycle	<50cc	40%			
	50–150cc	40%			
	150cc–250cc	50%			
	250cc–500cc	60%			
	500cc–800cc	80%			
	>800cc	100%			
3-wheeler	Passengers	55%			5%
	Goods	30%	5%		5%
Passenger car	<1000cc	60%	60%	60%	
	1000cc–1500cc	65%	60%	60%	
	1500cc–2000cc	70%	70%	60%	
	2000cc–2500cc	80%	85%	60%	
	2500cc–3000cc	90%	100%	60%	
	>3000cc	100%	100%	60%	

continued on next page

Table NEP7 *continued*

Vehicle type	Characteristics	Gasoline	Diesel	HEV/PHEV	BEV
	<50 kW				30%
	50 kW–100 kW				40%
	100 kW–150 kW				50%
	150 kW–200 kW				60%
	200 kW–300 kW				70%
	>300 kW				80%
Bus	11–14 seats		55%	55%	55%
	15–25 seats		35%	35%	35%
	>25 seats		5%	5%	5%
Goods vehicle	Single cab pickup		50%		5%
	Double cab pickup		60%		5%
	<5 tons	30%	30%		5%
	5 tons–20 tons	5%	5%		5%
	>20 tons	5%	5%		5%

BEV = Battery Electric Vehicle, ICE = Internal Combustion Engine, HEV = Hybrid Electric Vehicle, kW = kilowatt

Source: Excise Duty Act 2008 (updated 2021).

g. Vehicle Road Construction and Maintenance Duty

The road construction and maintenance duty is collected at the first registration of the vehicle. It is applied both to imported and domestically produced vehicles. The rates depend on the engine size for most 2- and 3-wheelers and on value for vehicles with four or more wheels. The rates are presented in Table NEP8. According to the government's Consolidated Financial Statements 2021–2022, the revenue amounted to NPR7.1 billion, equivalent to $60 million. This revenue is allocated to the Consolidated Fund but is officially earmarked for RBN. In practice, only a small portion is actually allocated to RBN.

Table NEP8: Vehicle Road Construction and Maintenance Duty Rates in Nepal

2- and 3-wheelers	
Characteristics	**Fee**
<125cc	NPR15,000
125cc–250cc	NPR18,000
250cc–400cc	NPR20,000
>400cc	10% of value
Electric motorcycle	NPR10,000
3-wheeler	NPR15,000
Electric 3-wheeler	NPR10,000

4 or more wheels	
Characteristics	**Fee**
Cars up to 2000cc	8%
Cars over 2000cc	10%
Electric car	5%
Bus/minibus/microbus	7%
Electric bus/minibus/microbus	2.5%
Truck	7%

Source: Customs Tariff 2023–2024, Department of Customs.

h. Vehicle Value-Added Tax

In 2022, Nepal reportedly imported $527 million worth of vehicles. The VAT is applied to these vehicles and is collected by the Tax Department under the Ministry of Finance. Applying the 13% VAT to this amount provides an estimated revenue of $69 million. This revenue is allocated to the Consolidated Fund.

i. Annual Vehicle Tax

Nepal collects revenue from an annual vehicle tax as indicated in Table NEP9. Initially, electric vehicles were exempted from the vehicle tax, but recently separate rates were introduced for electric vehicles, although these remain much lower than for vehicles with internal combustion engines. Hybrid and plugin hybrid vehicles are charged the same as vehicles with internal combustion engines. Rates are increased for vehicles older than 15 years. According to the Department of Transport Management, the revenue from the Vehicle Tax amounted to NPR10.7 billion in 2017–2018, equivalent to $105 million. This is significantly lower than can be expected from the number of registered vehicles and confirms that a large number of the registered vehicles are no longer operational and do not pay the annual vehicle tax. Based on the current vehicle tax rates presented in Table NEP9 and the current number of registered vehicles, the revenue is estimated to be in the order of NPR15.8 billion, equivalent to $121 million. This revenue is allocated to the Consolidated Fund.

Table NEP9: Annual Vehicle Tax Rates in Nepal

Vehicle type	**Characteristics**	**Rate** (NPR)
Motorcycle	<125cc	3,000
	125cc–150cc	5,000
	150cc–225cc	6,500
	225cc–400cc	11,000
	400cc–650cc	20,000
	>650cc	30,000
Electric motorcycle	<50 W	1,000
	50 W–350 W	1,500
	350 W–1000 W	2,000
	1,000 W–1500 W	2,500
	>1500 W	3,000
Passenger car	<1000cc	22,000
	1000cc–1500cc	25,000
	1500cc–2000cc	27,000
	2000cc–2500cc	37,000
	2500cc–3000cc	50,000
	3000cc–3500cc	60,000
	>3500cc	70,000
Electric car	<50 kW	10,000
	50 kW–125 kW	15,000
	125 kW–200 kW	20,000
	>200 kW	30,000

Source: Vehicle Tax 2080–2081 (2023–2024).

j. Tolling

RBN collects tolls under the name of road user charges. The toll rates distinguish between three categories of vehicles: i) 2- and 3-wheelers, ii) passenger cars and tractors, and iii) (mini)buses and trucks. Toll rates range from NPR10 for 2- and 3-wheelers to NPR140 for buses and trucks. Until 2018–2019, tolls were collected in four road sections, and in 2019–2020 this was expanded with an additional three road sections. This resulted in a sharp increase in toll revenue in 2019–2020. However, toll collection costs also increased sharply, reaching 24% of collected revenue. Tolling traditionally involves manual collections along main roads, leading to high collection costs. The toll collection is tendered competitively with an indication of the expected toll revenue, and bidders can indicate the amount they are willing to provide to RBN, with the risk of the actual toll collection amount placed on the bidders. Alternatively, the bidder is required to indicate the cost of the toll collection service, with the risk of the actual toll collection amount placed with RBN. RBN has had difficulty finding interested bidders and has in some cases collected the tolls itself with hired staff. It has therefore decided to introduce e-tolling, which will also reduce the cost of toll collection.

The revenue from the toll collection is limited. In 2019–2020 it amounted to NPR360 million and net of collection costs to NPR272 million, equivalent to $2.4 million. Since then, the toll collection has dropped drastically as a result of the COVID-19 pandemic and has not yet recovered. In 2022–2023 the net toll revenue amounted to only NPR3.4 million in 2022–2023, down from NPR30.7 million in 2021–2022. It is expected that the reintroduction of tolling with the higher traffic volumes and reduced collection costs related to e-tolling may result in net revenue of approximately $3 million. This revenue goes directly to RBN.

Table NEP10: Toll Revenues in Nepal

Year	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Toll revenue	107,405,640	157,708,100	359,924,329	38,151,245	34,716,250	3,443,118
Toll collection costs	2,874,280	18,447,019	88,075,447	5,258,359	3,993,904	0
Net revenue	**104,531,360**	**139,261,081**	**271,848,882**	**32,892,886**	**30,722,346**	**3,443,118**
Toll collection costs (%)	3%	12%	24%	14%	12%	0%

Source: RBN Annual Progress Reports.

5. Road user revenues

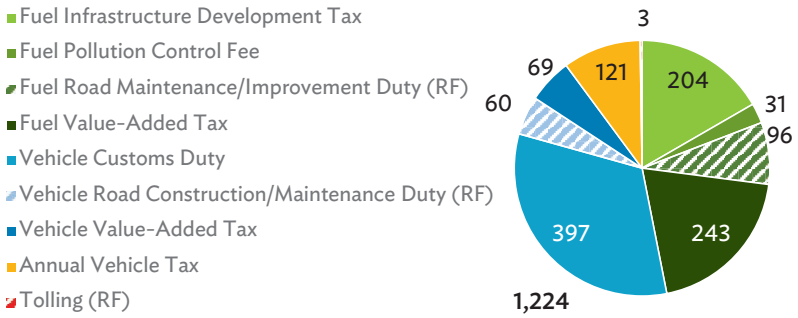
The estimated road user revenues are presented in Table NEP11. The total revenue from road users amounts to $1,224 million per year, nearly two-and-a-half times the estimated road maintenance needs and equivalent to 3% of GDP which can be considered high. A large portion is from fuel tax revenues, amounting to $574 million per year and making up 47% of the road user revenues. Vehicle-based revenues also form a large portion of the total revenue, providing $526 million per year or 43% of total revenue. The annual vehicle tax revenue is also significant and provides an estimated 10% of total revenue. Tolling only provides 0.2% of road user revenue based on the 2019–2020 revenue levels and currently provides even less due to repercussions of the COVID-19 pandemic. Of the current total revenue, only $55 million (4%) is allocated to RBN, although formally this allocation should be in the order of $159 million (13%) based on the earmarked revenues.

Table NEP11: Road User Revenues in Nepal

Road User Revenue	Revenue ($ million)	%	Road Fund ($ million)	%
Fuel Infrastructure Development Tax	204	17%		-
Fuel Pollution Control Fee	31	3%		-
Fuel Value-Added Tax	243	20%		-
Fuel Road Maintenance and Improvement Duty	96	8%	52	95%
Vehicle Road Construction and Maintenance Duty	60	5%		
Vehicle Customs Duty	397	32%		-
Vehicle Value-Added Tax	69	6%		-
Annual Vehicle Tax	121	10%		-
Tolling	3	0%	3	5%
Total	**1,224**	**100%**	**55**	**100%**

Source: Consultant's processing of data.

Figure NEP7: Road User Revenues in Nepal
($ million)



Source: Consultant's processing of collected data.

Revenue from carbon-based fuel taxes amounts to approximately $574 million per year in Nepal, forming 47% of the total road user revenues. More importantly, the fuel levy comprises an important portion of the current revenue of RBN that provides the financing for road maintenance. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. Electric vehicles also provide less revenue due to lower rates applied to the vehicle customs duty and excise duty, as well as the vehicle road construction and maintenance duty and the annual vehicle tax. As the number and percentage of electric vehicles increases, approximately $400 million in revenues from these sources will also be affected unless the rates are adjusted.

F. Pakistan

Pakistan is a large country in South Asia with a land area of 770,900 km^2 and a large population of 235.8 million people, resulting in a high population density of 300 persons per km^2. According to the World Bank, the 2022 GDP (US$ current) is $374.7 billion, resulting in a low GDP per capita of $1,589. The terrain ranges from the Indus plain in the east and the Balochistan plateau in the west to mountainous in the north. The climate ranges from continental in the north to a wet climate in the east and a tropical climate in the southeast.

1. Road network

Pakistan has a road network of 500,750 km. Important national roads are managed by the National Highway Authority (NHA) which is responsible for 13,570 km, including 80 km of expressways, 2,060 km of motorways and 11,400 km of highways. These roads carry 80% of total commercial traffic. Communication and Works (C&W) Departments, Works and Services Departments and the Frontier Highway Authority in the provinces and territories are responsible for the remaining expressways, motorways and highways as well as the primary roads and secondary roads, amounting to 113,000 km of roads. The 373,500 km of local roads are managed by the districts and municipalities.

Table PAK1: Road Lengths by Responsible Entity
(km)

Road classification	NHA	C&W	Local	Total
Expressway	78	350		**428**
Motorway	2,066	405		**2,471**
Highway	11,426	20,671		**32,097**
Metro road				**76**
Primary road		4,388		**4,388**
Secondary road		87,766		**87,766**
Local road			373,525	**373,525**
Total	**13,570**	**113,580**	**373,525**	**500,750**

C&W= Communications and Works Department/Authority, NHA=National Highway Authority

Source: National Highway Authority, Communications and Works Department/Authority.

The expressways, motorways and highways are all paved, as are most of the primary and secondary roads. An estimated 20% of local roads are paved. This puts the overall percentage of the road network that is paved around 40%.

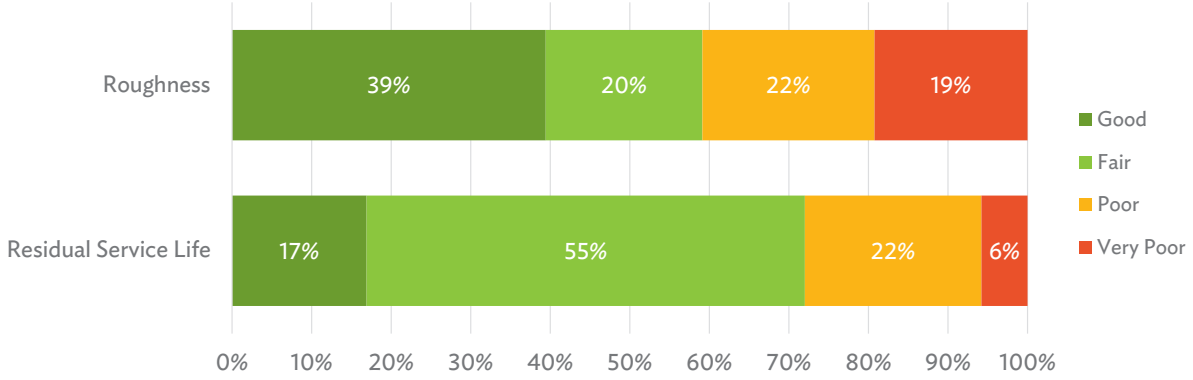
Road condition data is only available for the roads managed by NHA, which are surveyed every year with data stored in their road asset management system. This system collects data on the roughness of the road that is used as one of the main indicators of road condition. Data is also collected on surface defects such as rutting, cracking and raveling. The roughness and surface defect data are used to calculate the residual service life of the different road sections (the number of years until the wearing course needs to be renewed). The condition of the NHA network is categorized in both these criteria as is shown in Table PAK2 based on survey data for 11,089 km of NHA roads.

Table PAK2: NHA Road Network Conditions

Good (IRI<3 m/km)	**Fair** (3<IRI<4 m/km)	**Poor** (4<IRI<6 m/km)	**Very Poor** (IRI>6 m/km)
39%	20%	22%	19%
Good (RSL>4 years)	**Fair** (4<RSL<2.5 years)	**Poor** (2.5<RSL<1 years)	**Very Poor** (RSL<1 year)
17%	55%	22%	6%

Source: National Highway Authority, 2021.

Figure PAK1: NHA Road Conditions by Indicator



Source: National Highway Authority, 2021.

2. Road maintenance needs and budget

NHA carries out annual estimations of the maintenance needs based on an analysis of the network survey data using HDM-4. For the 2019–2020 fiscal year, they estimated a maintenance need of PKR64 billion ($393 million), an average of $29,000/km. Maintenance needs estimations for the other road networks are not available.

To estimate the total needs, a basic unit rate analysis has been carried out. For the NHA roads, the average rate of $29,000/km/year has been used. For the expressways, motorways and highways managed by C&W departments and authorities, the same unit rate has been applied, while for the primary and secondary roads managed by these entities, 50% of this rate has been used ($14,500/km/year). For the local roads, a low unit rate of $3,000/km/year has been applied. The results of this estimation are shown in Table PAK4, which shows a total estimated maintenance need of $3,472 million per year, equivalent to 0.9% of GDP.

Table PAK3: Estimation of Road Maintenance Needs

	NHA	C&W (EW+MW+HW)	C&W (PR+SR)	Local	Total
Length (km)	13,570	21,426	92,154	373,525	**500,675**
Unit rate ($/km/year)	29,000	29,000	14,500	3,000	
Maintenance needs ($ million/year)	394	621	1,336	1,121	**3,472**
Budget allocation ($ million/year)	212	311	668	336	**1,527**
Coverage (%)	54%	50%	50%	30%	**44%**

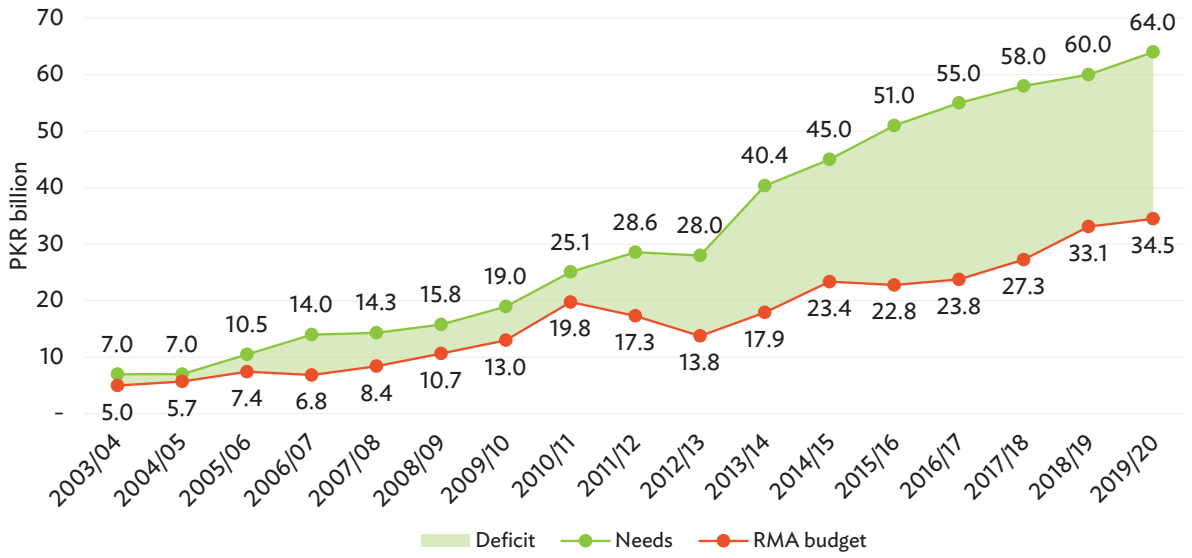
C&W= Communications and Works Department/Authority, EW=Expressway, HW=Highway, MW=Motorway, NHA=National Highway Authority, PR=Primary road, SR=Secondary road

Source: Consultant's estimation.

The NHA receives maintenance funding from an extra-budgetary Road Maintenance Account (RMA) that is financed through earmarked road user revenues. The allocation of funds is determined in the Annual Maintenance Plan (AMP) prepared by NHA. The RMA has been covering an ever-decreasing portion of the estimated road maintenance needs. In part, this is the result of additional roads being put under the responsibility of NHA, without the financing of the RMA being adjusted. The differences

between estimated needs and funding allocations over time are presented in Figure PAK2. For the 2019–2020 fiscal year, RMA funding amounted to only PKR34.5 billion ($212 million), 54% of the estimated maintenance needs.

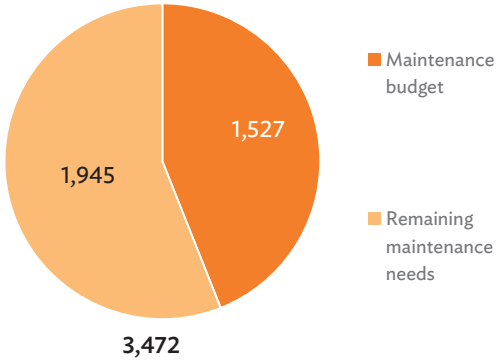
Figure PAK2: NHA Road Maintenance Needs and Budgets



Source: National Highway Authority, 2021.

Data on budget allocations to C&W departments and authorities is not available, but it is understood that they receive approximately 50% of their maintenance needs. For expressways, motorways and highways managed by C&W, this would imply a budget allocation of approximately $311 million, while for the primary and secondary roads, the allocation would amount to approximately $668 million. For the local roads budget data is also not available, and it is assumed that only some 30% of needs are financed, equivalent to $336 million. The total budget allocation for the different road entities therefore amounts to $1,527 million as shown in Table PAK3. This is equivalent to 44% of the estimated needs or 0.4% of GDP.

Figure PAK3: Road Maintenance Needs and Budget in Pakistan
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

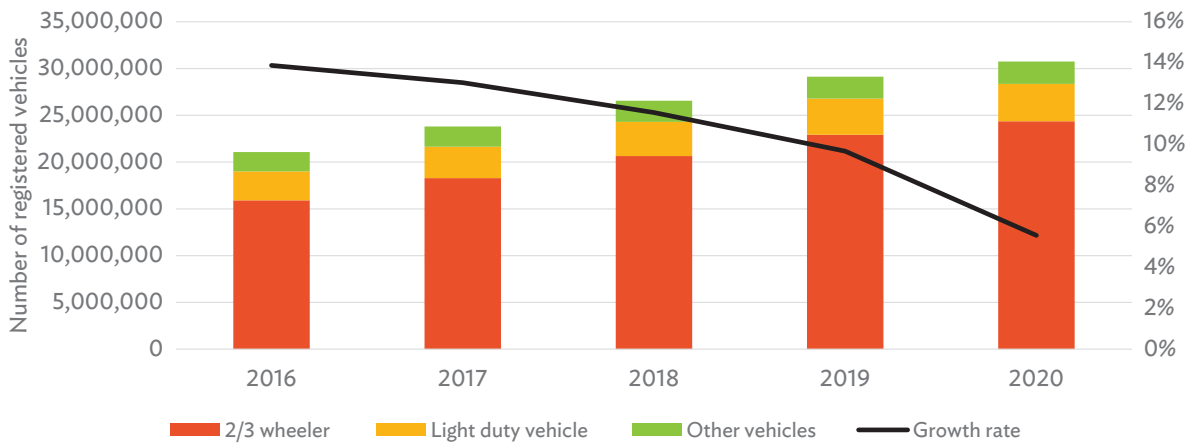
The vehicle fleet in Pakistan consisted of nearly 31 million vehicles in 2020 as shown in Table PAK4. However, these vehicle registration numbers are understood to be based on annual new registrations and do not appear to take account of the decommissioning of vehicles. They therefore provide an overestimation of the vehicle fleet size and growth rate. The majority of vehicles (79%) are 2- and 3-wheeler motorcycles and rickshaws, and this percentage is gradually increasing. Passenger cars make up only 13% of the vehicle fleet, only slightly higher than the percentage of buses, trucks and other vehicles. By far the majority of vehicles (68%) are registered in Punjab Province with lower percentages in Sindh (24%) and especially in Khyber Pakhtunkhwa (6%) and Balochistan (2%) where vehicle ownership per capita is much lower. The vehicle fleet has exhibited an average annual growth rate of about 10% from 2016 to 2020, although this growth is mainly in 2- and 3-wheeler motorcycles and rickshaws, with lower growth percentages for light duty vehicles (7%) and other vehicles (4%). These growth rates are likely an overestimation as they do not take account of decommissioning of vehicles. Pakistan has a fast-growing domestic vehicle manufacturing industry that provides a significant portion of new vehicles, producing approximately 300,000 cars and 2 million motorcycles in 2019. This includes both domestic brands as well as assembly of international brands.

Table PAK4: Total Registered Vehicles in Pakistan

Vehicle type	2016	2017	2018	2019	2020
Motorcycles 2 wheels	15,230,960	17,518,365	19,796,577	22,001,277	23,407,865
Motor rickshaws 3 wheels	671,403	763,076	843,300	919,020	951,425
Cars, jeeps, and station wagons	2,933,668	3,196,542	3,495,581	3,703,649	3,833,616
Cabs/taxis	170,759	170,890	171,117	171,179	171,462
Buses/minibuses	235,614	242,194	249,198	253,996	255,409
Trucks	269,471	278,120	284,949	288,652	293,460
Others Vehicles	1,555,975	1,643,489	1,725,445	1,799,789	1,844,302
Total	**21,067,850**	**23,812,676**	**26,566,167**	**29,137,562**	**30,757,539**

Source: Pakistan Statistical Yearbook 2022.

Figure PAK4: Total Registered Vehicles in Pakistan



Source: Pakistan Statistical Yearbook 2022.

The report on *Scaling Up Electric Mobility* in Pakistan prepared in 2021 estimates that there were 25,000 electric vehicles in the country at the time. Mostly these are 2- and 3-wheelers with few electric cars. The report introduces three possible penetration scenarios for electric vehicles. Under the high scenario, penetration is projected to reach 8.2 million electric vehicles by 2030. Under the medium and low scenarios these projections amount to, respectively, 4.8 million and 2.4 million electric vehicles by 2030. These scenarios have different impacts on fuel consumption, with the high scenario resulting in an estimated reduction of fossil fuel use by 18 million ton oil equivalent (TOE) over the full period 2021-2030, reaching a reduction in annual fuel consumption of 5.1 million TOE per year by 2030. Under the medium and low scenarios this reduction would amount to 10 million TOE and 5 million TOE, respectively, over the 2021–2030 period. This is equivalent to reductions in annual fuel consumption of 3.0 and 1.4 million TOE by 2030, respectively. Under the medium and low scenarios, the focus would lie on the electrification of 2- and 3-wheelers where the purchase costs are lower (conversion kits for existing motorcycles exist for as little as $1,200) and the lifespan is short. Although such 2- and 3-wheelers use little fuel, the large numbers involved mean that they account for approximately half the road transport fuel consumption in Pakistan.

Pakistan has a National Electric Vehicle Policy, enacted in 2021, that sets a clear target for the introduction of electric vehicles and provides incentives to do so. The policy sets an electric vehicle sales target of 30% for cars and 50% for 2- and 3-wheelers and buses. Although the policy introduces concessions for the import of electric vehicles, it does not provide any purchase incentives for their import and instead focuses on developing domestic production of electric vehicles. Charging infrastructure is also lacking due to the low penetration of electric vehicles. It is assumed that greater purchase incentives are required initially to motivate the purchase of electric vehicles and incentivize the construction of charging infrastructure. The impact on electricity demand is expected to be small, with the high scenario for electric vehicle penetration expected to require an additional 1.7–2.0 gigawatts of electricity, equivalent to 2% of the total electricity consumption. However, it should be noted that this policy is combined with the desire to establish a national electric vehicle manufacturing capacity and only provides incentives for electric vehicles with small battery packs. Most passenger vehicles need larger battery packs to make them useful.

4. Sources of road user revenues

Pakistan collects a range of road user revenues. Efforts to create a Road Fund financed by a fuel tax were unsuccessful. In 2003, the NHA established a RMA that receives revenues from the road user revenues listed in Table PAK5. These revenues are collected directly by the NHA or by entities under the Ministry of Communications. The RMA is an extra-budgetary road fund, with revenues deposited in a commercial bank account and not forming part of the General Budget.

Table PAK5: Road User Revenues Earmarked for the Road Maintenance Account

(i)	Tolls on roads and bridges
(ii)	Traffic fines on highways and motorways
(iii)	Charges for commercial use of the right-of-way
(iv)	Axle load charges (weigh station fees)
(v)	Supplementary heavy vehicle fee
(vi)	International transit fee
(vii)	Border fee
(viii)	Allocations from the federal government

Source: National Highway Authority Code, 2005.

a. Fuel Levy

The fuel levy was first introduced in 1961 through the Petroleum Products (Petroleum Levy) Ordinance and subsequent Petroleum Products (Petroleum Levy) Rules of 1967. This requires every company, refinery and licensee to pay the levy to the federal government. The levy is currently set at PKR60/liter ($0.26/liter) for both gasoline and diesel. The federal budget for fiscal year 2023–2024 estimates the revenue from the fuel levy to amount to PKR881 billion, equivalent to $3,075 million. In negotiations with the International Monetary Fund (IMF), Pakistan has pledged to boost its annual petroleum levy collection to PKR920 billion for the 2023–2024 fiscal year. According to the Pakistan Energy Demand Forecast 2021–2030, in 2021 approximately 90% of petroleum fuels were used in the transport sector, with the remainder used in the industry and power sectors. This is equivalent to the revenue from the petroleum levy of $2,768 million that can be attributed to the transport sector. This percentage of petroleum used in the transport sector is expected to increase over time. The revenue from the fuel levy goes to the federal budget and is not earmarked for the road sector.

b. Fuel Excise Duty

The excise duty on fuel is defined in the Federal Excise Act of 2005. The excise tax is applied to both imported and domestically produced goods. The excise duty on fuel is applied to liquefied natural gas (propane) and compressed natural gas (methane) that are used widely in vehicles in Pakistan. The excise duty does not appear to be applied to gasoline or diesel. The Yearbook 2022–2023 of the Revenue Division of the Federal Revenue Board reports the excise tax revenue from petroleum, oil and lubricants to amount to PKR8,904 million ($39 million) in 2022–2023, from PKR8,576 million ($48 million) in the previous fiscal year. Ninety percent of this revenue can be attributed to the transport sector, equivalent to $35 million. The revenue from the fuel excise tax goes to the federal budget and is not earmarked for the road sector.

Table PAK6: Excise Duty Rates for Fuel

Type of fuel	Excise Duty Rate
Liquefied natural gas (propane)	PKR0.178/m^3
Natural gas (methane)	PKR10/MMBTu

MMBTu = Million British Thermal Unit

Source: Federal Excise Act, 2005.

c. Fuel Customs Duty

The Yearbook 2022–2023 of the Revenue Division of the Federal Revenue Board reports the customs duty revenue from petroleum, oil and lubricants to amount to PKR279,842 million ($1,239 million) in 2022–2023, down from PKR260,272 million ($1,470 million) in the previous fiscal year. Ninety percent of this revenue can be attributed to the transport sector, equivalent to $1,115 million. The revenue from the fuel customs duty goes to the federal budget and is not earmarked for the road sector.

d. Fuel Sales Tax

Sales tax is defined in the Sales Tax Act of 1990. The sales tax rate was increased from 17% to 18% in 2023. For imported goods, the sales tax was set at 25%. The Yearbook 2022–2023 of the Revenue Division of the Federal Revenue Board reports that the sales tax revenue on domestic petroleum, oil and lubricants amounted to PKR151,863 million ($673 million) in 2022–2023, up from

PKR107,018 million ($605 million) in the previous fiscal year. For imported petroleum, oil and lubricants the sales tax revenue amounted to PKR290,149 million ($1,285 million) in 2022–2023, down from PKR473,002 million ($2,672 million) in the previous fiscal year. Total sales tax revenue from fuel thus amounts to $1,958 million in 2022–2023. Approximately 90% of this revenue is attributable to the transport sector, equivalent to $1,762 million. The revenue from the fuel sales tax goes to the federal budget and is not earmarked for the road sector.

e. Vehicle Customs Duty

The customs duty rates are presented in Table PAK7 for the 2023–2024 fiscal year. These show similar rates being applied to hybrid and battery electric vehicles as are applied to gasoline and diesel vehicles. However, reduced customs duty rates have since been introduced for electric vehicles, ranging from 1% for electric trucks and buses to 10% for passenger cars, although the rate for passenger cars has been further reduced to 1% in the 2023–2024 fiscal year. For electric 2- and 3-wheelers the rate is reduced to 50% of the prevailing customs duty rate, equivalent to a customs duty rate of 25%. The Yearbook 2022–2023 of the Revenue Division of the Federal Revenue Board reports the customs duty revenue from non-railway vehicles to amount to PKR88,989 million ($394 million) in 2022–2023, down from PKR181,449 million ($1,025 million) in the previous fiscal year.

Table PAK7: Customs Duty Rates for Vehicles

Vehicle type	Description	Gasoline	Diesel	Hybrid	Electric
Motorcycle	All	50%	-	-	50%
Passenger cars	<850cc	50%	50%	50%	50%
	850cc–1,000cc	55%	55%	55%	
	1,000cc–1,500cc	60%	60%	60%	
	1,500cc–1,8000cc	75%	75%	75%	
	1,800cc–3,000cc	100%	100%	100%	
Bus	>10 persons	20%	20%	20%	20%
Trucks	Dump trucks	30%	30%	30%	30%
	<5 tons	60%	60%	60%	
	>5 tons, 2 axles	30%	30%	30%	
	>5 tons, >2 axles	20%	20%	20%	

Source: Federal Board of Revenue.

f. Vehicle Excise Duty

The excise duty on vehicles is defined in the Federal Excise Act of 2005. The excise tax is applied to both imported and domestically produced goods. The excise duty on vehicles is applied to passenger cars with the rates depending on the engine capacity and on whether they are imported or produced domestically, as shown in Table PAK8. The Yearbook 2022–2023 of the Revenue Division of the Federal Revenue Board reports the federal excise duty revenue from motorcars to amount to PKR21,470 million ($95 million) in 2022–2023, from PKR19,702 million ($111 million) in the previous fiscal year.

Table PAK8: Excise Duty Rates for Vehicles

Type of vehicle	Excise Duty Rate
Imported passenger cars 1800cc–3000cc	25%
Imported passenger cars >3000cc	30%
Locally produced passenger cars >1700cc	10%

Source: Federal Excise Act, 2005.

g. Vehicle Sales Tax

Sales tax is defined in the Sales Tax Act of 1990. The sales tax rate was increased from 17% to 18% in 2023. For imported goods, including imported vehicles, the sales tax was set at 25%. This high rate is also applied to certain locally produced vehicles, including SUVs, 4x4s and vehicles with an engine capacity of more than 1400cc. The Yearbook 2022–2023 of the Revenue Division of the Federal Revenue Board reports that the sales tax revenue on non-railway vehicles amounted to PKR76,615 million ($339 million) in 2022–2023, down from PKR143,612 million ($811 million) in the previous fiscal year.

h. Provincial Motor Vehicle Taxes

Some road user revenues are collected in the provinces and territories instead of at the national level. These are reported as motor vehicle taxes in the respective budgets but include various revenues. Most of these are defined in the Motor Vehicles Act of 1939 and subsequent provincial motor vehicle acts issued in the different provinces and territories in the 1960s. One of the most important sources of revenue is an annual motor vehicle tax that is defined under the Motor Vehicles Act and that accounts for approximately two-fifths of revenue (in Khyber Pakhtunkhwa it makes up three-quarters of revenue). Also important are the annual vehicle registration fees that also make up two-fifths of total revenue, although in Khyber Pakhtunkhwa the fees have been abolished to promote vehicle registration. Other charges include vehicle route permit fees, fees for vehicle technical inspections, a luxury vehicles tax, other vehicle taxes, and bus and truck service fees. Total estimated revenue for 2021–2022 amounted to PKR36,512 million ($162 million). As shown in Table PAK9, half of this revenue is collected in Punjab and a further 40% in Sindh, with low revenues in Khyber Pakhtunkhwa and Balochistan.

Table PAK9: Revenues from Motor Vehicle Taxes by Year and by Territory
(PKR million)

Territory	2018–2019	2019–2020	2020–2021	2021–2022	2022–2023
Punjab	14,925	9,865	14,382	20,111	18,505
Sindh	7,334	6,222	9,827	12,455	14,544
Khyber	1,832	1,328	1,709	2,420	1,804
Balochistan	829	585	1,208	880	1,659
Total	**24,920**	**18,000**	**27,127**	**35,866**	**36,512**

Source: Territorial Departments of Finance.

Table PAK10: 2022–2023 Revenues from Motor Vehicle Taxes by Source
(PKR million)

	Punjab	Sindh	Khyber	Balochistan
Motor Vehicles Tax	6,570	5,912	1,337	646
Vehicle Registration Fee	9,850	6,148	-	199
Vehicle Route Permit Fee	940	156	360	168
Motor Vehicle Fitness Fee	65	114	90	-
Luxury Vehicles Tax	5	1,291	-	-
Other Taxes on Vehicles	-	11	-	569
Bus and Truck Service Fee	-	-	17	-
Miscellaneous	1,075	913	-	77
Total	**18,505**	**14,544**	**1,804**	**1,659**

Source: Territorial Departments of Finance.

i. Tolling

Tolls were first introduced in 1999. Toll collection on NHA roads is regulated by the NHA Act which allows the NHA to collect tolls on national highways and bridges. Toll rates are defined by NHA and are approved by the NHA Executive Board and published in the national press and on the NHA website. Different toll rates are applied for closed-entry motorways (total 1,570 km) and open-entry highways. The toll rates per kilometer for the motorways are listed in Table PAK11 and range from just under $0.01 per kilometer for cars to nearly $0.05 per kilometer for heavy trucks. Actual implementation of the toll collection is contracted out by NHA to operation and management contractors. According to the Audit Report on the Accounts of NHA, the tolling revenue in the 2021–2022 fiscal year amounted to PKR35,063 million, equivalent to $198 million. This revenue goes to the RMA where it comprises the primary source of financing.

Table PAK11: Motorway Toll Rates

Motorway	Length (km)	Toll rate ($/km)					
		Car	Bus <12 Seats	Bus 13–24 Seats	Bus >24 Seats	2- or 3-Axle Truck	Articulated Truck
M1 Islamabad-Peshawar	161	0.009	0.014	0.020	0.028	0.037	0.045
M3 Lahore-M4	228	0.010	0.014	0.021	0.030	0.039	0.048
M4 Pindi Bhattia-Shorkot	176	0.010	0.014	0.021	0.030	0.039	0.048
M4 Shorkot-Sher Shah	121	0.010	0.014	0.021	0.030	0.039	0.048
M5 Start-Shershah	392	0.010	0.014	0.021	0.030	0.039	0.048
M14 Hakla-DI Khan	293	0.009	0.014	0.020	0.028	0.037	0.045
E35/M15 Hasan Abdal-Manshera	100	0.007	0.012	0.017	0.025	0.032	0.039

km = kilometer

Source: National Highway Authority website.

j. Traffic Fines

Revenue from traffic fines collected on expressways, motorways and highways managed by NHA is earmarked for the RMA. These fines are collected by the National Highway and Motorway Police (NHMP) under the same Ministry of Construction as NHA. In 2019–2020, a total of 9.6 million fines were issued by the NHMP, down from 11.1 million the year before. The revenue for 2021–2022 amounted to PKR3,062 million, equivalent to $17 million.

k. Right-of-Way Fees

In 2009, the NHA issued standard operating procedures for leasing rights-of-way that aim to commercialize and develop them as an important source of income for the RMA. Revenue from the use of rights-of-way amounted to PKR2,164 million in 2021–2022, equivalent to $12 million. This revenue is earmarked for the RMA.

5. Road user revenues

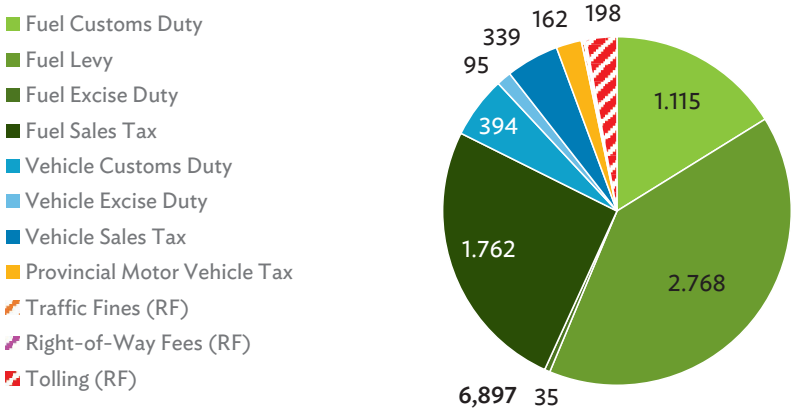
The different road user revenues are presented in Table PAK12. The total amount collected from these main road user revenues amounts to $6,897 million per year, almost double the estimated road maintenance needs of $3,472 million and equivalent to 1.8% of GDP. The majority of revenue is from fuel-related revenues, amounting to $5,680 million per year (82% of total revenues). Vehicle excise taxes, customs duties, and sales taxes together form a much smaller portion, providing $828 million per year (12% of total revenues). The annual provincial motor vehicle taxes provide a further $162 million (2% of total revenues). Tolling, traffic fines and right-of-way fees provide the remaining $227 million (3% of total revenues). Of this total revenue, only the latter $227 million, 3% of total revenue, is officially earmarked for the RMA that is used for the maintenance of roads managed by NHA, with the majority of RMA financing coming from tolling.

Table PAK12: Road User Revenues in Pakistan

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Fuel Levy	2,768	40%		
Fuel Excise Duty	35	1%		
Fuel Customs Duty	1,115	16%		
Fuel Sales Tax	1,762	26%		
Vehicle Customs Duty	394	6%		
Vehicle Excise Duty	95	1%		
Vehicle Sales Tax	339	5%		
Provincial Motor Vehicle Taxes	162	2%		
Tolling	198	3%	198	87%
Traffic Fines	17	0.2%	17	7%
Right-of-Way Fees	12	0.2%	12	5%
Total	**6,897**	**100%**	**227**	**100%**

Source: Consultant's processing of collected data.

Figure PAK5: Road User Revenues in Pakistan
($ million)



Source: Consultant's processing of collected data.

Carbon-based road user revenues amount to more than $5,680 million per year in Pakistan, forming 82% of total road user revenues. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. In addition, the revenue of the customs duty will reduce as the rates for most electric and hybrid vehicles are set at 1%. This can affect a further $394 million in revenues.

The transition to electric vehicles will generate only a small amount of additional revenue in terms of sales tax on electricity. The report on *Scaling Up Electric Mobility* in Pakistan estimates that the high penetration scenario of electric vehicles will only result in a 2% increase in electricity consumption. The 2022–2023 revenue from the withholding tax and sales tax on electricity is reported to amount to PKR95,594 million ($423 million) and PKR223,219 million ($989 million), respectively. A 2% increase in electricity consumption would therefore result in only $28 million in additional revenues. The report also mentions that the high penetration scenario would result in an annual reduction in fuel consumption of 5.1 million TOE by 2030, compared to a reported annual consumption in 2022 of 18 million TOE. This reduction in annual fuel consumption would therefore result in a reduction in fuel-based road user revenues of $1,585 million per year. The reduction in revenues from fuel-based charges is more than 50 times greater than the expected increase in revenues from electricity-based charges. Over the full 2021–2030 period, the reduction in fuel consumption is estimated to amount to 18 million TOE, resulting in a reduction in revenues of $5,590 million over this period.

G. Papua New Guinea

Papua New Guinea forms the eastern half of the island of New Guinea which it shares with Indonesia. New Guinea is the world's second largest island and Papua New Guinea has a significant land area of 452,900 km^2 and a population of 10.1 million people, resulting in a low population density of only 22 persons per km^2. According to the World Bank, the 2022 GDP (US$ current) is $31.6 billion, resulting in a relatively high GDP per capita of $3,116. The terrain is mountainous, and the climate is tropical, with high rainfall concentrated in a single rainy season.

1. Road network

According to the National Road Network Strategy 2018–2037, the road network in Papua New Guinea amounts to nearly 30,000 km. As a result of geography and severe terrain, the road network is fragmented into 12 unconnected subnetworks. There are no highways connecting the capital, Port Moresby, with the Highlands region, home to about 40% of the country's population. This is being addressed by Connect PNG, a corridor strategy focusing on establishing a more inter-connected network through staged upgrading and construction of missing links. The existing road network includes 8,737 km of national roads that are managed by the Department of Works under the Ministry of Works and Highways. In addition, there are about 21,000 km of subnational provincial and district roads managed by the provincial and local level governments.

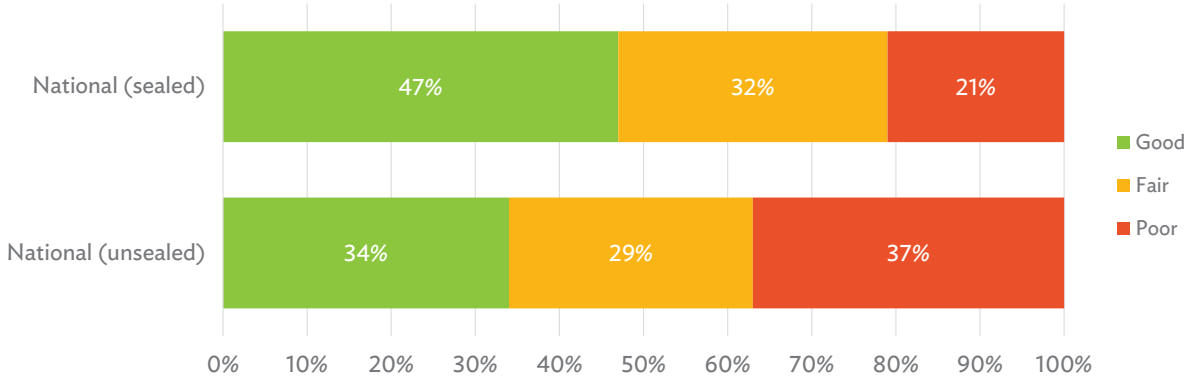
Table PNG1: Road Lengths by Class in Papua New Guinea

Road class	Length (km)	Good	Fair	Poor
National roads	8,738	38%	31%	31%
Sealed	*3,320*	*47%*	*32%*	*21%*
Unsealed	*5,418*	*34%*	*29%*	*37%*
Provincial and district roads	21,000			
Total	**29,738**			

Source: National Road Network Strategy 2018–2037.

Approximately 38% of the national road network is paved, while all the provincial and district roads are unpaved. As of 2017, the National Road Network Strategy reports that 38% of national roads are in good condition, 31% in fair condition and 31% in poor condition. For the paved national roads, the percentage in good condition is higher and the percentage in poor condition is lower.

Figure PNG1: Road Conditions by Road Class



Source: National Road Network Strategy 2018–2037.

2. Road maintenance needs and budget

The National Road Network Strategy estimates the required annual road maintenance budget to increase from PGK753 million in 2018 to PGK1,016 million in 2037 (at 2017 prices) for routine, periodic and emergency maintenance of the national road network. For 2023, the needs are estimated to amount

to PGK870 million, equivalent to $277 million which is considered high for such a small network. This budget is equivalent to $31,000/km/year, which is excessive for the roads concerned, most of which are unpaved.

Table PNG2: Budget Needs According to National Road Network Strategy
(PGK million)

Type of maintenance	2018	2023	2028	2033	2037
Routine	371	427	459	518	566
Periodic	332	393	385	402	400
Emergency	50	50	50	50	50
Total	**753**	**870**	**894**	**970**	**1,016**

Source: National Road Network Strategy 2018–2037.

Applying a simple unit rate analysis suggests that the maintenance needs are significantly lower at around $195 million per year for the entire road network, equivalent to 0.6% of GDP. This includes $100 million for national roads and an additional $95 million for provincial and district roads.

Table PNG3: Estimated Road Maintenance Needs

Class and surface type	Length (km)	Routine maintenance ($/km/year)	Periodic maintenance ($/km/year)	Total cost ($/year)
National sealed	3,320	4,000	10,000	**46,480,000**
National unsealed	5,418	2,500	7,500	**54,180,000**
Subnational unsealed	21,000	1,500	3,000	**94,500,000**
Total	**29,738**			**195,160,000**

Source: Consultant's estimation.

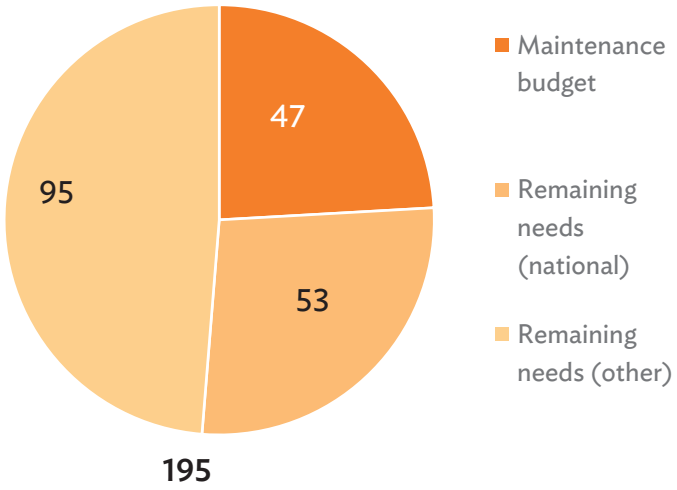
Actual budget allocations are much lower. For 2023, the recurrent budget includes the allocations as presented in Table PNG4. This includes allocations for national road maintenance, bridge maintenance and emergency maintenance, together amounting to PGK175 million, equivalent to $47 million equivalent to only 0.1% of GDP. There is no information available about budget allocations for provincial and district roads by local authorities.

Table PNG4: Department of Works Recurrent Budget 2023

Budget item	**Budget** (PGK million)
Personnel emoluments	91.73
Goods and services	43.72
Road maintenance	105.00
Bridge maintenance	50.00
Emergency works	20.00
New projects/activities	15.80
Total	**326.25**

Source: Department of Works Budget 2023.

Figure PNG2: Road Maintenance Needs and Budgets in Papua New Guinea
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

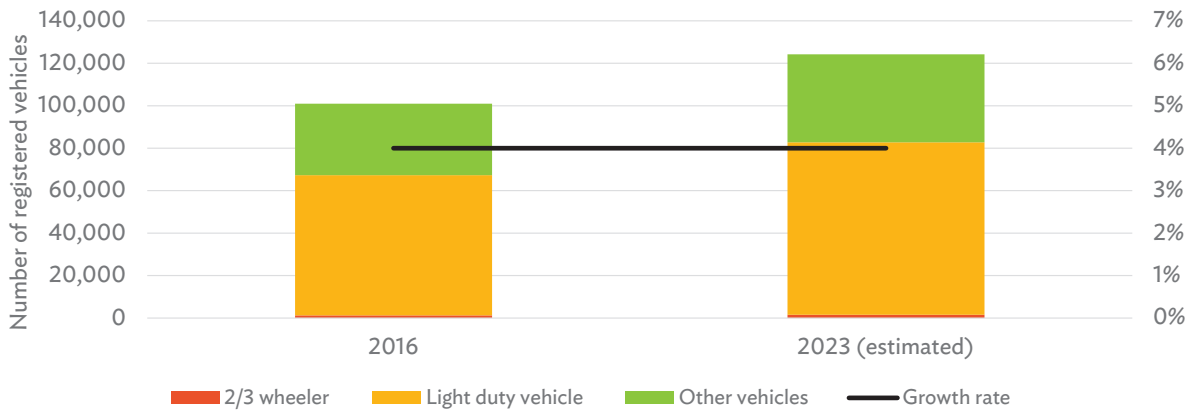
The registration of vehicles is outsourced to Motor Vehicles Insurance Ltd. (MVIL), with actual registration taking place at the provincial level. MVIL reportedly does not have a database of registered vehicles, resulting in a lack of data on the number of registered vehicles. There are also a large number of unregistered vehicles. The World Health Organization reported a total of 100,993 registered vehicles in 2016, of which only 1% involved 2- and 3-wheelers. According to MVIL, there are currently around 120,000 registered vehicles, excluding several thousands of unregistered vehicles. Exact vehicle registration data is not made available by MVIL, however, and even the Road Transport Authority does not have this data. Assuming a 3% annual growth rate (based on annual vehicle sales making up 5%–6% of registered vehicles), there would be approximately 124,000 vehicles by the end of 2023, which is in line with the number reported by MVIL.

Table PNG5: Number of Registered Vehicles in Papua New Guinea

Vehicle type	**2016**	**2023** (estimated)
2- and 3-wheelers	1,289	1,585
Passenger vehicles	66,017	81,193
Buses	11,615	14,285
Heavy trucks	22,072	27,146
Total	**100,993**	**124,209**

Source: Global Status Report on Road Safety 2018, WHO.

Figure PNG1: Total Registered Vehicles in Papua New Guinea



Source: Global Status Report on Road Safety 2018, WHO.

Sales of newly imported vehicles in Papua New Guinea are relatively stable at around 5,000 vehicles per year. There is little information available about hybrid or electric vehicles. Despite having ambitious goals like achieving 50% carbon neutrality by 2030 and full neutrality by 2050, Papua New Guinea does not yet appear to be implementing measures to promote the purchase of hybrid and electric vehicles, other than a zero rate on the excise tax for electric vehicles. In 2022, three electric vehicles were reported to have been imported (2 cargo vans and a passenger bus).

Table PNG6: Number of Newly Registered Vehicles by Year

Year	Newly registered vehicles
2016	5,654
2017	5,269
2018	4,574
2019	5,119
2020	5,183

Source: www.goodcarbadcar.net.

4. Sources of road user revenues

A Papua New Guinea Road Maintenance Trust Fund was established through the Road Management and Fund Act of 2020 for the maintenance, road safety and rehabilitation of national roads. The fund has several earmarked revenues as listed in Table PNG7. In practice the fund never became operational, and the earmarked revenues are understood to have been returned to the General Budget under the provisions of the 2017 Public Money Management Regularization Act and to be no longer earmarked for road works.

Table PNG7: Road User Revenues Earmarked for the Road Maintenance Trust Fund

(ix) Driver license fees
(x) Vehicle registration fees
(xi) Fuel levies imposed in respect of road users
(xii) Road user charges including road damage charges

Source: Road (Management and Fund) Act, 2020.

a. Fuel Excise Tax

Excise tax is collected on fuel. The current rates are set out in the Excise Tariff (2023 Budget) (Amendment) Act 2022, which re-established rates of PGK0.61 ($0.17) per liter for petrol and PGK0.23 ($0.06) per liter for diesel starting 1 July 2023. Prior to this date, from May to December 2022, the government had exempted fuel from excise as a cost-of-living relief measure following the increase in fuel costs due to the Russian invasion of Ukraine. This exemption went hand-in-hand with an exemption on the goods and services tax on fuel. The two exemptions together were estimated to result in a loss of PGK330 million in revenues according to the Customs Service. On an annual basis, these two road user revenues can therefore be estimated to be in the order of PGK495 million ($134 million). According to data provided by the Customs Service, 62% of this revenue is attributable to the fuel excise tax, equivalent to a revenue of $82 million. This revenue is, in theory, earmarked for the Road Maintenance Trust Fund.

Table PNG8: Excise Tax Rates for Fuel

Fuel Type	Jan–Jun 2023	Jul 2023 Onwards
Gasoline (PGK/liter)	Free	0.61
Diesel (PGK/liter)	Free	0.23

Source: Excise Tariff (2023 Budget) (Amendment) Act 2022.

b. Fuel Goods and Services Tax

The goods and services tax is a sales tax defined in the Goods and Services Tax Act of 2003 and is applied to all goods sold or imported. The rate is currently set at 10%. From May to December 2022, the government exempted fuel from the goods and services tax as a cost-of-living relief measure following the increase in fuel costs due to the Russian invasion of Ukraine. This was combined with an exemption for the fuel excise tax, with both measures expected to result in a loss of revenue of PGK330 million over the eight months. On an annual basis, this is equivalent to revenue of PGK495 million ($134 million), of which 38% may be attributed to the general sales tax on fuel, equivalent to $51 million.

c. Fuel Customs Duty

The customs duty on fuel was increased in 2022 for one year under the Customs Tariff (2022 Budget) (Amendment) Act 2021. The customs duty on fuel was planned to be reduced to zero in 2023, but this was only done for diesel. For gasoline, the rate was instead increased as defined in the Customs Tariff Act 2022. Exact data on fuel consumption is not available for Papua New Guinea. Based on the estimated loss of revenue from the exemption for fuel for the excise tax and the goods and services tax in the eight months in 2022, the total annual consumption of gasoline is estimated to be approximately 390 million liters. Applying the current excise tax rate for gasoline, revenue would amount to PGK39 million, equivalent to $11 million.

Table PNG9: Customs Duty Rates for Fuel

Fuel Type	2022	2023
Gasoline (PGK/liter)	0.05	0.10
Diesel (PGK/liter)	0.05	Free

Source: Customs Tariff (2022 Budget) (Amendment) Act 2021.

d. Vehicle Customs Duty

The customs duty on vehicles was set at zero through the Customs Tariff (Amendment) Act 2022. This road user revenue is therefore currently zero.

e. Vehicle Excise Tax

Excise tax is collected on imported vehicles (there is no local production of vehicles). The excise tariffs for most vehicles are set out in the Excise Tariff (2020 Budget) (Amendment) Act 2019, which introduces significant reductions in the excise tax rates. A 20% excise tariff applies to most light vehicles, including pickups, and 15% to medium and heavy trucks (20% if imported second-hand). The Excise Tariff (2021 Budget) (Amendment) Act 2020 introduced separate excise rates for hybrid and electric vehicles, but these were also set at 20%. A year later, the Excise Tariff (2022 Budget) (Amendment) Act 2021 reduced the excise rate for fully electric vehicles to zero. The Observatory of Economic Complexity reports an import value for vehicles to Papua New Guinea of $48.8 million in 2022. Assuming a 20% excise tax is applied to the majority of these vehicles, this corresponds to revenue of $10 million (note that this revenue would likely have been approximately three times as high before 2020 due to the higher excise rates).

Table PNG10: Excise Tax Rates for Vehicles

Vehicle type	Up to 2020		From 2020 onwards	
	New	Used	New	Used
3-wheel lightweight vehicle	60%	80%	20%	20%
Passenger cars <1,000cc	60%	80%	20%	20%
Passenger cars gasoline 1,000cc–1,500cc	60%	80%	20%	20%
Passenger cars gasoline 1,500cc–3,000cc	60%	80%	20%	20%
Passenger cars gasoline >3,000cc	60%	80%	20%	20%
Passenger cars diesel <1,500cc	60%	80%	20%	20%
Passenger cars diesel 1,500cc–2,500cc	60%	80%	20%	20%
Passenger cars diesel 2,500cc–2,700cc	60%	80%	20%	20%
Passenger cars diesel >2,700cc	110%	120%	40%	40%
Sports and racing cars	110%	120%	40%	40%
Utility vehicles <3.5 tons	40%	60%	20%	20%
Security Van	15%	20%	15%	20%
Dump trucks	15%	20%	15%	20%
Trucks <5 tons	15%	20%	15%	20%
Trucks 5–20 tons	15%	20%	15%	20%

Source: Excise Tariff (2020 Budget) (Amendment) Act 2019.

Table PNG11: Excise Tax Rates for Hybrid and Electric Vehicles

Vehicle Type	2021		2022	
	New	Used	New	Used
Hybrid vehicles	20%	20%	20%	20%
Plugin hybrid vehicles	20%	20%	20%	20%
Electric vehicles	20%	20%	Free	Free

Source: Excise Tariff (2021 Budget) (Amendment) Act 2020, Excise Tariff (2022 Budget) (Amendment) Act 2021.

f. Vehicle Goods and Services Tax

The goods and services tax is a sales tax defined in the Goods and Services Tax Act of 2003 and applied to all goods sold or imported. The rate is currently set at 10%. Based on the value of imported vehicles of $48.8 million reported by the Observatory of Economic Complexity, the revenue of this tax applied to vehicles would be $5 million.

g. Vehicle Registration Fee

Vehicle registration fees are set by the Road Transport Authority but under an outsourcing arrangement, the revenues are collected by the provincial offices of Motor Vehicle Insurance Limited (MVIL), the state-owned third-party insurer under Kumul Holdings. Based on the estimated number of registered vehicles presented in Table PNG5 and the fee rates presented in Table PNG12, the revenue is estimated to be in the order of PGK60 million, equivalent to $16 million. This revenue is, in theory, earmarked for the Road Maintenance Trust Fund.

Table PNG12: Vehicle Registration Fee Rates

Vehicle type	Fee rate (PGK)
Motorcycle without sidecar	185
Motorcycle with sidecar	345
Passenger vehicle <1300cc	345
Passenger vehicle 1300–2000cc	460
Passenger vehicle 2000cc–4000cc	690
Passenger vehicle >4000cc	920
Bus more than 9 persons 1300–2000cc	345
Bus more than 9 persons 2000cc–4000cc	460
Bus more than 9 persons >4000cc	690
Truck <1 ton	345
Truck 1–2 tons	460
Truck 2–3 tons	690
Truck 3–6 tons	920
Truck 6–8 tons	1,150
Truck 8–10 tons	1,380
Truck > 10 tons	1,380 + 140 per ton over 10 tons

Source: Motor Vehicle Insurance Limited.

Only a small portion of this revenue is reportedly transferred by MVIL to the General Budget. MVIL in their annual reports present the net income from registrations and licensing as presented in Table PNG13. This amounts to only $800,000–$900,000 per year, approximately 5% of the total estimated revenue from the vehicle registration fee. This percentage is also mentioned by the Road Transport Authority. This would suggest an extremely costly revenue collection exercise where 95% of revenue is spent on collection costs.

Table PNG13: Net Registration and Licensing Income of Newly Registered Vehicles by Year

Year	**Net registration income** (PGK)
2019	2,652,529
2020	3,038,965
2021	2,886,839

Source: Motor Vehicle Insurance Limited.

h. Driving License Fees

The Road Traffic (Fees and Charges) Regulation 2017 also defines the tariffs for the issue and renewal of driving licenses. It is assumed that there are approximately 250,000 persons with a driving license (assuming approximately two drivers per registered vehicle) and that they renew their license every five years. This would imply a revenue of PGK14 million equivalent to $3.8 million. This revenue is in theory earmarked for the Road Maintenance Trust Fund. Here too, it appears that the portion of the revenue collected by MVIL transferred to the government is small.

Table PNG14: Driving License Renewal Rates

Validity	**Rate** (PGK)
1 year	70
2 years	130
3 years	180
4 years	230
5 years	280

Source: Road Traffic Act 2014.

5. Road user revenues

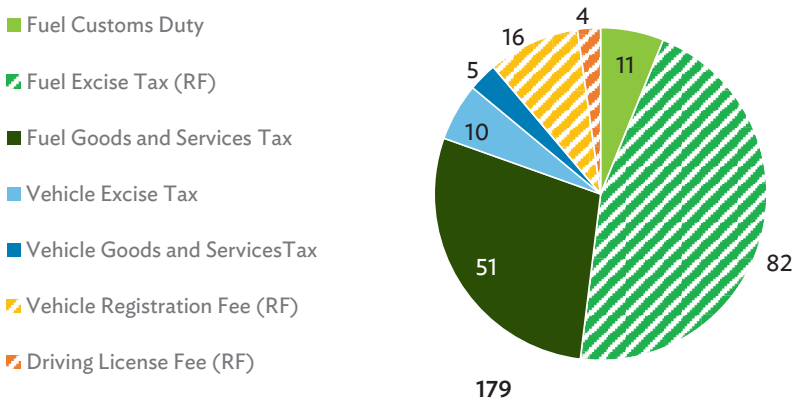
The different road user revenues are presented in Table PNG15. The total amount collected from these road user revenues amounts to $179 million per year, slightly less than the estimated road maintenance needs of $195 million and equivalent to only 0.6% of GDP. The majority of revenue is from the fuel excise tax, the goods and services tax on fuel and the customs duty on fuel, amounting to $144 million or 80% of road user revenues. Vehicle excise tax and the goods and services tax on vehicles make up $15 million in revenues (9%), with a slightly larger amount made up by the annual vehicle registration fees and driving license fees ($20 million, 11%). Over $100 million in revenues is supposedly earmarked for the Road Maintenance Trust Fund, but in practice, the road fund is not yet operational, and these revenues go to the General Budget.

Table PNG15: Road User Revenues in Papua New Guinea

Road User Revenue	Revenue ($ million)	%	Road Fund ($ million)	%
Fuel Customs Duty	11	6%	-	-
Fuel Excise Tax	82	46%	82	80%
Fuel Goods and Services Tax	51	28%	-	-
Vehicle Customs Duty	-	-	-	-
Vehicle Excise Tax	10	6%	-	-
Vehicle Goods and Services Tax	5	3%	-	-
Vehicle Registration Fee	16	9%	16	16%
Driving License Fee	4	2%	4	4%
Total	**179**	**100%**	**102**	**100%**

Source: Consultant's processing of collected data.

Figure PNG2: Road User Revenues in Papua New Guinea
($ million)



Source: Consultant's processing of collected data.

Carbon-based road user revenues amount to $144 million per year, forming 80% of total road user revenues. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. The vehicle excise tax has a zero rate for fully electric vehicles, and will also be affected by decarbonization, involving a current revenue of $10 million or 6% of total road user revenues.

H. Timor-Leste

Timor-Leste forms the eastern half of the island of Timor which it shares with West Timor, a province of Indonesia. Timor-Leste has a land area of only 14,900 km^2 and a population of 1.3 million people, resulting in a medium population density of 89 persons per km^2. According to the World Bank, the 2022 GDP (US$ current) is $3.2 billion, resulting in a medium GDP per capita of $2,389. The terrain is relatively flat along the coast and quickly becomes mountainous inland. The climate is tropical, with high rainfall concentrated in a single rainy season.

1. Road network

The registered road network in Timor-Leste comprises 7,505 km of roads. This includes 30 km of the expressway from Suai to Zumalai, 1,401 km of national roads connecting the different municipal centers to the capital Dili and each other, and 767 km of municipal roads connecting to the administrative posts. The expressway, national roads and municipal roads are managed by the Directorate General of Roads, Bridges, and Flood Prevention and Control (DGRBFPC) under the Ministry of Public Works. In addition, there are 605 km of urban roads in the different municipal centers, 1,975 km of core rural roads connecting larger *sucos* (villages), 1,630 km of non-core rural roads connecting smaller *sucos*, and 1,097 km of rural roads and tracks connecting *sucos* to smaller *aldeias* (hamlets). According to the 2003 Law on the Road Transport System, these urban and rural roads also fall under the responsibility of the central government and DGRBFPC, but in practice they are managed by the 13 municipalities with technical and financial support from DGRBFPC. There are around 456 bridges in the road network.

Table TIM1: Road Lengths by Class in Timor-Leste

Road class	Length (km)
Expressway	30
National	1,401
Municipal	767
Urban	605
Rural (core)	1,975
Rural (non-core)	1,630
Rural (aldeias)	1,097
Total	**7,505**

Source: Road Sector Assessment, ADB 2021.

Most of the road network was built before independence from Indonesia. Although many national and municipal roads were paved at the time of independence (mainly with penetration macadam), these pavements have since deteriorated severely. Over the past two decades, the road network has gradually been rehabilitated and upgraded with asphalt concrete pavement and higher geometric standards. Apart from the expressway where specific expressway standards were applied, all national roads are being upgraded to a paved six-meter carriageway R3 standard, with the exception of some short sections around the capital Dili that have been upgraded to a 4-lane R1 standard. Municipal roads are being upgraded to a paved five-meter carriageway R5 standard, while rural roads are being constructed to a paved or unpaved 3.5-meter single-lane RR1 standard. The technical standards are presented in Table TIM2.

Table TIM2: Technical Road Standards in Timor-Leste

Standard	EW	R1	R3	R5	RR1
Projected ADT	>10,000	>10,000	2,000–10,000	400–2,000	20–400
Design period	20 years	20 years	20 years	10 years	5 years
Design speed	80–100 km/h	60–100 km/h	50–70 km/h	30–60 km/h	20–40 km/h
Surface	Paved	Paved	Paved	Paved	(Un)Paved
Lane width	3.6 m	3.5 m	3.0 m	2.5 m	3.5 m
Number of lanes	4	4	2	2	1
ROW width	40 m	40 m	30 m	25 m	15 m
Unit cost	$10,000,000/km	$3,000,000/km	$900,000/km	$600,000/km	$175,000/km

Source: Promoting Sustainable Road Network Infrastructure, ADB 2019.

In 2019, an assessment was carried out of the national and municipal road networks, complemented by data for the rural roads from the Roads for Development program. For the paved national and municipal roads, a distinction was made between recently upgraded roads with an asphalt concrete surface, roads that were undergoing upgrading and that would soon have a new asphalt concrete pavement, and roads with an old, deteriorated penetration macadam pavement 20–30 years old that required rehabilitation or upgrading. The data shows that the national roads are predominantly paved, with two-thirds having a new surface or being under construction, and the remainder mainly having an old, paved surface. For the municipal roads, less than one-fifth has a new surface or is under construction, with about half the network having a deteriorated pavement and more than one-quarter being unpaved, mostly consisting of earthen roads. For the core rural road network only one-fifth is paved, while three-fifths have a gravel surface and the remainder have an earthen surface. In the case of urban roads, a large portion is paved. The non-core rural roads are almost all unpaved.

Table TIM3: Percentage of the Road Network by Surface Type

Road class	Total length (km)	Paved	Under construction	Deteriorated pavement	Gravel	Earth
Expressway	30	100%	-	-	-	-
National	1,401	32%	29%	34%	2%	3%
Municipal	767	3%	15%	54%	3%	24%
Rural (core)	1,975	21%	-	-	60%	19%

Source: Promoting Sustainable Road Network Infrastructure, ADB 2019.

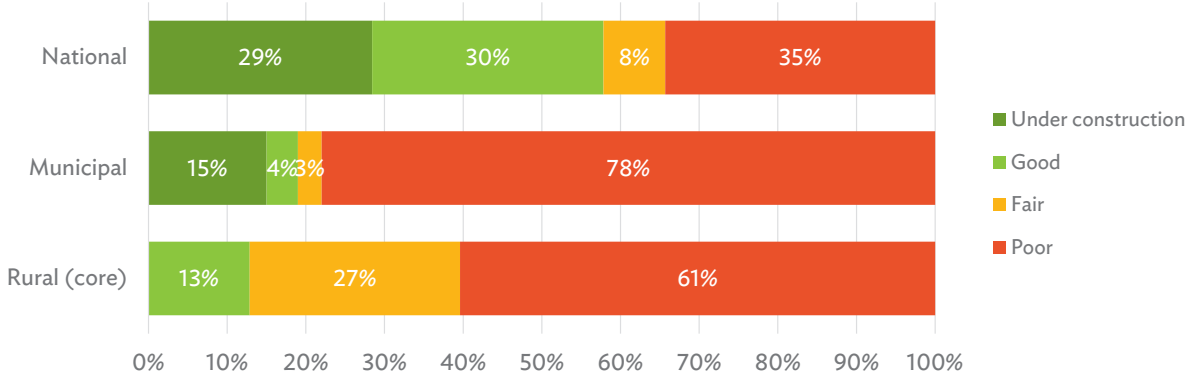
As a result of the road upgrading over the past two decades, a large portion of the national road network is currently in good or fair condition. This is also the case for the municipal roads and the core rural roads that have been upgraded in recent years, although this involves a smaller portion of these road networks. The roads that have not been recently upgraded tend to be in poor or bad condition due to a lack of maintenance over the past 20 years. Based on data collected in 2019, two-thirds of the national roads were in good or fair condition or were undergoing upgrading works with investments from government and development partners, with the remaining one-third in poor condition. For municipal roads, the situation was less positive as only limited investments were being made in these roads. As a result, only 5% was considered to be in good condition and a further 15% under ongoing works, with the remainder considered to be mostly in poor condition. In the core rural road network, upgrading works have been ongoing for a longer period with development partner support, and 40% of the network was considered to be in good or fair condition, with over 60% in poor condition.

Table TIM4: Road Network Conditions

Road Class	Good	Fair	Poor	Under Construction
National	30%	8%	35%	29%
Municipal	4%	3%	78%	15%
Rural road (core)	13%	27%	61%	-

Source: Maintenance Program 2020–2030, ADB 2021.

Figure TIM1: Road Conditions by Road Class



Source: Maintenance Program 2020–2030, ADB 2021.

2. Road maintenance needs and budget

ADB carried out an assessment of the road maintenance needs in 2019. Based on the existing road conditions and the ongoing and planned road upgrading works, this estimated the total maintenance needs to increase from $17.4 million in 2019 to $59.6 million by 2030 as additional roads were upgraded and put under planned maintenance. This would come with a shift in funding allocations away from basic maintenance of poor roads to keep them passable, to the routine and periodic maintenance of roads in good and fair condition. For 2025, the estimated road maintenance needs amount to $41.4 million, equivalent to 1.3% of GDP, which is high and likely beyond the capacity of the country to finance. These cost estimates do not include the non-core rural roads.

Table TIM5: Estimated Road Maintenance Needs
($ million)

Road class	2019	2025	2030
National	5.4	17.4	23.4
Municipal	4.9	4.0	10.9
Rural core	5.9	9.4	14.7
Urban	1.2	10.6	10.6
Total	**17.4**	**41.4**	**59.6**

Source: Road Investment and Maintenance Strategy, ADB 2021.

Timor-Leste has an Infrastructure Fund financed from drawdowns from the Petroleum Fund, which in turn, is financed from the investment of oil revenues. The Infrastructure Fund forms the main source of financing for road upgrading and rehabilitation projects, including counterpart funding for projects financed by development partners. Although it may also be used to finance road maintenance, this does not happen in practice and the focus lies on road improvement works. The government has indicated interest in establishing a Road Maintenance Fund to be financed from earmarked road user revenues, but this was never put into practice and road maintenance funding continues to come from the General Budget, with actual allocations forming less than half the identified road maintenance needs.

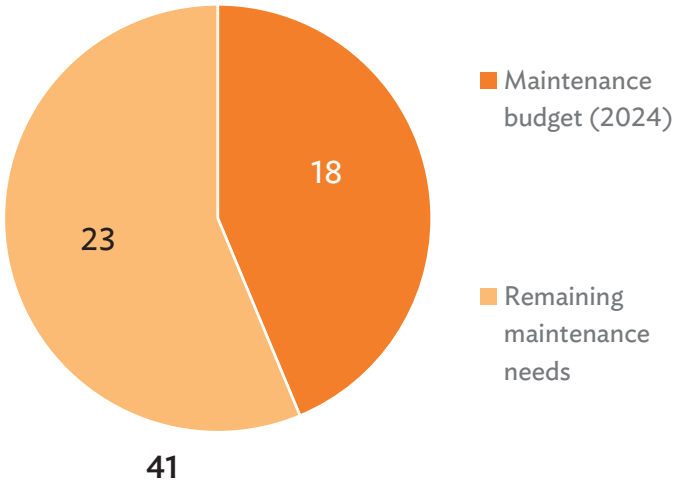
Allocations from the General Budget to road maintenance have been gradually increasing. From 2016–2018 the budget allocation to road maintenance averaged approximately $2 million per year, mainly aimed at rural roads as counterpart funding for the Roads for Development project. In 2019 the funding increased significantly to $11.4 million, forming over 90% of the General Budget allocation to roads and allowing significant allocations to national and municipal roads. In 2020, as a result of COVID-19, allocations were reduced back down to $2.9 million, but subsequently increased again to $7.0 million in 2021 and $7.9 million in 2022. In 2023 there was a significant increase in the amount of road maintenance funding, both in absolute terms and as a portion of the total road budget, as the maintenance budget reached $25.4 million. However, in 2024 the budget was reduced again to $18.0 million under the new government (one-third of the government road sector budget), equivalent to 0.6% of GDP. In past years, the portion for national and municipal roads has remained relatively constant at 23%, while the portion for urban roads increased from 6% in 2019 to 33% in 2024, and the portion for rural roads reduced from 48% to 20%. Allocations to emergency maintenance are generally large, reaching 30% in 2023.

Table TIM6: General Budget Allocations to Road Maintenance
($)

Maintenance Budget	2019	2020	2021	2022	2023	2024
National roads	1,912,149				5,419,125	2,061,871
Municipal roads	700,800				742,082	2,018,678
Urban roads	662,650				2,597,706	6,026,961
Rural (core) roads	5,505,199				8,192,626	3,603,224
Bridges	1,140,000				875,000	50,000
Emergency maintenance	1,466,202				7,604,624	4,313,286
Total maintenance	**11,387,000**	**2,940,000**	**6,955,000**	**7,926,000**	**25,431,163**	**18,074,020**
Total roads and bridges	12,386,000	5,738,000	25,160,000	30,039,000	40,471,258	51,515,032
Percentage maintenance	92%	51%	28%	26%	63%	35%

Source: Annual budgets.

Figure TIM2: Road Maintenance Needs and Budget in Timor-Leste
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

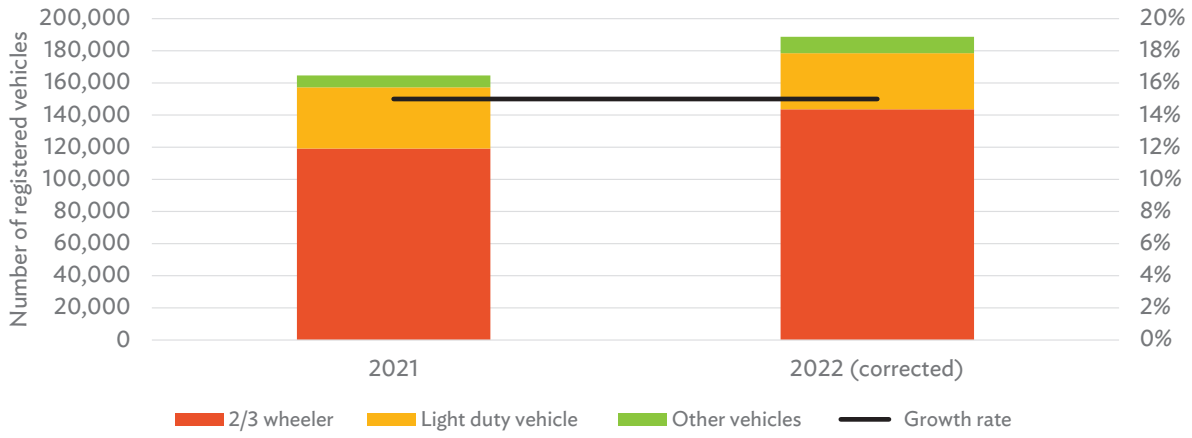
Timor-Leste had a registered vehicle fleet of 173,844 vehicles in 2022 according to the Land Transport Management Information System (LTMIS), with nearly two-thirds of all vehicles registered in the capital Dili. However, this data does not cover the vehicles registered in Lautem, Viqueque, and Covalima municipalities that did not use the LTMIS system and registered vehicles manually, explaining the reduction in light vehicles in 2022 compared to 2021 (when the LTMIS system had not yet been introduced). Correction for these municipalities (using the 2021 data) results in a total estimated vehicle fleet of 188,685 vehicles and an annual growth rate of 15%. However, since this growth rate is based on vehicle registration numbers obtained under two different systems, it is not considered reliable.

Table TIM7: Total Registered Vehicles in Timor-Leste

Vehicle type	2021	2022 (LTMIS)	2022 (corrected)
2- and 3- wheel motorcycles	119,196	130,644	143,608
Light vehicle	38,027	33,656	34,910
Heavy vehicle	7,409	9,544	10,167
Total	**164,632**	**173,844**	**188,685**

Source: Ministry of Transport and Communications, 2022.

Figure TIM1: Total Registered Vehicles in Timor-Leste



Source: Ministry of Transport and Communications, 2022.

Over the period 2020–2022, an average of 19,000 vehicles were newly registered each year in Timor-Leste. These are mainly second-hand imports from Japan and other countries.

Table TIM8: Newly Registered Vehicles by Year

Category	2020	2021	2022
Motorcycle	18,808	13,436	13,009
Light Vehicles	3,258	3,373	3,615
Heavy Vehicles	394	431	517
Total	**22,460**	**17,240**	**17,141**

Source: Ministry of Transport and Communications, 2022.

There is little data available on the number of hybrid and electric vehicles. In 2023, UNESCAP reported a total of 1,504 electric motorcycles, approximately 1% of the total motorcycles. There are no electric passenger cars recorded. The government is reportedly providing incentives for the purchase of electric vehicles in the form of tax exemptions and reduced registration fees and is requiring companies with large vehicle fleets to use electric vehicles. However, no evidence was found of such tax exemptions or reduced fees. The lack of charging infrastructure is reported to be the main obstacle to the introduction of electric vehicles.

4. Sources of road user revenues

Timor-Leste collects several road user revenues, but the rates applied are low and as a result, the revenues are only a small portion of GDP. The 2003 Law on the Road Transport System introduces the concept of a road fund with a fee to be charged to road users commensurate with the wear and damage they cause to the roads. Despite this legal basis, efforts to create a Road Maintenance Fund financed by vehicle registration fees, an increase to the existing fuel excise tax, and a new heavy vehicle surcharge were unsuccessful. All road maintenance funding continues to be financed through annual allocations from the General Budget, while rehabilitation and upgrading works also receive funding from the Infrastructure Fund.

a. Fuel Excise Tax

The fuel excise tax on gasoline and diesel is defined in the Taxes and Duties Act of 2008. Timor-Leste collects an excise tax of $0.06/liter on gasoline and diesel. The reported consumption of gasoline and diesel for the period 2020–2022 is shown in Table TIM9. Based on the total consumption of 110 million liters of fuel and the excise tax rate of $0.06/liter, the estimated revenue for 2022 is $6.6 million.

Table TIM9: Fuel Consumption for Land Transport

Fuel Type	2020	2021	2022
Automotive gasoline (liters)	48,495,445	48,865,440	55,425,708
Automotive diesel (liters)	55,983,467	52,506,173	54,568,616
Total	**104,478,912**	**101,371,613**	**109,994,324**

Source: Autoridade Nacional do Petróleo e Minerais Annual Reports.

b. Fuel Sales Tax

The sales tax in Timor-Leste is 2.5%. The sales tax is applied to the combination of the import value, the excise tax and the import duty. With an average fuel price across the country of $1.64 per liter in July 2022, the sales tax makes up approximately $0.04 of this price. Fuel consumption in 2022 amounted to 109,994,324 liters, resulting in an estimated revenue of $4.4 million.

c. Vehicle Excise Tax

The excise tax on vehicles is defined in the Taxes and Duties Act of 2008, with updated excise tax rates published in 2023. Timor-Leste collects an excise tax on light passenger vehicles based on the value of those vehicles as shown in Table TIM10 (this has changed from a previous excise tax rate of 35% only for luxury vehicles valued at $70,000 or more). According to the Observatory of Economic Complexity (OEC), the value of imported vehicles amounted to $34.3 million in 2022. With 17,141 vehicles imported, this gives an average value of $2,000, suggesting that most vehicles were valued at less than $10,000 and therefore were exempt from excise tax. Although some imported vehicles were likely above the $10,000 threshold, the revenue is expected to be negligible. Increasing the excise tax rate for vehicles under $10,000 to 10% would likely result in approximately $3.4 million in revenue.

Table TIM10: Vehicle Excise Tax Rates

Vehicle Type	Excise Tax Rate
Value < $10,000	0%
Value $10,000–$25,000	10%
Value $25,000–$50,000	20%
Value > $50,000	30%

Source: Timor-Leste Customs Authority.

d. Vehicle Import Duty

The import duty on vehicles in Timor-Leste is 5%. With an import value reported by the OEC of $34.3 million in 2022, this suggests a revenue from the import duty on imported vehicles of $1.7 million.

e. Vehicle Sales Tax

The sales tax on vehicles in Timor-Leste is 2.5%. The sales tax is applied to the combination of the import value, the excise tax and the import duty. Based on the value of the vehicles imported into Timor-Leste of $38.3 million reported by the OEC, and the estimated import duty for these vehicles of $1.7 million, the sales tax would be applied to a total amount of $40.0 million (there is little to no excise tax due to the low value of the vehicles imported). This suggests a revenue from the sales tax on imported vehicles of $0.9 million.

e. Vehicle Registration Fee

A registration fee is collected for all newly imported vehicles (there is no annual registration fee). The rates are presented in Table TIM11. Based on the number of imported vehicles in 2022 reported by the Ministry of Transport and Communications and presented in Table TIM8, the revenue is estimated to amount to $1.1 million.

Table TIM11: Vehicle Registration Fee Rates

Vehicle Type	Registration Fee ($)
Motorcycle	54.50
Light vehicle	97.50
Heavy vehicle	145.00

Source: Ministry of Transport and Communications, 2022.

5. Road user revenues

The different road user revenues are presented in Table TIM12. The total amount collected from these road user revenues amounts to $14.7 million per year, approximately one-third of the estimated road maintenance needs of $41.4 million and equivalent to only 0.5% of GDP. The revenue from road users is less than the current allocations to road maintenance from the General Budget. This reflects the low road user revenue levels in Timor-Leste, and the dependence on oil revenues to finance the road sector. The majority of revenue is from fuel-based revenues, amounting to $11.0 million (75% of total revenues). Vehicle import duties, sales taxes and registration fees make up the remainder of the revenue of $3.7 million (25% of total revenues). Revenue from the vehicle excise tax is currently negligible, but an increase of the rate for low-value vehicles to 10% would provide an additional $3.4 million. There are

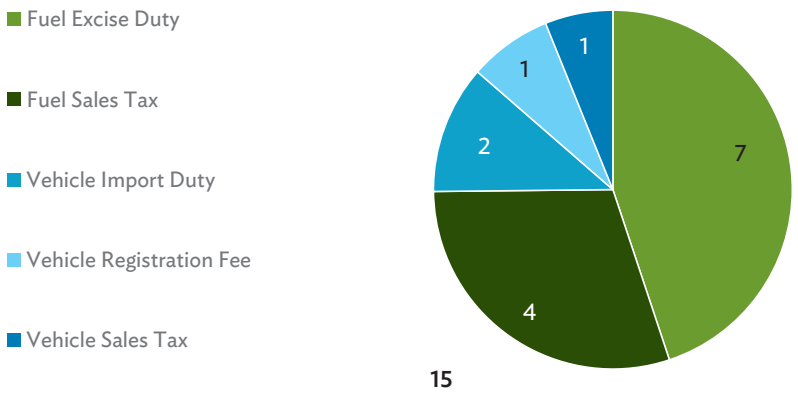
no annual vehicle taxes or fees, and their introduction could also provide additional revenue, although the collection would be more complicated. There is no earmarking of revenues to a road fund or the road sector.

Table TIM12: Road User Revenues in Timor-Leste

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Fuel Excise Tax	6.6	45%	-	-
Fuel Sales Tax	4.4	30%	-	-
Vehicle Excise Tax	-	-	-	-
Vehicle Import Duty	1.7	12%	-	-
Vehicle Sales Tax	0.9	6%	-	-
Vehicle Registration Fee	1.1	7%	-	-
Total	**14.7**	**100%**	**-**	**-**

Source: Consultant's processing of collected data.

Figure TIM2: Road User Revenues in Timor-Leste
($ million)



Source: Consultant's processing of collected data.

Carbon-based road user revenues amount to $11.0 million per year, forming 75% of total road user revenues. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. Other road user revenues are currently not affected by decarbonization, unless lower rates will be introduced for hybrid and electric vehicles.

I. Uzbekistan

Uzbekistan is a large landlocked country in Central Asia with a land area of 440,700 km^2 and a population of 35.6 million people, resulting in a medium population density of 79 persons per km^2. According to the World Bank, the 2022 GDP (US$ current) is $80.4 billion, resulting in a medium GDP per capita of $2,255. The terrain ranges from the expansive Kyzylkum and Karakum deserts in the north and south to fertile valleys and rugged mountain ranges. The climate is continental, with hot summers and cold winters.

1. Road network

Uzbekistan has a road network of 182,000 km. The 2007 Law on Roads (ZRU 117) classifies roads into public roads, streets of cities and other settlements, inter-farm rural roads and economic roads. Public roads have a total length of 42,695 km, including 3,981 km of international roads, 14,100 km of state roads and 24,614 km of local roads. These public roads are managed by the Committee for Roads under the Ministry of Transport. Road construction and capital repairs are supported by the State Unitary Enterprise (SUE) Directorate for the Construction and Reconstruction of Public Roads in the case of government funding, and by Avtoyul Invest Agency under the Committee for Roads in the case of development partner funding. Road maintenance and regular repairs are managed by the 14 Regional Departments under Committee for Roads, and implemented by the 39 SUE Line Maintenance, 13 SUE Bridge Maintenance, 161 SUE District Road Maintenance, regional subdivisions of SUE Landscaping and five corridor-based road maintenance enterprises of Committee for Roads.

The streets of cities and other settlements, together with the inter-farm rural roads, are often referred to as internal roads. According to the Rural Road Strategy 2035, there are 139,305 km of internal roads managed by the Republic of Karakalpakstan, the 12 regional governments and the city of Tashkent. They are supported by SUE Corporate Services under the Committee for Roads which acts as the client for internal road works, which are all outsourced.

Table UZB1: Road Lengths by Class and Surface Type
(km)

Road Class	Cement Concrete	Asphalt concrete	Black Gravel	Gravel	Earth	Total
International						**3,985**
State	497	22,563	17,622	1,501	685	**14,115**
Local						**24,640**
Inter-farm	521	45,919		59,327	33,558	**139,453**
Total	**1,018**	**68,482**	**17,622**	**60,828**	**34,243**	**182,193**

Source: Ministry of Roads and Transport Development 2023.

The technical standards applied in Uzbekistan are presented in Table UZB2, while the percentage of the road length of each technical standard is listed in Table UZB3. International roads are mostly technical Category I or II, while state roads are more or less evenly spread between Categories II, III and IV. Local roads are mainly Category IV with a large portion of Category V roads that do not meet the minimum requirements for Category IV. Inter-farm rural roads are all Category V roads.

Table UZB2: Technical Road Standards in Uzbekistan

Technical category	I	II	III	IV	V
Traffic capacity (PCU)	>14,000	6,000–14,000	2,000–6,000	200–2,000	<200
No. of lanes	≥4	2	2	2	1
Surface type	AC/CC	AC/CC	AC/CC	AC/CC/ST	-
Lane width (m)	3.75	3.75	3.5	3	4.5
Subgrade width (m)	28.5	15	12	10	8

AC = Asphalt Concrete, CC = Cement Concrete, PCU = Passenger Car Unit, ST = Surface Treatment

Source: SNK 2.05.02-07.

Table UZB3: Public Roads by Technical Standard

Technical Category	I	II	III	IV	V
International roads	44%	32%	15%	6%	3%
State roads	6%	29%	28%	34%	3%
Local roads	-	3%	12%	57%	28%
Inter-farm roads	-	-	-	-	100%

Source: Strategic Network Level Assessment, PADECO 2014.

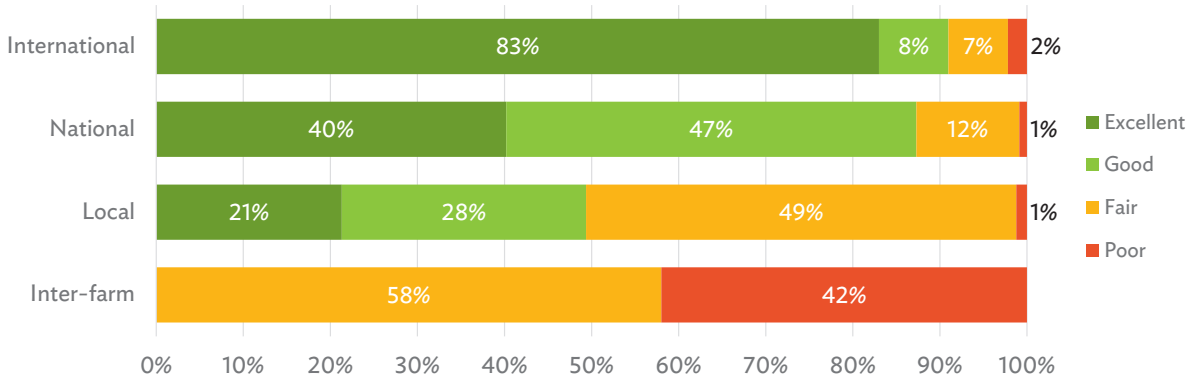
Road condition data is collected through visual assessments carried out during the spring and autumn surveys by the state-owned road maintenance enterprise. Mechanized road surveys are being gradually introduced but are not yet applied at the network level. Over the past decade, a large portion of the international road network and a portion of the state road network have been upgraded and rehabilitated. As a result, approximately 90% of international and state roads are considered to be in excellent or good condition. For local roads, this percentage is slightly below 50%. The reported length of public roads in poor condition requiring rehabilitation is quite low. In the case of inter-farm roads, the portion in poor condition requiring rehabilitation is much greater and reportedly 42%.

Table UZB4: Road Conditions by Road Class

Road Class	Excellent	Good	Fair	Poor	Total
International	3,304	318	272	87	**3,981**
State	5,668	6,640	1,669	123	**14,100**
Local	5,245	6,907	12,161	301	**24,614**
Public roads	**14,217**	**13,865**	**14,102**	**511**	**42,695**
Inter-farm		80,403		58,902	**139,305**

Source: Road Subsector Development Strategy and Action Plan, 2021.

Figure UZB1: Road Conditions by Road Class



Source: Road Subsector Development Strategy and Action Plan and Rural Road Strategy 2035.

2. Road maintenance needs and budget

An HDM-4 strategy analysis was carried out for the international road network in 2014 under the CAREC Corridor 2 Road Investment Program, determining that an optimal budget of $1,690 million was required over the 20-year period, equivalent to $85 million per year. The HDM-4 strategy analysis results were subsequently expanded to include state and local roads, identifying a minimum requirement of $9,395 million for the 20-year period, equivalent to $470 million per year. These costs do not include winter maintenance or maintenance and repair of structures and other road elements. Excluding capital repair (rehabilitation), the estimated costs average $388 million per year.

The Committee for Roads estimates that, on average, $8,000/km/year is required to cover the costs of current repair and maintenance. For the public road network of 42,869 km, this works out to $343 million per year, which is in line with the HDM-4 estimation. In 2021, a simple estimation of maintenance needs was carried out as part of the development of the Road Subsector Development Strategy and Action Plan. This was based on average unit costs provided by the Committee for Roads as presented in Table UZB5 and resulted in an estimated total cost for repair and maintenance of $366 million per year for the full public road network. This excludes rehabilitation costs and is only slightly lower than the estimation in the HDM-4 strategy analysis carried out in 2014, which does not include winter maintenance. This is considered the absolute minimum budget required, as it involves low standards and frequencies of periodic maintenance interventions.

Table UZB5: Average Repair and Maintenance Costs by Road Class
($/km)

Intervention	International	National	Local
Current repair (periodic maintenance)	117,600 (7 years)	80,640 (10 years)	39,675 (10 years)
Routine maintenance (pavement)	1,260	864	690
Off-carriageway maintenance	1,000	750	500
Winter maintenance	1,000	750	500

Source: Road Subsector Development Strategy and Action Plan, 2021.

Table UZB6: Estimated Repair and Maintenance Costs per Year
($ million)

Intervention	International	National	Local	Total
Current repair (periodic maintenance)	66.9	113.7	97.7	**278.2**
Routine maintenance (pavement)	5.0	12.2	17.0	**34.2**
Off-carriageway maintenance	4.0	10.6	12.3	**26.9**
Winter maintenance	4.0	10.6	12.3	**26.9**
Total	79.9	147.0	139.3	366.1

Source: Road Subsector Development Strategy and Action Plan, 2021.

For internal roads, the Rural Road Strategy 2035 includes an estimation of the funding needs for the core rural road network consisting of a selection of local roads and inter-farm rural roads. This identifies a maintenance need of UZS1,190 billion per year ($109 million) for the existing paved CRRN roads, increasing to UZS2,116 billion per year ($191 million) as the remaining CRRN roads are rehabilitated and upgraded. However, it must be noted that the CRRN comprises two-thirds of local roads that fall under the public road network. If the local roads are excluded, the maintenance needs reduce to UZS224 billion for the current paved CRRN inter-farm roads ($20 million), increasing to UZS712 billion ($65 million) as the remaining CRRN inter-farm roads are rehabilitated and upgraded.

Table UZB7: CRRN Maintenance and Current Repair Costs
(UZS billion per year)

Region	Existing Paved CRRN Roads				CRRN Roads Requiring Rehabilitation			
	Summer maintenance	Winter maintenance	Current repair	Total	Summer maintenance	Winter maintenance	Current repair	Total
Karakalpakstan	17	2	91	**121**	13	2	72	**95**
Andijan	8	1	44	**58**	6	1	33	**44**
Bukhara	20	3	111	**147**	26	3	145	**192**
Jizzakh	5	1	28	**37**	5	1	26	**35**
Fergana	24	3	131	**174**	4	1	22	**30**
Kashkadarya	21	3	118	**156**	16	2	89	**119**
Khorezm	7	1	40	**53**	8	1	43	**57**
Namangan	11	1	58	**77**	7	1	37	**50**
Navoi	8	1	46	**60**	2	0	9	**12**
Samarkand	14	2	76	**101**	16	2	88	**116**
Surkhandarya	11	1	60	**79**	13	2	70	**93**
Syrdarya	3	0	17	**22**	3	0	14	**19**
Tashkent	14	2	79	**105**	9	1	48	**63**
Total	**163**	**20**	**898**	**1,190**	**127**	**16**	**698**	**925**

Source: Rural Road Strategy 2035.

Until 2019, road repair and maintenance were funded by the Republican Road Fund (RRF), which received financing from earmarked revenues, including a corporate turnover tax, a vehicle registration fee, a foreign vehicle entry fee and a fuel tax in the Republic of Karakalpakstan. In 2018, the expenditure of the RRF amounted to UZS5,046 billion ($592 million), of which $269 million was allocated to maintenance and repair of public and internal roads. In 2019 the Republican Road Fund was abolished and replaced by the Republican Trust Fund for Road Development. This is financed from annual allocations from the State Budget and interest-free loans from the Fund for Reconstruction and Development to finance the construction, reconstruction and rehabilitation of public roads. This is complemented by budget allocations from the Republic of Karakalpakstan, the 12 regions and the city of Tashkent to finance the current repair and maintenance of public roads. Initially, the budget allocations to the Republican Trust Fund were limited, with expenditure on maintenance and repair dropping to $145 million in 2019 and $130 million in 2020. However, since then the budget allocations have increased for the past three years, as can be seen in Table UZB8. For 2024 the total allocations of the Republican Trust Fund amounted to UZS5,485 billion ($439 million), with allocations to repair and maintenance amounting to UZS3,019 billion ($241 million), only slightly below the previous allocations from the RRF.

Table UZB8: Expenditure Allocations for the Republican Trust Fund for Road Development
(UZS billion)

Source of funding	2022	2023	2024
Construction/reconstruction	3,133	3,401	2,400
Capital and current repairs, maintenance, landscaping	2,135	2,465	2,649
Disaster prevention and mitigation of consequences	232	295	371
Committee for Roads operational costs	39	90	65
Total	**5,539**	**6,251**	**5,485**

Sources: Budgets for 2022, 2023, and 2024.

For the financing of the internal roads, data was collected as part of the preparation of the Rural Road Strategy 2035. Funding levels varied significantly from one year to the next and Table UZB9 presents the average annual funding levels for the period 2017–2021. This shows a total average allocation of UZS1,384 billion ($131 million) for a network of 139,305 km, an average of just under $1,000/km/year. Most of the budget is allocated to current repairs. The amount of maintenance and repair funding actually exceeds the identified maintenance needs for the core rural road network because funds are also allocated to non-core roads. The sources of funding for the internal roads show that most of the funding comes from the national budget rather than the local budget. This reflects a strong dependence of the regions on the national government for the maintenance and repair of the internal roads.

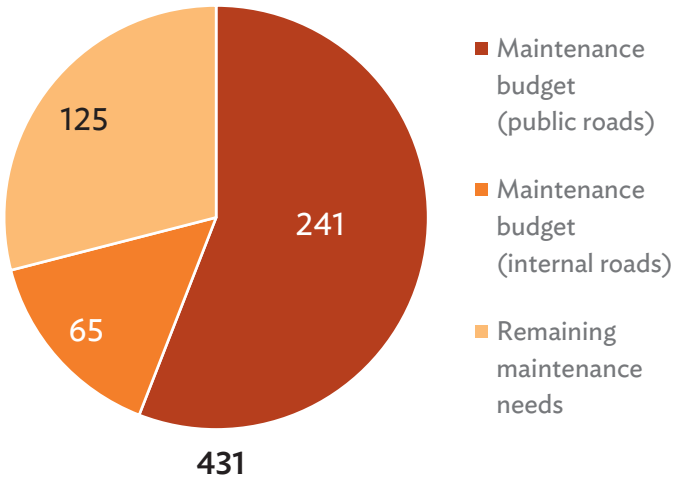
Table UZB9: Average Annual Internal Road Financing for the Period 2017–2021
(UZS million)

Activity	State Budget	Local Budget	Development partners	Total
Construction	153.3	2.6	7.2	**163.1**
Capital repair	39.3	20.0	0.5	**59.7**
Current repair	842.2	221.3	91.6	**1,155.1**
Summer maintenance	3.3	2.8	-	**6.2**
Total	**1,038.1**	**246.8**	**99.3**	**1,384.2**

Source: Rural Road Strategy 2035.

The maintenance and repair needs of the total road network in Uzbekistan are estimated to amount to $366 million for public roads and $65 million for inter-farm roads, a total of $431 million. The allocated budget for repair and maintenance amounts to approximately $241 million for public roads, leaving a gap of $125 million. The allocated budget for inter-farm roads is reportedly $131 million, exceeding the estimated needs (the excess appears to be used for non-core roads).

Figure UZB2: Road Maintenance Needs and Budgets in Uzbekistan
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

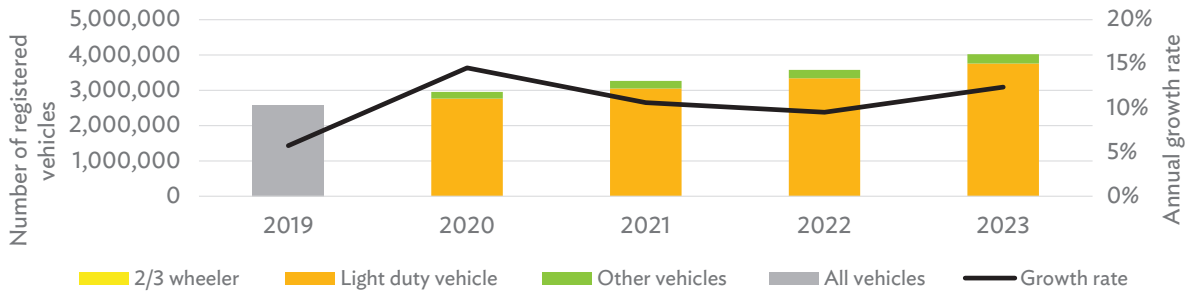
The Uzbekistan Statistics Agency reported a total of 4,020,744 vehicles at the end of 2023, mostly passenger cars (94%). A large portion of vehicles are registered in Tashkent City and the surrounding Tashkent region (26%) and in other economically important regions such as Samarkand (12%) and Fergana (10%). The number of vehicles has been increasing steadily at an average of 12% per year over the past five years. However, it appears that the vehicle registration numbers are based on annual new registrations and do not take into account any decommissioning of vehicles. The vehicle registration numbers therefore are an overestimation of the vehicle fleet size and growth rate. Most passenger cars are produced in Uzbekistan. Of the 424,658 newly registered vehicles in 2023 (including 391,604 light vehicles), 85% were produced in Uzbekistan and the rest were imported from other countries. Comparing this to the 312,764 newly registered vehicles in 2022, of which 93% were produced in Uzbekistan, it is clear that an increasing number of vehicles are being imported as a result of the abolishment of the import fee and excise tax on imported vehicles in 2022. According to the Uzbekistan Statistics Agency, the value of imported ground transport vehicles (excluding rail transport) amounted to $2,654 million in 2022, including both vehicles (49,954 passenger cars and 12,468 other vehicles) as well as spare parts. An increasing number of imported vehicles are from the People's Republic of China. The vehicle fleet in Uzbekistan mainly consists of vehicles running on natural gas (methane, 65%), followed by gasoline vehicles (24%), liquid natural gas vehicles (propane, 8%), and a small percentage of diesel vehicles (2%). Electric and hybrid vehicles make up a small portion (0.4%).

Table UZB10: Total Registered Vehicles in Uzbekistan

Vehicle type	2019	2020	2021	2022	2023
Passenger car		2,767,126	3,051,734	3,342,039	3,760,000
Minibus		8,518	15,800	15,710	9,100
Bus and minibus	**2,580,133**	5,711			6,300
Truck		168,810	195,784	216,274	240,917
Special purpose		5,130	5,152	5,360	5,400
Total	**2,580,133**	**2,955,295**	**3,268,470**	**3,579,383**	**4,020,744**

Source: Uzbekistan Statistics Agency.

Figure UZB3: Total Registered Vehicles in Uzbekistan



Source: Uzbekistan Statistics Agency.

According to the *E-mobility Country Profile* for Uzbekistan prepared in 2023 by the Urban Electric Mobility Initiative and the Asian Transport Outlook, Uzbekistan began the electrification of its auto industry in 2019. In June of that year, the government issued a presidential decree exempting electric vehicles from excise tax and customs duty, which reduced their price by up to half. In 2021, electric

vehicles were also exempted from the 3% car registration tax, which is included in the retail price of traditional vehicles.

Despite having a strong domestic vehicle production capacity of 341,650 vehicles in 2023, Uzbekistan currently has only limited local production or assembly of electric vehicles and relies mainly on imports. According to the *E-mobility Country Profile*, more than 5,000 electric cars were sold in 2022, three and a half times more than in 2021 and amounting to 10% of vehicle imports. In 2023, imported electric and hybrid vehicles tripled again and reportedly made up one-third of vehicle imports. Two-thirds of the electric car sales were new, while the remaining were used vehicles. In May 2023, UzAuto Motors, in partnership with BYD Auto, set up a joint venture called BYD Uzbekistan Factory to construct up to 50,000 plugin hybrid vehicles per year (2 models). ADM Jizzakh is also partnering with Chery International to produce hybrid and electric cars.

In terms of charging infrastructure, there are currently approximately 50 charging stations in Uzbekistan, mostly in Tashkent and Samarkand. The lack of charging infrastructure is the main challenge for the use of electric vehicles and is the reason for the strong interest in hybrid vehicles. Uzbekistan is targeting to have 2,500 charging stations by 2025. By decree of the President, all newly built businesses and shopping centers, entertainment places, gas stations, hotels and other facilities along national and international highways will be equipped with charging stations. A separate decree tasks the Ministry of Transport with creating incentives for private taxi companies to acquire electric vehicles and mandates the development of charging infrastructure for public electric buses.

4. Sources of road user revenues

Uzbekistan collects a wide range of road user revenues. Until 2019, a number of these were earmarked for the Republican Road Fund. However, this was abolished in 2019 and replaced by the Republican Trust Fund for Road Development which does not have any earmarked road user revenues. In addition to the Republican Trust Fund, there are also Regional Trust Funds for Road Development in the Republic of Karakalpakstan, the 12 regions and the city of Tashkent. Resolution No. 123 of 2020 provides the regulations for these funds and earmarks regional fuel levies, parking fees and fees linked to the technical inspection of vehicles, as well as newly introduced fees for roadside advertising and use of the right-of-way for business facilities to these Regional Trust Funds. A vehicle ownership fee is also mentioned, but this is allocated directly to cities and districts for their internal roads.

a. Fuel Excise Tax

The Tax Code (ZRU-508, December 2018) defines an excise tax on fuel, including gasoline, diesel, liquefied natural gas (propane) and compressed natural gas (methane). The rates are defined in the annual State Budget Law and can be adjusted during the course of a year. This was originally an *ad valorem* tax equivalent to a percentage of the wholesale price. From 2008 onward, the *ad valorem* rates were changed to fixed rates for petrol and diesel, while *ad valorem* percentages continued to be used for compressed natural gas and liquefied gas. In 2022, in response to the fact that Uzbekistan had become a net importer of gas rather than a net exporter and to avoid an increase in gas prices, the excise tax on liquefied gas was dropped, as was the excise tax on imported natural gas. According to the Uzbekistan Statistics Agency, in 2022 the fuel consumption for road transport was reported to include 1,284,300 tons of gasoline, 708,700 tons of diesel, 506,300 tons of liquefied gas (propane) and 3,741,700 tons of natural gas (methane). Based on this consumption and the tax rates indicated in Table UZB11, the total revenue from the fuel production excise tax was estimated to be UZS1,745 billion in 2022, equivalent to $160 million. The revenue from the fuel production excise tax is not earmarked for the road sector and goes directly to the State Budget.

Table UZB11: Fuel Excise Tax Rates

Fuel Type	2020	2021	2022	2023	2024
Gasoline (UZS per ton)	250,000	275,000	275,000	303,000	303,000
Diesel (UZS per ton)	200,000	240,000	264,000	291,000	326,000
Natural gas – methane (%)	20%	20%	20%	20%	20%
Liquefied gas – propane (%)	30%	30%	-	-	-

Source: Tax Code.

b. Fuel Excise Tax for End Consumers

The State Budget for 2002 introduced a tax from individuals on the consumption of petrol, diesel and gas for vehicles (consumption tax), replacing the ownership tax from individuals paid on vehicles. This consumption tax was applied to the end user at petrol stations and tax reporting was carried out by the petrol stations on a monthly basis. In 2019, the fuel consumption tax was replaced by a fuel excise tax for end consumers through an amendment to the Tax Code (ZRU-508, December 2018). With the change to an excise tax, the tax is no longer collected by petrol stations but is applied directly to the retail price set by the government. Based on the reported fuel consumption for 2022 and the tax rates presented in Table UZB12, the total revenue from the fuel excise tax for end consumers is estimated to amount to UZS3,569 billion, equivalent to $328 million. Noteworthy is that many vehicles in Uzbekistan run on natural gas (methane), which is the main source of this road user revenue ($203 million). The revenue from this fuel excise tax for end consumers is collected by the State Tax Committee and is transferred to the Republic of Karakalpakstan, the regions and the city of Tashkent according to the fuel consumption in these areas.

Table UZB12: Rates of the Fuel Excise Tax for End Consumers

Fuel Type	2020	2021	2022	2023	2024
Gasoline (UZS per ton)	378,480	465,530	512,000	565,000	565,000
Diesel (UZS per ton)	346,275	425,918	468,000	516,000	578,000
Liquefied gas (UZS per ton)	540,645	665,493	730,000	807,500	904,000
Natural gas (UZS per m^3)	435	500	550	605	678

Source: Tax Code.

c. Fuel Value-Added Tax

The Tax Code (ZRU-508, December 2018) defines a value-added tax (VAT) of 12%. Fuel prices in Uzbekistan in 2022 were UZS11,000/liter for gasoline, UZS12,500/liter for diesel and UZS3,350/m^3 for methane. Based on these prices and the consumption volumes, the value at the fuel station is estimated to amount to UZS34,326 billion. The VAT portion of this value is estimated to amount to UZS3,677 billion, equivalent to $339 million.

d. Vehicle Import Fee

Resolution No. 334 of 1993 introduced a fee on the purchase or temporary import of vehicles into Uzbekistan, which is collected by the Ministry of Internal Affairs on the registration of the vehicle. The fee was not applied to vehicles produced in Uzbekistan and is only applied to imported new and used vehicles. The rates were defined in the annual State Budget Law. For new vehicles, a percentage of 3% of

the value was charged. For used vehicles, the rate depended on the type of vehicle and its age and was coupled to the engine size and the minimum wage (UZS822,000 in 2021) as shown in Table UZB13. The revenue collected from this fee used to be earmarked for the Republican Road Fund and in 2018 was reported to amount to UZS1,044 billion, equivalent to $133 million. After the abolishment of the RRF in 2019, this revenue continued to be collected and was credited to the State Budget in accordance with the State Budget Resolution for 2019 (PP-4086). However, this fee was abolished in 2022 and is no longer included in the annual State Budget Law.

Table UZB13: Vehicle Import Fee Rates
(% of minimum wage for each horsepower)

Vehicle Type	New	Less than 3 years old	3-7 years old	More than 7 years old
Motorcycle	3% of value	10%	7%	5%
Passenger car		11%	9%	6%
Other vehicles		16%	13%	9%

Source: Law ZRU-657, State Budget 2021.

e. Vehicle Excise Tax

The Tax Code (ZRU-508, December 2018) defined a vehicle excise tax that was collected by the State Customs Committee when a vehicle was imported into Uzbekistan. The rates depended on the type of vehicle and its engine capacity (cm^3). Table UZB14 presents the rates as defined in the 2019 State Budget. The additional rate that depends on the engine capacity was by far the most important, easily amounting to a few thousand dollars. Total revenue was estimated to be in the order of $20 million per year (it was only applied to imported vehicles, not to domestically produced vehicles). Revenue from this excise tax went to the State Budget and was not earmarked for the road sector. However, in 2022 the excise tax on vehicles was abolished.

Table UZB14: Vehicle Excise Tax Rates

Vehicle Type	Base Rate	Additional Rate
Motorcycle	$20	
Passenger car	$30–$40	$2-3 per cm^3
Bus (≥10 passengers)	$20	$2.0 per cm^3
Freight vehicle (<5 tons)	$30	$1.2 per cm^3
Freight vehicle (5–20 tons)	$70	$1.2 per cm^3
Freight vehicle (>20 tons)	$70	$3.0 per cm^3
(Semi-)trailers	$5	
Tanker and self-loading (semi-)trailers	$15	

Source: Presidential Resolution PP-4086 for the 2019 State Budget.

f. Vehicle Customs Duty

The vehicle customs duty rates are defined in Resolution No. PP-3818 of 2018. Rates for new light vehicles were recently reduced, with the new rates valid up to 2026. Based on 49,954 imported passenger cars in 2022 with a value of approximately $1,800 million, and assuming that these are mainly new cars

(maximum one-year old) with an average engine size of 1,400cc, the revenue is estimated to amount to approximately $312 million.

Table UZB15: Customs Duty Rates

Vehicle type	New Gasoline	New Diesel	New Hybrid	Electric	Used
Motorcycle	20%	-	-	0%	20%
Passenger cars <1,000cc	0%	0%	15% (plugin) 30% (other)	0%	40%+$3.00/cc
Passenger cars 1,000–1,200cc	5%	5%			
Passenger cars 1,200–1,500cc	15%+$0.60/cc	15%+$0.60/cc			
Passenger cars 1,500–1,800cc	15%+$0.80/cc	15%+$1.20/cc			
Passenger cars 1,800–2,500cc	15%+$1.00/cc	15%+$1.20/cc			
Passenger cars 2,500–3,000cc	15%+$1.00/cc	15%+$1.50/cc			
Passenger cars >3,000cc	15%+$1.25/cc	15%+$1.50/cc			
Bus >10 passengers	20%+$2.00/cc	30%+$1.20/cc	20%+$2.00/cc	0%	
Truck <5 tons <2,500cc	30%+$1.20/cc	30%+$1.20/cc	-	0%	30%+$1.20/cc
Truck 5–20 tons	70%+$3.00/cc	70%+$3.00/cc	-		70%+$3.00/cc
Truck >20 tons	70%+$3.00/cc	70%+$3.00/cc	-		70%+$3.00/cc
Special purpose	5%	5%	-	-	5%

Source: Presidential Resolution PP-3818 of 2018.

g. Vehicle Value-Added Tax

The Tax Code (ZRU-508, December 2018) defines a value-added tax (VAT) of 12%. Application of the VAT to the value of imported vehicles and spare parts in 2022 ($2,654 million) results in revenue of $318 million. With 362,236 domestically produced vehicles reportedly registered in 2023, and assuming an average value of UZS125 million ($10,000), the market rate for the popular Chevrolet Cobalt, the value of the domestically produced vehicles would be equivalent to $3,635 million. Applying 12% VAT results in a revenue of $436 million. Total revenue from the VAT on vehicle sales is therefore estimated to amount to $754 million.

h. Foreign Vehicle Entry Fee

Resolution No. 334 of 1993 introduced a fee for the entry and transit of foreign vehicles into Uzbekistan set at $400 per vehicle. Initially, this included both freight vehicles and buses but now it only includes freight vehicles. Over time, bilateral agreements were introduced. The current rates are indicated in Table UZB16. The foreign vehicle entry fees are collected by the State Customs Committee. This road user revenue used to be earmarked for the Republican Road Fund and amounted to $20 million in 2018. With the abolishment of the RRF in 2019, 80% of the revenue now goes to the Fund for Development and Support of the Committee for Roads which serves to cover the operational costs of the Committee for Roads and its underlying departments and enterprises (this does not cover the costs of works), with the remaining 20% going to the State Budget.

Table UZB16: Fee Rates for Foreign Freight Vehicles
($ per Vehicle)

Country	Under 10 tons	10–20 tons	Over 20 tons
Tajikistan	100	150	200
Kazakhstan	300	300	300
Kyrgyz Republic	300	300	300
Turkmenistan	50	100	150
European Union	150	150	150
Afghanistan	50	50	50
Other countries	400	400	400

Source: Law on the State Budget 2024 ZRU-886, 2023.

i. Heavy Vehicle Fee

In 2023 the Tax Code was amended to include a fee for freight trucks and trailers with more than 10 tons carrying capacity to compensate for the damage caused by heavy vehicles. The fee is collected by the Ministry of Transport of Karakalpakstan and by the regional transport departments. The fee is paid on an annual basis and the rates are defined in the annual State Budget Law. The rates depend on the carrying capacity of the vehicle and are linked to a 'base calculated value' (BRV: базовой расчетной величине) that is adjusted each year. For 2024, the base calculated value is set at UZS340,000. With 240,917 trucks registered in 2024 and applying the lowest rate of 5 BRV, the revenue is estimated to be in the order of UZS400 billion ($32 million).

Table UZB17: Heavy Vehicle Fee Rates

Carrying capacity of truck or trailer	Rate
10–25 tons	5 BRV
25–35 tons	8 BRV
More than 35 tons	10 BRV

BRV = Base Calculated Value (базовой расчетной величине) for 2024 is set at UZS340,000

Source: Presidential Resolution PP-4086 for the 2019 State Budget.

j. Tolling

Tolls are not yet collected on roads in Uzbekistan. The 2007 Law on Roads expressly mentions that road tolling is to be dealt with in a separate law. A draft law on toll roads was prepared in August 2019. This focuses on the creation of new expressway routes operated as toll roads under public–private partnerships as alternatives to existing roads. The strategy expressly mentions Tashkent–Andijan and Tashkent–Samarkand–Bukhara for the construction of such toll roads. Resolution PP-4545 further identifies a set of five road and tunnel projects considered suitable for tolling under public–private partnerships. These include Tashkent–Andijan, Tashkent–Samarkand, Syrdarya–Bakht, Kamchik Pass tunnel and Takhtakarachi Pass tunnel. Of these, feasibility studies are currently being prepared for Tashkent–Andijan and Tashkent–Samarkand. Applying tolling on existing roads is currently not being considered as a means of financing the operation and maintenance of these roads.

5. Road user revenues

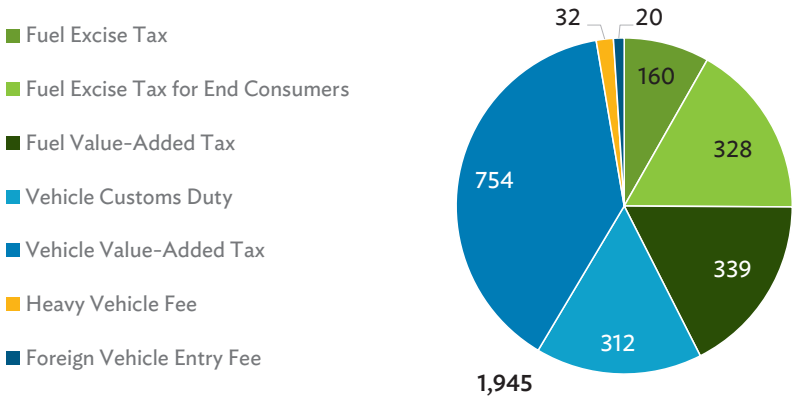
The different road user revenues are presented in Table UZB18. The total amount collected from these main road user revenues amounts to nearly $1,950 million per year, four and a half times the estimated road maintenance needs and equivalent to 2.4% of GDP. A large portion is from fuel-related tax revenues, amounting to $827 million per year (43% of total revenue). The vehicle customs duty and value-added tax are the greatest source of revenue, together amounting to $1,066 million per year (55% of total revenue). Other vehicle-based taxes such as the excise tax and import fee were abolished in 2022, resulting in the loss of considerable revenue (over $150 million per year). Annual heavy vehicle fees and foreign vehicle entry fees are a smaller revenue stream of just over $50 million per year (3% of total revenue). None of these revenues are earmarked for the Republican Trust Fund or Regional Trust Funds, although the foreign vehicle entry fee is earmarked for covering the operational costs of the Committee for Roads.

Table UZB18: Road User Revenues in Uzbekistan

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Fuel Excise Tax	160	8%	-	-
Fuel Excise Tax for End Consumers	328	17%	-	-
Fuel Value-Added Tax	339	17%		
Vehicle Value-Added Tax	312	16%	-	-
Vehicle Customs Duty	754	39%	-	-
Foreign Vehicle Entry Fee	20	1%	-	-
Heavy Vehicle Fee	32	2%	-	-
Total	**1,945**	100%	**-**	**-**
(Vehicle Import Fee – abolished in 2022)	(133)	(7%)	-	-
(Vehicle Excise Tax – abolished in 2022)	(20)	(1%)	-	-

Source: Consultant's processing of collected data.

Figure UZB4: Road User Revenues in Uzbekistan
($ million)



Source: Consultant's processing of collected data.

Carbon-based road user revenues amount to $827 million per year in Uzbekistan. This revenue will be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. In addition, the revenue of the vehicle customs duty will reduce as the rates for battery electric vehicles are set at 0%. This can affect a further $312 million in revenues.

J. Vanuatu

Vanuatu is a small island state in the Pacific with a land area of 12,200 km^2 and a population of 0.3 million people, resulting in a low population density of 26 persons per km^2. According to the World Bank, the 2022 GDP (US$ current) is $1.1 billion, resulting in a medium GDP per capita of $3,231. Vanuatu is made up of 83 islands (65 inhabited), with 1,300 km separating the northern and southern extremes. Economic growth is concentrated in the urban centers of Port Vila on Efate and Luganville on Espiritu Santo. The terrain is steep and mountainous, formed by volcanic activity, with roads running in the strip of land between the mountains and the coast. The climate is tropical with heavy rainfall and frequent damaging cyclones.

1. Road network

Vanuatu's classified road network amounts to 3,023 km, complemented by 46 bridges and 500 drifts and culverts. According to data collected in 2017 under the Roads for Development (R4D) program and stored in the Road Inventory Management System, the national public road network comprises just over 2,000 km of roads. These public roads are managed by the Public Works Department (PWD) under the Ministry of Infrastructure and Public Utilities. PWD manages its road maintenance and smaller construction contracts through six regional PWD units, one in each of the six provinces. Major works, usually donor-funded, are managed by headquarters units. PWD is traditionally a works agency with its own force-account units complemented by numerous community-based contracts. However, it is transitioning toward a road network manager, accountable for the serviceability of the network and using larger national (usually island-based) contractors. In addition to the public roads, there are just under 1,000 km of feeder and urban roads that are the responsibility of provincial governments and municipalities under Vanuatu's Decentralization Act 2013.

Table VAN1: Road Lengths by Province and Surface Type
(km)

Province	Sealed	Gravel	Earth	Total
Malampa	-	150	257	**407**
Penama	-	74	281	**355**
Sanma	68	354	102	**523**
Shefa	130	62	165	**356**
Tafea	0	82	262	**344**
Torba	-	42	9	**52**
Subtotal public roads	**198**	**764**	**1,075**	**2,037**
Feeder/urban	125	436	425	986
Total	**323**	**1,200**	**1,500**	**3,023**

Source: R4D Program Independent Evaluation, Final Report.

Only 10% of the public road network is sealed, almost all of which is on Efate or Espiritu Santo. A further 37% of the public road network has a gravel surface, with over half the network having a simple earthen surface. For the urban and feeder roads, these percentages are similar, although most of the sealed and gravel roads are urban roads. Information on road conditions is not available for Vanuatu.

2. Road maintenance needs and budget

A basic unit rate analysis of the road maintenance needs is presented in Table VAN2. Using the average costs per kilometer for sealed, gravel and earthen roads and multiplying these by the length of roads concerned, the annual road maintenance needs are estimated to amount to approximately $12.5 million. This is equivalent to 1.1% of GDP, which is high and represents a challenge to cover the costs.

Table VAN2: Estimated Road Maintenance Needs

Surface type	Length (km)	Routine maintenance ($/km/year)	Periodic maintenance ($/km/year)	Total cost ($/year)
Sealed	198	3,000	10,000	**2,579,200**
Gravel	764	2,000	7,500	**7,255,150**
Earth	1,075	1,000	1,500	**2,686,500**
Total	**2,037**			**12,520,850**

Source: Consultant's estimation.

The Public Roads Strategy 2030 includes targets for budget allocations to the road sector. Over the full 2022–2040 period, the average annual budget requirement is $29.5 million. However, over half this amount is intended for sealing and upgrading works, reducing over time as the rural and urban roads are brought to a paved standard. The planned allocation to road maintenance forms 40% of this budget, averaging $12 million per year with little variation between the different five-year periods. This is in line with the estimated road maintenance needs.

Table VAN3: Planned Budget Allocations by Type of Activity
($ million)

Activity	2022–2025	2026–2030	2031–2035	2036–2040	Total
1A: Seal/upgrade urban roads	59	74	0	0	**133**
1B: Seal/upgrade rural core roads	35	44	44	44	**168**
2A: Maintain passability of non-core roads	17	34	38	38	**128**
2B: Maintain sealed roads	26	25	23	21	**94**
2C: Emergency maintenance	1	2	2	2	**6**
3A: Basic access for 70% of Ni-Vanuatu	6	8	8	8	**30**
Total	**146**	**186**	**115**	**113**	**560**

Source: Ministry of Infrastructure and Public Utilities Public Roads Strategy, 2023.

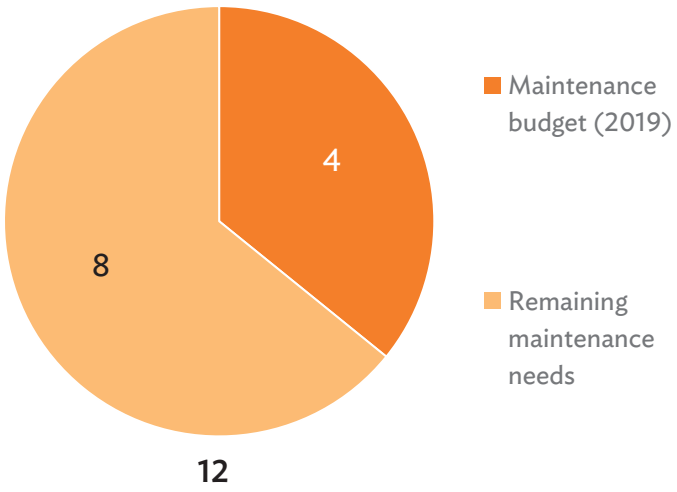
Road maintenance and rehabilitation allocations from the recurrent budget in 2017 amounted to only VUV645 million ($6 million). In 2019, the Annual Workplan had a total budget of VUV1,477 million ($13 million), including VUV1,363 million for rural roads and VUV113 million for urban roads. The Annual Workplan budget mainly consisted of funding for road improvements financed through R4D and the Vanuatu Infrastructure Reconstruction and Improvement Project. Funding for routine and periodic maintenance (including material supply and stockpiling) is largely funded from the PWD budget, with funding allocations actually reducing compared to 2017 and comprising only 33% of the total roads budget in 2019 compared to 75% in 2017. The 2019 allocation for road maintenance amounted to approximately VUV481 million (including stockpiling and material supply), equivalent to $4.3 million, or 0.4% of GDP.

Table VAN4: Road Maintenance Budgets for 2017 and 2019
(VUV million)

Province	Routine	Periodic	Improvements	Stockpiling	Materials	Total
Malampa	27.0	22.6	309.3	25.2	6.7	390.7
Penama	7.5	23.4	210.5	5.0	6.7	253.0
Sanma	51.5	44.6	20.0	20.0	6.7	142.8
Shefa	44.5	19.8	263.5	21.5	6.7	355.9
Tafea	14.8	19.1	110.9	9.8	6.7	161.2
Torba	7.6	2.9	38.9	3.2	6.7	59.2
Subtotal rural	**152.9**	**132.2**	**953.1**	**84.6**	**40.0**	**1362.9**
Sanma	6.5	27.7	15.9	3.9	0.0	54.0
Shefa	12.4	2.1	27.1	13.3	4.9	59.9
Subtotal urban	**18.9**	**29.8**	**43.0**	**17.2**	**4.9**	**113.9**
2019 total	**171.8**	**162.1**	**996.1**	**101.8**	**44.9**	**1476.7**
Percentage	12%	11%	67%	7%	3%	100%
2017 total	**187.1**	**174.5**	**161.4**	**80.0**	**42.0**	**645.0**
Percentage	29%	27%	25%	12%	7%	100%

Source: PWD Annual Workplan 2019, Investment Design Document Roads for Development Phase 2.

Figure VAN5: Road Maintenance Needs and Budget in Vanuatu
($ million)



Source: Consultant's processing of collected data.

3. Vehicle fleet

Data on registered vehicles in Vanuatu is limited. According to the Department of Energy's 2023 Vanuatu Fuel Standards Policy Brief, there were an estimated 8,518 vehicles in 2020. This figure includes both registered vehicles and a small number of unregistered vehicles in rural areas. In 2010, the vehicle fleet was reported to be 5,508 vehicles, indicating an annual growth rate of approximately 4.5%. This growth is primarily driven by pickups and trucks. Pickups and trucks, which have a growth rate exceeding 10%, while

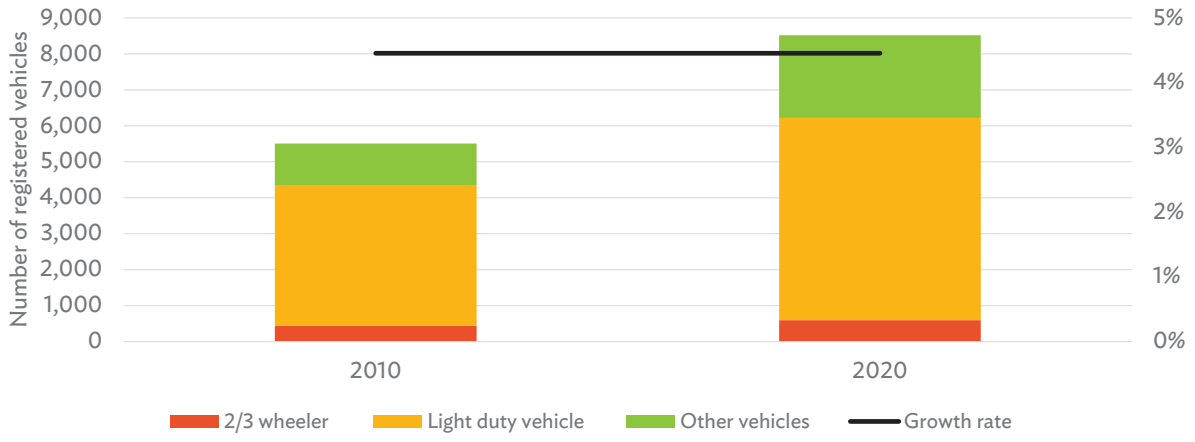
the number of passenger cars has seen minimal increase. Most registered vehicles are concentrated in Port Vila, with a smaller proportion in Luganville. The detailed composition of this fleet is presented in Table VAN5 below.

Table VAN5: Number of Registered Vehicles in Vanuatu

Vehicle Type	2010	2020
Motorcycles	441	596
Passenger cars	2,919	3,153
Pickups	991	2,470
Buses	936	1,618
Trucks	220	681
Total	**5,508**	**8,518**

Source: Vanuatu Fuel Standards Policy Brief, 2023.

Figure VAN1: Total Registered Vehicles in Vanuatu



Source: Department of Energy.

Each year over 1,000 vehicles are imported into Vanuatu, mainly used vehicles. Due to the lack of requirements for emission standards or vehicle ages, these are generally inexpensive older vehicles. As a result, a large portion of the vehicle fleet is more than 10 years old.

Table VAN6: Number of Newly Registered Vehicles by Year

Year	Newly Registered Vehicles
2018	1,537
2019	1,254
2020	915
2021	1,057

Source: Vanuatu Fuel Standards Policy Brief, 2023.

There is no information available on electric vehicles in Vanuatu. Electric charging stations do not yet exist, although there are plans to construct some. Vanuatu's Revised and Enhanced Nationally Determined

Contributions 2021–2030 sets targets for the introduction of electric vehicles, including 10% electric buses for public transport, 10% electric government vehicles, and 1,000 electric 2-wheelers by 2030. The 2017 and 2022 Harmonized Coding Systems exempted hybrid and electric vehicles from import duties (15%–25%) and from excise taxes (20%), resulting in a significant reduction in the import price of such vehicles. However, despite the target for 1,000 electric motorcycles, these are not exempted from import duties according to the 2022 Harmonized Coding System.

4. Sources of road user revenues

Vanuatu collects a variety of road user revenues, mainly on fuel and vehicles (there is no tolling in Vanuatu). All revenues go to the General Budget and there is no road fund with earmarked revenues.

a. Fuel Import Duty

The import duty on vehicles is defined in the Import Duties Act and its subsequent amendments. The import duty rates are defined in the Harmonized Coding System HS2022 of the Vanuatu Customs and Inland Revenue Department and are presented in Table VAN7. The Department of Energy Vanuatu in their 2023 Fuel Standards Policy Brief reported over 56 million liters of fuel being imported each year, with diesel making up the main volume (63%). Approximately half the fuel consumption is related to land transport (followed by electricity production). Based on this consumption and the import duty rates of Table VAN7, the revenue from the fuel import duty is estimated to amount to VUV308 million, equivalent to $2.7 million.

Table VAN7: Import Duty Rates for Fuel

Fuel Type	Import Duty
Motor spirit, other, unleaded (gasoline)	VUV10/liter
Distillate fuel (diesel)	VUV10/liter

Source: Vanuatu Harmonized Coding System HS2022.

b. Fuel Excise Tax

The excise tax is defined in the Excise Law of 2003 and subsequent amendments. The excise tax rates are defined in the Harmonized Coding System HS2022 of the Vanuatu Customs and Inland Revenue Department and are presented in Table VAN8. Based on the fuel consumption of 56 million liters per year reported by the Department of Energy, of which half is consumed for land transport and 63% is diesel, the revenue of the fuel excise tax is estimated to amount to VUV508 million per year, equivalent to $4.5 million.

Table VAN8: Excise Tax Rates for Fuel

Fuel Type	Import Duty
Motor spirit, other, unleaded (gasoline)	VUV20/liter
Distillate fuel (diesel)	VUV15/liter

Source: Vanuatu Harmonized Coding System HS2022.

c. Fuel Value-Added Tax

The Value-Added Tax (VAT) was increased in 2018 from 12.5% to 15%. According to the Reserve Bank of Vanuatu, the price of diesel in October 2023 was VUV201/liter, while gasoline was VUV189/liter. Based on the fuel consumption reported by the Department of Energy, this would put the retail value of the fuel used for land transport at approximately VUV5,500 million ($49 million). The revenue from this value-added tax is estimated to be in the order of VUV718 million, equivalent to $6.4 million.

d. Vehicle Import Duty

The import duty on vehicles is defined in the Import Duties Act and its subsequent amendments. The rates are defined in the Harmonized Coding System HS2022 of the Vanuatu Customs and Inland Revenue Department and are presented in Table VAN9. Import duty rates are the same for new and used vehicles but are set at zero for vehicles with hybrid or electric engines. For 2022, the Observatory of Economic Complexity reports a total value of imported vehicles of $8.8 million. Applying an average import duty rate of 20% to this value gives an estimated revenue of $1.8 million.

Table VAN9: Import Duty Rates for Vehicles

Vehicle Type	Import Duty
Motorcycles <250cc	15%
Motorcycles >250cc	20%
Motorcycles electric	15%
Passenger cars gasoline <1,000cc	15%
Passenger cars gasoline 1,000cc–1,500cc	20%
Passenger cars gasoline 1,500cc–3,000cc	25%
Passenger cars gasoline >3,000cc	40%
Passenger cars diesel <1,500cc	10%
Passenger cars diesel 1,500cc–2,500cc	15%
Passenger cars diesel >2,500cc	20%
Dump trucks	15%
Buses >10 passengers	15%
Dual purpose vehicles <1,500cc	10%
Dual purpose vehicles 1,500cc–2,500cc	15%
Dual purpose vehicles >2,500cc	20%
Trucks <3 tons	5%
Trucks 3–5 tons	10%
Trucks 5–20 tons	15%
Trucks >20 tons	20%
Hybrid or electric vehicles	-

Source: Vanuatu Harmonized Coding System HS2022.

e. Vehicle Excise Tax

The excise tax on vehicles is defined in the Excise Law of 2003 and subsequent amendments. The excise tax is applied to vehicles imported into the country with rates presented in Table VAN10. The tax rate is generally 20% of the value of the vehicle, except for gasoline vehicles with large engine capacities.

Motorcycles and new vehicles are exempted from paying excise tax, as are vehicles with hybrid or electric engines. For 2022, the Observatory of Economic Complexity reports a total value of imported vehicles of $8.8 million. Applying a 20% excise tax to this value gives an estimated revenue of $1.8 million.

Table VAN10: Excise Tax Rates for Used Vehicles

Vehicle Type	**Excise Tax**	**Minimum Tax** (VUV)
Motorcycles	-	-
Used passenger cars gasoline <1,000cc	20%	200,000
Used passenger cars gasoline 1,000cc–1,500cc	20%	200,000
Used passenger cars gasoline 1,500cc–3,000cc	25%	250,000
Used passenger cars gasoline >3,000cc	40%	250,000
Used passenger cars diesel <1,500cc	20%	100,000
Used passenger cars diesel 1,500cc–2,500cc	20%	150,000
Used passenger cars diesel >2,500cc	20%	150,000
Used buses >10 passengers	20%	200,000
Used trucks <1,500cc	20%	100,000
Used trucks 1,500cc–2,500cc	20%	150,000
Used trucks >2,500cc	20%	150,000
Hybrid or electric vehicles	-	-
New vehicles	-	-

Source: Vanuatu Harmonized Coding System HS2022.

f. Vehicle Value-Added Tax

The Value-Added Tax (VAT) was increased in 2018 from 12.5% to 15%. This is applied to vehicles when they are imported into Vanuatu and sold to their first owner. For 2022, the Observatory of Economic Complexity reports a total value of imported vehicles of $8.8 million. Applying the value-added tax to this value gives an estimated revenue of $1.3 million.

g. Vehicle Change of Ownership Fee

The vehicle change of ownership fee is defined in the Law on Road Traffic (Control) of 1962 with subsequent amendments. It is currently set at 7% of the estimated value of the vehicle excluding VAT, import duty and road tax. This fee is paid on the registration of a newly imported vehicle and for the change of ownership on a subsequent sale of the vehicle. For 2022, the Observatory of Economic Complexity reports a total value of imported vehicles of $8.8 million. Applying the change of ownership fee to this value gives an estimated revenue of $0.6 million. It is not known how many changes of ownership of vehicles already registered in Vanuatu take place annually, but this is likely a smaller number and involves vehicles with a lower value. The total revenue is therefore estimated to be approximately $0.8 million.

h. Road Tax

The annual road tax is defined in the Law on Road Traffic (Control) of 1962 with subsequent amendments. The road tax needs to be paid by vehicle owners in March each year. The rates are presented in Table VAN11. Late payments are penalized, with the rates going up by 25% in April and another 25% in May. Vehicle owners first need to carry out a vehicle technical inspection and obtain a road worthiness certificate before they pay the road tax. The payment of the annual road tax is indicated by a road tax

sticker. Based on the vehicle fleet presented in Table VAN5 and assuming all vehicle owners pay their road tax and pay it on time, this road user revenue is estimated to provide VUV164 million in 2020 equivalent to $1.5 million.

Table VAN11: Road Tax Rates

Vehicle Category	**Capacity**	**Road Tax** (VUV)
Motorcycles	100cc or less	6,732
	Exceeding 100cc	8,976
Passenger vehicles	1,100cc or less	11,220
	1,100–1,500cc	14,586
	1,500–2,000cc	19,635
	2,000–2,500cc	25,245
	Exceeding 2,500cc	38,000
Other vehicles	Up to 1 ton	10,659
	1–2 tons	21,318
	2–3 tons	31,416
	3–5 tons	40,392
	5–10 tons	60,000
	Exceeding 10 tons	85,000

Source: Vanuatu Customs and Inland Revenue Department.

5. Road user revenues

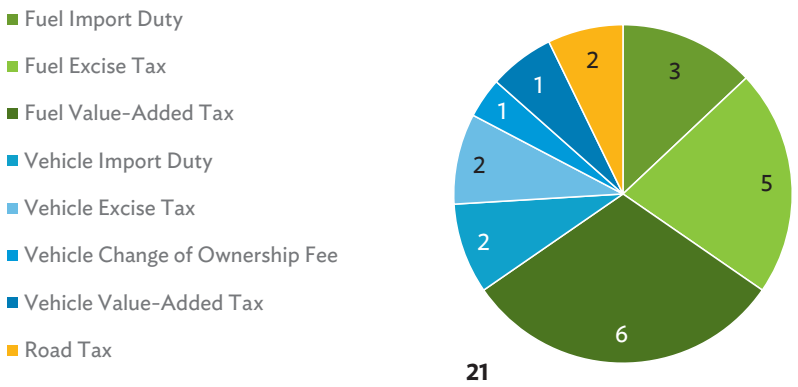
The different road user revenues in Vanuatu are presented in Table VAN12. The total amount collected from these main road user revenues amounts to $21 million per year, approximately 175% of the estimated road maintenance needs and equivalent to 1.9% of GDP. A large portion is from fuel-related tax revenues, amounting to $13.6 million per year (65% of total revenue). The vehicle import duty, excise tax, value-added tax and registration fee form the second largest source of revenue, together amounting to $5.7 million per year (27%). The annual road tax paid by vehicle owners contributes the remaining $1.5 million (7%) of revenues. None of these revenues are earmarked for the road sector and all go directly to the General Budget.

Table VAN12: Road User Revenues in Vanuatu

Road User Revenue	**Revenue** ($ million)	**%**	**Road Fund** ($ million)	**%**
Fuel Import Duty	2.7	13%	-	-
Fuel Excise Tax	4.5	22%	-	-
Fuel Value-Added Tax	6.4	31%	-	-
Vehicle Import Duty	1.8	9%	-	-
Vehicle Excise Tax	1.8	9%		
Vehicle Value-Added Tax	1.3	6%	-	-
Vehicle Change of Ownership Fee	0.8	4%	-	-
Road Tax	1.5	7%	-	-
Total	**20.8**	**100%**	**-**	**-**

Source: Consultant's processing of collected data.

Figure VAN2: Road User Revenues in Vanuatu
($ million)



Source: Consultant's processing of collected data.

Revenue from carbon-based fuel charges amounts to $13.6 million per year in Vanuatu. This revenue is likely to be directly affected by a transition to hybrid and electric vehicles over time as less fuel is consumed. In addition, the revenue of the vehicle import duty and excise tax will be reduced as the rates for electric and hybrid vehicles are set at zero. This can affect a further $3.6 million in revenues. These effects are expected to become visible in the coming years as the number of hybrid and electric vehicles is expected to increase as a result of the duty and tax incentives.

Road Maintenance Financing and Cost Recovery Options

The Future of Road User Revenues in Developing Asia and the Pacific

This paper on road maintenance financing and cost recovery options is the first of three that present the results and recommendations of a study on the Future of Road User Revenues in Developing Asia and the Pacific. It was developed as part of the Asian Development Bank's technical assistance on Improving Infrastructure Sustainability through Better Asset Management, which aims to enhance asset management maturity and operations across infrastructure sectors in ADB developing member countries. This report covers: Bangladesh, Cambodia, the Kyrgyz Republic, Mongolia, Nepal, Pakistan, Papua New Guinea, Timor-Leste, Uzbekistan, and Vanuatu.

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