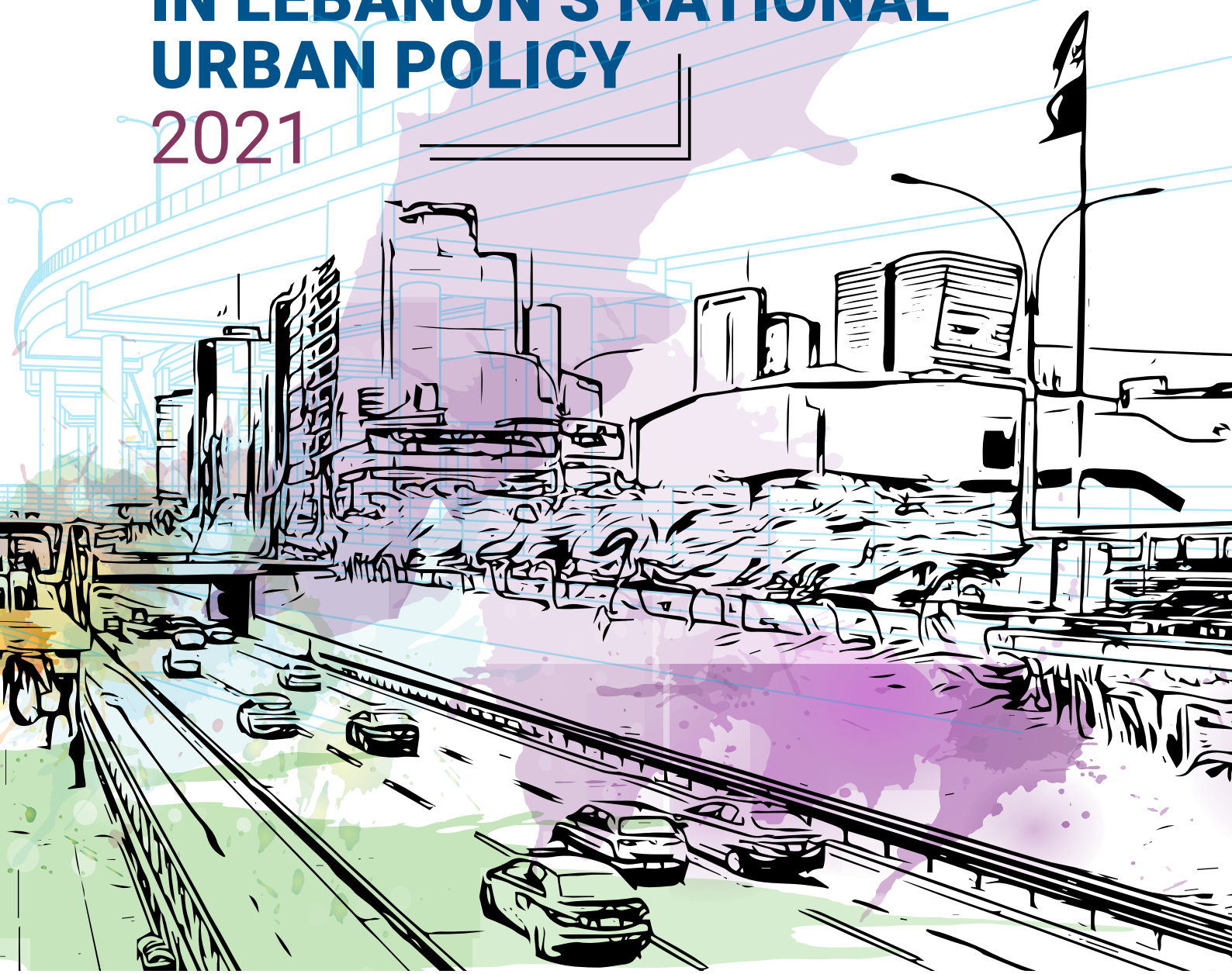
GUIDE FOR MAINSTREAMING TRANSPORT & MOBILITY IN LEBANON'S NATIONAL URBAN POLICY

2021



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The United Nations Human Settlements Programme (UN-Habitat) is the United Nations agency for human settlements. It is mandated by the United Nations General Assembly to promote socially and environmentally sustainable towns and cities with the goal of providing adequate shelter for all. UN-Habitat's programmes are designed to help policymakers and local communities get to grips with human settlements and urban issues and find workable, lasting solutions.

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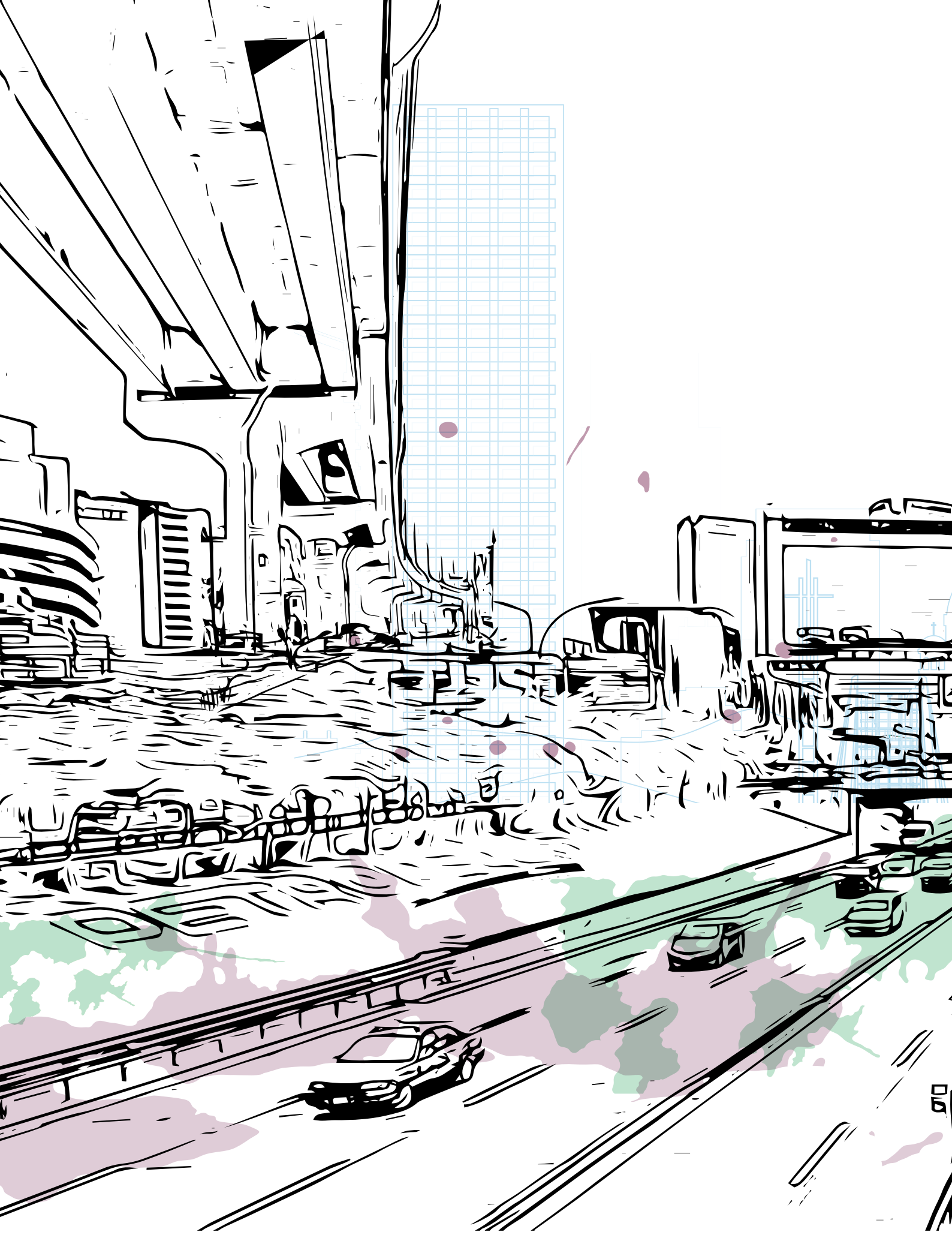

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ACT	Action towards Climate-friendly Transport
AI	Artificial intelligence
AQI	Air Quality Index
ASI	Avoid-Shift-Improve
AUB	American University of Beirut
AV	Autonomous vehicle
BEV	Battery electric vehicle
BRT	Bus rapid transit
CAV	Connected and autonomous vehicle
CDR	Council for Development and Reconstruction
CEDRE	Conference for Economic Development and Reform through Enterprises
CIP	Capital Investment Programme
CNG	Compressed natural gas
CO	Carbon monoxide
CO2	Carbon dioxide
CSO	Civil society organization
DGLMT	Directorate General of Land and Maritime Transport
DGRB	Directorate General of Roads and Buildings
DGUP	Directorate General of Urban Planning
EASI	Enable-Avoid-Shift-Improve
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
ESCWA	[United Nations] Economic and Social Commission for Western Asia
EU	European Union
FEV	Fuel-efficient vehicle
GBA	Greater Beirut Area
GBPTP	Greater Beirut Public Transport Project
GCC	Gulf Cooperation Council
GDP	Gross domestic product

GEF	Global Environment Facility
GHG	Greenhouse gas
GIZ	Gesellschaft für Internationale Zusammenarbeit GmbH
GoL	Government of Lebanon
HCUP	Higher Council of Urban Planning
HDV	Heavy-duty vehicle
HEV	Hybrid electric vehicle
HOV	High-occupancy vehicle
ICE	Internal combustion engine
ICEV	Internal combustion engine vehicle
IEA	International Energy Agency
IoT	Internet of Things
IT	Information technology
Kgoe	Kilogramme of oil equivalent
LAU	Lebanese American University
LBP	Lebanese Pound(s)
LDV	Light-duty vehicle
MaaS	Mobility as a Service
MENA	Middle East and North Africa
MoE	Ministry of Environment
MoF	Ministry of Finance
MoIM	Ministry of Interior and Municipalities
MoPWT	Ministry of Public Works and Transport
NAMA	Nationally Appropriate Mitigation Action
NGO	Non-governmental organization
NMVOC	Non-methane volatile organic compound
NOx	Nitrogen oxide
NPMPLT	National Physical Master Plan of the Lebanese Territory
NUA	New Urban Agenda
NUP	National urban policy
OECD	Organization for Economic Cooperation and Development
Pass-km	Passenger-kilometre(s)
PHEV	Plug-in hybrid electric vehicles
PPP	Public–private partnership
ROAS	Regional Office for Arab States [of UN-Habitat]
RPTA	Railway and Public Transport Authority
SDG	Sustainable Development Goal
SISSAF	Support for Infrastructure Sector Strategies and Alternative Financing
SUV	Sport utility vehicle
TAVMA	Traffic and Vehicle Management Authority

TDM	Travel demand management
TMO	Traffic Management Organization
TOD	Transit-oriented development
UAE	United Arab Emirates
UITP	Union Internationale des Transports Publics [International Association of Public Transport]
UN DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-Habitat	United Nations Human Settlements Programme
URC	UNEP [United Nations Environment Programme] Risoe Centre on Energy, Climate and Sustainable Development
USD	United States dollar(s)
USJ	Université Saint-Joseph [Saint Joseph University]
V2I	Vehicle-to-infrastructure
V2P	Vehicle-to-pedestrian
V2V	Vehicle-to-vehicle
xEV	Any electric vehicle
YTD	Year to date

EXECUTIVE SUMMARY

The National Urban Policy (NUP) programme, initiated in 2017 by the United Nations Human Settlements Programme (UN-Habitat) in Lebanon, aims to support the management of the country's rapid urbanization, capitalizing on its opportunities and addressing its stresses. As part of a regional programme also covering Jordan, Tunisia and Sudan, the programme in Lebanon completed a major milestone in 2018 with the publication of a diagnosis report (UN-Habitat Lebanon, 2018). This comprised the completion of the diagnosis phase in a five-phase NUP process consisting of feasibility, diagnosis, formulation, implementation, and monitoring and evaluation. Following the diagnosis report's publication, consultations undertaken with relevant stakeholders identified **transport as one of two sectors, along with housing, particularly important for the country's sustainable urban development**.

According to the global NUP Guiding Framework (UN-Habitat, 2015), policy formulation in the NUP process consists of evaluating policy options, formulating policy proposals, building consensus, assessing institutional capacity, in addition to researching implementation, monitoring and evaluation practices in preparation for the subsequent policy implementation phase. Thus, leading into the NUP formulation phase in Lebanon, the programme has chosen to focus on the two identified sectoral priorities mentioned above, starting with the production of thematic mainstreaming guides.

Addressed to policymakers and other relevant stakeholders and experts in Lebanon's transport sector in particular and urban planning in general, this guide proposes a set of policy orientations, recommendations and priorities. These aim to transition the sector to a sustainable future by helping to improve the state of mobility and the provision of transport services across the country, and particularly in Lebanese cities, as around 88.5 per cent of the country's population lives in urban areas (UN DESA – Population Division, 2019). The transport sector in Lebanon is considered one of the most unsustainable in the Middle East region, due to weak governance structures and regulatory frameworks, the absence of a modern and reliable public transport system, and a car-friendly culture dominated by large old-model polluting cars. This situation has contributed to a number of challenges with corresponding adverse impacts, primarily including a poorly planned urban transport infrastructure; high levels of roadway congestion at all times of the day; and the accompanying environmental, health and financial cost burdens. In short, the transport system in Lebanon has devolved into an unreliable network of gridlocked roadways without alternative means of mobility, encroaching on urban space to restrict freedom of walking/cycling and the enjoyment of leisure activities, and thus contributing to the deterioration of quality of life in Lebanese cities.

Based on a literature review of: a) national institutional and legislative documents, b) industry reports on future global trends in transport and mobility, c) country reports and articles on lessons stemming from successful regional and global experiences in transport/mobility, d) techno-economic case studies of local transport challenges, and e) results of two stakeholder orientation sessions[1] held by UN-Habitat Lebanon and a circulated online survey aimed at prioritizing policy recommendations, this guide presents:

- A contextual analysis of the transport sector in Lebanon with an overview of the main challenges facing the overall transport system and the state of mobility in urban areas.
- An overview of the main ongoing and planned sustainable transport projects, initiatives and policies in Lebanon.

1 The first session (in English) addressed representatives of the academia, the private sector and civil society organizations (CSOs) (27 November 2020), and the second (in Arabic), local and national government representatives (9 December 2020).

- An overview of future global trends for new transport technologies and mobility service models.
- A summary of successful regional and global experiences in transport and mobility planning with key lessons learned.
- A synthesis of the recommendations from local studies for addressing the challenges facing the Lebanese transport sector, mainly those related to transport governance, infrastructure, services, energy, environment, land-use planning and mobility cost issues.
- A set of policy recommendations meant to address the identified challenges and needs, structured within the Enable-Avoid-Shift-Improve (EASI) policy formulation framework for sustainable mobility, and the recommendations from UN-Habitat (2019).
- A set of key indicators that can be monitored and evaluated during the future policy implementation and monitoring and evaluation phases.
- A stakeholder mapping of concerned stakeholders in Lebanon's transport sector.
- A synthesis of the results of the policy prioritization exercise, including an analysis of the online survey responses and a summary of insights provided and concerns raised during the stakeholder orientation sessions.

Prior to formulating transport and mobility policy recommendations tailored to the Lebanese context, a number of key lessons and conclusions were drawn from local studies as well as global and regional experiences, as follows:

- To urgently define a holistic vision for a sustainable transport sector in Lebanon that improves mobility, urban form and overall quality of life.
- To perform fundamental institutional and regulatory reforms to improve coordination and planning, and to enable the transition of the sector out of its current firefighting mode.
- To rebuild a formal public transport system, including modern urban bus services on dedicated lanes, with park-and-ride locations and intercity links; and rail for passengers and freight along the busiest corridors.
- To reclaim urban space for walking and leisure, and to enable cycling and micromobility with dedicated infrastructure that ensures safety and convenience for users.
- To reduce unnecessary travel by building on recent experiences from the COVID-19 confinement period with travel demand management (TDM) and remote work-related measures.
- To reduce reliance on motorized means through a variety of incentive/disincentive schemes, awareness-raising activities, mobility/transit-oriented development (TOD) and access management strategies that enable walking and alternative transport means.
- To scrap older polluting vehicles and promote the adoption of cleaner car and bus vehicle technologies with financial incentives and provision of the necessary energy infrastructure.
- To enable citizen participation in urban transport planning and promote transparency, efficiency and effectiveness across concerned stakeholders through capacity-building and partnerships with the private sector and international agencies.
- To build a platform for improved data collection and dissemination of transport statistics, and an ecosystem for continuous innovation to meet local transport and mobility needs.
- To develop mechanisms for ensuring equal access to all users and vulnerable groups, and to integrate operators of the informal public bus system into any new formal public transport system in a way to balance social equity and economic performance for the greater good.

The set of proposed EASI policies were thus designed to make the general lessons and conclusions drawn above applicable to the transport sector in Lebanon, with clear goals and objectives that ensure each policy is implementable, as follows:

- "Enable" policies: A set of 14 policy recommendations aimed at improving the efficiency and capabilities of the sector's governance system, and preparing the appropriate environment for supporting the implementation of the proposed "avoid," "shift" and "improve" policies.

- "Avoid" policies: A set of 19 policy recommendations aimed at reducing the need for motorized travel through land-use and transport planning, and TDM.
- "Shift" policies: A set of 13 policy recommendations aimed at increasing the modal shares of public transport and non-motorized means, such as walking and cycling.
- "Improve" policies: A set of 11 policy recommendations aimed at improving the efficiency of transport modes while minimizing their environmental footprint.

Implementing these policies will require overcoming barriers to change by:

- Mobilizing civil society and concerned stakeholders to overcome the lack of political will by collaboratively lobbying in the public sector for fundamental change.
- Establishing collaborative frameworks with local and international watchdog organizations to overcome lack of transparency through the creation of appropriate mechanisms.
- Establishing collaboration with international donor and development agencies to overcome the limited resources at the national and municipal levels.
- Raising awareness and lobbying for the creation of mechanisms to overcome lack of equitable access and inclusion of vulnerable groups.

Finally, to ensure the successful implementation of the proposed policy recommendations, a number of monitoring and evaluation indicators were considered in the form of preliminary studies, policy mechanisms and implementation milestones, as detailed in the guide.

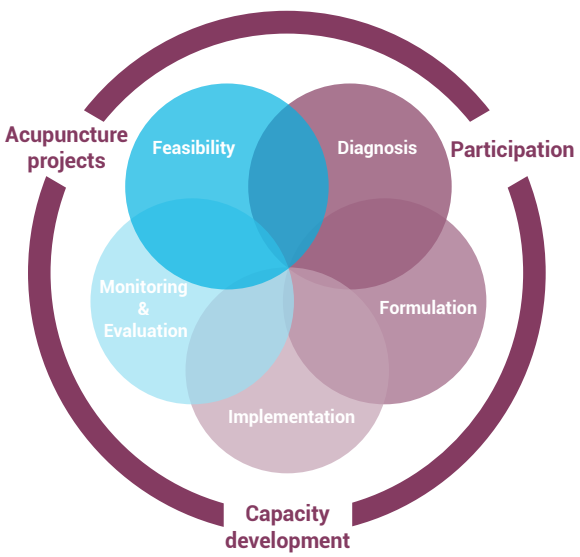
1 INTRODUCTION

Lebanon is one of the most urbanized countries in the world, with 88.5 per cent of the population living in urban areas (UN DESA – Population Division, 2019). This puts great pressure on urban transport infrastructure, such as roadways and bridges, public transport stations, airports and other facilities. The result is deterioration in the quality of services, the environment and ultimately people's health and well-being. Therefore, a systemic approach is needed to address these interrelated problems at their core in a comprehensive way, such as the NUP approach supported by UN-Habitat. The objective of the NUP is to manage rapid urbanization by evaluating ongoing country planning practices and promoting new sustainable practices that can help improve prosperity levels, environmental quality, and community quality of life.

Overview of Lebanon's NUP

Lebanon's NUP programme was initiated in 2017 by UN-Habitat's Regional Office for Arab States (ROAS) under the umbrella of a regional programme for developing inclusive and sustainable NUPs in four countries of the Middle East and North Africa (MENA) region. Lebanon's NUP approach is guided by the global NUP guiding framework (UN-Habitat, 2015), which follows five main phases (feasibility, diagnosis, formulation, implementation, and monitoring and evaluation) anchored on three supporting pillars (participation, capacity development, and acupuncture projects), as illustrated in Figure 1.

Figure 1. NUP process



Source: UN-Habitat (2015)

For the feasibility phase, UN-Habitat Lebanon completed and published a feasibility study on reforming the urban planning system in Lebanon (UN-Habitat Lebanon, 2013), which provided an assessment of the planning institutions and practices in Lebanon, and introduced a road map for the elaboration of sound urban planning frameworks. The overall lesson from the feasibility phase was to enable more transparency, participation and consultation of stakeholders, with particular recommendations to:

- Address planning at the regional level, while allowing the territory to inform the scale at which regional planning should be carried out.
- Strengthen the existing institutional set-up through technical assistance to provide the required tools, capacities and coordination frameworks for sustainable regional development.
- Develop regional planning and urban development frameworks to fill in the existing gap between national and local planning tools and frameworks.
- Identify key gaps in the existing legal framework to determine the required modifications of laws and regulations that would impede the establishment and implementation of regional sustainable development.

In 2018, UN-Habitat Lebanon published a diagnosis report that provided a context analysis for Lebanon from the social, economic and political perspectives, using the three key thematic areas of an NUP: urban legislation, urban economy, and urban planning and design (UN-Habitat Lebanon, 2018). The main challenges facing the urban planning system in Lebanon were identified as follows:

- Lack of communication and inconsistency between the national and local levels.
- Absence of integrated planning in the urban management system.
- Centralized and hierarchical administrative system of Lebanon.
- Poor appreciation of the concerns and interests of stakeholders, beneficiaries and related end users.
- Lack of public participation in urban planning.
- Inefficiency of some urban planning laws, rules and regulations.
- Lack of inter-organizational relationships.

- Expansion of urban areas and challenges related to urban sprawl and informal settlements issues.

The output of the diagnosis phase was a set of recommendations for setting an urban policy framework for Lebanon, providing a basis for upcoming national multisectoral policy interventions. As part of the diagnosis phase, two sectors were highlighted as priority areas in Lebanon in need of policy reforms: housing and transport/mobility.[2] Leading into the policy formulation stage entails elaborating the two sectoral priorities identified in the diagnosis phase. The policy formulation phase consists of evaluating policy options, formulating policy proposals, building consensus, assessing institutional capacity, in addition to researching implementation, monitoring and evaluation practices in preparation for the next policy implementation phase.

Lebanon's transport challenges

Lebanon lacks an integrated and inclusive transport system, with mostly informal public transport services and very limited infrastructure for alternative transport means, such as walking and cycling. Thus, mobility is concentrated on car use on heavily congested roadways, with high consumption of polluting fossil fuels, making the road transport sector in Lebanon the second largest consumer of energy, and having long-term impacts on human health and the environment. In addition, the national and local government authorities responsible for managing the sector have unclear responsibilities and limited resources, which limit the potential for properly developing the sector towards better accessibility and higher efficiency and effectiveness.

The development of an NUP for Lebanon can therefore be an opportunity to better plan, implement and integrate new transport infrastructure, technologies and service models into appropriate urban forms in a way to provide people with easy access to a wide variety of transport modes. This will enable urban residents to reach more destinations, opportunities and amenities in a safe, convenient and affordable way, which can markedly improve living quality in Lebanese cities. This can also contribute to economic prosperity and growth, such as by attracting new businesses and investments to a functional and liveable environment, ultimately creating a more sustainable future.

Purpose and methodology

Leading into the policy formulation phase, this report is intended to serve as a guide for mainstreaming transport and mobility into Lebanon's NUP with a proposed set of policies designed to improve the efficiency and effectiveness of the Lebanese road transport sector in order to better serve the mobility needs of urban residents. The guide is aimed at policymakers and decision-makers in transport specifically and urban planning spheres in general, who can use it to build a portfolio of proposed policies and measures as required to guide development initiatives at national, regional and local levels. It is also directed at relevant stakeholders and experts in academia, the private sector and civil society, who can use it to supplement their agendas with the background information, data and policy proposals found in the guide.

THIS GUIDE, AIMED PRIMARILY AT POLICYMAKERS AND DECISION-MAKERS IN TRANSPORT AND URBAN PLANNING SPHERES, PROVIDES A SET OF POLICY RECOMMENDATIONS FOR THE LEBANESE TRANSPORT SECTOR, STRUCTURED UNDER THE COMMONLY ADOPTED EASI POLICY FORMULATION FRAMEWORK FOR SUSTAINABLE TRANSPORT AND MOBILITY.

The methodology used to develop the proposed policies in this guide consists of the following main steps:

- A review of national transport institutional and legislative documents to provide a contextual analysis of the transport sector and identify key gaps.
- A review of local case studies and interventions to identify the main challenges facing the transport sector in Lebanon from the technical, economic, environmental, regulatory and institutional perspectives.

2 Transport refers to the act of moving people and goods from one destination to another, whereas mobility refers to the ability that individuals have to reach destinations, opportunities and amenities in an easy and convenient way. The distinction is made in this guide since mobility affects and is closely affected by urban form.

- A synthesis of the results of local studies to identify sustainable solutions for addressing the identified challenges, with a focus on the concurrent improvement of transport systems and urban space for better urban mobility.
- A review of current and future global trends in transport and mobility to prepare for upcoming transport technologies and mobility service models.
- A synthesis of lessons learned from successful regional and global experiences about planning and development of sustainable transport and mobility systems.
- A review of UN-Habitat guidelines on policy formulation and transport in NUP, in particular UN-Habitat (2019) and UN-Habitat and UNEP (2015).
- Formulation of a set of policy recommendations based on the review and syntheses of the literature and guidelines above, and using the commonly adopted Avoid-Shift-Improve (ASI) policy formulation framework for sustainable transport and mobility. The framework was supplemented with an "enable" component to ensure the appropriate institutional and regulatory environment is made available by the public sector to support the proper implementation of the proposed ASI policies.
- A prioritization exercise of the proposed policy recommendations by stakeholders and experts following two orientation sessions organized by UN-Habitat Lebanon, grouping representatives of academia, private sector and CSOs in the first session (27 November 2020), and local and national government representatives in the second (9 December 2020). The prioritization was done by presenting the proposed policies to stakeholder representatives and experts during the orientation sessions, engaging the participants in open discussion on the policies and collecting their feedback, and circulating an online survey to prioritize the proposed policies and gather additional input/concerns.

Therefore, the guide builds on outputs of the previous NUP phases such that the proposed policies are tailored for the Lebanese context, by ensuring each policy is aligned with the challenges identified in the diagnosis phase, while accounting for the existing infrastructure, regulatory and institutional capabilities, and the current state of the economy. The policies seek to transition the transport sector to a sustainable future by (1) minimizing unnecessary travel, (2) reducing reliance on motorized modes by enabling walking and bicycling and discouraging the use of cars, (3) shifting to public transport and the use of micromobility devices, (4) improving the efficiency of vehicle technologies to reduce the use of polluting fossil fuels, and (5) reducing mobility costs.

Structure of the guide

This guide is structured as follows:

- Sections 2 and 3 provide a detailed overview of the main challenges facing road transport and mobility, respectively, in Lebanon at the levels of transport mode availability, impacts and externalities of urban transport, and governance framework.
- Section 4 gives a brief overview of ongoing and planned sustainable transport projects and initiatives in Lebanon, covering regulatory and institutional reforms, capacity-building and awareness-raising projects, and infrastructure development projects.
- Section 5 proposes a set of tailored policy recommendations for the Lebanese case, aimed at improving the sustainable development of transport and mobility based on the EASI approach. The proposed policies are designed to present concrete, viable solutions to the identified challenges facing the transport sector and the state of mobility in Lebanese cities.
- Section 6 presents a stakeholder mapping of the relevant primary and secondary stakeholders in Lebanon's transport sector, and the results of the policy prioritization exercises conducted with stakeholder representatives to identify the most feasible and beneficial policies and capture the associated concerns.
- Section 7 provides selected lessons from global and regional experiences about how these issues have been dealt with elsewhere in the world, successfully or not.
- Section 8 concludes the guide with an overview of the approach adopted in the report, the key areas of policy intervention and the main barriers to change that need to be considered in the implementation of the proposed policies.

2 OVERVIEW OF CHALLENGES AND OPPORTUNITIES FOR LEBANON'S ROAD TRANSPORT SECTOR

Road transport activity in Lebanon has seen rapid and continuous growth over the past two decades in line with sustained population and economic growth, until the onset of the economic crisis in 2019 and the outbreak of the COVID-19 pandemic in 2020. However, the growth in travel activity was not met with an appropriate development of the needed infrastructure and services. In fact, there has been no progress made on public transport by government authorities or the private sector since the end of the 15-year Lebanese Civil War in 1990, and no major initiatives to promote and enable alternatives to motorized transport in cities or across the country in general. This has contributed to severe traffic congestion conditions in urban areas and across the country, making the Lebanese transport sector one of the most unsustainable in the Middle East region (Haddad, Mansour and Stephan, 2015).

The challenges facing road passenger transport in Lebanon and the opportunities available for improvement are described through a multitude of observations and data presented in the following subsections.

2.1 High motorization rates and severe traffic congestion

Mobility in Lebanon is almost exclusively dependent on motorized transport, including approximately 1.49 million cars for passenger travel, over 150,000 light-duty vehicles (LDVs) and heavy-duty vehicles (HDVs) for passenger and freight movement, including buses for public transport and trucks for movement of goods, in addition to over 100,000 motorcycles, reaching a total of about 1.75 million registered vehicles (MoIM, 2015). This represents a distribution of around 85 per cent for passenger cars, 0.9 per cent for buses, 7.9 per cent for LDVs and HDVs, and 6.2 per cent for motorcycles. With a 2015 population of approximately 5.5 million (not counting Syrian refugees in border areas), this translates to a share of over 270 cars per 1,000 persons or about 1 passenger car for every 3.7 people, putting Lebanon among the most motorized countries in the Middle East, as shown in Figure 2. This is largely due to the absence of alternatives to car use, on the one hand, and the availability of financial facilities by banks and financing institutions in the form of low-interest car loans (until the start of the ongoing financial crisis), on the other. These are aided by the government's economic policy of pegging the local currency to the US dollar at a fixed exchange rate over the past three decades (until the currency exchange fluctuations started in late 2019, later on leading to de-pegging), making the purchase of passenger cars more affordable.

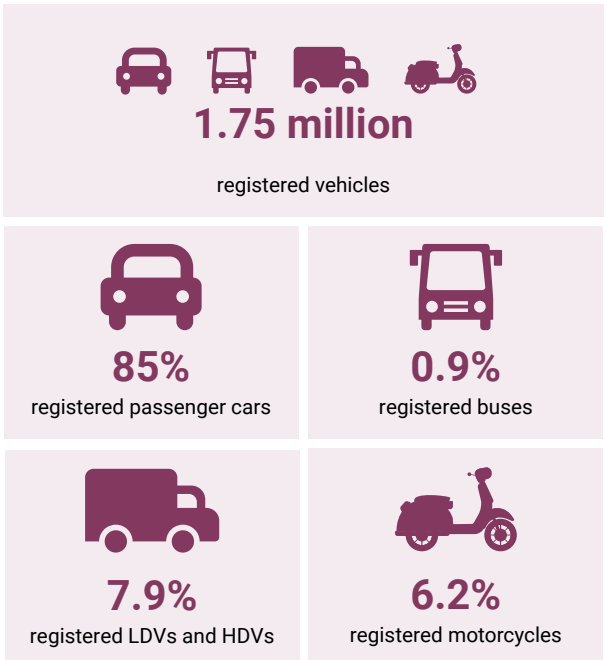
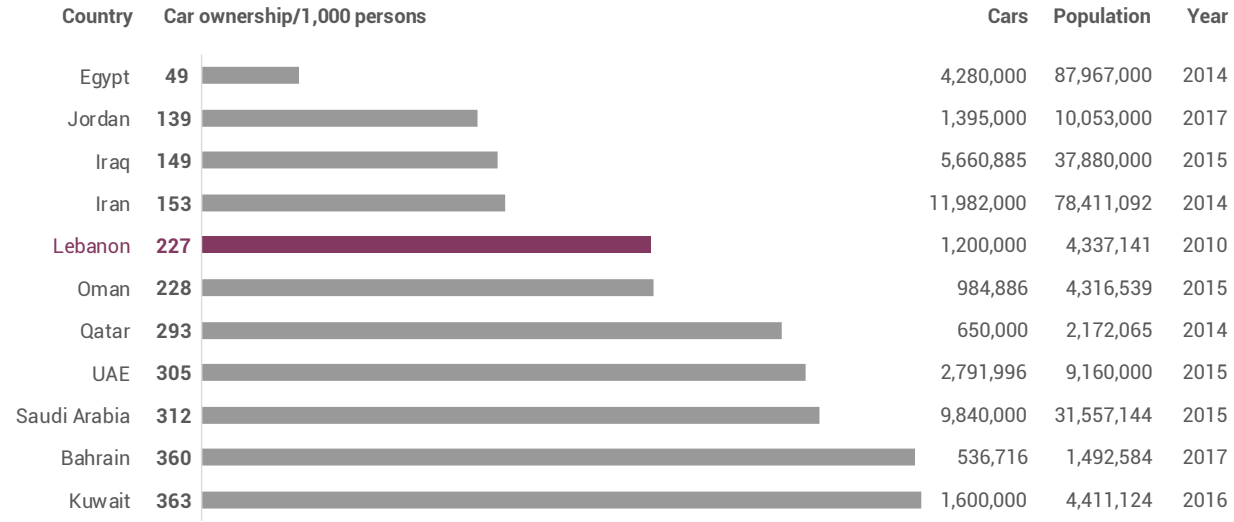


Figure 2. National car ownership rates per 1,000 persons in Middle Eastern countries



Source: Adapted from UITP (2019)

When combined with high population density in urban areas, the reliance on motor vehicles contributes to high rates of traffic congestion for long periods of the day, extending beyond the typical peak periods during work commutes. This is the case in all of Lebanon's major cities, particularly in the Greater Beirut Area (GBA), where over 40 per cent of the population is concentrated (UNDP and IPTEC, 2016). The GBA is also the business hub of Lebanon and was host to an estimated 5 million daily passenger trips by private car in 2015, with an estimated average annual traffic growth rate of 3 per cent for 2016–2020 (World Bank, 2016). Traffic congestion is compounded by the underdeveloped and poorly maintained roadway infrastructure, which slows down traffic due to potholes, the near absence of street lighting and lane markings, the lack of merging and breakdown lanes, inadequate traffic signs and signals, and slippery pavements in wet weather. Moreover, it is estimated that the influx of Syrian refugees to Lebanon since 2011 had increased traffic by an average of 20 per cent in the GBA until 2013, and up to 50 per cent in major cities where refugees are located (World Bank, 2013).

IN LEBANON, HIGH MOTORIZATION RATES, COUPLED WITH AN INEFFICIENT PUBLIC TRANSPORTATION SYSTEM, HAVE CREATED A PROBLEM OF CONSTANT TRAFFIC CONGESTION, AIR POLLUTION, AND REDUCED MEANS OF MOBILITY.

Several road expansion projects have been undertaken to ease congestion over the years, but poor transport planning and the absence of any impactful urban planning have condemned their outcome to failure from the outset, especially in the absence of any non-motorized or public transport projects to support improvements to the roadway network. This is most evident in the state of highways and major arterials, which are lined up with commercial establishments without any frontage roads and are exposed to unregulated access from city streets without dedicated exits or on-ramps, making them mere extensions to internal roads with a very poor level of service. The lack of planning is also evident in the failure to accommodate the high rate of motorization with adequate parking space, especially in city centres and dense urban areas, forcing drivers to double-park or even park over sidewalks and in no-parking curbside zones, which further reduces traffic flow speeds and contributes to heavy traffic – there is an estimated 48,990 paid parking spots available in Beirut, while parking demand is almost 17 times higher, at an estimated 829,140 spots per day (Haydar, 2020).

One of the most negative impacts of the unsustainable motorization trend is the lack of consideration to non-motorized road users; walking and cycling have become extremely unattractive, even unsafe options, as described in Section 3 on mobility challenges. But out of adversity arise new opportunities for improvement, like the readiness for change towards

Charles H. Mills collection (1966)

sustainable options given that the comfort and convenience of automobile use have been lost to endless traffic jams. The Lebanese people have been advocating for change at all levels through a multitude of non-governmental organizations (NGOs) lobbying stakeholders concerned with the transport sector for sustainable mobility options, especially in light of the recent economic crisis, which is making car ownership costs prohibitive. At the same time, the temporary government restrictions on vehicle circulation recently imposed in response to the COVID-19 pandemic, such as the odd-even license plate number rule, showed tangibly some of the positive impacts of reduced traffic in terms of shorter travel times and better air quality. This is a further opportunity that can be built upon to control the increase in motorization and its negative impacts on mobility in Lebanon.

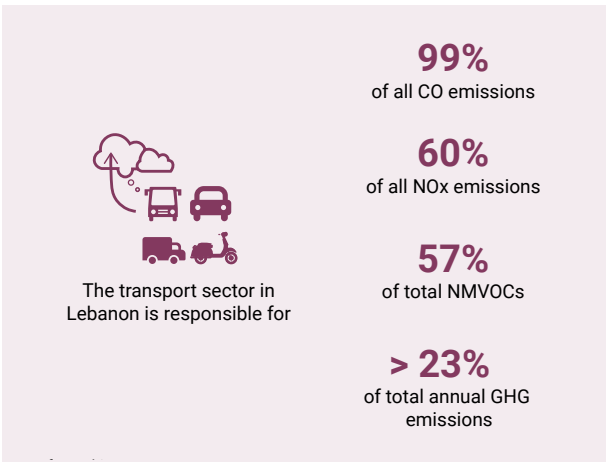
2.2 Energy, environmental and health impacts

The increase in demand for motorized mobility translates to rising energy consumption in road transport, which in Lebanon is overwhelmingly powered by fossil fuels, with gasoline and diesel accounting for 97.9 per cent of total fuels consumed in transport and at least 40 per cent of total oil consumption in the country (MoE, UNDP and GEF, 2016). Consumption levels become even higher in gridlocked traffic since a trip takes longer to complete, but also due to slower driving speeds and longer idling periods during a trip, both of which lead to the inefficient operation of conventional internal combustion engines (ICEs). Furthermore, older vehicle models, which dominate the Lebanese vehicle fleet, with over 70 per cent of cars being older than 10 years, are responsible for higher energy consumption due to the inefficiency of their outdated engine technologies. Similarly, larger vehicle types, which account for over 60 per cent of the Lebanese passenger car fleet, contribute to the increase in energy consumption due to their large (over 2.0 litres) gas-guzzling engines (MoE, URC and GEF, 2012).

Lebanon is overwhelmingly powered by fossil fuels, with gasoline and diesel accounting for **97.9%** of total fuels consumed in transport.

For these reasons, road passenger transport in Lebanon is characterized by high energy demand

per capita, estimated in 2007 at 15.06 GJ per capita, which exceeds the global average. And the more fuel is consumed, the more emissions are discharged into the atmosphere, including greenhouse gas (GHG) emissions (mainly carbon dioxide [CO2]), which are a major contributor to global warming and climate change, and pollutant emissions, which affect human health. Indeed, the transport sector in Lebanon is the second biggest source of all GHG emissions emitted in the country, with over 23 per cent of total annual GHG emissions in the country, and is a major emitter of harmful pollutants, accounting for 99 per cent of all carbon monoxide (CO), 60 per cent of all nitrogen oxide (NOx) and 57 per cent of total non-methane volatile organic compounds (NMVOCs) (MoE, UNDP and GEF, 2016).



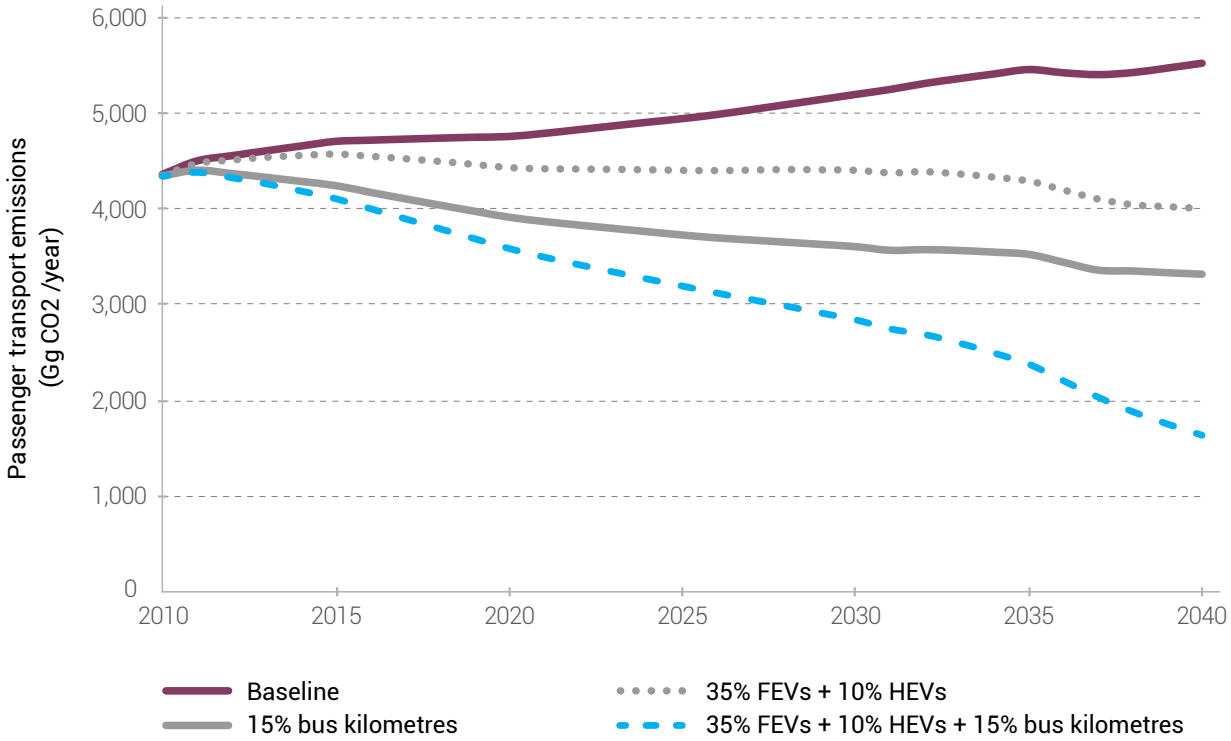
The problems are especially severe in dense urban areas with slow-moving traffic in typically narrow streets, and suburban areas neighbouring major highways, where mobility has become synonymous with noxious fumes and a primary cause of respiratory and other diseases, in addition to being a source of stress, loss of productivity and waste of disposable income. But despite the alarming environmental impacts, there is hope for making progress through the country's commitment to mitigate emissions under the 2016 Paris Agreement by parties of the United Nations Framework Convention on Climate Change (UNFCCC). In fact, Lebanon committed to reducing its GHG emissions by at least 15 per cent by 2030 compared to 2010 levels (MoE, 2015). This is planned to be accomplished by providing incentives to renew the vehicle fleet with fuel-efficient vehicles (FEVs) and hybrid electric vehicles (HEVs) to achieve a share of 35 per cent and 10 per cent of the market, respectively, by 2040, and by revitalizing the public transport system to increase its share of passenger-kilometres (pass-km) travelled by bus by 15 per cent.

A study of the reduction potential in fuel use and CO2 emissions of the prioritized passenger vehicles (FEVs and HEVs) under real driving conditions on GBA roads revealed that if no mitigation actions are taken, the baseline scenario (the upper, purple line in Figure 3) would see a continuous and rapid increase in CO2 emissions, in line with the growing motorization trend (Haddad, Mansour and Afif, 2018; MoE, UNDP and GEF, 2016). It also revealed that renewing the passenger fleet alone (the second, dotted grey line) is not enough to reverse the growth, and that reviving public transport by itself (the third, grey line) is more beneficial but still not enough by itself. However, combining the two mitigation strategies (the lowest, blue line) has the potential to reduce CO2 emissions by 71 per cent relative to the reference conventional gasoline engine vehicles, which is enough to reverse the increasing trend and to decrease emissions below their current levels.

TRANSPORT IS ONE OF THE SECTORS PARTICULARLY LINKED TO LEBANON'S SOCIALLY, SPATIALLY, ENVIRONMENTALLY AND FINANCIALLY UNSUSTAINABLE URBANIZATION.

A similar study (Haddad, Mansour and Diab, 2019) was done for the freight transport sector in Lebanon and showed that there is a need to switch all LDVs and half of all HDVs to electric vehicle technologies, in addition to shifting 20 per cent of heavy goods movement to electric rail in order to reverse growth trends in CO2 emissions from freight trucks by 2040. The fuel crisis witnessed in 2021, in addition to lifting the subsidy on fuel, have exponentially increased the cost of transport (with a spillover effect on the prices of goods and services) in Lebanon, making it less accessible to many vulnerable households. Hence, the switch to electric vehicle technologies can potentially be one of the solutions for the ongoing transport situation.

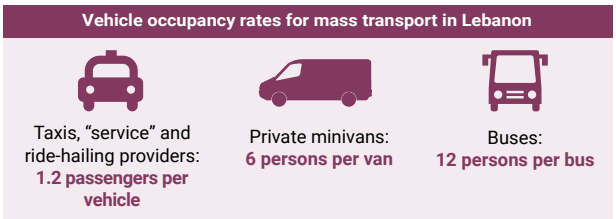
Figure 3. CO2 reductions in Lebanon's passenger transport sector under different mitigation strategies



2.3 Inadequate bus system and absence of rail

The public transport system in Lebanon was largely destroyed during the country's civil war between 1975 and 1990. As a result, the railway system, which consists of about 400 km of installed rail and almost 30 stations serving four rail lines along Beirut–Damascus, Naqoura–Tripoli, Tripoli–Homs and Rayak–Aleppo, became completely inoperative and all attempts to revive it have not been concretized. Similarly, a single attempt to revitalize the public bus system in the late 1990s with the purchase of 200 newer-model buses was short-lived, and the public bus system has been reduced to less than 40 old-model buses operating on nine lines to serve a population of over 2 million people in the GBA and surrounding areas (Baaj, 2002). No other alternative public transport modes are available in Lebanon, such as marine ferry or internal aviation flights.

To date, the major share of mass transport in Lebanon is claimed by exclusive-use taxis and shared-ride taxis (known as "service"), in addition to newer ride-hailing providers, such as Uber and Careem, all of which rely mostly on the use of passenger cars, with a low vehicle occupancy rate of 1.2 passengers per vehicle (MoE, URC and GEF, 2012). Private minivans and buses make up the other share of the market, with estimated occupancies of 6 and 12 persons per van and bus, respectively. These operate in an ad hoc manner without any fixed routes, schedules, stops or stations, or any coordination or central management, and with only basic information provided by third parties in the form of paper maps and non-real time mobile applications. Also missing are any measures, equipment or infrastructure to make public transport easily accessible to the elderly, people with disabilities and other vulnerable groups.

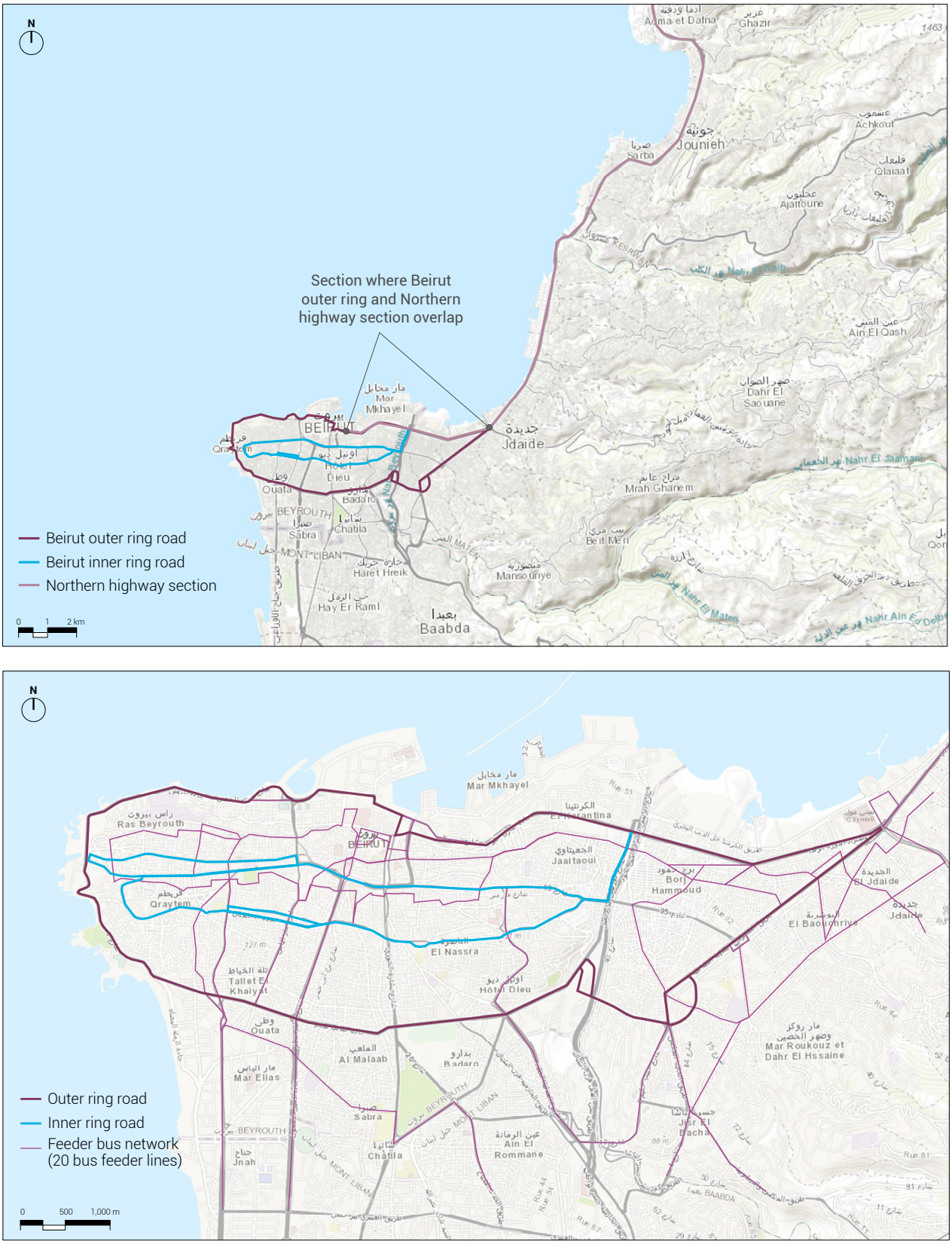


As a result, public transport in Lebanon is considered unreliable, uncomfortable and unsafe by international standards, limiting ridership and forcing commuters to continue relying on private automobiles. This is a major factor behind the unsustainability of the land transport sector in the country, as illustrated in Figure 5, which compares cities around the world based on modal share of private cars versus gross domestic product (GDP) per capita. This ranks Beirut alongside car-dependent cities that suffer from the highest rates of urban sprawl, like some North American and Australian cities. However, what makes Beirut's position even more untenable is the lack of any viable alternatives that are offered by American and Australian cities, such as bus and rail, as well as the lack of necessary resources for improving the system over time, as is the case for the city of Riyadh, for example, where major public transport projects are under way, including bus, metro and monorail.

This unsustainable reality is due in large part to lack of vision and strategy necessary for proper planning and development of Lebanese cities and the transport sector, compounded by administrative mismanagement of the public transport system. This has hindered all modernization efforts by CSOs and international agencies, leaving the market to be controlled by private operators, many of whom operate without a proper license. For example, unofficial figures show that 33 per cent of taxi licenses (known as "red plates") are illegal, leading to uncompetitive practices among operators. Moreover, the public transport system in Lebanon remains unregulated, which leads to chaotic operations and contributes to traffic jams instead of alleviating congestion, an uncharacteristic role due to the absence of dedicated lanes and the irregular pick-up/drop-off patterns, further increasing traffic collision risks and casualties.

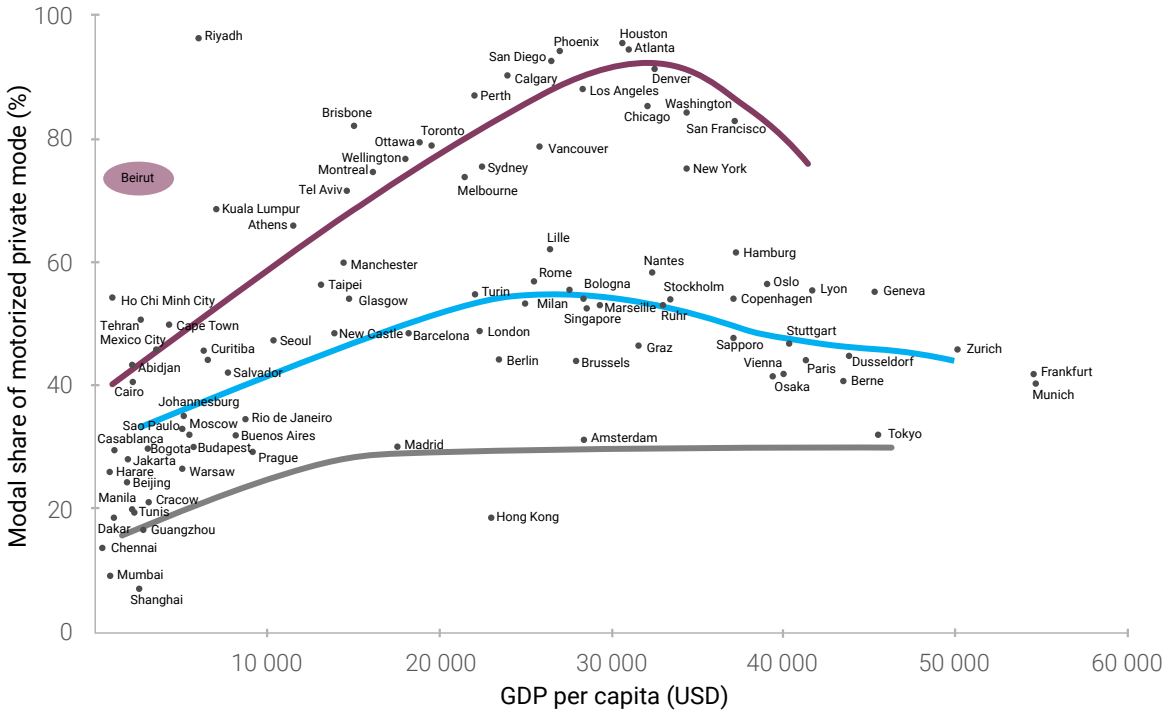
One promising opportunity for improvement in this sector is the World Bank's Greater Beirut Public Transport Project (GBPTP), approved in 2019 by the Lebanese Cabinet and Parliament (World Bank, 2021). The project consists of dedicated bus lanes on the northern coastal highway linking Tabarja in the north to Beirut's central business and residential districts, with 120 bus rapid transit (BRT) buses and 250 feeder buses, as illustrated in Figure 4.

Figure 4. BRT alignment (top) and its feeder bus network (bottom) in the GBA, according to the World Bank's GBPTP



Source: CDR (2017)

Figure 5. Modal share of motorized private mode versus GDP per capita in various cities across the world



Source: Adapted from UITP database (2005)

Implementation of initial project phases had started (World Bank, 2021) and the BRT service was expected to be deployed by 2025, with promising potential benefits in terms of reduced congestion along Beirut's busiest arterial (World Bank, 2017). However, since the onset of the crisis in Lebanon, the redirection of the loan to other uses has been in discussion with the Government of Lebanon (GoL). Many questions and concerns remain about the project, such as the ability to attract users, service costs, choice of bus technologies, and the impact of reserving bus lanes in already congested car traffic, in addition to public concern about possible infringement on the rail right of way, among others. It is also noteworthy that a recent initiative by the United Nations Development Programme (UNDP) to support the modernization of the Lebanese Railway and Public Transport Authority (RPTA) through institutional reform and capacity-building was suspended in 2019

by the RPTA, which can have a negative impact on its own ability to operate and manage any future public bus or rail systems.

But if implemented successfully, the World Bank project can have promising energy savings and environmental benefits, among others (CDR, 2017), since a BRT operation on dedicated lanes is faster and therefore consumes less fuel (up to 80 per cent savings compared to a similar bus operating in congested traffic). And if low-carbon bus technologies are used, namely HEV and compressed natural gas (CNG) buses, as mandated in the project specifications, these technologies have the potential to reduce GHG emissions by 8 and 14 per cent, respectively, compared to a diesel BRT bus, as well as reduce other pollutant emissions significantly (Haddad and Mansour, 2019; MoEW, UNDP and SODEL, 2018).

In the meantime, and in the absence of a national public bus service that connects urban and rural areas, some smaller regional initiatives by municipalities and the private sector are emerging to fill the gap, and have the potential to be effective in improving mobility and setting a higher standard for public transport. In fact, municipal-level initiatives with the private sector can serve as pilots for future public bus services in terms of knowledge transfer about new bus technologies and other operational experiences. They can also contribute to the development of local training and maintenance capabilities, and potentially even serve as feeder systems for a national network.

2.4 Fragmented institutional and regulatory framework

In Lebanon, several governmental institutions have different types of authority over the transport sector, including the authority to regulate, implement, operate, manage and oversee various parts of the sector. The main entities and their agencies are:

- **Ministry of Public Works and Transport (MoPWT)**, namely the following directorates:
  - The **Directorate General of Land and Maritime Transport (DGLMT)** is responsible for the organization, administration and oversight of the entire land transport sector and its proper development, as well as oversight of public transport services.
  - The **RPTA** (also known as Office des Chemins de Fer et des Transports en Commun or OCFTC) is part of the MoPWT but operates as an independent body in charge of managing and operating the railway and public bus networks.
  - The **Directorate General of Roads and Buildings (DGRB)** is responsible for the construction, rehabilitation and maintenance of the public roadway network.
  - The **Directorate General of Urban Planning (DGUP)** is mandated to develop and review national urban master plans and regulations for urban planning. It presides over the Higher Council of Urban Planning (HCUP), which is a coordination mechanism between concerned ministries and agencies.
- **Ministry of Interior and Municipalities (MoIM)**, namely the following organizations:
  - The **Traffic Management Organization (TMO)** is in charge of developing traffic and parking operating plans and overseeing the implementation of traffic laws.
  - The **Traffic and Vehicle Management Authority (TAVMA)**, which is included in the TMO, is in charge of vehicle registration and inspection, driver licensing and traffic code implementation.
- The **Council for Development and Reconstruction (CDR)** reports directly to the Council of Ministers and receives funds separately from donors. It is responsible for roadway planning and project implementation. It is also mandated to develop master plans for urban planning.
- The **Ministry of Finance (MoF)** is responsible for the allocation and disbursement of funds for the implementation of the majority of transport projects by ministries and municipalities.
- **Municipalities** are in charge of roads within their municipal jurisdiction and the associated regulation of traffic.

The different institutions and their associated responsibilities were outlined in detail during the diagnosis phase of Lebanon's NUP (UN-Habitat Lebanon, 2018), as presented in Figure 6.

Figure 6. Government functional responsibilities for land transport

Mode/ function/ process	Roads	Traffic management	Parking	Public transport	Paratransit	Freight	Accidents	Urban transport	Vehicle registration	Rail transport
Policy	DGRB	TAVMA DGRB		DGLMT	DGLMT			DGLMT		DGLMT
Regulation	DGRB	TAVMA DGRB	DGU	DGLMT	DGLMT	DGLMT	DGRB		MoIM TAVMA	RPTA
Planning	DGRB CDR		TAVMA	RPTA						
Financing	MoF CDR	MoF CDR		RPTA MoF			MoF CDR			
Project preparation & implementation	DGRB CDR Municipalities						DGRB CDR Municipalities			RPTA
Operation management		Municipalities	MoIM TAVMA	RPTA			DGRB Municipalities			
Maintenance management	DGRB	Municipalities	MoIM TAVMA	RPTA			DGRB Municipalities			
User information		MoIM TAVMA	MoIM TAVMA				MoIM TAVMA		MoIM TAVMA	

Source: UN-Habitat Lebanon (2018)

As the figure shows, there is no central authority responsible for the land transport system, which is the main factor behind the absence of a holistic national transport strategy, or any road map for sustainable mobility. This situation of having responsibilities dispersed among various stakeholders, sometimes with overlapping mandates, also leads to conflicting plans and decisions, delays in the implementation of actions, and ultimately gridlocked outcomes. In addition, there is a lack of coordination between agencies even within the same ministry; weak integration of project activities between funding, implementing and operating agencies across different ministries; and a total absence of comprehensive urban transport and land-use planning. For example, different institutions implement different parts of the same project without detailed coordination among them or clear communication with the public.[3]

A HOLISTIC FRAMEWORK IS NEEDED, PARTICULARLY ONE THAT ADDRESSES ALL THE MAJOR ASPECTS AND DRIVERS OF SUSTAINABLE MOBILITY IN DEVELOPING COUNTRIES LIKE LEBANON, WHERE ACCESS TO MOBILITY IS SEVERELY DEFICIENT, ADVERSE IMPACTS OF TRANSPORT ARE SIGNIFICANT, AND INSTITUTIONAL AND POLICY FRAMEWORKS ARE MISSING OR BROKEN.

The inadequate institutional framework, combined with decaying governmental bodies operating without a national strategy or the needed resources, has contributed to a number of direct and indirect adverse consequences on the transport sector, notably:

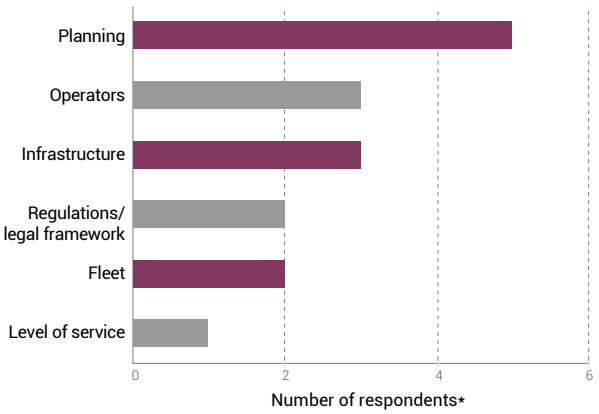
- The unregulated licensing of private transport operators, with lack of monitoring of their performance, contributing to unrestrained competition, with no accountability for poor performers and illegal operators.
- The lack of a proper policy environment to enact much needed market privatization, liberalization, and deregulation of the transport sector.
- No process for citizen participation in urban transport planning.
- Lack of public awareness about traffic laws and chronic inconsistencies in their enforcement.
- A situation where the automobile is promoted over mass transport through bank loan facilities, a road usage taxation scheme that favours old cars, and new and used car imports that are affordably priced due to the past policy of fixing the currency exchange rate against the US dollar.

3 An Interministerial Committee for Cities or a National Habitat Committee should be established to coordinate efforts among the different stakeholders concerned with urban development, in order to optimize resources, and ensure the inclusion of cross-sectoral considerations in sectoral policies constitutive of the NUP (UN-Habitat Lebanon, 2021b; 2021c).

- No clear regulatory provisions to protect the rights of people with disabilities and other vulnerable groups for accessibility to transport services, and no mechanisms for paratransit (on-demand, door-to-door) services for those who cannot use public transport.
- Dependence on government subsidies and insufficient funding for initiating large-scale and long-term transport projects.

Similar challenges have been reported by different developing countries, including neighbouring Jordan, when ranking challenges faced in their transport sectors, as shown in Figure 7.

Figure 7. Ranking of main challenges facing bus sector reform by different developing countries



* The questionnaire on the bus sector reform aimed at collecting information on existing transport in a number of cities in developing countries. Responses were received from Tbilisi (Georgia), Yerevan (Armenia), Gjakova (Kosovo), Zarqa (Jordan) and Irbid (Jordan).

Source: EBRD (2019)

One of the key opportunities for progress on the structural reform of the transport sector in Lebanon is the active involvement of civil society through community action and NGOs. The latter have been actively lobbying the MoPWT and concerned stakeholders to:

a) Develop a sustainable national transport strategy that has been missing since the end of the Lebanese Civil War in 1990; and

b) Use the funding opportunity of the 2018 Conference for Economic Development and Reform through Enterprises (CEDRE) aimed at providing USD 11 billion in infrastructure funding, conditional on required government reforms, in order to switch the focus of transport projects from road building to the development of an efficient and effective multimodal transport system.

Specifically, CEDRE requires the creation of independent organizing and oversight authorities to organize the different sectors of the economy, which presents a key opportunity to advance the state of planning and coordination in the transport sector and create independent oversight over implementing agencies.

Bicycle license (1944)
© Lebanese Internal Security Forces (1944), reposted on Facebook (2019)

3 OVERVIEW OF MOBILITY CHALLENGES AND OPPORTUNITIES IN LEBANESE CITIES

Mobility is all about the ease of access to destinations, opportunities and amenities, which is achieved through easy access to a variety of efficient and affordable choices of transport modes. Therefore, mobility reflects the freedom people have to move and to have goods transported in a convenient and efficient way in order to accomplish their social and economic needs and aspirations. Convenience here means having easy access to a variety of transport options that are safe and reliable. And efficiency refers to the time and cost for using these options. Therefore, a person limited to commuting by car in always congested traffic at considerable cost cannot be said to have mobility, just like a city providing a limited bus network with infrequent service cannot be considered as offering mobility. Conversely, urban residents can be said to enjoy mobility when urban form enables them to commute by affordable and convenient non-motorized means (such as walking, bicycling and the use of micromobility devices) to nearby work, school and social engagement locations. Therefore, it is important to look into the essential elements of convenience and efficiency in order to understand the state of mobility in Lebanon.

The following subsections detail the main challenges that impede mobility in Lebanon, and the opportunities to reinforce sustainability and enable mobility in both urban and rural areas.

3.1 Lack of walking, bicycling spaces and poor road safety

Most cities in Lebanon have become unfriendly to cyclists and pedestrians. Foremost among them is Beirut, where urbanization has developed rapidly in ad hoc and unchecked ways (UN-Habitat Lebanon, 2021a), making it a city where it is difficult to commute in any mode of transport, especially walking and cycling. Some of the main factors behind these difficulties are:

- No use of zoning or land-use planning to encourage walking and cycling in Lebanon. Therefore, very few pedestrian-only zones exist in the GBA and other cities, with only occasional car-free days in limited areas.
- Lack of sidewalks beside most roadways, and a poor state of use for the majority of existing ones, in addition to common infringement by cars parked over most sidewalks, and random obstructions, such as unofficial signposts and barriers for illegally reserving curbside parking spots in front of residential buildings and commercial establishments.
- Lack of marked pedestrian crosswalks at intersections, and lack of pedestrian walkways, bridges, tunnels and other structures to provide safe pedestrian crossing of roadways.
- Near absence of parks and public squares for walking, bicycling and scootering, with the few available, such as the Nijmeh Square in Downtown Beirut, becoming inaccessible to the public due to security measures.
- No dedicated bicycle lanes in or around the GBA, with only temporary bike trails in limited areas made available for biking on occasion. A 3-km bike lane with traffic (separated using roadway markings only) was implemented in the city of Tripoli in 2016, and a dedicated bike trail was implemented in 2019 within the city of Byblos.[4]
- Only one operational bike-sharing system installed in Byblos in 2017, with only a handful of bikes available. A few similar bike-sharing systems were installed in the GBA in 2018 but have still not been made operational to date, such as the one installed in Sassine Square, Achrafieh. Others have been removed in the past months of political and economic instability, such as the bikes on Mme Curie Street near the Lebanese American University's (LAU) Beirut Campus.
- Dominance of highways and roadways over urban space, such as the four-lane highways of Fouad Chehab, Charles Helou and George Haddad cutting off the residential areas of Achrafieh and Gemmayzeh from each other and the city centre.
- Priority to the automobile and high risk of accidents as a result of the long-standing car culture in Lebanon, meaning that car drivers feel entitled to the road and typically fail to stop for crossing pedestrians, or maintain a safe clearance with bicycles at the edge of the roadway.

4 More recently, a bike-sharing initiative was launched in Tyre. For more information, see United Nations (2021).

© UN-Habitat (2021)

In a recent survey conducted by TRACS NGO (2019) after the COVID-19 traffic restrictions imposed by the government, 43.9 per cent of respondents agreed that they would prefer to walk or bike for commuting whenever possible, as this form of mobility can guarantee social distancing. Thus, it is crucial for authorities to respond quickly and effectively to this urgent public health need, such as by providing emergency bike lanes similar to those introduced in Bogotá, Colombia, in March 2020 (Wray, 2020), and installing pop-up walking lanes like those installed in Denver, Colorado (Shared-Use Mobility Center, 2020), during the pandemic.

However, respondents of the above-mentioned TRACS NGO recent survey also reported feeling unsafe walking or bicycling in Beirut, due to the lack of proper infrastructure and safety features. In particular, pedestrians account for 29 per cent of the casualties of car accidents "due to the fact that pedestrians have very often to share the road with road vehicles due to a lack of sidewalks, pedestrian crossings" (Choueiri, Choueiri and Choueiri, 2013). Table 1 presents car accident statistics for Lebanon over the period of 2010–2019.

Table 1. Road traffic accidents and casualties in Lebanon for the period of 2010–2019

Traffic accident statistic	10-year annual average	Yearly count	Year
Average annual number of crashes	4,365		
Average annual number of injured	5.854		
Average annual number of fatalities	547		
Average annual rate of fatalities (%)	12.5		
Maximum number of crashes in one year		4,907	2014
Maximum number of injuries in one year		6,697	2012
Maximum number of fatalities in one year		657	2014

Source: Compiled from Internal Security Forces data

Some traffic-calming measures are commonly used in Lebanon, in particular speed bumps on internal roads to slow down traffic in residential and commercial areas. However, these measures very rarely involve urban land-use planning and regulations, which are most effective for calming traffic as well as for reducing car dependence – for example, changing street design standards to create pedestrian-only spaces where services such as shopping and recreational activities are available. At the same time, the chronic lack of enforcement of traffic laws encourages motorists to drive recklessly and at high speeds, which in turn poses a high risk to cyclists and pedestrians and discourages alternative forms of mobility.

An opportunity for promoting walking in Beirut is in the "exceedingly compact structure of the city, which offers good conditions for non-motorized transport" (MAN Group, 2013). Some of the popular initiatives already launched by NGOs – such as morning walking groups by Achrafieh 2020 NGO, and walking tours and events organized by Achrafieh Stairs initiative – can serve as a starting point for spreading a walking culture. Several pilot designs for walking trails in the GBA have also been completed and await implementation, such as the Beirut Municipality's soft mobility project (known as the "Liaison Douce") along Rue de Damas (Île de France, n.d.), and the upgrading of Jeanne d'Arc Street in Ras Beirut by the American University of Beirut (AUB)'s Neighborhood Initiative (AUB, n.d.).

Similarly, a major initiative that can be built upon to incentivize cycling is the Beirut Municipality's project for creating dedicated bike lanes in the GBA (shown in Figure 8 and reviewed in Section 4 below).

A similar initiative is in the lobbying efforts with the MoPWT by the NGOs Bike du Liban and TRACS to launch a dedicated bike lane along the northern coastal road linking Dbayeh Municipality in the GBA to the northern city of Tripoli through all the municipalities along the way, such as Jounieh, Byblos and Amchit. Also, countless bike-to-work and other campaigns and bicycling events have been organized by municipalities, the private sector and professional biking clubs across Lebanon to promote the widespread adoption of bicycles for mobility. All of these have fostered a core biking culture that can help propel the bicycle beyond a recreational and sports activity into a reliable form of mobility in Lebanon.

Figure 8. Beirut Bicycle Network – Project Phase 1

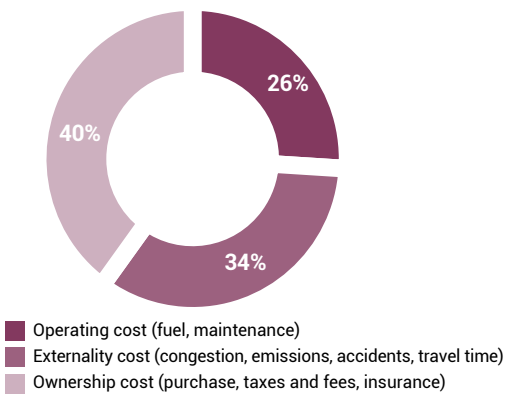
Track length: 8 km; Lane width: 1.5km; 70% separated lane, 27% advisory lane, 3% share lane
Source: Municipality of Beirut (2019)

3.2 High mobility cost and lack of innovative mobility choices

The cost of motorized mobility in Lebanon was estimated in 2015 to range from USD 0.43 per vehicle-kilometre travelled for small-size vehicle categories, to USD 0.64 for large-engine sport utility vehicles (SUVs) (MoE and UNDP, 2015). Considering that on average a regular commuter in Lebanon drives 12,000 km per year, which corresponds to approximately 33 km per day, the daily cost of mobility would amount to the equivalent of LBP 21,000 (at the current official exchange rate of USD 1 = LBP 1,500). This is 2.6 times the official allowance of LBP 8,000 per working day (in 2020) that employers are required by law to pay a worker in order to subsidize the cost of transport. Therefore, mobility in Lebanon can be considered as posing a significant financial burden on commuters.

When further considering the significant and continuing devaluation of the Lebanese Pound since 2019, which has raised all vehicle-related costs by multiple folds, in line with the rate of unofficial trading of the US dollar in the market, it becomes evident that motorized mobility is becoming entirely unsustainable. The breakdown of the major components of mobility costs in 2015 is shown in Figure 9, where the detailed costs are as follows: fuel accounts for 20 per cent of the total, followed by emissions including pollution and climate change that together account for 13 per cent, travel time and accident costs at 11 per cent each, then congestion cost at 8 per cent, for a combined 52 per cent of the total cost of mobility.

Figure 9. Breakdown of mobility costs in Lebanon



Source: Adapted from MoE (2015)

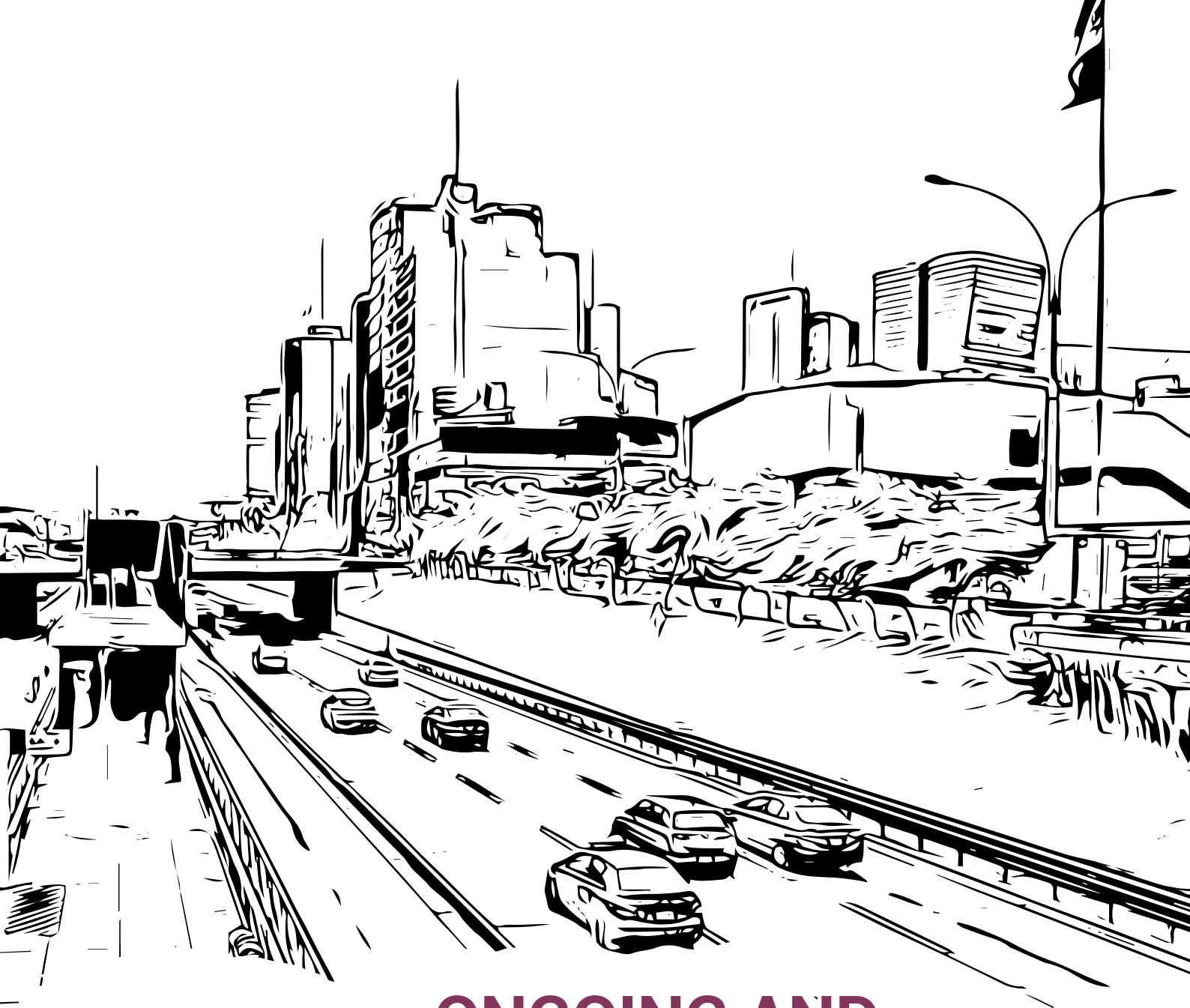
Most of these major cost components can be mitigated, at least in large part, by proper urban and transport planning policies and strategies aimed at reducing motorized vehicle trips and commuting distances, as detailed in Section 5 on mainstreaming transport in Lebanon's NUP. Such measures would directly lower travel time, congestion, fuel consumption and emissions, and indirectly lower the risk of accidents. Therefore, there is an urgent need to find new solutions for affordable, reliable and safe mobility in the country, especially since the transport sector is the backbone of the Lebanese economy – for touristic, industrial and/or agricultural activities.

Opportunities abound for innovative mobility choices that are appropriate for the Lebanese context. For example, in the GBA, 50 per cent of trips are over a distance of less than 5 km (MoE, URC and GEF, 2012), which makes the use of e-bikes practical for most urban trips. E-bikes are the fastest-growing segment in the cycling industry today, increasing by eightfold since 2014 in the United States (Hoovers, 2019). In New York, e-bike sharing is estimated to help switch 1 million daily trips away from passenger cars, reducing traffic congestion by 25,000 vehicle-hours of delay, and CO_2 emissions by 300 metric tons daily (Steer Group, 2018). Therefore, the widespread adoption of carbon-neutral e-bikes can also serve to mitigate the high levels of road transport emissions in Lebanon. This is mostly due to the practicality of the technology itself (e.g. long battery life, allowing over 80 km of travel distance on a single charge) and the innovative bike-sharing business model, as described in Section 7.1.4. The common use of gasoline scooters in the GBA as a solution for manoeuvering through traffic congestion and reducing mobility cost constitutes a niche market of commuters likely to adopt e-bikes, since the latter provide similar benefits, which could potentially help in attaining high user-adoption levels similar to current global trends.

Another opportunity for a quick win, at least on the environmental level, is the switch of passenger cars to HEV technology, which currently benefits from tax reduction incentives to encourage user adoption. This is because HEV technology does not require any new infrastructure, and at the same time, it can help reduce energy consumption and emissions by up to 28 per cent in real-world GBA driving conditions compared to a conventional gasoline car, and reduce mobility costs by up to 14 per cent (MoEW, UNDP and SODEL, 2018). And while this does not solve the traffic congestion problem, it does contribute to raising environmental awareness among commuters, which can be developed over time to transform the culture away from motorized transport. User adoption in this case can be greatly accelerated, as with the case of Jordan, by further incentivizing taxi fleets to switch to HEVs or even plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs), albeit at higher cost. This can also serve to transform the existing shared-ride taxis, known as "service," to a modern e-hailing system.

A NATIONAL STRATEGY FOR SUSTAINABLE TRANSPORT IS A CRITICAL ELEMENT FOR AN EFFECTIVE TRANSITION TO SUSTAINABLE MOBILITY. SUCH A STRATEGY SHOULD NECESSARILY ENCOMPASS A PORTFOLIO OF THE POLICIES PROPOSED IN THIS GUIDE, INVOLVING INFRASTRUCTURE DEVELOPMENT, MITIGATION ACTIONS, INCENTIVES AND DISINCENTIVES, AWARENESS-RAISING AND OTHER INSTRUMENTS DESCRIBED IN THE GUIDE.

Finally, another overdue initiative to lower mobility costs and transition out of motorized transport in Lebanon is on the supply side of the transport sector, where the mismanagement of public transport over the past decades has placed a fiscal burden on the public treasury that can no longer be sustained by the economy in crisis. Most notable is the case of the RPTA, which maintains minimal services since the decommissioning of much of the railway network, but still requires heavy subsidies every year to cover its operating costs. Therefore, reclaiming the role of public transport in Lebanon, along with much needed institutional reforms and capacity-building for the managing authorities of the sector, are an utmost priority that can no longer be ignored.



4 ONGOING AND PLANNED SUSTAINABLE TRANSPORT PROJECTS AND INITIATIVES IN LEBANON

The main ongoing projects and initiatives, as well as those planned but not yet started or implemented for mainly political and bureaucratic gridlock reasons, are summarized in this section. These cover regulatory and institutional reforms, capacity-building and awareness-raising, and infrastructure development. The overview reveals that the transport sector is not prioritized in Lebanon as a strategic sector for national economic growth and sustainable development, especially when it comes to sustainable mobility, which is largely overlooked. Instead, the government treats mobility and transport as an unprofitable commercial enterprise rather than an essential service and a right for citizens and society, and it generally disregards the direct and significant impacts that the sector has on quality of life in the country. In particular, it is evident that transport is viewed almost exclusively from an infrastructure development perspective, separately from city planning concerns that seek to improve the living conditions of urban residents, or to overcome the social, economic and political barriers to the movement of people and the integration of communities.

It is important to note that this section presents only those major projects and initiatives that have at least gained official adoption or approval by government agencies. As such, ongoing initiatives and proposals by NGOs and the private sector, which have not been officially endorsed by the public sector, are not presented in this overview.

4.1 Regulatory and institutional reforms

Table 2 summarizes the main projects under consideration in recent years related to regulatory and institutional reforms in the Lebanese road transport sector.

Table 2. Main ongoing and planned regulatory and institutional reform projects in the Lebanese road transport sector in recent years

Outcome	Project	Status
Legal implementation mechanisms to reduce GHG and air pollutant emissions from the transport sector	Develop the mechanisms for implementing Law No. 78 of 2018 on the Protection of Air Quality in transport (Official Gazette, 2018), per the law's provisions under Article 10 for mobile sources and Article 11 for fuel standards.	Not started/not funded
Institutional framework for implementing the Nationally Appropriate Mitigation Action (NAMA) car scrappage programme to replace older polluting conventional fuel vehicles with newer FEV technologies	Establish an institutional framework for NAMA (MoE, n.d.), per outcome A of phase 1 (2017–2020) to establish and operate entities for financing, coordination and implementation of a car scrappage programme for older-model polluting vehicle technologies.	Not started/not funded
Regulatory framework to incentivize replacement of older conventional fuel vehicles with newer FEV technologies	Establish a regulatory framework for NAMA (MoE, n.d.), per outcome B of phase 1 to establish an incentive scheme, eligibility criteria and emission standards with their legal basis for the car scrappage programme.	Not started/not funded
Regulatory and institutional frameworks to formulate a transport sector strategy and secure international financing	Support the formulation of a long-term comprehensive transport sector strategy, with institutional structures for coordination and management, in a participatory way under the project titled Support for Infrastructure Sector Strategies and Alternative Financing (SISSAF) (European Union [EU] project).	Studies completed, not implemented by MoPWT/DGLMT
Support for the implementation of a southern Mediterranean regional transport action plan	Support the formulation/reform of regulations, formation of urban transport authorities, and use of efficient and innovative fleet management solutions under the EuroMed Transport Support Project (EuroMed Transport Support Project, n.d.).	Ongoing
Modernization of the RPTA, so that it can advance and cope with the reform of the transport sector	Establish a UNDP unit (2015–2021) to modernize the institutional capacities of the RPTA, so that it can coordinate and manage technical projects (GoL and UNDP, 2018).	Suspended by RPTA in 2019

An example of important initiatives by NGOs that are yet to be endorsed by the relevant ministries is the proposal to amend Article 55 of Law 79 to completely exempt small-class HEVs from all customs, excise, road usage and registration fees at purchase to promote the adoption of these vehicle technologies. Currently, HEVs only benefit from a reduction of taxes and fees to 20 per cent of the vehicle purchase price, regardless of vehicle class, while BEVs benefit from complete exemption but without having the needed recharging infrastructure to operate them in the country. It is also important to note that these incentives have been at risk of termination due to the severe economic crisis in the country.

4.2 Capacity-building and awareness-raising projects

Table 3 summarizes the main projects under consideration in recent years related to capacity-building and awareness-raising in the Lebanese road transport sector.

As seen in Table 3, most capacity-building initiatives are related to the NAMA car scrappage programme, which should have been completed by the end of 2020 as a crucial preparatory phase in the transition to FEV technologies with a lower carbon footprint (MoE, 2017a). The lack of progress on this important initiative constitutes a setback for Lebanon's ability to meet its commitments under the Paris Agreement, and also delays the development of environmental awareness in Lebanese society as a first step in the cultural transformation towards the adoption of public transport and non-motorized travel means. This is why, the upcoming Global Environment Facility (GEF) project (GEF, 2019) aiming to support the deployment of electric mobility holds the most promise for putting Lebanon back on the track of transitioning to cleaner fuel vehicle technologies.

4.3 Infrastructure development projects

The vast majority of infrastructure development in the transport sector in Lebanon consists of road rehabilitation and capacity expansion to improve motorized traffic flow. This strategy is not considered to make transport sustainable, as previously discussed in this guide. In fact, it has long been established that this strategy leads to an increase in motorized travel in the long term, through what is known as induced traffic.

Table 3. Main ongoing and planned capacity-building and awareness-raising projects in the Lebanese road transport sector in recent years

Outcome	Project	Status
Awareness-building for the NAMA car scrappage programme	Develop marketing resources and launch a marketing campaign to promote the NAMA (MoE, n.d.) scrappage programme, and develop awareness-building and educational resources for car dealers to support the programme, per outcome C of phase 1 (2017–2020).	Not started/not funded
Pilot for the NAMA car scrappage programme	Implement a pilot scrappage programme for the NAMA (MoE, n.d.) on old low-efficiency red-plate taxis, per outcome D of phase 1 (2019–2020).	Not started/not funded
Modernization of the RPTA, so that it can advance and cope with the reform of the transport sector	Establish a UNDP unit (2015–2021) to update the technical capacities of the RPTA and support it to develop a public transport strategy (GoL and UNDP, 2018).	Suspended by RPTA in 2019
Promoting innovation and technology transfer for sustainable transport through TDM and low-carbon vehicles	Provide technical assistance to support the deployment of electric vehicle technologies for public and private transport under the project titled Lebanon Sustainable Low Emission Transport Systems by the GEF (GEF, 2019).	Studies completed, not implemented by MoPWT/DGLMT

However, upgrading the roadway network is important and necessary to relieve congestion and improve road safety, as well as to prepare for the integration of future vehicle technologies, such as autonomous vehicles (AVs), which require high-quality pavements, lane markings and traffic signs and signals to operate properly, as noted in Section 7.1.3 of this guide.

The main sustainable transport projects related to infrastructure development under consideration in recent years are shown in Table 4. It can be seen that public transport development remains very weak and mostly confined to projects in the GBA and Tripoli, with no tangible progress on alternative transport means within or outside the GBA.

Table 4. Main ongoing and planned infrastructure development projects in the Lebanese road transport sector in recent years

Outcome	Project	Status
Improve public transport services	Construction of a BRT and feeder bus network in the GBA with trunk lines on the northern, southern and eastern approaches to the GBA (World Bank, 2021).	Ongoing
	Design and construction of an intercity public bus network with expanded service, stops and stations in the GBA (DGLMT project).	Not started
	Construction of a public bus service and passenger terminal with new buses, parking, taxi station and an information technology (IT) system for Greater Tripoli under the Sustainable Urban Public Transport Investment Programme (SUPTIP) by the European Investment Bank (EIB) (EIB, 2018).	Funding secured
	Rehabilitating the 80-km railway coastal line from Beirut to Tripoli (EIB, 2018).	Preliminary study completed
	Implementing a freight rail line from Tripoli Port to the Syrian border at Abboudieh.	Not started
Modernization of the RPTA, so that it can advance and cope with the reform of the transport sector	Construction of underground parking facilities underneath Hassan Khaled Public Garden in Msaytbeh, Beirut Municipal Civic Center in Mazraa, and Jesuit Public Garden in Achrafieh (CDR, n.d.).	Ongoing
	Construction of underground parking and/or public bus station at the Cola roundabout (CDR, n.d.).	Ongoing
Improve non-motorized mobility options	Construction of 28 km of a dedicated (physically separated) bike lane in Beirut.	On hold: tender process launched for construction of phase 1 (8 km out of 28 km split over three phases) but cancelled later in 2019
	Design for 78 km of a dedicated bike lane on the northern coastal road between Dbayeh and Tripoli.	Proposal adopted by MoPWT in 2019 but no formal approval or funding for the design study
	Construction of a green soft link ("Liaison Douce") for pedestrians, bicycles and public transport between Horsh Beirut Public Park and the downtown area (Île de France, n.d.).	Preliminary study completed by Beirut Municipality in partnership with the Institute of Planning and Urbanism of the Île-de-France Region (Institut d'aménagement et d'urbanisme de la région d'Île-de-France [IAU-IdF])

The transport projects listed as part of the CEDRE Capital Investment Programme (CIP) are not included in Table 4 for two main reasons: 1) the vast majority of the proposed projects consist of roadway construction and expansion, which only emphasize motorized travel and are therefore outside the focus of this guide; and 2) these are still only indicative projects that have not been officially approved for implementation.

It is also important to note that road rehabilitation projects in Lebanon are generally poorly executed or not adequately targeted where in fact needed, such that they end up wasting public resources and jeopardizing road safety. In particular, roadway maintenance projects are not adequately funded or executed properly and at the right time, posing risks to motorists as well as pedestrians and nearby developments. These serious concerns should be addressed in any capacity-building initiatives of the relevant authorities.

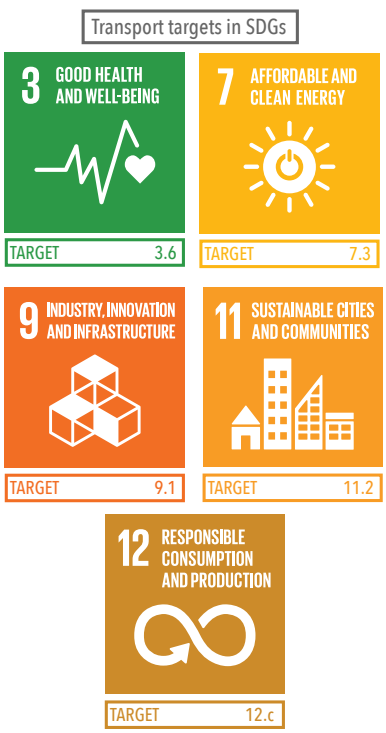
5 FRAMEWORK FOR MAINSTREAMING TRANSPORT INTO LEBANON'S NUP

Based on the diagnosis of the challenges and opportunities for the transport and mobility sector in Lebanon (see Sections 2 and 3 above), policy recommendations should be proposed to transition the sector towards sustainable mobility trends, in a way to meet the needs and aspirations of all citizens, especially commuters and urban residents most affected by transport's adverse impacts. The recommendations should be comprehensive and should cover different types of interventions by a range of stakeholders over the short-, medium- and long-term horizons. Such policy recommendations should be in line with the best practices and future trends of sustainable mobility, particularly those that are interrelated with urban planning.

Therefore, the formulation of policy recommendations for Lebanon should also consider the general guidelines for the formulation of NUP (UN-Habitat, 2015), especially for mainstreaming transport and mobility into NUP (UN-Habitat, 2019; 2020). An NUP covers three thematic areas (urban legislation, urban economy and urban planning/design), based on three key pillars (capacity-building, participation and acupuncture projects). For example, if a transport policy is to promote alternative transport, a legislative framework needs to be available to regulate the use of specific alternative transport means, and the provision of their infrastructure needs to be considered within an urban planning framework to ensure proper integration with the urban environment without adverse impacts. In addition, proper mechanisms for financing and implementing the policy need to be considered, such as through a particular regulatory arrangement between the public and private sectors. This may require the development of human resources in the public sector, in addition to engaging the community in the planning process.

THIS GUIDE PROPOSES POLICY RECOMMENDATIONS TO TRANSITION THE SECTOR TOWARDS SUSTAINABLE TRENDS, IN A WAY TO MEET THE NEEDS AND ASPIRATIONS OF ALL CITIZENS, ESPECIALLY COMMUTERS AND URBAN RESIDENTS MOST AFFECTED BY TRANSPORTATION'S NEGATIVE IMPACTS.

To that end, a holistic framework is needed, particularly one that addresses all the major aspects and drivers of sustainable mobility in developing countries like Lebanon, where access to mobility is severely deficient, adverse impacts of transport are significant, and institutional and policy frameworks are missing or broken. The choice of framework for Lebanon should therefore address these deficiencies and be aligned with the Agenda 2030 for Sustainable Development and its 17 Sustainable Development Goals (SDGs),[5] as well as the New Urban Agenda's (NUA)[6] shared vision on "sustainable cities and human settlements for all," which seeks to "promote age- and gender-responsive planning and investment for sustainable, safe and accessible urban mobility for all and resource-efficient transport systems for passengers and freight, effectively linking people, places, goods, services and economic opportunities" (UN-Habitat, n.d.). The chosen framework and proposed policy recommendations are presented in the following subsections.



5 Transport is directly linked to targets of five SDGs: SDG 3, 7, 9, 11 and 12. For more information, see SLOCAT Partnership (n.d.).

6 The NUA was adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador, in 2016, and was endorsed the same year by the United Nations General Assembly. It is an "action-oriented document" aimed at "driving sustainable urban development at the local level" and fostering the SDGs and targets. For more information, see UN-Habitat (n.d.).

5.1 The Enable-Avoid-Shift-Improve (EASI) framework for policy formulation

The strategies and policies for planning future mobility in a particular city or country are greatly dependent on the existing infrastructure, institutional and regulatory capabilities, and the state of the economy. The policy initiatives universally considered most useful are those that focus on upgrading the quality of public transport services, improving traffic flow through better roadway networks, and enhancing mobility through encouraging walking and cycling. Crucial factors for success have been linked to the following: municipal budget for transport, urban-rural planning and dynamics, and transport governance (MAN Group, 2013).

Given these constraints and factors, the commonly adopted ASI policy framework for sustainable mobility is considered most appropriate for the effective implementation of the NUA vision in Lebanon (UN-Habitat and UNEP, 2015). The ASI framework is the driver of many holistic initiatives towards sustainable transport, such as the recent Action towards Climate-friendly Transport (ACT). This is because the ASI framework is "inspired by the principles of sustainability" and "focused on the mobility needs of people instead of car infrastructure" (GTZ, 2007), making it a holistic framework for designing sustainability into all modes of road transport. The framework covers a wide range of policy areas based on "avoiding" unnecessary trips, "shifting" to more efficient transport modes, and "improving" trip efficiency. The ASI framework is made more appropriate for the case of Lebanon – where state institutions are plagued with lack of resources, excessive bureaucracy and lack of transparency – by adapting it with an additional "enable" component (to become known as the EASI framework). This component is focused on supporting state institutions with capacity-building and institutional and regulatory reforms.

The adapted EASI policy framework calls for policy recommendations to:

- "Enable" sustainable mobility by establishing an effective governance system with the needed institutions, trained human resources and adequate financial resources to regulate, manage and finance the development and operation of the transport sector and all its systems.
- "Avoid" or minimize individual motorized travel and trip length through the integration of land-use and transport planning to develop compact cities, where residential, work and leisure districts are closely connected and intermixed.[7]
- "Shift" to sustainable mobility modes, such as public transport and non-motorized travel, to make them the main modes of transport for the majority of commuters.
- "Improve" vehicle technology and fuel efficiency for passenger cars and public transport.

The framework is illustrated in Figure 10.

Based on the emerging global and regional mobility trends, including the post-COVID-19 pandemic ones, and given the state of transport and mobility in Lebanon, along with the identified potential opportunities for improvement as reviewed in the other sections of this guide, the following subsections present policy recommendations under each component of the EASI framework that are appropriate for the Lebanese context.

5.1.1. "Enable" policies

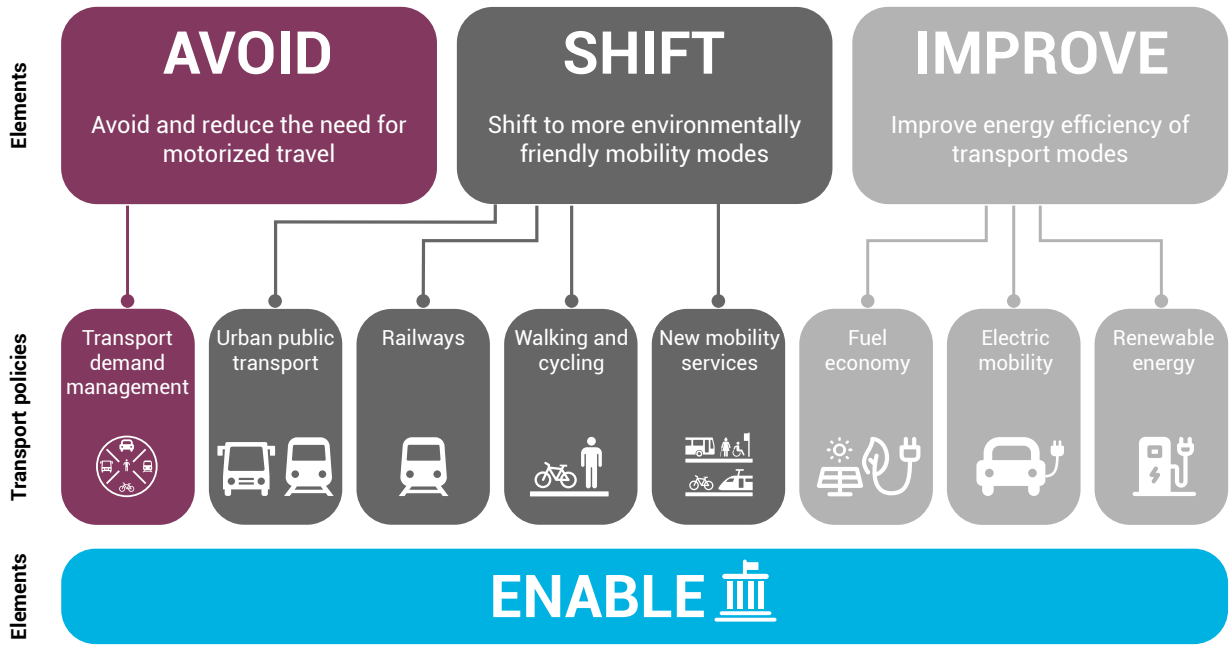
The "enable" approach is the application of policies and strategies to establish an effective governance system for the transport sector, with proper institutional frameworks that can support regulatory reform, capacity-building, financing and management of the transport sector. These enabling policies are especially important for the case of Lebanon, due to the weak and limited capabilities of state institutions.

As with all institution-building efforts, a blueprint is first needed to identify all needs and demands, set clear objectives, and develop comprehensive solutions to meet these objectives. This blueprint is the government's national sustainable transport strategy that is still lacking to date.[8] This is the primary enabling mechanism for organizing efforts and

7 For more information, see UN-Habitat Lebanon (2021b).

8 The National Physical Master Plan of Lebanese Territories (NPMPLT) noted in one of its perspectives the need to unify the territory through an

Figure 10. The EASI framework for sustainable mobility



Source: Adapted from Sustainable Urban Transport Project (2011)

resources to start tackling the identified challenges at their root cause. The key element in the blueprint is defining a strategic vision with the main objectives that the national transport system is supposed to deliver (such as serving the tourism sector with quick urban mobility, supporting the export of industrial and agricultural products with easy border transit, or enabling the country to serve as a logistics hub for the reconstruction of Syria with freight railway lines). Comprehensive solutions can then be developed to address the diagnosed problems while supporting the vision and strategic objectives of the sector.

In 2016, a draft policy and strategy for the Lebanese land transport sector was developed with the MoPWT as part of the SISSAF project, with three main objectives: 1) to provide sustainable road transport means; 2) to stimulate economic growth; and 3) to introduce institutional reform and develop needed human resources. To date, this draft strategy has not been finalized and no details about it have been shared with the public (MoE, 2017b). Another effort in this direction is the CIP of the CEDRE Paris conference, but which basically consists of a "laundry list" of projects focused on road building, without a clear vision or strategy for the development of the transport sector towards public transport and future mobility trends.

Therefore, NGOs and experts have been actively lobbying for the modernization of the public bus system, the rehabilitation of rail, and the provision of dedicated bike lanes, as part of a comprehensive vision for affordable, clean and safe mobility. These groups, and the public at large, should be given a voice through public participation in the development of the transport sector, as is the case worldwide. Therefore, a particularly important enabling policy is to build participatory processes that engage all stakeholders in various parts and stages of transport planning in order to ensure the long-term sustainability of projects and initiatives. In particular, involving the general public and engaging any directly affected communities from early on in the planning process makes it more likely to get buy-in for urban transport development and implementation of modern mobility solutions.

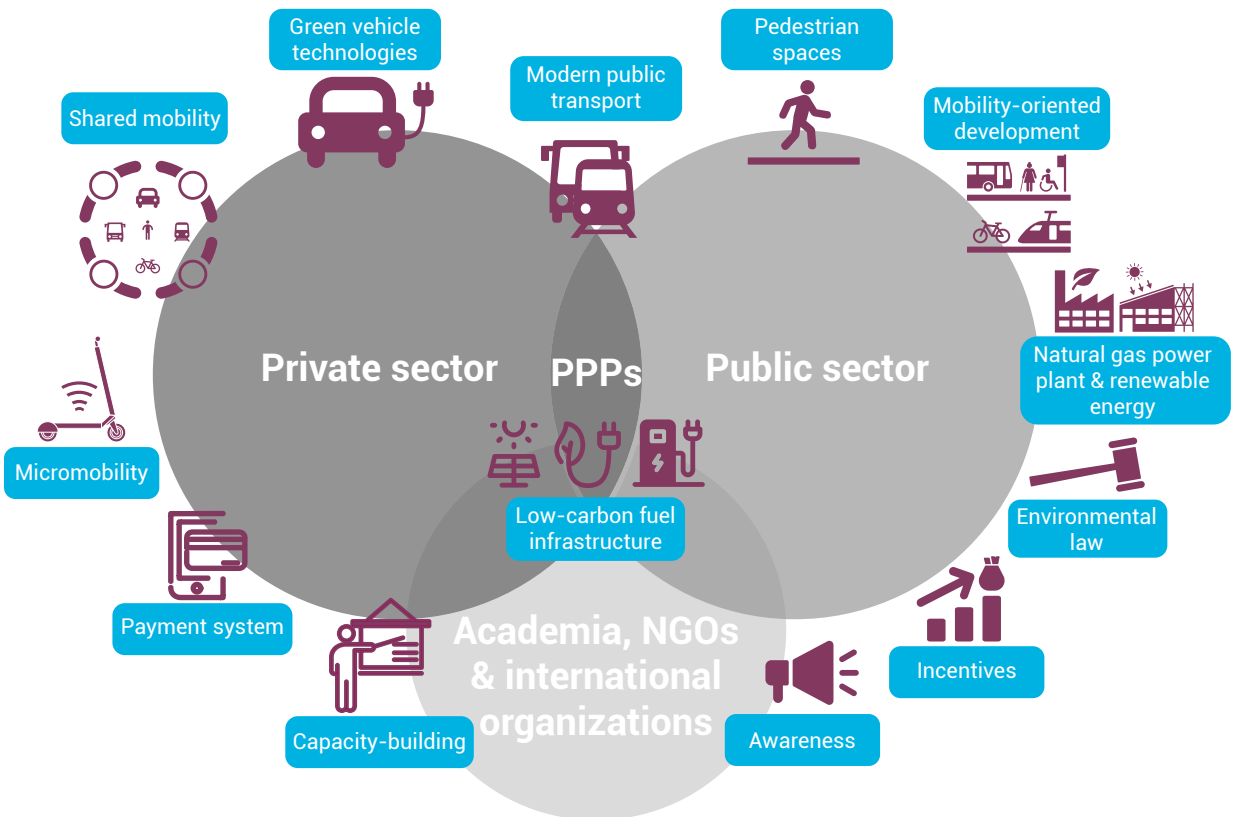
efficient transportation network (CDR, 2005). However, the NPMPLT focused mainly on improving and creating new road networks.

Moreover, since state institutions currently lack the human and financial resources to meet the aspirations of citizens for modern transport, the state must engage the private sector with public–private partnerships (PPPs) not only to implement projects, but also to operate certain services, such as public transport and micromobility under build-operate-transfer (BOT)-type models. In parallel, capacity-building of the relevant government authorities is essential to ensure that fair and transparent tendering processes are used, and that the human resources and expertise needed to carry out change in the public sector are developed.

Awareness campaigns will be needed to enable a massive transformation in culture and to fight resistance to change at all levels, as well as to raise enough political support for pushing through major reforms.

Finally, all of the above recommendations show that collaboration and pooling of resources are needed to develop the sector out of its long-standing status quo, which requires engagement with multiple stakeholders, including the public and private sectors, NGOs, municipalities and international bodies, with of course the engagement and support of the general public, as illustrated in Figure 11.

Figure 11. Multi-stakeholder collaboration to enable key mobility policies



"Enable" policies tailored for the case of Lebanon are proposed in Table 5.

Table 5. "Enable" policies for Lebanon

Policy	Recommendation
National transport strategy	Draft a national transport plan and road map to guide the development of the transport sector towards more sustainable, integrated and inclusive transport modes, with provisions for addressing gender disparities, the needs of people with disabilities, and equal access to all vulnerable groups.
Establish a regulatory authority	Create a central regulatory authority responsible for planning and development of the transport sector, monitoring service quality, setting tariffs, overseeing tendering processes, supervising contractor compliance, resolving conflicts, providing transport data and statistics, and ensuring public involvement and transparency.
Involve the public in transport planning	Create institutional mechanisms that allow for citizen participation in urban transport planning, with mechanisms that ensure the public has a chance to voice their demands and concerns about transport projects in a fair, effective and transparent way.
Create an innovation and entrepreneurship ecosystem	Enable innovative mobility solutions by connecting potential innovators with the local entrepreneurship ecosystem (e.g. Université Saint-Joseph [USJ]'s Berytech, LAU Fouad Makhzoumi Innovation Center, Beirut Digital District) through workshop series, competitions of ideas, and innovation challenges focused on transport applications, such as mobility payment systems.
Develop a unified statistics platform	Integrate transport data collection across relevant public agencies, the private sector and NGOs under one central authority (National Urban Observatory), and improve transport data quality, analysis capabilities, and dissemination means to the public.
Provide capacity-building for bus operators	Prepare public and private bus fleet operators for the transition to new electric and natural gas bus technologies and improved quality of service, with pilot training programmes for drivers on eco-driving practices, for maintenance workers on procedures and safety measures, and for support staff on international practices to plan, schedule, manage and control modern bus operations.
Provide capacity-building for the public transport authorities	Restructure and reform the RPTA to upgrade its capabilities and avoid overlap with the mandate of the DGLMT (one could become the central regulatory authority for the transport sector, while the other could manage network and services operations).
Regulate the operation of micromobility devices and sharing systems	Draft a law for regulating the operation of e-scooters/e-bikes on public roads and sidewalks to encourage the adoption of micromobility while protecting pedestrians and cyclists, and to regulate the operation of e-scooter/e-bike-sharing systems, including parking and storage.
Establish regulatory and institutional frameworks for operating new bus technologies	Develop procedures and specifications for safely operating, refuelling and maintaining new CNG and electric buses – including for compression and discharge of natural gas, handling of high electric voltage levels, adoption of charging equipment interfaces, and safe disposal of batteries – and establish regulating and oversight authorities under relevant institutions.
Implement relevant laws approved but still on the books	Implement Law No. 78 of 2018 on the Protection of Air Quality in transport to accelerate the reduction of GHG emissions, and update the related Decree 6603/1995 to more stringent standards on permissible levels of exhaust fumes and exhaust quality for mobile sources.
Adopt developed privatization frameworks	Adopt PPP models (as developed by the High Council for Privatization and PPP) to implement approved projects and operate public transport and other services as a potential solution for the inefficient and ineffective publicly operated service.
Secure funding and resources from international donors and organizations	Integrate staff from international organizations and donor agencies in the public sector to plan and implement the development of the transport sector, and benefit from funding and capacity-building under international transparency and accountability standards, which are necessary conditions to have in the case of Lebanon.
Subsidize the transition to new bus technologies	Develop a financial subsidies programme for private bus operators to transition to electric, natural gas and newer EURO 6 diesel bus technologies, with exemption of new buses and imported spare parts from customs, excise, value-added tax (VAT) and/or registration fees, and removal of fuel tax on electricity and natural gas for public transport.
Incentivize the building of a new energy infrastructure	Develop a financial incentives programme for energy providers to build a new infrastructure for natural gas and electricity for transport with reduced loan interest rates, tax breaks and extended loan periods on equipment for recharging/refuelling stations.

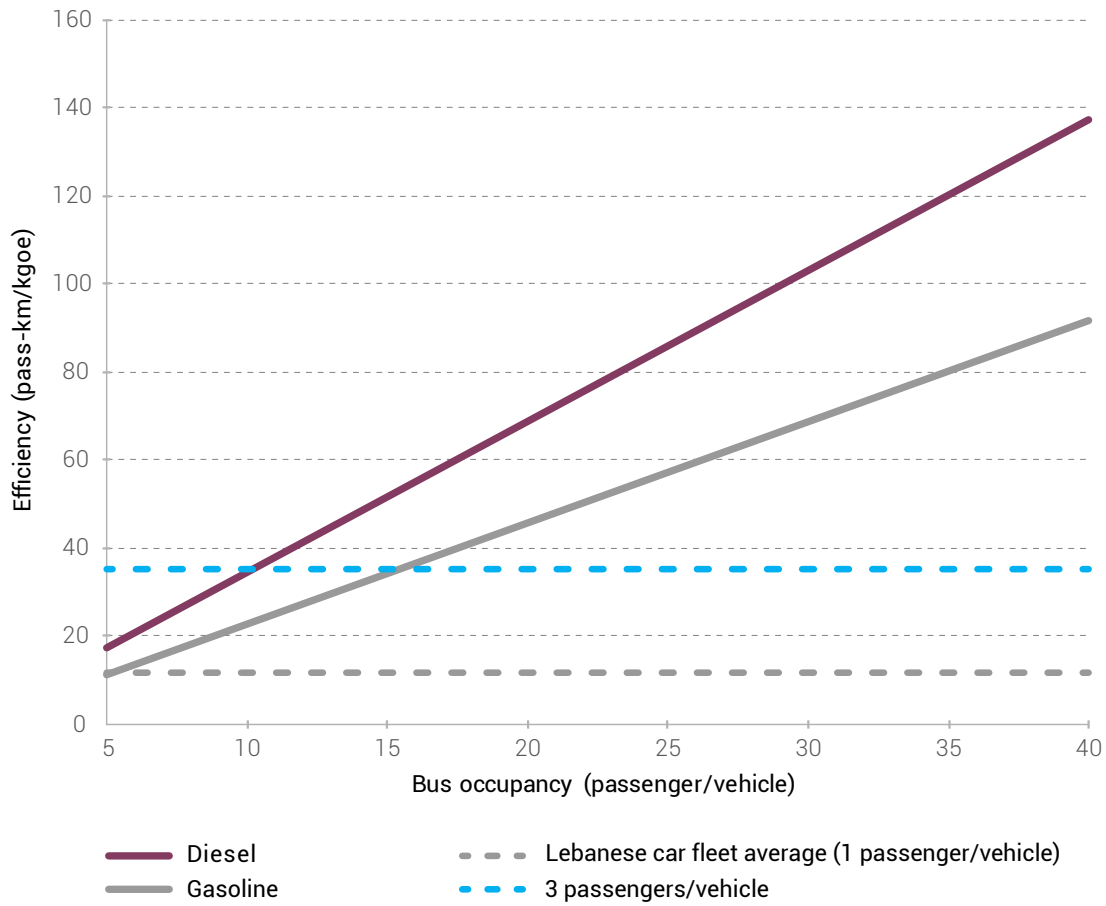
It is worth noting that people in Lebanon have been demanding serious reforms at all levels of government. This could be the impetus for making the implementation of enabling policies such as those proposed above more feasible in the near term, with a view to improving all sectors of the economy, of which a primary one is the transport sector.

5.1.2. "Avoid" policies

The "avoid" approach is the application of policies and strategies to eliminate or reduce the need for individual motorized travel. This approach is based on the realization that allowing the continuous increase in travel demand is unsustainable, and that measures to reduce motorized demand are less costly than those for increasing roadway capacity to meet rising demand in an unsustainable way. Therefore, TDM is one of the key mechanisms under the "avoid" approach, such as with redistributing travel demand over off-peak periods or rerouting it through different geographical areas.

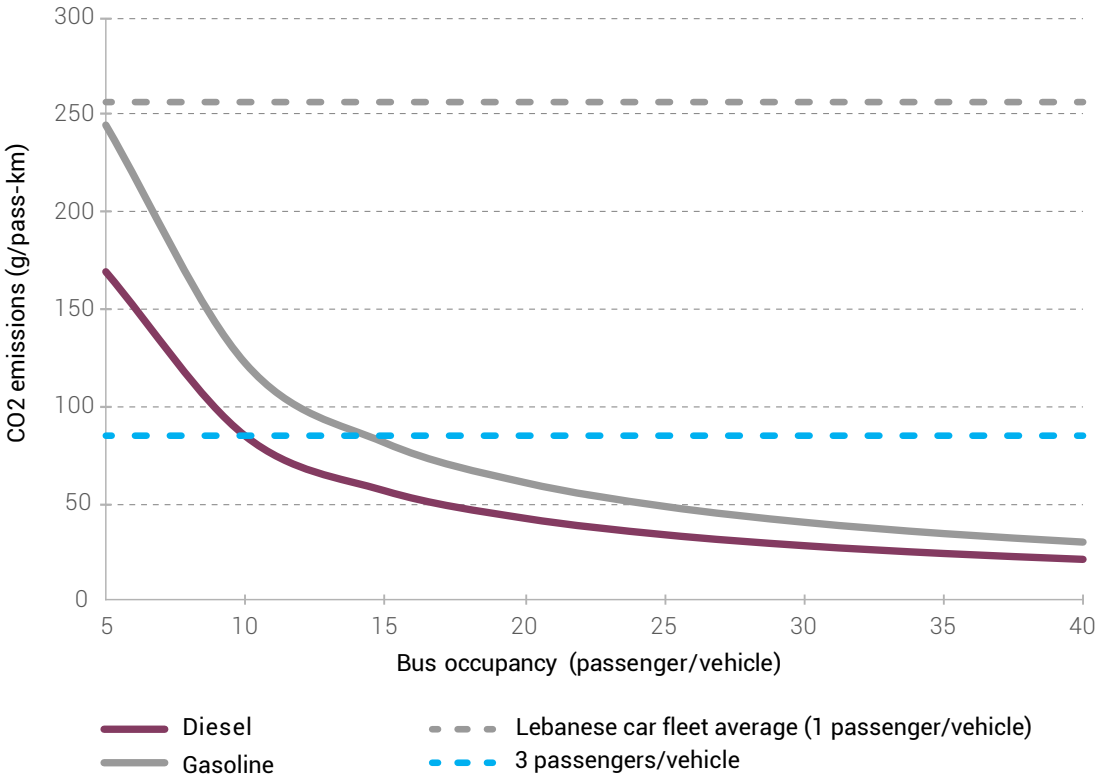
A useful measure for Lebanon is carpooling, as it helps to avoid unnecessary motorized trips per person and thereby offers an intermediate solution to the severe congestion conditions due to single-ride passenger cars, at least until more sustainable transport modes are developed, such as public bus and rail. Carpooling with two to four passengers onboard (or an average of three passengers) would equal the current trip efficiencies of local buses and minivans in Lebanon, which amount to travelling 12 pass-km per kilogramme of oil equivalent (kgoe) in consumed energy. This is triple the energy efficiency of a single-occupancy vehicle, as illustrated in Figure 12 for GBA driving conditions. This translates to a significant reduction of CO2 emissions (a third of the grams of CO2 emissions per pass-km from a single-occupancy vehicle), as shown in Figure 13.

Figure 12. Efficiency of Lebanese average passenger cars and carpooling relative to bus occupancy



Source: Adapted from MoE, URC and GEF (2012)

Figure 13. CO2 emissions of Lebanese average passenger cars and carpooling relative to bus occupancy



Source: Adapted from MoE, URC and GEF (2012)

Carpooling today is made easier and more feasible with the widespread availability of mobile applications in Lebanon, such as Carpolo, which acts as a bridge between random drivers and passengers. In addition, other websites and mobile applications have been developed for smaller niche communities, such as matching students of the same or nearby universities to share rides. These simple and convenient tools were popular for an initial period of time before being largely forgotten because of a lack of awareness, policies and incentives for carpooling. But with the worsening economic crisis in Lebanon, the potential for revitalizing carpooling using these freely available or affordable tools could be significant from financial and environmental perspectives, and can help to build a culture of shared mobility in the country.

It is important to note, however, that the health risks of COVID-19 greatly impact carpooling, due to the need for social distancing. Therefore, other "avoid" measures should be reinforced, such as working from home and shopping online, in addition to relying on walking and bicycling where feasible. The pandemic and the economic crisis in Lebanon also present an impetus to provide emergency bike lanes in Lebanese cities, both as a means of addressing mobility needs as a result of these challenges, and as a first step towards change of culture away from motorized travel in the long term.

Other key policies under the "avoid" approach are those aimed at achieving synergy between urban and transport planning and development, with the goal of organizing the ad hoc evolution of Lebanese cities and the transport system over the past decades. Chief among those are mobility-oriented development and TOD, which aim to cluster residential, business and leisure space within walking distance of public transport and alternative transport means.[9] Furthermore, neighbourhood upgrading

9 Such synergies are elaborated on in UN-Habitat Lebanon (2021b).

interventions should also include innovative transportation solutions that foster connectivity and increase vulnerable residents' access to livelihood opportunities.

Policy recommendations for avoiding travel that are feasible for the Lebanese context are provided in Table 6.

Table 6. "Avoid" policies for Lebanon

Policy	Recommendation
Promote telecommuting	Provide a proper IT infrastructure and tax incentives to employers to have their staff work from home.
Promote flexible time and work travel planning	Develop flexible work schedules with major employers to reduce congestion at peak times. Encourage employers to develop workplace measures and incentives for staff to use non-motorized transport, including providing lockers and bicycle parking onsite.
Apply alternate-day travel	Restrict travel on certain highways or to particular urban areas to odd or even days, based on license plate numbers. This can also be done by road space rationing, where vehicles are not allowed on certain highways, based on their license plate number.
Charge tolls on urban highways	Reduce motorized travel to busy urban areas by charging a fee on urban highway portions, based on time of use, distance travelled, or access to a specific area. It must be noted that using congestion pricing, which is based on applying toll surcharges during peak traffic periods, would be very difficult to apply in Lebanon and is therefore not recommended.
Use air-pollution-based car bans	Prevent access to urban areas with high local air pollution levels, for example, based on an Air Quality Index (AQI), with corresponding warning levels and progressively stricter bans on trucks, cars and other motorized travel. It must be noted that using air pollution pricing, which is a similar measure based on applying toll surcharges at urban entry points, would be very difficult to apply successfully in Lebanon and is therefore not recommended.
Reallocate road space	Shift road space allocated for car traffic or car parking to serve other modes, such as sidewalks, bike lanes, high-occupancy vehicle (HOV) or bus lanes, on a temporary (e.g. in a health emergency, such as the COVID-19 pandemic) or a permanent basis.
Create pedestrian-only zones	Ban car access to central business districts, historical and cultural areas, and other busy urban areas, and redesign streets to make walking attractive, while providing separate trails for bicycles, e-scooters and other micromobility devices.
Promote carpooling	Promote ride sharing to reduce the number of same-destination trips by multiple individuals through the provision of infrastructure, such as HOV lanes, and/or by applying tolls or travel restrictions on single-occupancy vehicles.
Use access management strategies	Adopt land-use development patterns that favour attractive walking spaces and multi-use trails interconnected over long distances serving major urban centres, with provisions for shared micromobility infrastructure.
Apply parking surcharges	Apply tax surcharges to increase parking costs inside cities in order to discourage urban motorized travel, and use the additional income to subsidize bicycle storage.
Upgrade the walking infrastructure	Reclaim sidewalks from parked cars and other obstructions, and redesign urban spaces to provide wider sidewalks, accessible pedestrian bridges over urban highway portions at convenient intervals, and safe signalized crossings on secondary roadways.
Prioritize biking and micromobility over motorized traffic	Create cycle paths that serve major urban centres and connect residential and commercial developments, and provide dedicated bike lanes separated with physical barriers from the road traffic, including secure bike storage areas with rental lockers.
Provide information tools	Provide traveler information through improved intelligent transport systems, mobile applications, social networks and wayfinding tools to redistribute demand outside of peak periods or redirect congested traffic to alternative routes.
Incentivize online shopping	Encourage emerging trends towards online shopping by reduced taxes for online purchases over an initial limited period of time, such as three years.
Raise awareness on the impacts of car use, e-work and e-learning	Conduct workshops or use other participatory mechanisms to change the automobile culture by redefining travel needs, environmental and cost impacts, and available alternatives, in a way to ease resistance against remote learning and working.
Create acupuncture projects	Pilot small-scale urban planning projects with a focus on avoiding motorized transport, such as reclaiming public spaces to create IT-enabled work clusters (e.g. local libraries with dedicated space for remote working and online learning).
Mandate mobility-oriented urban planning and development	Mandate clustered designs for new urban and suburban developments (following the mixed land-use patterns in Lebanese cities, with provisions for shops on the ground floor and mixed residential and office buildings) to reduce the need for travel. Emphasize accessibility to public transport means in all developments and redevelopments.
Tighten urban zoning based on roadway constraints	Ban high-rise buildings and large commercial malls in dense urban areas with narrow streets, and mandate a public transport infrastructure for commercial zones and urban areas.
Update urban zoning laws	Update zoning laws to ban commercial establishments alongside highways unless a frontage road is available, and ensure loading/unloading zones and proper parking spaces are allocated in commercial and industrial areas.

Grey-shaded rows are for national-scale initiatives that are the responsibility of the central government, while the other rows are for the subnational/municipal level.

The proposed policy recommendations can make significant positive contributions to commuters in terms of reducing road congestion, fuel costs and emissions. But they can also help increase employee satisfaction and retention, productivity from saved travel time and access to more modern urban spaces, thereby helping improve the general quality of life for urban residents.

5.1.3. "Shift" policies

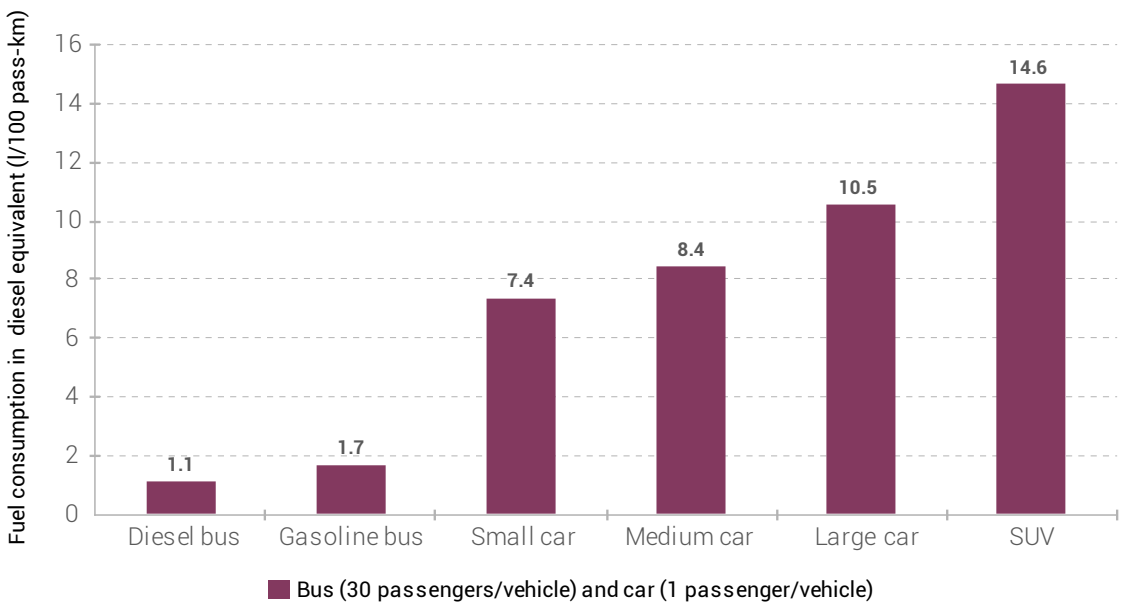
The "shift" approach is the application of policies and strategies to transition travel from costly, high-energy-consuming and polluting modes, such as motorized means, towards cheaper, more efficient and environmentally friendly modes, such as public transport. The "shift" policies do not eliminate or reduce trips, but they seek to make travel more sustainable by moving demand onto higher-occupancy vehicles and non-motorized modes.

The most efficient non-motorized means of transport are obviously walking, cycling and micromobility, since these modes provide the highest energy savings with corresponding environmental and cost benefits. Shifting to these alternative mobility means can also help to reclaim urban spaces away from roadways and large parking areas and, in the long term, can counter the encroachment of cars on public spaces.

It is important to note that the "shift" approach is particularly appropriate for Lebanese cities, because in the case of Lebanon, the "exceedingly compact structure of the city offers good conditions for non-motorized transport" (MAN Group, 2013). Even in the GBA, 35 per cent of passenger car trips have a distance lower than 4 km, with 11 per cent lower than 2 km (Mansour, Zgheib and Saba, 2011). Furthermore, non-motorized modes have been made more feasible by the COVID-19 pandemic and the severe economic crisis in Lebanon, which have highlighted the importance of enabling the shift to these modes through proper policies and infrastructure.

But the most beneficial shift is to public transport, because of its mass scale potential in removing cars from the roads. In particular, rail transport can be considered as the most efficient option, due to its high transport capacity per trip compared to other modes, as well as its ability to handle freight. Buses are also highly beneficial, especially at high occupancy rates and when operating on dedicated lanes without traffic congestion. Figure 14 presents the fuel savings in litres per 100 km travelled for conventional fuel buses with an average occupancy of 30 passengers per bus, compared to passenger cars in the Lebanese fleet with single-passenger occupancy, showing a clear advantage for buses in terms of fuel consumption savings per pass-km.

Figure 14. Fuel consumption (litre per 100 pass-km) per bus and car type for the Lebanese fleet



Source: Adapted from MoE, URC and GEF (2012)

When combined with newer clean bus technologies, such as CNG and electric bus technologies, benefits in reduced energy consumption and emissions become even more significant, as discussed under the subsection titled "Improve" Policies.

Another way to push the "shift" strategy is through building park-and-ride public car lots near bus and/or train stations, which breaks up motorized travel into two parts: a part that remains motorized up to the park-and-ride lot, and a second part where commuters switch to either public transport, micromobility or walking to complete the trip. However, to ensure continued emphasis on reducing motorized travel altogether, this must be accompanied by "avoid" policies that promote mobility-oriented urban development, such as a countrywide TOD strategy that promotes clustered urban form with easy access to all expanded and revitalized public transport services and alternative transport means.

"Shift" policies applicable for Lebanon are proposed in Table 7.

Table 7. "Shift" policies for Lebanon

Policy	Recommendation
Revitalize bus services	Modernize urban and intercity bus transport by expanding the bus network, organizing routes and schedules, providing stations at major hubs and covered bus stops that are accessible to people with disabilities, and acquiring new bus technologies to encourage ridership.
Prioritize bus operation on roadways	Dedicate curbside lanes on major arterials within the GBA for all buses, and implement intelligent transport systems, such as transit signal priority (TSP) on red lights to reduce the frequency and duration of stops in traffic for buses.
Rehabilitate the rail network	Reclaim the rail right of way from encroachment violations, rehabilitate the rail track and railway stations, finalize designs of new lines, and acquire new locomotive technology.
Prioritize public transport projects	Reprioritize projects in the CEDRE CIP for the transport sector to shift spending from roadway infrastructure to the bus and rail networks, particularly the BRT and feeder bus network, and the northern coastal railway line (Beirut–Tripoli) for passengers and freight.
Link seaports to the rail network and the airport to the bus network	Link all seaports and the airport to public transport. In particular, the reconstruction of Beirut Port after the devastating explosion of 4 August 2020 should connect the container terminal to rail in order to minimize freight movement by truck (Souhaid et al., 2020).
Provide a shared micromobility infrastructure	Make provisions for e-scooter parking zones in urban planning design to boost micromobility usage as an alternative to car use in cities, and create multi-use trails shareable among pedestrians, bicycles and micromobility devices.
Upgrade the walking infrastructure	Reclaim sidewalks from parked cars and other obstructions, and redesign urban spaces to provide wider sidewalks, accessible pedestrian bridges over urban highway portions at convenient intervals, and safe signalized crossings on secondary roadways.
Prioritize biking over motorized traffic	Create cycle paths that serve major urban centres and connect residential and commercial developments, and provide dedicated bike lanes separated with physical barriers from road traffic, including secure bike storage areas with rental lockers.
Apply parking surcharges	Apply tax surcharges to increase parking costs inside cities in order to discourage urban motorized travel, and use the additional income to subsidize bicycle storage and related infrastructure.
Build park-and-ride facilities near public transport hubs, and automated parking in urban centres	Invest in automated multistorey car-stacker parking blocks near central business districts and commercial areas that are severely underserved in parking spaces, and construct park-and-ride facilities at major city entrances. Rehabilitate the Charles Helou Station and parking lot to serve as an intermodal station (IMS), where drivers from outside GBA can park their cars and continue their journey inside the city by bus service or on shared bicycles and micromobility devices. This policy is to be enacted only in conjunction with the policy for applying parking surcharges in urban centres.

Require parking garages in all municipalities	Require municipalities to build parking garages to meet demand and free up urban road space for pedestrians, cyclists and micromobility users. This policy is to be enacted only in conjunction with the policy for applying parking surcharges in urban centres.
Provide public transport subsidies	Subsidize transit costs for employees with targeted subsidies (such as special transit passes paid for partially by employers) instead of the current flat transport allowance, and provide easy access to public transport in urban areas, such as convenient bus stops and routes.
Raise awareness about alternative transport means and public transport	Conduct media campaigns and workshops to spread awareness about the environmental, cost and health benefits of alternatives to motorized transport, such as walking, biking and micromobility, and promote environmental responsibility across all segments of the population to counter the widespread car culture in Lebanese society.
	Conduct media campaigns and workshops to spread awareness about public transport as a cost-effective and cleaner mobility solution, highlighting health and safety measures provided by operators and required from users to make effective use of services.

Rows with purple text are the same or similar to previously proposed policies under the "avoid" approach, and grey-shaded rows are for subnational/municipal-level policies.

In addition to the policies proposed above for the road transport sector, other complementary policies in other parts of the sector could help achieve the same objectives of making mobility in Lebanon more sustainable, through shifting to modes with higher capacity per trip, such as the implementation of internal marine transport using a water taxi system serving major cities along the Lebanese coast (contingent, of course, on providing first- and last-mile transport to embarking and disembarking locations). Similarly, the implementation of government plans from 2012 to rehabilitate the René Mouawad Air Base in northern Lebanon for use as a regional civilian airport for low-cost airlines and cargo has the potential to reduce road trips to the Rafic Hariri International Airport, the only airport in Beirut currently serving the entire country, and thereby reduce congestion in the GBA.

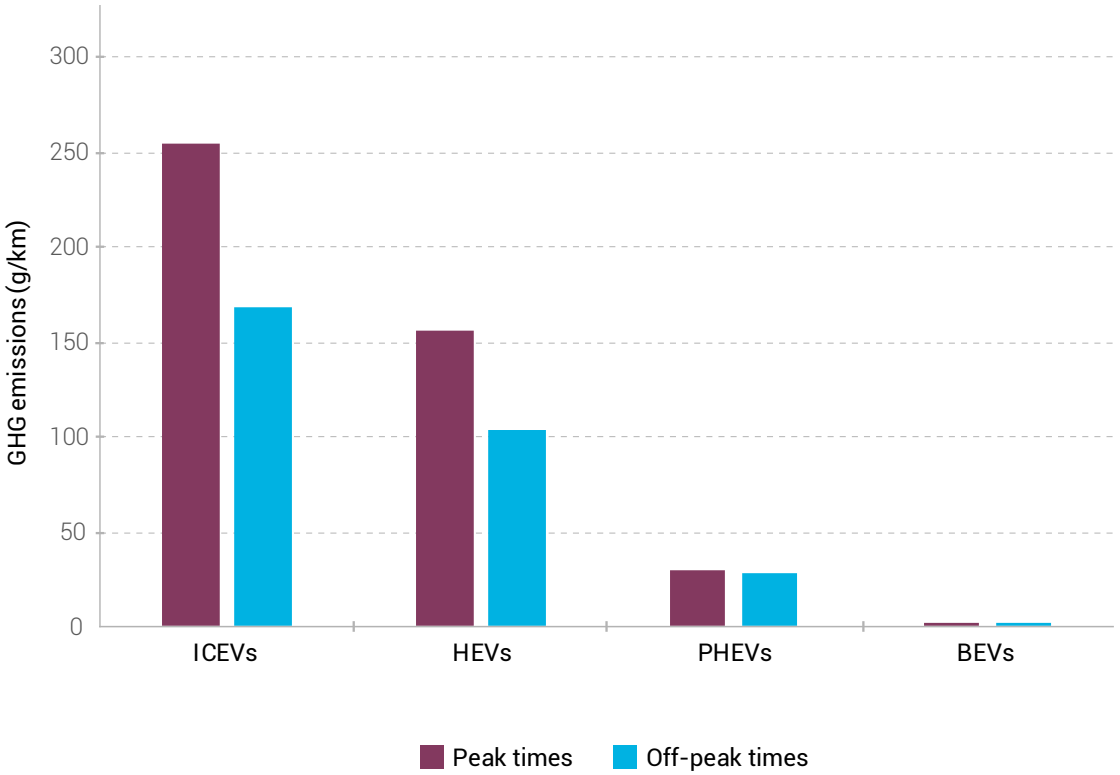
5.1.4. "Improve" policies

The "improve" approach is the application of policies and strategies to advance the energy efficiency of vehicle powertrain technologies, and to use cleaner alternative fuels and sources of energy in order to improve trip efficiency and reduce the carbon footprint of the transport system. TDM strategies are helpful here in improving trip efficiency through access management measures that support smooth traffic flow while improving the use of urban spaces.

The first beneficial strategy under this approach that is the easiest to implement is to replace older-model, larger-size gas-guzzling vehicles, which are heavy polluters, with smaller FEVs through a car scrappage incentives programme. FEVs operate with downsized but turbocharged engines, which provide high performance for considerably reduced fuel consumption and CO2 emissions relative to the average passenger car in the current Lebanese fleet, with 28 per cent savings for a compact car and 36 per cent for a subcompact one (MoE, URC and GEF, 2012). A comprehensive scrappage programme has been designed for Lebanon but is pending implementation (MoE, 2017a).

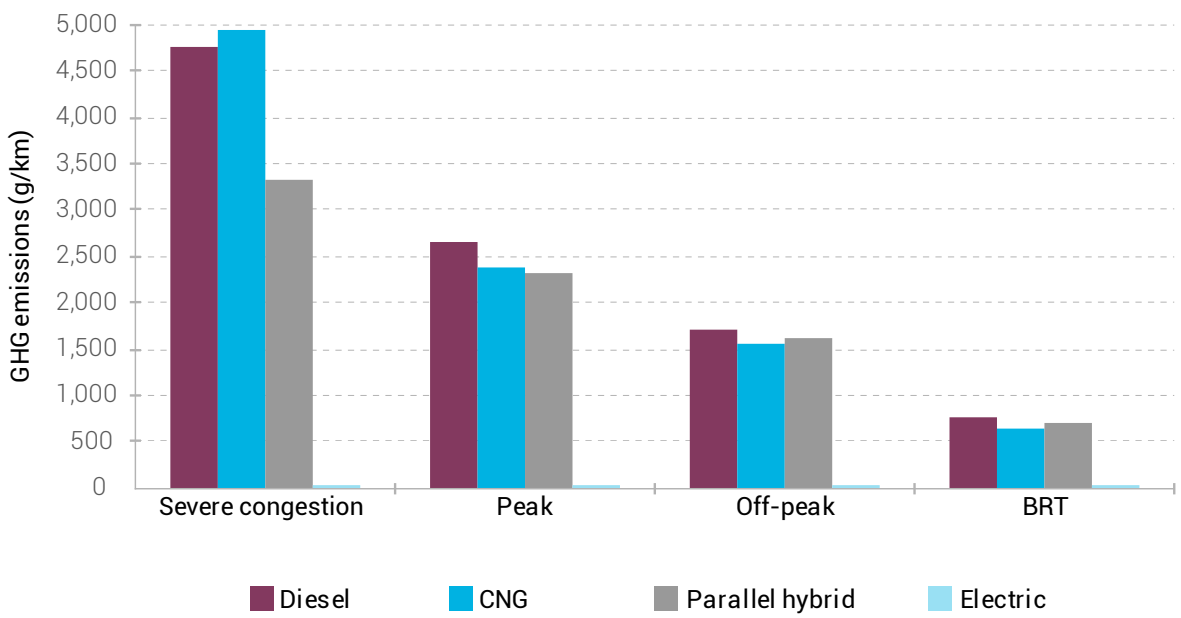
The most beneficial "improve" strategy is to provide tax subsidies in order to encourage the transition to electric vehicles – such as HEVs, PHEVs and BEVs – which present the highest savings in fuel consumption and emissions, but for higher purchase costs. Previous assessments of electric passenger car performance in GBA driving conditions revealed significant reduction potential in fuel consumption and GHG emissions relative to a reference mid-size gasoline internal combustion engine vehicles (ICEVs). For example, HEVs and PHEVs are 38.7 and 88.6 per cent more fuel-efficient than their gasoline counterparts, respectively. This translates to substantial reductions in GHG emissions, as shown in Figure 15, with BEVs having zero tailpipe emissions, which plays a critical role in cleaning up air and noise pollution inside cities (Mansour, Haddad and Zgheib, 2018).

Figure 15. GHG emissions by vehicle type in GBA driving conditions during peak and off-peak times



Source: Adapted from Mansour, Haddad and Zgheib (2018)

Figure 16. GHG emissions of bus technologies in GBA driving conditions



Source: MoEW, UNDP and SODEL (2018)

Electric vehicle technologies in buses are also effective in fuel and emission savings, especially in heavy congestion conditions, where HEV buses have the potential to reduce GHG emissions by over 25 per cent compared to conventional diesel buses, as shown in Figure 16 (Haddad and Mansour, 2019; MoEW, UNDP and SODEL, 2018). It must be noted that all bus technologies are much more efficient when operating under BRT conditions, since the bus runs on dedicated lanes at higher speeds with fewer stops than running with traffic.

Again, BEV technologies are the most effective solution for buses just like for passenger cars, but only in the long term and at a much higher investment cost, since they require a wide-scale deployment of an electric-charging infrastructure, in addition to a clean and reliable electricity supply. Currently, Lebanon's power plants operate largely on heavy fuel and diesel oil to generate electricity, which is considered a "dirty" energy mix. This means that reductions in GHG and air pollution from BEV tailpipes would be offset by increased harmful emissions at the power plants from burning more fuel oil to supply additional electricity for charging BEVs. Under Lebanon's 2030 strategy for the energy sector, the energy mix would rely overwhelmingly on cleaner natural gas, with plans for additional power plants and network upgrades to increase power supply and distribution, which would make BEVs feasible in Lebanon (Mansour and Haddad, 2017; MoEW, UNDP and SODEL, 2017).

In the interim, HEVs are a readily available solution to improve trip efficiency and reduce emissions in Lebanon's road transport sector, since they do not need charging from the grid and therefore do not require a charging infrastructure. These vehicles currently benefit from a reduction in customs, excise and registration fees to offset their relatively higher purchase price, but more incentives should be enacted to completely remove taxes and fees on small-size HEVs, at least over an initial limited period of time, to speed up their adoption.

In addition, CNG vehicles are very beneficial in terms of reducing air pollutants harmful to human health and should also be considered for the medium to long term when a natural-gas-refuelling infrastructure is made available. But these vehicles are cost-effective only for public transport and "service" vehicles (i.e. in buses and taxi and service fleets that run for at least 30,000 km per year, as opposed to individuals who drive 12,000 km per year on average) (Mansour and Haddad, 2017; MoEW, UNDP and SODEL, 2017).

Policies under the "improve" approach that are most applicable for the Lebanese context are proposed in Table 8.

Table 8. "Improve" policies for Lebanon

Policy	Recommendation
Activate a car scrappage programme	Implement the Lebanese Government's car scrappage and replacement programme designed to remove old polluting cars for scrapping and replacement with new FEVs, by providing a package of incentives to private car owners and taxi fleet companies.
Modernize the vehicle inspection process	Implement existing plans for constructing additional vehicle inspection facilities and upgrading existing ones to modern international standards with required equipment, procedures and trained staff to inspect conventional engine, xEV and CNG vehicle technologies and to ensure their compliance with safety and environmental regulations. In parallel, develop roadside emissions inspections programmes to ensure convenient and wide coverage for all regions and rural areas.
Incentivize the adoption of electric and natural gas vehicles	Speed up the adoption of various electric vehicles (collectively known as xEVs) and CNG vehicles in the Lebanese market through reduced loan interest rates, reduced insurance premiums, and the removal of all registration fees and taxes on small-size HEVs for early adopters over a limited initial period, while maintaining the current incentives for larger-size HEVs and BEVs for the same time period, in addition to developing an incentives scheme for CNG vehicles.
Upgrade bus technologies	Acquire alternative fuel buses (xEVs and/or CNG) for the BRT project in the GBA, as mandated under the terms of the World Bank loan for the GBPTP.

Rehabilitate rail assets	Remove all encroachments on the rail right of way, rehabilitate existing rail assets, train human resources and acquire new electric locomotive technologies.
Improve electricity production capacity and energy mix	Clean up electricity generation by switching the mix from oil to natural gas, as per the sector's 2030 strategy, upgrade the power distribution network and increase supply by building additional power plants in rural areas, while exploring the relocation of existing power plants outside urban areas.
Raise awareness about cleaner passenger car technologies	Launch media campaigns and workshops to promote existing financial incentives for the purchase of electric vehicles, and educate the general public about the environmental, cost and health benefits of electric and natural gas vehicles compared to conventional vehicles.
Enact incentives for FEVs and disincentives for older vehicles	Reform the current taxation scheme under which newer vehicle technologies incur higher taxes by adopting a bonus-malus tax policy, which exempts FEVs from road usage fees while charging a gas guzzler tax on older and larger cars, to discourage the purchase and continued operation of fuel-inefficient vehicles. Non-financial measures can also be used, such as larger shares of parking for smaller cars/xEVs in urban areas.
Use access management strategies	Modify roadway designs and land-use development patterns to reduce features that impede traffic flow in urban areas, such as intersections and entrances/exits for establishments, and use medians to separate turning vehicles from the main traffic.
Develop strict highway zoning laws	Enforce zoning laws that ban commercial establishments alongside highways, which should only be accessed through frontage roads, and ensure loading/unloading zones and proper parking spaces are allocated in commercial and industrial areas.
Build natural-gas-refuelling and electric-charging infrastructures	Build a small-scale natural-gas-refuelling infrastructure to enable the use of CNG vehicles in public transport in the medium to long term, and develop an electric-charging infrastructure in partnership with the private sector by equipping or switching existing fuel stations with fast chargers and installing new charging locations.

Rows with purple text are the same or similar to previously proposed policies under the "avoid" and "shift" approaches.

Finally, it is worth pointing out that the need for radical development in the refuelling infrastructure could be a major opportunity to drastically change petrol stations, currently unpleasant spaces that commuters visit only for brief moments to refuel their vehicles, into rest areas with pleasing designs offering food and other services where people spend at least 15 minutes to an hour, or more, waiting for fast chargers to replenish the batteries of their electric vehicles. This could also be an opportunity to overhaul urban spaces nearby and around service stations to make them more people-friendly, such as with parks as well as leisure and play areas.

5.2. Considering monitoring and evaluation

The "enable" policies are designed to ensure that the proposed ASI policies can be implemented by promoting capacity-building of relevant authorities and concerned stakeholders, and the creation of the required institutional, regulatory and incentive/disincentive frameworks. To further avoid obstacles during the implementation of the proposed policies, it is essential to consider from now the types of key indicators that should be monitored and evaluated during the future policy implementation and monitoring and evaluation phases (UN-Habitat, 2015). The main monitoring and evaluation indicators for the proposed ASI policies are shown in Table 9.

Table 9. Monitoring and evaluation framework for the proposed ASI policies

Policy category	Monitoring and evaluation framework
Avoid • Use access management strategies	Integrate access management principles and techniques into public and stakeholder involvement processes. Establish a process to coordinate access management provisions with the urban planning process.
Avoid and Shift • Prioritize biking and micromobility over motorized traffic • Provide a shared micromobility infrastructure	Complete detailed design of proposed dedicated bike lanes on the northern coastal road and coordinate lane construction between MoPWT and concerned municipalities. Draft a law for regulating the operation of e-bikes and e-bike-sharing systems. Complete feasibility study for identifying and assessing incentives to encourage user adoption of e-bike technology.
Shift • Prioritize bus operation on roadways	Start implementation of the BRT project's Component 1 (BRT station and lane construction, fleet acquisition, and systems implementation). Complete facility designs for the Tripoli public bus service and start a service staff training programme for planning, scheduling, management and control of bus operations and proper operation and maintenance of different bus vehicle technologies.
Shift • Rehabilitate the rail network • Link seaports to the rail network and the airport to the bus network	Complete a detailed design for a passenger rail transport network on the northern corridor, including the link to Beirut Port.
Improve • Activate a car scrappage programme • Modernize the vehicle inspection process	Establish the coordinating, implementing and financing entities for NAMA implementation. Assess all existing vehicle inspection facilities, equipment, and staff capabilities and develop recommendations for upgrading inspection programmes for new electric and natural gas vehicle technologies.
Improve • Incentivize the adoption of electric and natural gas vehicles • Enact incentives for FEVs and disincentives for older vehicles	Complete a study on the costs and benefits of providing financial incentives to first-time buyers of small-size electric vehicles for a limited period of time after purchase. Secure funding for incentives and amend Article 55 of Law 79/2018 to exempt these vehicles from all customs, excise, and road usage and registration fees at purchase for an initial period of time. Enact a new law for subsidizing electricity and natural gas for the transport sector.
Improve • Build natural-gas-refuelling and electric-charging infrastructures	Establish policy mechanisms for implementing Decree 167/2017 of Article 20 under Law 444/2002 for offering financial incentives to providers of infrastructure and equipment for clean fuels. Develop procedures and specifications for refuelling/recharging and maintenance of natural gas and electric vehicles.

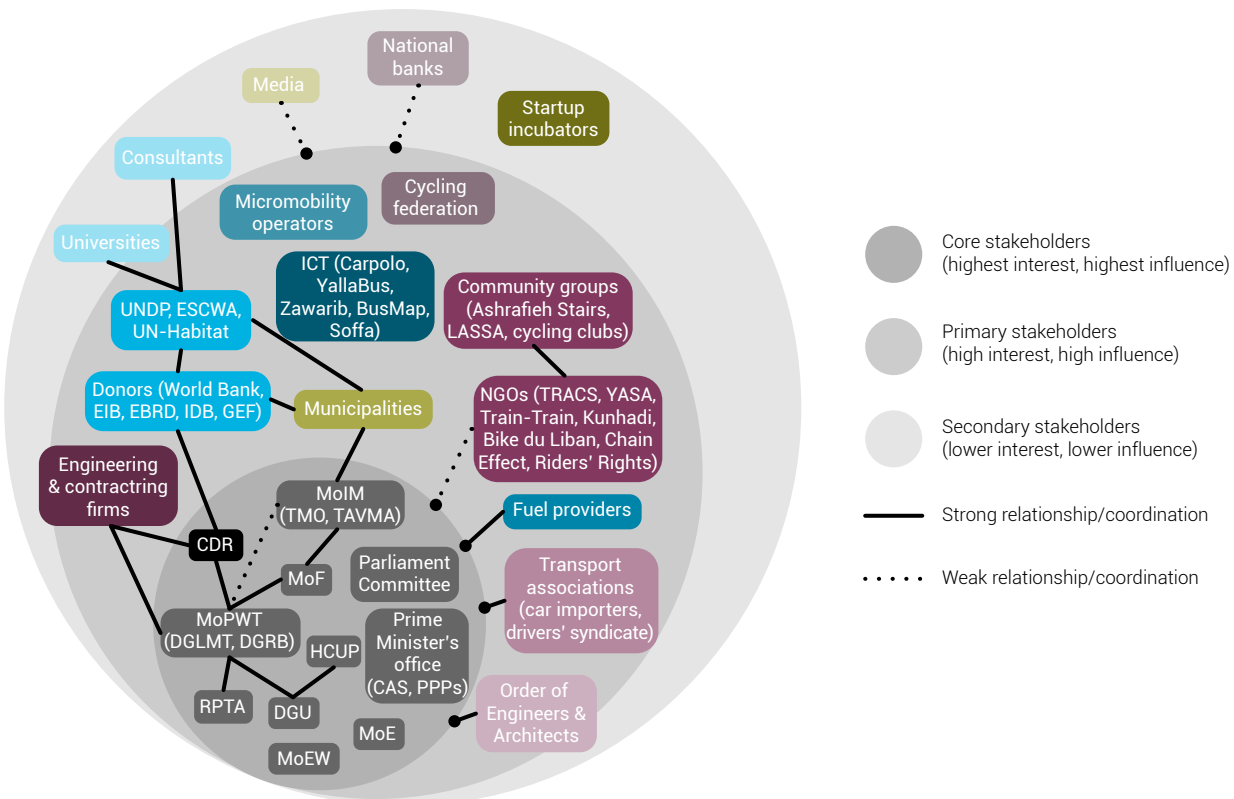
6 PRIORITIZING THE PROPOSED EASI POLICIES FOR LEBANON

A policy analysis exercise was carried out to assess the importance of the policy recommendations proposed in the previous section under the EASI framework in order to prioritize them from the perspective of some relevant stakeholders, in line with the key pillar of participation in the NUP process. This was done by developing an online survey instrument with a ranking scheme to measure policy impacts and feasibility time frames, according to relevant criteria across different categories, covering the technical, environmental, economic, social, political and administrative categories. Criteria selection was done based on two main objectives: reducing motorized travel in favour of modern future trends of sustainable mobility and smart cities, while maximizing the social, environmental and economic development benefits of the transport sector.

The survey approach was chosen over others due to the continuing COVID-19 pandemic and the prevailing political situation in Lebanon, which made it challenging to hold a more interactive consultation workshop. However, care was taken to explain to stakeholders the purpose and general context of the exercise, as well as to provide definitions for the technical terms used in the survey, as shown in Tables 13 and 14 of Appendix 1. Furthermore, interviews and discussions with active NGOs in the transport sector were held through online means to understand the needs and demands of the grass-roots community for transport and mobility, especially after the October 2019 civil uprising, the COVID-19 pandemic and the severe economic crisis in Lebanon.

Before administering the online survey, a stakeholder mapping was done to identify the relevant stakeholders in the Lebanese road transport sector, according to best practices for considering stakeholder influence, interest and involvement. In this case, the stakeholder mapping tool by Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) (TRANSfer, n.d.) was used for guidance. The stakeholder map is presented in Figure 17.

Figure 17. Stakeholder mapping for the road transport sector in Lebanon



Orientation sessions were organized engaging representatives of relevant stakeholder groups over two parts: the first session on 27 November 2020 involving civil society, the private sector and academia, and a second session on 9 December 2020 involving government stakeholders at all levels. The orientation sessions were designed to disseminate information and solicit feedback about the NUP process in Lebanon, as well as to engage the active participation of all stakeholders in the sectoral interventions as part of the NUP process, namely the mainstreaming of the housing and transport sectors into the NUP.

A POLICY ANALYSIS EXERCISE WAS CARRIED OUT TO ASSESS THE IMPORTANCE OF THE POLICY RECOMMENDATIONS PROPOSED IN THE PREVIOUS SECTION UNDER THE EASI FRAMEWORK IN ORDER TO PRIORITIZE THEM FROM THE PERSPECTIVE OF SOME RELEVANT STAKEHOLDERS, IN LINE WITH THE KEY PILLAR OF PARTICIPATION IN THE NUP PROCESS.

The survey instruments are presented in Appendix 1, Table 11 for user-side policies and Table 12 for provider-side policies. Some of the proposed EASI policies, such as those related to raising awareness or implementing existing laws, were not included in the exercise since they are considered necessary and easily feasible and therefore should be a high priority by default.

For user-side policies, results from the survey showed overwhelming consensus on policies advocating a "shift" to walking and cycling through the provision of pedestrian spaces and infrastructure for shared bikes and e-scooters. This indicates a high acceptance among survey respondents of alternative transport means, with many citing the need to change the "prevailing local mentality of preferring the automobile over shared transport or even non-motorized mobility," as one respondent put it, as a priority. Also prioritized was the need for "seizing the opportunity of the damage caused by the [Beirut] Port explosion, to start pedestrianizing some areas in Beirut," as noted by one respondent. The only concerns voiced about alternative transport were those related to safety; this demonstrates the need for physically separated bike lanes and wide sidewalks.

Equally well received were the "shift" policies advocating for the revitalization of public transport through a better bus service, and the revival of rail for people and goods. However, concerns were raised about the risks of the COVID-19 pandemic on the use of bus transport, and doubts were expressed about the near-term feasibility of reviving the railway network. For one respondent, emphasis was placed on the "urgency" for implementing these policies and on the need for "enhancing the technology of buses to make them accessible [to people with disabilities] and more comfortable [for all riders]." Other concerns were related to the need to integrate bus drivers currently operating the informal system of minivans and bus services into any new public transport system, as well as to the quality of the user experience, including, as one respondent mentioned, the "possibility of providing a unified payment system across different modes of transport." These concerns reflect a desire by stakeholders to see a modern public transport system in place as soon as possible, one that features the key elements of sustainability.

THERE IS AN URGENT NEED FOR CREATING A TRANSPARENT PROCESS FOR CITIZEN PARTICIPATION IN URBAN TRANSPORT PLANNING. THIS CAN HELP IMPROVE THE OUTCOMES OF THE PLANNING PROCESS, AS WELL AS ENSURE SUPPORT IN OVERCOMING BARRIERS TO CHANGE.

The "avoid" policies designed to promote telecommuting and flexible work times were also very well received overall, and they were generally preferred over those promoting carpooling and construction of park-and-ride facilities, while restrictive policies like odd-even car days and car bans were less well received. A concern about the lack of parking was voiced; it was mentioned by one of the respondents that "the issue of parking in residential neighbourhoods remains a challenge as long as alternative means of transport are not provided." This can be interpreted that people might be ready for alternatives to the use of cars, but that solutions are needed in the interim.

Another concern related to the "avoid" policies was about the need to emphasize TDM measures, with a focus on the interaction between transport and land use, such as the development of transit-oriented

neighbourhoods. Along similar lines, the policy for tightening urban zoning laws was deemed essential for improving urban spatial quality and overall quality of life in urban areas, but with many concerns about its short-term feasibility and its benefits for mobility.

The "improve" policies for better vehicle technologies were also prioritized by respondents, as they were considered to be feasible in the near term and beneficial overall, especially from an environmental perspective, but they were perceived to come at a high financial cost. In fact, concerns were voiced by the respondents about the ability to transition to hybrid or electric cars in the current economic crisis, and even to deal with the "running and maintenance costs on the owners who might not be able to afford [them]."

For provider-side policies, responses to the survey were limited, but the most well-received "enable" policies were the development of a national transport strategy and the creation of the necessary regulatory authorities for the transport sector, with noted importance on the need to address the local level, such as the additional involvement of municipalities. Capacity-building and funding of these authorities were also prioritized, with a request for measures to institute the "refinement of proposed urban policies based on feedback from their impacts [after implementation]."

Subsidies for speeding up the introduction of new bus technologies and the construction of the required infrastructure were also very well received; in fact, the need for "more explicit policies regarding taxation and subsidies" was noted by a respondent.

Other enabling policies related to the development of the transport sector through the creation of a National Urban Observatory (to collect and integrate transport statistics)[10] and by enabling citizen participation were also well received, but with reservations about their short-term feasibility and long-term sustainability, perhaps reflecting the local experience with similar enabling initiatives that have failed to deliver what they had promised. Finally, policies promoting innovation, entrepreneurship and PPPs were prioritized over the other "enable" policies.

In summary, the policy prioritization exercise revealed the following for user-side policies:

- A readiness to shift to public transport and alternative means, such as walking and cycling, if the proper infrastructures are provided.
- Adaptability to telecommuting and flexible work times as a way of reducing work trips.
- A desire for emphasizing the TOD of neighbourhoods.
- Recognition of the near-term potential of electric vehicle technologies in reducing the environmental footprint of motorized transport, provided financial incentives are made available to reduce their costs.

For provider-side policies, consensus was strongest around the following:

- The need for a national transport strategy and the creation of the necessary regulatory authorities for the transport sector, with capacity-building and funding of these authorities.
- Subsidies for modernizing public bus service with new bus technologies and infrastructure.

10 See UN-Habitat (2020).

7 FUTURE TRENDS FOR SUSTAINABLE TRANSPORT AND MOBILITY

The transport sector is undergoing a major transformation worldwide involving all forms and aspects of mobility at a scale and scope the sector has not experienced in decades, from radical changes in vehicle technologies to new business models for delivering mobility services and moving goods, essentially overthrowing the traditional ways with which people have always used vehicles and public transport systems.

Four major trends are forthcoming: autonomous driving, connectivity of vehicles and systems, electrification of vehicle technologies, and shared mobility (commonly referred to as the "ACES" of future mobility). These trends are motivated by a number of factors, the most prominent of which is a growing focus on sustainability, in addition to the digitalization of industries, which are both changing the way we live and work and how we move in-between. Indeed, the high-tech future of transport is intertwined with the evolution of urban life into smart and sustainable cities, enabling this transition and, in turn, becoming a reality through its realization. After a century of transport powered by polluting oil-based fuels and revolving around the idea of private vehicle ownership and the resultant urban sprawl, mobility is moving to a future where technology is the driver; travel is planned on the spot; and modal choices are cleaner, diversified and integrated, while being available at the commuter's convenience and fingertips.

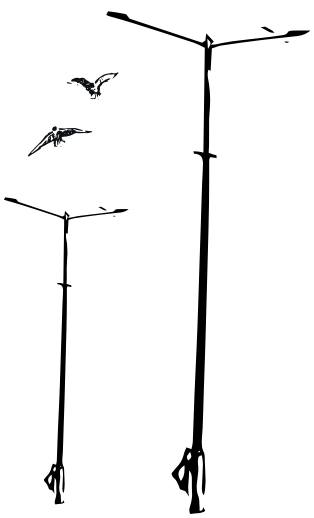
This section presents an overview of the global trends and innovations in the future of transport, as well as the preparations needed to realize them – from infrastructure needs to new regulations and operating models. This includes an overview of ongoing preparations and progress towards that end from some of the leading countries in the Middle East region, as well as the main challenges being faced and the lessons that can be learned from tackling them. The overview and examples included in this section, along with the overview of the current state of challenges facing the transport and mobility sector in Lebanon today in Sections 2 and 3, form the basis for policy formulation to transition the sector to a sustainable future as proposed in the previous sections.

7.1. Global trends towards new and alternative fuels, vehicles and transport modes

The following subsection presents the development of electric vehicles as the technology of choice over the near to medium term for reducing the carbon footprint of road transport. This cleaner technology is expected to power future automated vehicles as well as bicycles and other small mobility devices, discussed further under this subsection. The use of these technologies in shared mobility models is presented in the final subsection.

7.1.1. Vehicle electrification

The sharp rise in the price of oil at the turn of the century, along with the alarming impacts of transport emissions on human health and the environment, motivated a major shift to cleaner alternative fuels and more efficient vehicle technologies. Primary among those innovative fuel-vehicle technologies are electric vehicles, which gained traction in the late 2000s, due to their advanced technology readiness, their relatively affordable costs, and their substantial ability to reduce tailpipe emissions. Figure 18 illustrates the three types of electric vehicle technologies, namely HEVs, PHEVs and BEVs – collectively known as xEVs.[11]



11 HEVs are powered primarily by a conventional ICE, assisted by an electric motor relying on energy from a battery for part of the trip. HEVs do not require charging from the electric grid, since the ICE is capable of charging the battery. PHEVs rely primarily on electric power until the battery is depleted, at which point, the vehicle can switch over to use an ICE. PHEVs typically have a bigger battery that can be charged by an ICE or externally from the electricity grid. BEVs are all electric, so they do not use an ICE, relying completely on an oversized battery pack, which must be charged from the power grid. BEVs are zero-emission vehicles, since they run fully on the electric power stored in the battery. Regenerative braking is available in all electric vehicle technologies and serves to improve their efficiency by recovering energy from braking and using it to help charge the battery.

Figure 18. System comparison of main electric vehicle technologies (xEVs)

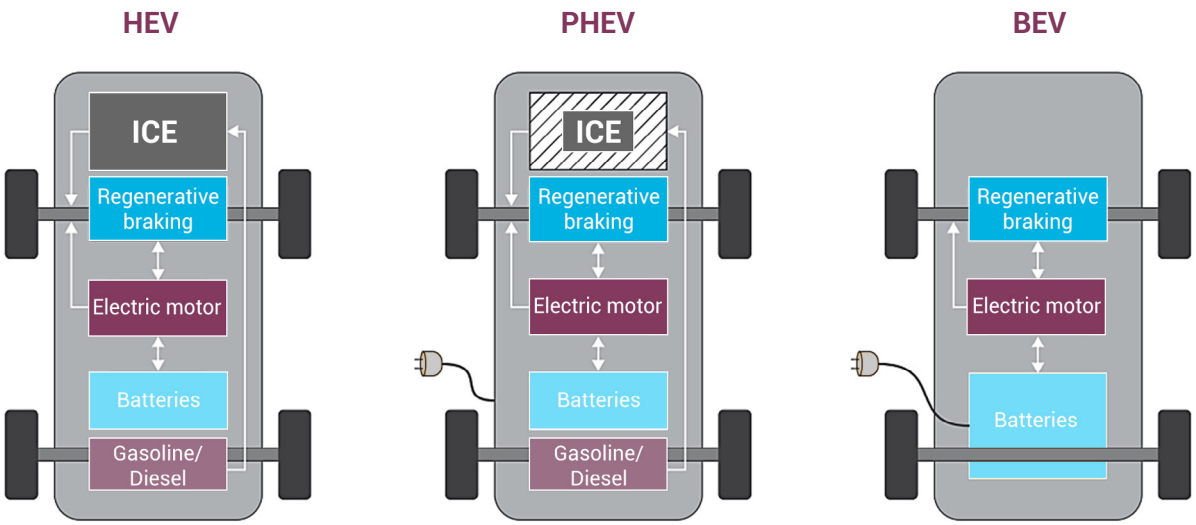


Table 10. Comparison of electric vehicle average savings and surcharges compared to conventional vehicles

Electric vehicle type	Fuel and GHG savings*	Annual operating cost savings*	Purchase price surcharge*	Infrastructure needs
HEV	Moderate	Moderate	Low	None (existing fuel stations)
PHEV	High	Low	Moderate	Network of electric chargers
BEV	100%	High	High	Extensive network of electric chargers

* Current savings are relative to a conventional vehicle; the purchase price is driven mostly by battery cost based on its size.

Table 10 summarizes the average savings (in terms of fuel consumption, emissions and operating costs) of each of the electric vehicle technologies and their current purchase price surcharge relative to a conventional gasoline vehicle.

HEVs are now a core segment of the automotive market, with sales trends continuously increasing as battery costs drop due to innovations in battery technology. BEV sales are expected to rise significantly over the medium term (2030) and dominate vehicle sales by 2050 (IEA, 2020), driven by strong legislation on vehicle emissions and financial incentives to encourage and speed up technology adoption.

But vehicle electrification is not limited to passenger cars alone; indeed, all motorized transport can equally benefit from electric powertrains and the trend is already on the rise for LDVs, buses, heavy-duty trucks and even rail.[12] As a result, cities are struggling to catch up with the provision of the necessary charging infrastructure at residential, roadway and public locations; the additional power supply, distribution and power management systems needed to handle the new demand; and the development of pricing policies to control the load on the power grid in peak times. This requires long-term strategic planning that integrates multimodal transport policies, energy policies and urban planning policies to prepare cities for the impending transformation towards electrification, particularly for the large-scale deployment of BEV technology, where the vehicles cannot rely on a backup gasoline/diesel fuel tank if they run out of battery power. In this case, an

12 Major cities in the United States, China and European countries lead the transition to electric mobility, according to a 2019 E-Mobility Index (Roland Berger, 2019).

extensive and costly infrastructure of electric chargers needs to be implemented in both urban and rural areas to ensure that these vehicles can operate like conventional vehicles without any range restrictions.

7.1.2. Micromobility

Following the same trend of vehicle electrification for conventional transport means, the recent micromobility revolution involves the integration of electric motors in small-size, lightweight and low-speed vehicles to assist in their propulsion and facilitate their use for short urban trips.[13] Therefore, micromobility devices are emerging as a practical alternative to cars in urban areas and a necessary supplement to public transport for the first and last mile of a journey. This is because electric propulsion makes them a viable solution for the majority of inner-city travel, which typically consists of distances below 8 km, which is considered too close to drive but too far to walk. Like conventional motorcycles, they contribute to reducing the number of cars on the road, while providing the ability to navigate through gridlocked traffic and the challenge of finding parking in city centres. Even more noteworthy is the potential ability of these devices to help cities tackle the major challenge of air and noise pollution from road traffic, as they can also serve as a sustainable mitigation approach thanks to their zero-emission footprint.

These added capabilities come however at an additional financial cost, where the 2019 average price of an e-bike in the United States ranges between USD 600 to over USD 8,000 (Evans, 2019). These costs are expected to go down in line with decreasing battery costs, and even further as micromobility achieves economies of scale. Moreover, the cost of renting an e-bike or e-scooter is relatively cost-effective compared to other mobility solutions, ranging from USD 1.25 to USD 3.5 per trip on average, with cities requiring rental companies to offer discounts for low-income residents (NACTO, 2018). For this reason, shared usage is already a key aspect of the micromobility revolution, as discussed below in the Section 7.1.3 on shared mobility. Other challenges facing the user adoption of micromobility devices include their limited usability in bad weather conditions and by the elderly and disabled commuters, the lacking stowage capacity for carrying items, and their vulnerability to theft and vandalism. Most importantly, there is a need for regulating the safe operation and storage of these devices to integrate them effectively into city life, such as controlling their operation and storage on sidewalks for pedestrian safety, as well as creating the needed infrastructure for their safe operation on public streets with dedicated bike lanes that prevent collisions with road vehicle traffic.

The micromobility revolution is still at its early beginnings, especially in terms of its potential for transforming the way people move in and interact with the city environment. The market's growth potential is very promising, according to industry forecasts, estimated to become in the USD 200 billion range in the United States and above the USD 100 billion range in Europe by 2030 (McKinsey, 2019). This expected growth is incentivized by such measures as purchase rebates, subsidy of rental fees, and special access to lanes/roads and riding areas. It is also expected that user adoption of micromobility solutions will make significant strides in the wake of the COVID-19 pandemic and the global economic crisis, since these devices enable social distancing and are readily available and affordable, as further discussed in Section 7.3. Furthermore, new microvehicle designs are expected to reinforce the growing adoption trends in the future, from the smaller portable devices to larger, more comfortable vehicles.

7.1.3. Connected and autonomous vehicles (CAVs)

The arrival of CAVs is expected to redefine the way cities are built and revolutionize transport and mobility in urban contexts. This is because these vehicles rely on advanced automation technologies that will change the way people interact with cars and other transport means, while also bringing new infrastructure to make cities smart. Some of this infrastructure – such as cameras, sensors and

13 Micromobility includes any electric vehicle below 500 kg with a top speed of 25 km per hour, such as electric bikes (known as e-bikes), scooters, skateboards, Segway-type devices and pedal-assisted bicycles (such as a pedelec). Traditional bicycles/tricycles and skateboards can also be considered micromobility, even though they do not benefit from electric power. However, it is really the addition of the electric motor to these two-wheelers that is driving the current micromobility revolution, since it greatly extends the range and usefulness of these devices for inner-city commuting.

network devices – can in turn improve people's quality of life in urban settings through the use of the associated augmented data capabilities for facilitating many daily needs.

CAVs are classified according to their level of operating autonomy, from Level 1 (providing driver assistance in limited situations, such as the automatic park-assist and adaptive cruise control features) to Level 5 (fully self-driven without human interaction, known as AVs or driverless vehicles).[14] These vehicles require a new roadway infrastructure that cities need to start providing in order to prepare for the mass deployment of CAVs, such as the following:

- Advanced on-road telematics: information systems for tracking real-time vehicle location and monitoring vehicle performance, such as speed, mileage and fuel usage. The data is used to ensure the vehicle's safe, reliable and efficient operation.
- Roadside sensors: electronic sensors incorporated into curbs and sidewalks to allow vehicles to keep track of their surroundings.
- Smart signage and lane markings: road signs and lane markings with embedded electronics that can transmit messages that are machine-readable by the vehicle's sensors and computers.
- Communication infrastructure: includes a host of communication technologies, such as Internet-of-Things (IoT) devices, data centres, and mobile networks for exchanging information between vehicles (V2V), with pedestrians (V2P), and with the infrastructure (V2I), as illustrated in Figure 19.

The truly transformative impact on mobility is expected from Level 5 CAVs, which are considered the ultimate future of automobiles and are expected to change the way we use vehicles for mobility away from the traditional model of vehicle ownership towards shared mobility (discussed in the following subsection).[15] However, the large-scale implementation of fully AVs in developed countries is still at least a decade or more away, according to recent technology road maps by industry experts (McKinsey, 2017), at which point, they are expected to contribute to the alleviation of traffic congestion thanks to better manoeuvering and more synchronized (smooth and predictable) operation on narrower driving lanes, and to a substantial reduction in traffic accidents caused by human error.

As a result, these vehicles are expected to have more optimal energy consumption, contributing to a considerable decrease in air pollution and GHG emissions.[16] Most notably, AVs can provide increased mobility for people with disabilities and the elderly, and can eliminate the need to search for parking near one's destination, with the potential ability of moving parking garages out of dense downtown areas to house entire vehicle fleets offsite. This is expected to change the way cities look and people interact with urban spaces, thereby requiring careful planning and preparation in advance (Victoria Transport Policy Institute, 2020).[17]

In all cases, government planning and regulation is a big part of preparing for the future of CAVs, whether in terms of regulating the vehicle's onboard technology to ensure it operates safely and efficiently, or in terms of transport planning for the urban environment where these vehicles will first be deployed at a mass scale (Public Sector Consultants and Center for Automotive Research, 2017). In particular, planning decisions regarding enabling and support infrastructure, such as dedicated lanes and communication facilities, need to be made early on, in addition to planning for parking needs. For the long term, public authorities need to plan for the paradigm shift that CAVs are expected to bring to passenger transport through autonomous

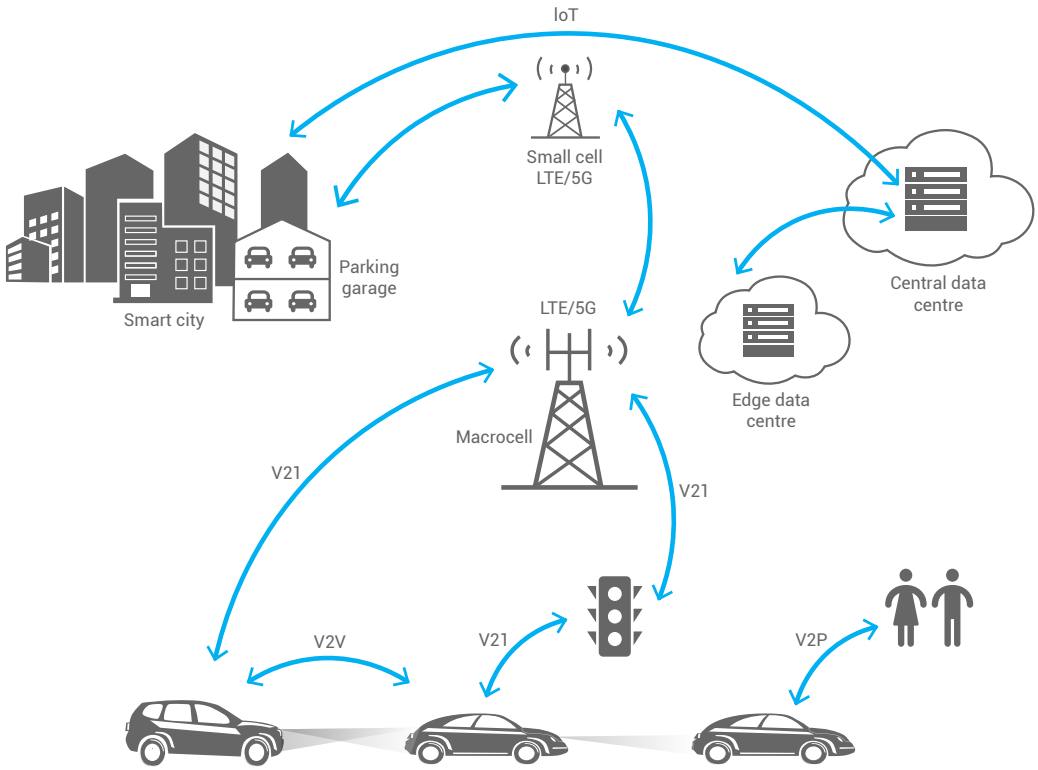
14 Levels in-between are different degrees of connectivity and automation, where the car can handle more functions and manage more situations while still depending on human intervention to varying extents.

15 Level 5 CAVs would rely entirely on their own internal systems to navigate an entire trip without the intervention of a human driver or much assistance from external infrastructure. This means that the vehicle's own systems must be able to drive the car (or bus or even freight truck) safely on all types of roadways, including highways at high speeds, and with the artificial intelligence (AI) needed to make 100 per cent reliable decision-making in non-routine situations, such as recognizing and avoiding obstacles, determining the right of way at unsignalized intersections, or responding to human instructions in an accident scene or on a road construction site.

16 Combined with vehicle electrification, CAVs in general and AVs in particular can significantly improve air quality in urban areas without compromising trip range, thanks to their improved powertrain efficiency.

17 However, it is important to note that there is considerable uncertainty about the actual time frame for commercial readiness of AV technology, as well as about the real potential of this innovation to be a game changer once it achieves mass adoption. But what is fairly certain is that most developing countries are still very far away from being able to adopt this technology and benefit from it in the foreseeable future.

Figure 19. Required communication infrastructure for CAVs



Source: Qorvo (2018)

shared mobility. This will apply not only to car transport but also to public transport, where the integration of AVs with public transit are expected to transform travel by making it possible to carry out trip planning and payment under a unified platform of "Mobility as a Service" (MaaS) (described in Section 7.1.4). Cities will need to redesign mass transit around autonomous bus lines, and regional authorities will need to prepare roadways for the operation of an autonomous BRT system and long-haul freight trucks. New zoning requirements to accommodate autonomous car parking, taxi pick-up/drop-off, bus stops, and loading/unloading zones will also be needed, as well as new travel pricing policies, such as road usage charges for CAVs versus other vehicles. Such transport policies should be developed in accordance with national urban policies to minimize any negative impacts on the urban environment while maximizing the potential benefits of new technologies and mobility models for commuters.

7.1.4. Shared mobility

Shared mobility refers to the shared use of any transport mode through an easy, fast and affordable access model over a limited time period (Chang et al., 2019). An early form of shared mobility was ride-sharing by carpooling to the office with co-workers living nearby or along a common travel route, which earned the benefit of using uncongested carpool lanes, otherwise known as HOV lanes.[18] This is designed to alleviate traffic congestion and air pollution on major thoroughfares during peak weekday hours, but falls way short of the transformative impact of the emerging shared mobility revolution of the future.

Combining new digital technologies with innovative business models, shared mobility today includes ride hailing through the use of mobile applications (also known as e-hailing[19]), where a nearby driver is located

18 HOV lanes are most popular in the United States and Canada, where passenger transport is largely dependent on high-capacity multilane urban motorways, with China being a more recent adopter over the past decade.

19 Ride-hailing companies Uber and Careem have been active in Lebanon since 2014.

quickly and hired on a private or even public ride-sharing basis, much like hailing a taxi from the street but in a quicker, easier-to-pay, more reliable and more affordable way.[20]

Another key aspect of shared mobility is sharing micromobility devices for short trips; it includes bike sharing and scooter sharing, where bicycles/e-bikes/e-scooters can be borrowed or rented on a short-term basis from a docking station, or using a smartphone application under the dockless option.[21] Shared micromobility is currently the fastest-growing means of mobility worldwide, with the total number of trips more than doubling from 2017 to 2018 (NACTO, 2018). This is due to the affordability and added convenience of this service, especially for first- and last-mile transport.

When combined further with autonomous and electric vehicle innovations, shared mobility can reinvent the future of transport away from car ownership towards the use of self-driving taxis (or "robo-taxis"), shared AV rides in passenger cars, and shared mass transit (known as microtransit), which can be privately or publicly operated with multi-passenger shuttles or vans to provide on-demand or fixed-schedule service along dynamic or fixed routing. This is expected to reduce mobility costs, traffic congestion and travel times, particularly on highways and in sprawled regions, and to minimize accidents and tailpipe emissions, while improving convenience and comfort.

Autonomous shared mobility is expected to become a reality in the 2030s and to evolve into a network of integrated services, under the concept of MaaS. MaaS allows commuters to subscribe to an integrated suite of multimodal mobility services available on demand in one package, including next-generation public transport and private vehicles that are automated, connected and electric. Commuters can thus travel by using a single application to book and pay for an entire trip in one go, for example, by e-hailing a ride from home to a public bus station across town, riding the bus to a stop close to the final destination, and then taking a bike share to the final destination. An extension of MaaS is the use of this model to also access the delivery of goods and services on demand.

Shared mobility directly influences and is influenced by most facets of urban planning, in particular:

- Land-use planning to accommodate future shared mobility facilities and services, such as car-share parking, bike-share kiosks, and required communication infrastructure.
- Redesign of curbside areas to accommodate shared mobility services, such as ride-hailing pick-up and drop-off locations that are safe and convenient.
- Rezoning of freed-up roadway and public parking spaces (expected to drop by up to 90 per cent) to shift the focus of cities back to people instead of cars, such as through walking spaces, cycling lanes, and public gathering areas.
- Regulating the use of the public right of way by shared mobility vehicles, such as scooters on sidewalks or fast e-bikes in dedicated bicycle lanes.
- Developing new building codes to enable the installation of slow charger devices for BEVs that conform to international standards.

Some of the main impacts of shared mobility on urban planning are shown in Figure 20.

Finally, operators of shared mobility services will be expected to tackle some of the expected challenges and limitations of this new mobility model, particularly in terms of providing fast and reliable response to incidents related to quality of service in the absence of a driver, or accidents related to vehicle operation.

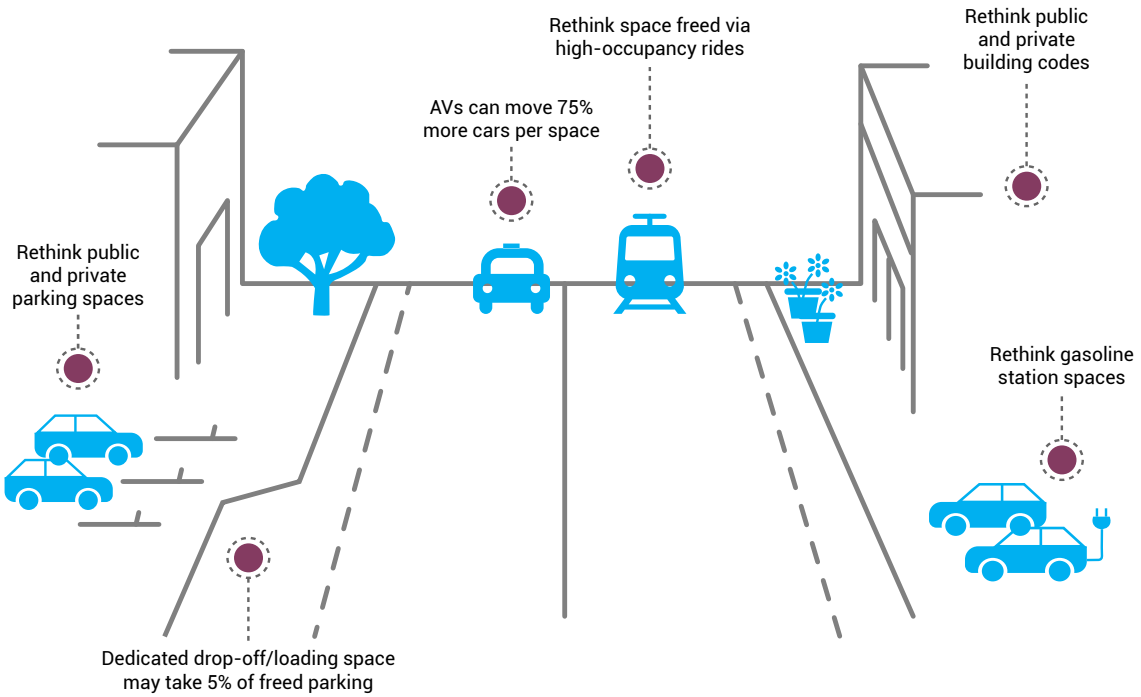
7.2. Regional mobility trends in Middle Eastern countries

The Middle East region has seen a significant increase in the demand for mobility over the past three decades due to GDP and population growth above the world

20 Shared mobility also includes car sharing for long-distance trips, similar but cheaper than a short-term car rental service and without the time-consuming bureaucratic procedures. A car subscription model also exists for longer-term access to a vehicle in return for regular payment, minus the contractual commitments and high costs of traditional car leasing.

21 Mapping applications, such as Google Maps, are already integrating public bike-sharing (PBS) systems into their route planning by showing nearby docking stations with available bikes and scooters.

Figure 20. Space allocation opportunities made possible by shared mobility



Source: Adapted from World Economic Forum (2019)

average, which is being met by substantial investments in road transport infrastructure, especially by the wealthier countries in the region (World Economic Council, 2011). Roadway construction projects remain very active in the developing countries of the Middle East and are increasingly involving the private sector, but there is also a significant increase in bus, light rail and even metro plans and projects in the more developed countries. This shows that most governments are prioritizing transport infrastructure to meet growing demand, with some focusing on sustainable urban mobility to improve access and choices for commuters, as well as clean up the environment in major cities.

BUS UTILIZATION IN BEIRUT IS AMONG THE LOWEST IN THE MIDDLE EAST.

However, several Middle Eastern countries – including Iraq, Lebanon, Palestine, Syria and Yemen – are still struggling with decade-old wars and internal conflicts or instabilities, which have hampered their economic progress and consequently their ability to carry out major transport projects and initiatives. Therefore, the development trends for sustainable mobility in the region are concentrated mostly in the Gulf Cooperation Council (GCC) countries, particularly Saudi Arabia and the United Arab Emirates (UAE), which have made significant strides in transport over the past few years, with plans and preparations in process to integrate the latest technologies, innovations, regulations and best practices related to the sector. Lessons learned from these initiatives are reviewed in the following subsections.

7.2.1. United Arab Emirates

In the UAE, the government set a National Smart Mobility Strategy to "be among [the] world['s] leading countries in smart intermodal mobility" by 2030 by emphasizing safe, efficient and climate-friendly transport means that enrich user happiness. The UAE plans to accomplish these goals by integrating multiple innovations – including CAVs, vehicle electrification, shared mobility and micromobility – under an integrated ecosystem supported by a compatible infrastructure and dynamic policies and regulations (UAE Ministry of Infrastructure Development, 2020). In this way, the national strategy can serve as a guiding framework and impetus for a holistic transition to the future of mobility at all levels.

At the subnational level, each of the UAE's emirates derives strategies and plans within the overarching vision of the national strategy, such as:

- Abu Dhabi's Capital Surface Transport Master Plan, which aims to develop a sustainable integrated transport system by 2030, focusing on regional rail, metro and trams (UAE, 2021a).
- Dubai's Plan 2021, which aims to develop the first "smart and sustainable city" by 2030 by building an integrated and fully connected infrastructure to provide easy access to all social and economic centres and services (UAE, 2021b).

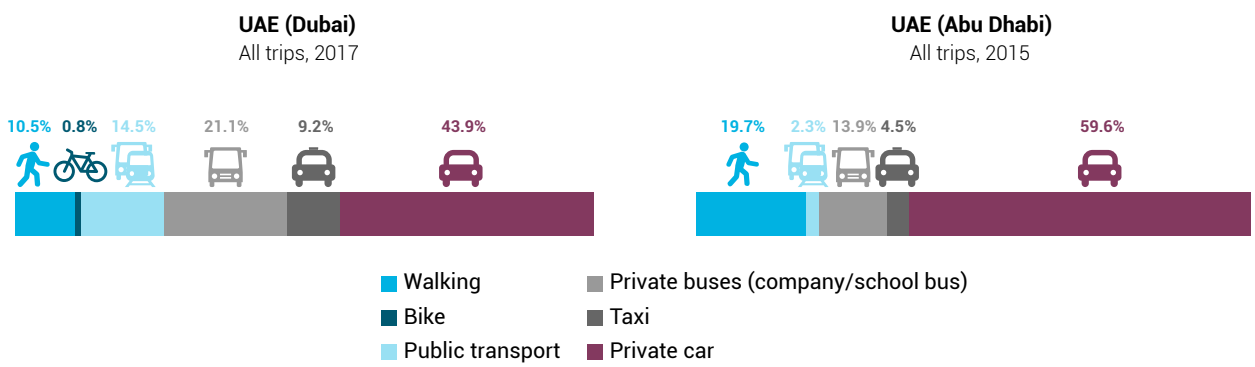
The cities of Dubai and Abu Dhabi are thus routinely incentivized to compete for the latest high-tech innovations in the realm of mobility. Notable examples are Dubai's plans to integrate AVs for completing 25 per cent of all travel journeys within a decade, or to take to the skies to avoid traffic jams on the ground through the implementation of flying taxis (which are autonomous drones capable of carrying one or two people) and sky pods (which are suspended autonomous capsules that move quickly on steel cables). For its part, Abu Dhabi is looking to build on its pioneering experience in sustainable city development with Masdar City launched in 2010. Masdar introduced the first use of electric and autonomous shuttles, buses and personal cars in the region while emphasizing walking, running and cycling by a carefully planned infrastructure, such as the Al Mamsha track with convenient bike-share stations. This experience made it possible to embark in 2018 on the Zayed Smart City Project, moving to use the latest technologies, such as AI and IoT by 2023.

Both cities are also looking to bridge the distance between them with the futuristic Hyperloop high-speed vacuum tube-based train, which can travel at aircraft speeds. But beyond the physical infrastructure projects, the development of sustainable mobility in the UAE benefits from the institutional and regulatory support of an efficient government that is low on bureaucracy, as well as the advances from other key sectors of the national economy, including IT and cybersecurity.

It is true that the UAE, like all oil-rich countries in the Gulf, has the financial resources to embark on ambitious and innovative projects, but there are several important lessons that can be learned from its experience regardless of resource levels. The first is having a clear strategy for the transport sector, at the national and/or subnational levels, that is in line with and supports the objectives of the country's overall vision for the future. This changes transport from a problem that needs to be solved to an enabler that can reinforce the strengths of the country's productive sectors. And when supported by a responsive digital government with streamlined regulations, as is the case in the UAE, this can create a suitable environment for innovations to thrive. The second lesson is, therefore, to establish the right institutional arrangements that can accelerate the development of sustainable mobility and engage the private sector effectively. The latter has a key role in the research and development of the relevant technologies as well as the implementation and operation of mobility systems.

The result of the UAE's continuous planning and improvement strategies is a balanced modal share, as

Figure 21. Modal shares for all trips taken in the UAE cities of Dubai and Abu Dhabi



Source: UITP (2019)

shown in Figure 21 for Dubai and Abu Dhabi, illustrating how the sector can become an enabler for economic growth, social equity, and urban quality of life.

7.2.2. Saudi Arabia

In Saudi Arabia, a new transport strategy emerged in 2016 as part of the kingdom's Vision 2030 initiative; it is designed to turn it into a hub for transport and logistics in the Middle East region, playing to its current strengths of having a well-developed and modern roadway, rail and port infrastructure, and its strategic geographical position at the crossroads of Asia, Europe and Africa. Further motivated by the drop in the price of oil worldwide, Saudi Arabia is starting to develop an economy that is non-oil dependent and is working to expand the scope of cooperation under the GCC common market. This translates into a reliance on the national and regional transport networks for "facilitating a smoother flow of goods, people and capital," as outlined in Vision 2030 (Kingdom of Saudi Arabia, 2016).

To enable these transitions, the Saudi Government is constructing shared road and railway networks to link with other countries in the region, such as the westward GCC Railway Network Project, with plans for an eastern link with Africa through Egypt. It is also increasing investment by the private sector to accomplish projects, including new international partnerships, and launching programmes to support a transition to sustainable transport in urban areas. For example, the Saudi Energy Efficiency Program (2012–2032) is designed to accelerate the replacement of old vehicles with FEVs through the enforcement of efficiency standards and incentive/disincentive schemes. Several national rail projects are planned or ongoing, including the Haramain high-speed rail and the Saudi Arabia Railways (SAR) passenger train.

At the subnational level, the crowded cities of Riyadh and Jeddah have each launched a series of master plans and programmes to execute a variety of infrastructure projects, covering all transport modes. Jeddah's Transportation Master Plan targets the reduction of car dependency and the transition to walkable streets and neighbourhoods, while offering easier access to more transit choices, including public bus, commuter rail and trams; a driverless metro; a water bus system; and BRT. Similarly in Riyadh, the city launched the King Abdulaziz Project for Public Transport (2003–2023) to develop comprehensive solutions to traffic congestion, consisting of an urban roadway network, a public bus network, a driverless metro, a monorail project in the King Abdullah Financial District, and the Riyadh–Dammam high-speed railway (Royal Commission for Riyadh City, n.d.).

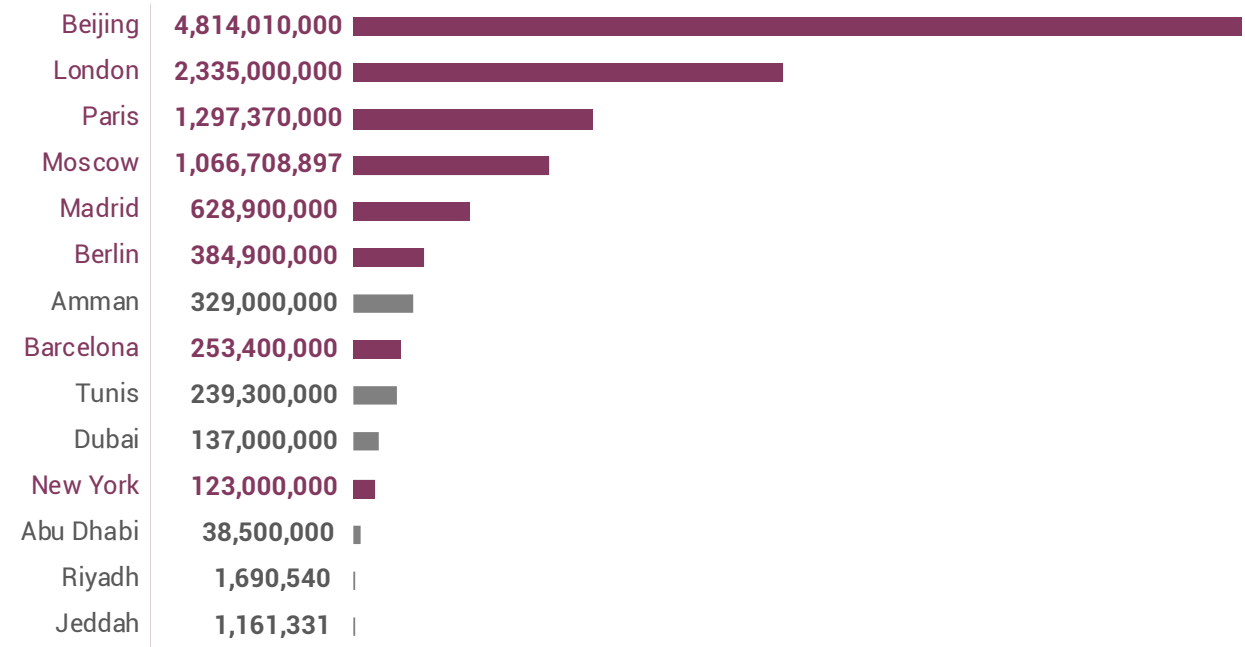
However, despite the availability of a modern infrastructure and the proliferation of mobility choices, major Saudi cities still suffer from high car motorization rates (85 per cent in Riyadh and over 60 per cent in other urban areas), reflecting the need for increased awareness and regulations to change the current car culture and steer towards more sustainable practices.

7.2.3. Jordan

In the Levant countries of the eastern part of the Middle East region, Jordan stands out as the country making headways in transport and mobility, despite its limited financial resources. A concerted effort has been made over the past decade to increase the number of HEVs in order to reduce fuel consumption and emissions from the transport sector. This was done by initially removing customs duties and import taxes on HEVs for a limited period of time starting in 2008, and later reducing these taxes to lower levels than those for conventional vehicles, in addition to incentives for replacing older car models with HEVs.

The success of this strategy in rapidly introducing large numbers of hybrids into Jordan's car fleet made it a stepping stone for the introduction of BEVs at an equally rapid pace under the 2017 National Green Growth Plan (Jordan MoE, 2017). In addition to aggressive incentives, the government launched Tawsileh, a public transport service in Amman using BEVs, and further substituted 300 of its own gasoline cars with Tesla BEVs (El Issa, 2017). Taxi operators came on board, replacing large numbers of their conventional vehicle fleet with hybrids and BEVs. However, the installation of a charging infrastructure still lagged significantly behind demand, with electric car owners having to wait for long hours at the few charging stations available (15 stations in 2017). In addition, awareness about the proper operation of the vehicles and maintenance of the batteries was also said to be lacking. To respond to demand, the government plans to introduce 3,000 charging stations powered by renewable energy by 2025.

Figure 22. Annual bus ridership in selected cities of the world



Note: Only where annual ridership data was available.

Source: Adapted from UITP (2019)

In parallel, the Jordanian capital of Amman ranks at the top of all Middle Eastern cities in terms of annual bus ridership, as shown in Figure 22. However, car use remains preferred by commuters due to the unattractiveness of the current public transport system, which is considered to be inefficient, unreliable and underdeveloped (Friedrich-Ebert-Stiftung, 2019). This is because the majority of the bus fleet is privately owned and does not operate on fixed routes and timetables, making it difficult to reform and improve the overall quality of service.

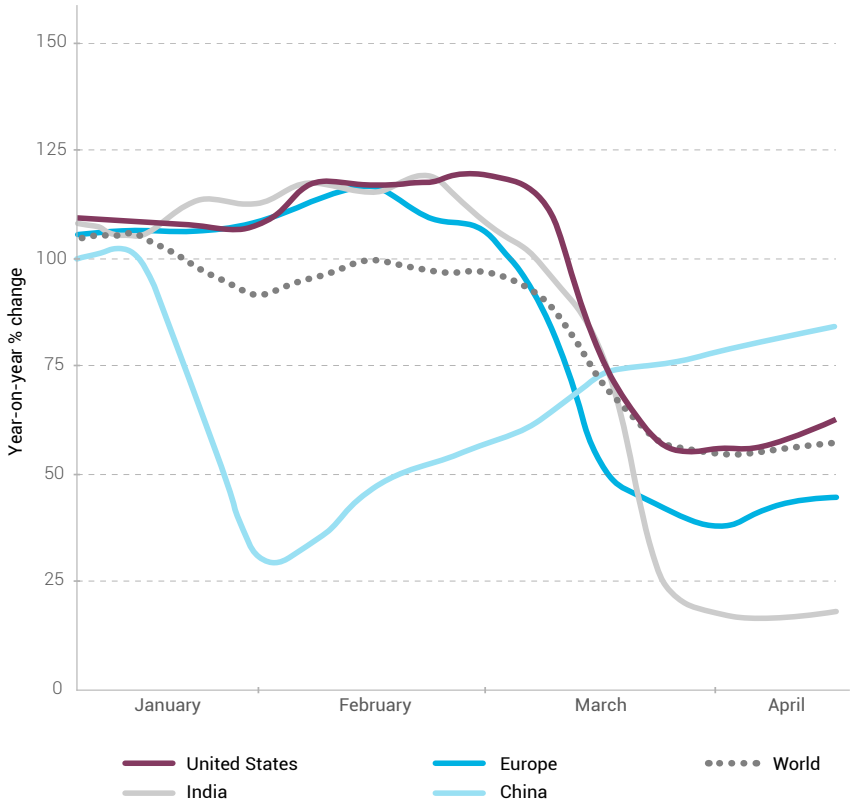
The government's reform of the public transport sector is part of the country's Long-term National Transport Strategy and Action Plan (Jordan Ministry of Transport, 2021), which aims to increase the share of public transport ridership to reach 25 per cent by 2025 and reduce car use in densely populated areas by implementing a national BRT system in the capital Amman and by linking it with the industrial city of Zarqa. Other plans include the introduction of new bus routes in four other cities and the complete restructuring of public transport services from individual operators currently under lifetime licenses to fleet operators selected by competitive tendering. This is expected to improve the provision and quality of services through the acquisition of a new bus fleet and the construction of appropriate maintenance depots, in addition to the implementation of fixed bus routes and schedules.

The main lesson from Jordan's sustainable mobility journey so far is that rapid progress is possible even with limited resources, but that government planning and an efficient bureaucracy are essential for the proper execution of projects and needed reforms. For example, if it were not for years of "unexplained delays" and the disappearance of external GCC funding "possibly reallocated to other projects," Jordan's BRT would now be serving an estimated 142 million passengers every year (Zureiqat, 2018). The country's overall public transport system has been described as "resistant to reform," but efficient governance, combined with a comprehensive national plan for the sector, can eventually secure the right resources and overcome obstacles along the way.

7.3. Mobility trends through the COVID-19 pandemic and global economic crisis

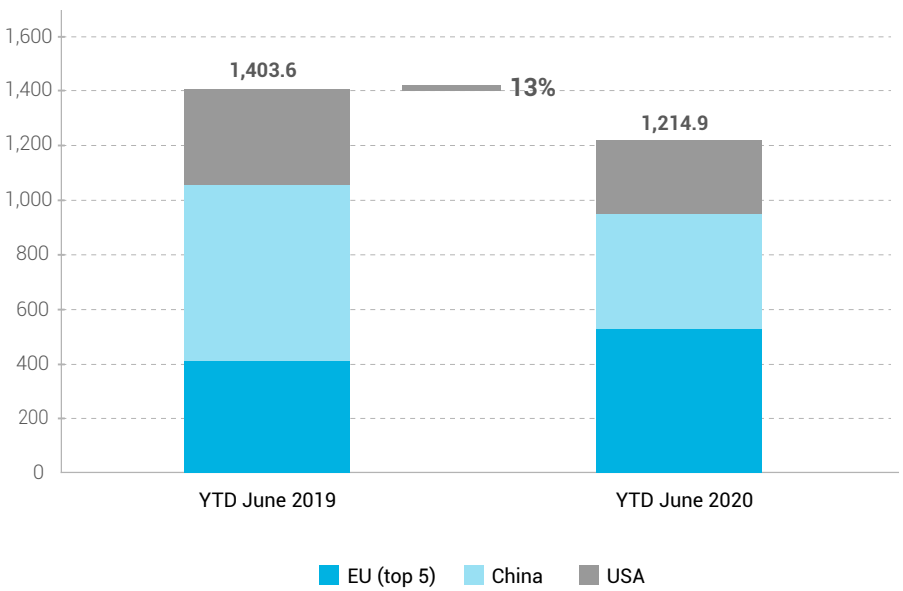
The continuing COVID-19 pandemic and the ensuing global economic crisis have taken their toll on commuters worldwide and the transport sector in

Figure 23. Road transport activity drop after the start of COVID-19 in 2020 relative to 2019



Source: IEA (2020)

Figure 24. Drop in electric vehicle sales after the start of COVID-19 in 2020 relative to 2019 (YTD June 2019 versus YTD June 2020) (in thousand units)



EV = Battery electric + plug-in hybrids + hybrids

Source: Strategy& (2020)

all its modes, particularly on public transport and aviation. Recurring periods of lockdown since March 2020 have disrupted the regular provision of transport services, and new measures of social distancing have hindered the recovery of normal operations and continue to discourage people from using mass transport as before.

Road traffic has fallen drastically in all regions of the world, with the worldwide average road transport activity falling by about 50 per cent during the first few months of the pandemic compared to its 2019 levels (IEA, 2020), as shown in Figure 23.

In line with the pandemic's impacts directly on transport and indirectly on the world economy, the global sales of electric vehicles in the third quarter of 2020 dropped by 13 per cent compared to the same period in the previous year,[22] as shown in Figure 24.

But most hit by the pandemic is public transport, where services had to be suspended in most regions, while other operators were forced to restrict service frequency and vehicle occupancy to a great extent. However, reduced capacity introduces its own challenges, such as increasing queues and wait times for riders, which increase exposure risks and further discourage commuters away from public transit.

The silver lining to this ongoing reality is that urban air quality has improved substantially across the globe, due largely to the reduced emissions of air pollutants from transport. There has also been a significant drop in casualties from road traffic accidents, reaching a 40 per cent reduction of road traffic deaths in France for March 2020 compared to 2019. In many cities around the world, people switched to walking and cycling as a safer form of mobility, where they can control their social distancing with others, and the use of shared micromobility surged to make it the preferred alternative to public transport. For example, shared bike use has doubled in many cities compared to pre-pandemic levels (International Transport Forum, 2020).

THE CONTINUING COVID-19 PANDEMIC AND THE ENSUING GLOBAL ECONOMIC CRISIS HAVE TAKEN THEIR TOLL ON COMMUTERS WORLDWIDE AND THE TRANSPORT SECTOR IN ALL ITS MODES, PARTICULARLY ON PUBLIC TRANSPORT AND AVIATION.

Once the world is able to deal effectively with the health threat of the pandemic, it is unlikely that life will go back to business as usual, especially in the transport sector.[23] Several mitigation measures should be considered, primary of which is how to maintain increasing user adoption of alternative mobility means and to avoid the reverting back to cars as a familiar choice and a safe exit strategy from social exposure. For example, cities can implement a portfolio of the measures summarized below, concurrently or in phases, with some as short-term temporary solutions and others as first steps for future permanent plans:

- Incentivize shared micromobility operators by easing taxes and regulations, and providing emergency infrastructure quickly to encourage safe walking and cycling (for example, bicycle lanes separated from traffic with construction separators and temporary lane markings while reducing maximum traffic speeds and implementing traffic-calming measures).
- Incentivize users to purchase micromobility devices or subscribe to shared micromobility services over an initial limited time period until user adoption reaches a critical mass.
- Reallocate sidewalk spaces to allow for physically spaced walking and cycling by reclaiming street spaces from travel lanes and car parking while restricting car access to central business districts, and readjust the timing of traffic lights to favour pedestrians, scooterists and cyclists.
- Incentivize the use of mass transit by reducing costs while improving the implementation and monitoring of safety measures and integrating

22 Total sales of PHEVs continued their rise, with an increase of +121 per cent in the top markets of the European Union (EU), namely France, Germany, Italy and Spain, in addition to the United Kingdom (Strategy&, 2020).

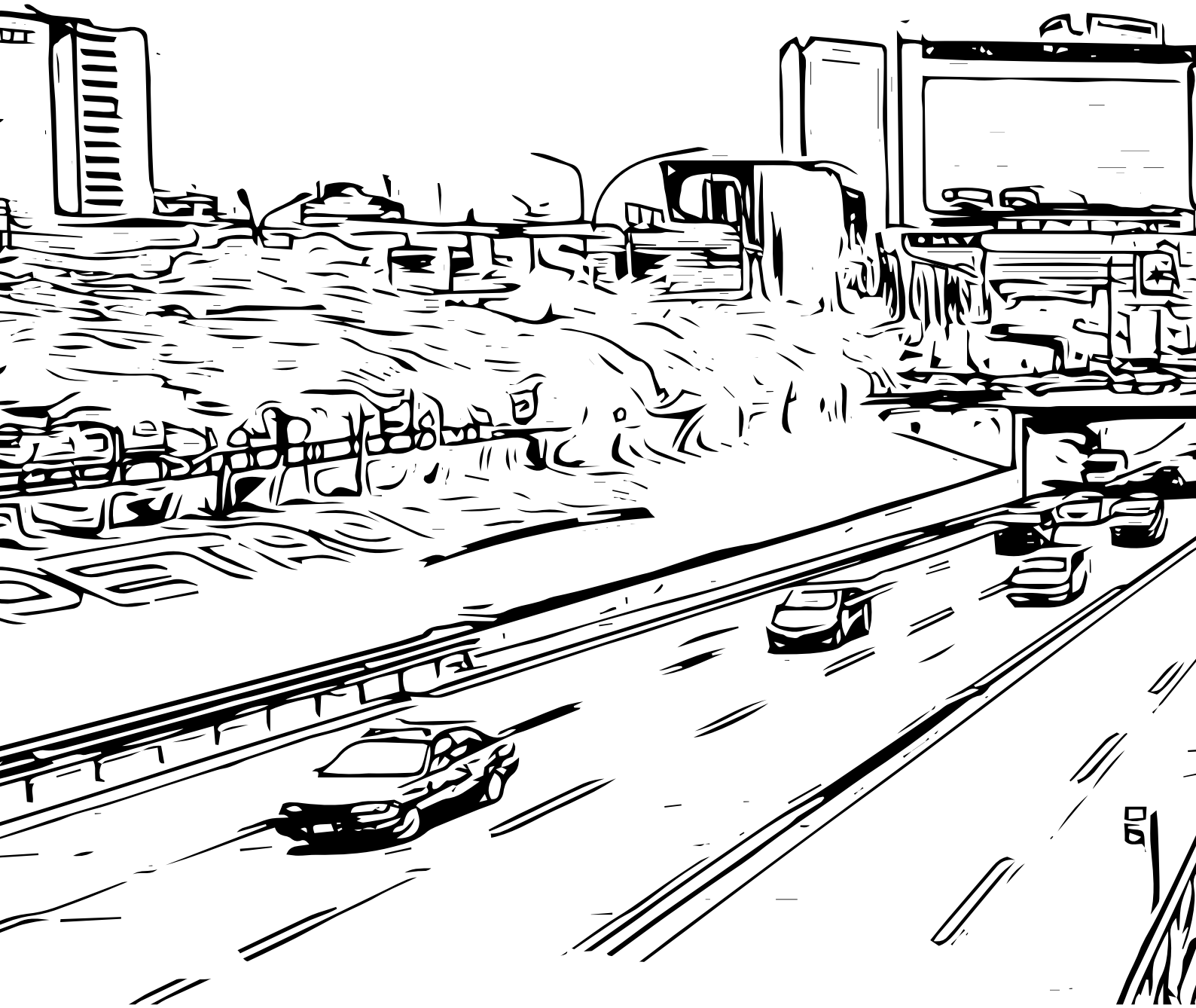
23 People's concerns about maintaining social distancing on public transport are expected to continue even beyond the end of the pandemic, which raises several uncertainties about the recovery of public transit in the long term.

technologies to improve ridership comfort, with a focus on maintaining public transport as the preferred urban mobility solution.

- Allocate temporary priority lanes and other expediting measures for freight movement and delivery of goods as needed, especially in crisis mode.
- Accelerate the preparation for future shared mobility and the smart integration of AVs with digital technologies.

The role and mandate of transport agencies has been strengthened by the pandemic (OECD, 2020), which can be used to enhance their ability to coordinate efficiently with other agencies, such as security and health agencies, in order to quickly implement required emergency measures in the transport system.[24] All future scenarios previously considered far-fetched should be explored by government and transport authorities, most notably those related to maintaining remote working or flexible working hours to reduce or manage work commutes where feasible. The financial stimulus packages budgeted by governments for COVID-19 could be used as a ready tool to embark on the journey for transforming work, greening cities and preparing for futuristic transport technologies, including for delivery of goods by drones and small robots already available.

24 For example, tactical urbanism measures, such as emergency cycling lanes, should be deployed with less bureaucratic delays in crisis situations. Transport agencies should also enhance their monitoring capabilities, such as respecting social distancing on buses or restricting car travel to alternate days based on license plate number, in order to restore public trust in the safety of mass transit and to maintain the gains achieved from reduced car travel.



8 CONCLUSION

Since its initiation in 2017, Lebanon's NUP programme for managing rapid urbanization in the country has completed the first two of its five phases, namely the feasibility and diagnosis phases. In the latter phase, the project identified the transport sector as one of two sectoral priorities (along with housing[25]) for mainstreaming into a future NUP's third phase on policy formulation. This is because the transport sector in Lebanon has been left to emerge in a largely unplanned way for decades now, reactively keeping up with increasing demand for mobility with an almost exclusive focus on roadway construction. The result is an overreliance on passenger cars for transport, which has come at the expense of urban space and has contributed to a deterioration of the environment, human health and the overall quality of life in Lebanese cities.

Leading into the NUP's policy formulation phase, an evaluation of transport and mobility policy options, concurrently with relevant urban land-use planning options, is mandated in order to formulate appropriate policies that can guide the sustainable development of the transport system for better mobility and use of urban space, especially that transport and urban form are closely interlinked in a mutually influential way (UN-Habitat Lebanon, 2021b). Stakeholder participation in the process was ensured by inviting representatives from a range of relevant entities (including national and local government authorities, the private sector, academia and CSOs) to two orientation sessions (held in November and December 2020) aimed to equip stakeholders with the necessary understanding of the NUP and to achieve their active participation in the process through discussions, feedback solicitation and a policy prioritization exercise using online surveys.

As a result of this process, this guide, aimed primarily at policymakers and decision-makers in transport and urban planning spheres, provides a set of policy recommendations for the Lebanese transport sector, structured under the commonly adopted EASI policy formulation framework for sustainable transport and mobility. "Enable" policies are meant to prepare the appropriate governance environment necessary for supporting the implementation of the "avoid," "shift" and "improve" policies. "Avoid" policies aim to reduce the need for motorized travel through concurrent land-use and transport planning and TDM. "Shift" policies aim to increase the modal shares of public transport and alternative transport means, such as walking and cycling. "Improve" policies aim to improve the efficiency of transport modes while minimizing their environmental footprint.

Drawing on a review of the challenges facing the transport sector in Lebanon, the results of local case studies for addressing these challenges, and the lessons learned from successful regional and global experiences in transport and mobility planning, the following primary areas for policy intervention were identified:

- Institutional and regulatory frameworks
- Public transport and non-motorized transport infrastructures
- New transport technologies and service models
- Mobility-oriented urban development
- Vehicle fuel infrastructures

A set of complementary EASI policies was formulated addressing the above areas, tailored to the Lebanese case in a way to respond to the identified challenges and needs, with clear goals and objectives that ensure each policy is implementable. Notably, it was argued that a national strategy for sustainable transport is a critical element for an effective transition to sustainable mobility. Such a strategy should necessarily encompass a portfolio of the policies proposed in this guide, involving infrastructure development, mitigation actions, incentives and disincentives, awareness-raising and other instruments described in the guide.

Implementing these policies will require overcoming barriers to change, namely:

- Lack of political will
- Lack of data
- Lack of transparency
- Limited government resources at the national and city levels
- Lack of inclusion of vulnerable groups
- Deeply ingrained behaviours and practices

25 For more information, see UN-Habitat Lebanon (2021c).

In light of the current political and economic crisis facing the country with widespread public demands for government reforms, and given the strong involvement of civil society in awareness-raising and capacity-building activities, there is an urgent need for creating a transparent process for citizen participation in urban transport planning. This can help improve the outcomes of the planning process, as well as ensure support in overcoming barriers to change.

Finally, to ensure the successful implementation of the proposed policy recommendations, guidance for the selection of monitoring and evaluation indicators were considered as part of a framework in the form of preliminary studies, policy mechanisms and implementation milestones.

Appendix 1 Survey instruments for policy prioritization

Assessment criteria for the survey instrument used in the policy prioritization exercise were selected based on their suitability for measuring the impact of proposed EASI policies in meeting the set objectives. The set objectives are the following: reducing motorized travel in favour of modern future trends of sustainable mobility and smart cities while maximizing the social, environmental and economic development benefits of the transport sector.

Two survey instruments were developed for the proposed EASI policies: the first one, presented in Table 11, was administered to users of the Lebanese road transport sector and covered the proposed ASI policies; and the second one, presented in Table 12, was administered to stakeholders in the public sector, covering the proposed "enable" policies.

Table 11. Survey instrument to prioritize user-side policies

Criteria	Better vehicle technologies	Better bus service	Shared bikes, e-scooters	Telecommuting, flexible work times	Carpooling, park-and-ride facilities	Odd-even car days, car bans	Pedestrian spaces	Tightening of urban zoning laws	Revival of rail for people, goods
Consistency with local context:									
Is feasible in the near to medium term									
Reduces COVID-19 risks									
Reduces the burden of the economic crisis									
Mobility effectiveness:									
Reduces travel time									
Reduces trip length									
Improves accessibility for vulnerable groups									
Improves quality of service									
Improves transport reliability (in wet weather and peak times)									
Environmental effectiveness:									
Reduces GHG emissions									
Improves air quality									
Socioeconomic effectiveness:									
Reduces transport costs									
Improves urban spatial quality									
Enables the use of urban space by people									
Improves urban quality of life									
Scoring values: The scoring numeric values are from 0 to 5, where 0 is not relevant/no impact and 5 is highly relevant/highest impact.									

Table 12. Survey Instrument to prioritize provider-side policies

Criteria	National transport strategy	Regulatory transport authority	Citizen participation in planning	Ecosystem for innovation and entrepreneurs	Centre for transport statistics	Capacity-building for the MoPWT	Integration of a technical team supported by the United Nations in the MoPWT	Public–private partnerships	Subsidies for new bus technology, infrastructure
Consistency with national context and plans:									
Is relevant to existing national plans and needs									
Is feasible in the near to medium term									
Technical effectiveness:									
Improves mode choice									
Improves accessibility for vulnerable groups									
Improves quality of service									
Encourages sector development									
Environmental effectiveness:									
Reduces GHG emissions									
Improves air quality									
Institutional effectiveness:									
Improves sector governance									
Improves project funding									
Improves transparency									
Socioeconomic benefits:									
Reduces transport costs									
Improves urban spatial quality									
Enables the use of urban space by people									
Improves urban quality of life									
Scoring values: The scoring numeric values are from 0 to 5, where 0 is not relevant/no impact and 5 is highly relevant/highest impact.									

Values, ranging from 0 to 5, are determined as follows:

5: Highest relevance/highest impact
3: Highly relevant/ high impact
4: Relevant/moderate impact
2: Less relevant/less impact
1: Least relevant/least impact
0: Not relevant/no impact

The definition of each of the assessment criteria for both user-side and provider-side policies is presented in Tables 13 and 14:

Table 13. Definition of assessment criteria in the survey instrument for user-side policies' prioritization

User-side policies		
	Criteria	**Definition**
Consistency with national context	Is feasible in the near to medium term	The policy is feasible in the short to medium term.
	Reduces COVID-19 risks	The policy helps to mitigate the risks of the global COVID-19 pandemic, such as by enabling social distancing.
	Reduces the burden of the economic crisis	The policy helps to mitigate the financial burdens of the economic crisis in Lebanon, such as by enabling more affordable public transport.
Mobility effectiveness	Reduces travel time	The policy reduces the time it takes to complete trips, such as by reducing traffic congestion.
	Reduces trip length	The policy reduces trip distances, such as by reducing urban sprawl.
	Improves accessibility for vulnerable groups	The policy helps the elderly, people with disabilities, and other vulnerable groups to access and use transport services.
	Improves quality of service	The policy improves user experience and trip quality in terms of increased comfort, trip connectivity, and travel safety.
	Improves transport reliability (in wet weather and peak times)	The policy helps to provide commuters with mobility means they can rely on in normal and challenging conditions.
Environmental effectiveness	Reduces GHG emissions	The policy helps reduce GHG emissions from transport, which affect climate change.
	Improves air quality	The policy helps reduce pollutant emissions from transport, which are harmful to human health.
Socioeconomic effectiveness	Reduces transport costs	The policy makes transport more affordable.
	Improves urban spatial quality	The policy increases the attractiveness and usability of urban layout for residents and commuters.
	Enables the use of urban space by people	The policy helps to reclaim urban space from cars for the benefit of residents and commuters.
	Improves urban quality of life	The policy helps to provide a pleasant experience of living and commuting in urban settings.

Table 14. Definition of assessment criteria in the survey instrument for provider-side policies' prioritization

Provider-side policies		
	Criteria	**Definition**
Consistency with national context and plans	Is relevant to existing national plans and needs	The policy supports the national needs for reducing motorized transport and improving mobility, and is aligned with national urban and transport plans.
	Is feasible in the near to medium term	The policy is feasible in the short to medium term.
Technical effectiveness	Improves mode choice	The policy helps to provide commuters with more transport options that are easily accessible.
	Improves accessibility for vulnerable groups	The policy helps the elderly, people with disabilities, and other vulnerable groups to access and use transport services.
	Improves quality of service	The policy improves user experience and trip quality in terms of increased comfort, trip connectivity, and travel safety.
	Encourages sector development	The policy helps to promote the sustainable development of the transport sector.
Institutional effectiveness	Improves transport governance	The policy helps to increase the efficiency and effectiveness of public sector transport agencies, such as by streamlining administrative procedures, reducing project delays, and implementing regulations, etc.
	Improves project funding	The policy helps to secure international and private sector financing for transport projects.
	Improves transparency	The policy reduces corruption and political gridlock in transport projects through transparency measures, such as financial auditing of projects, independent tendering processes, etc.
Environmental effectiveness	Reduces GHG emissions	The policy helps reduce GHG emissions from transport, which affect climate change.
	Improves air quality	The policy helps reduce pollutant emissions from transport, which are harmful to human health.
Socioeconomic benefits	Reduces transport costs	The policy makes transport more affordable.
	Improves urban spatial quality	The policy increases the attractiveness and usability of urban layout for residents and commuters.
	Enables the use of urban space by people	The policy helps to reclaim urban space from cars for the benefit of residents and commuters.
	Improves urban quality of life	The policy helps to provide a pleasant experience of living and commuting in urban settings.

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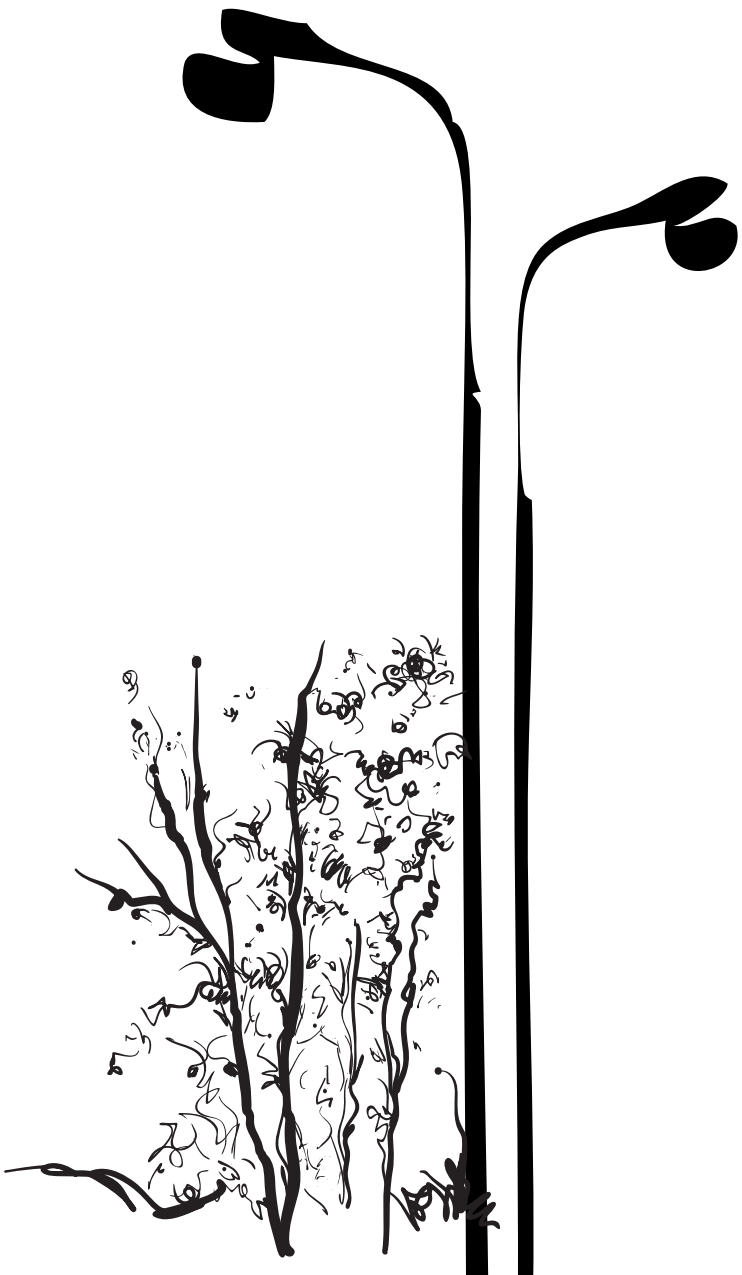

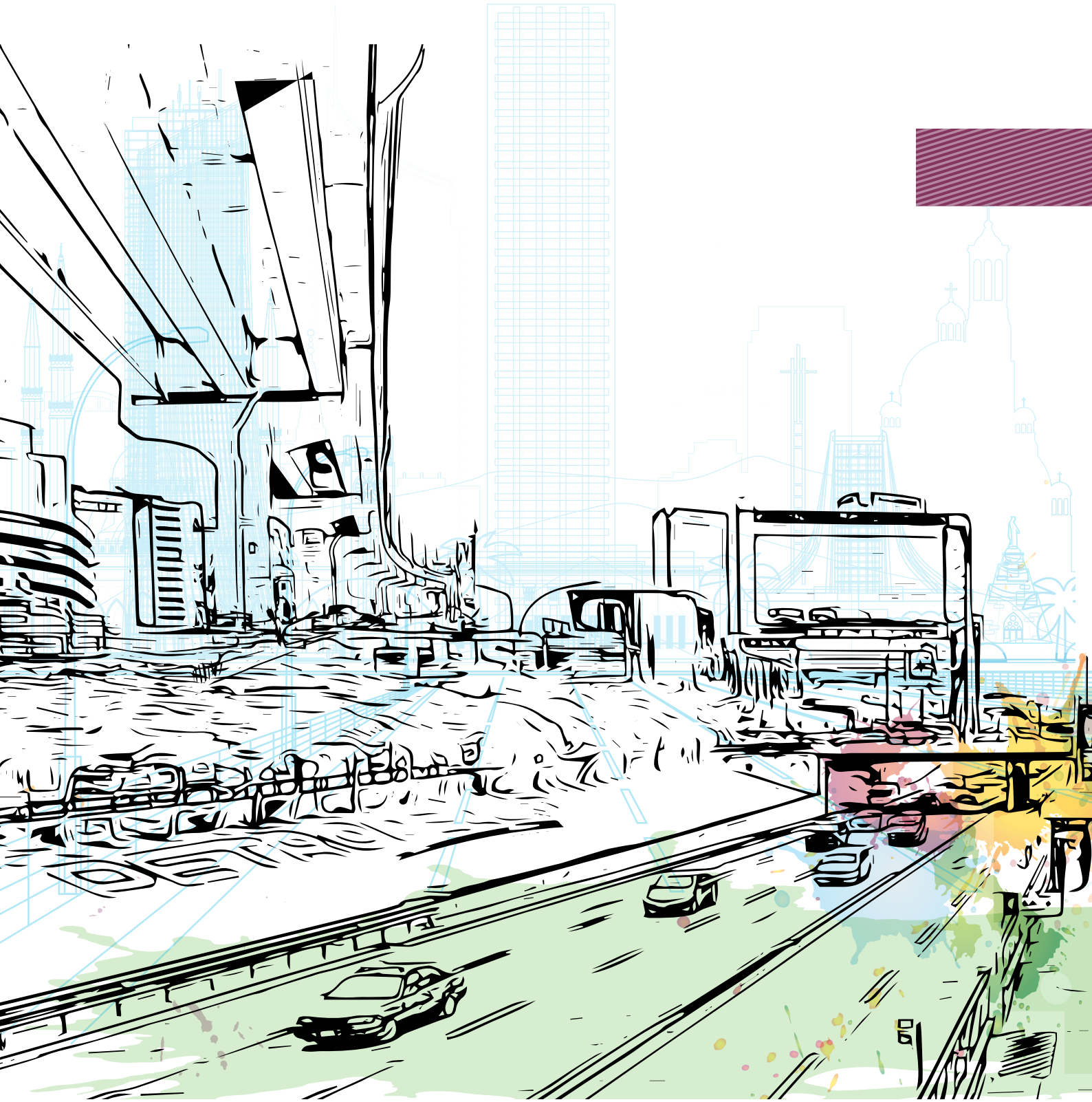

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