NEW MOBILITY & ROAD INFRASTRUCTURE

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INTRODUCTION

SUMMARY

EXECUTIVE SUMMARY

The transport sector today is undergoing profound changes, particularly in the area of mobility. The world's population continues to grow[1], as does its urban share. 75% of Europeans now live in urban areas[2]. This situation implies a concentration of the movement of goods and people and poses challenges to the transport sector, particularly the road infrastructure sector. Road transport accounts for more than three-quarters of inland passenger transport and more than 70% of inland goods transport in Europe.

The transport sector must now give priority in meeting the objectives to fight against climate change, given that the sector accounts for a large proportion of greenhouse gas emissions, a proportion which is itself largely attributable to road transport. Limiting temperature rises in accordance with the Paris Agreement remains essential and is based on the rapid and downward trend in greenhouse gas emissions.

In order to fight mainly against congestion problems in many urban centres around the world, new actors have emerged and are experimenting with innovative tools and systems. These concern traffic management, interaction and connectivity between the different actors on the road, and they are in full expansion. The objective is to make road traffic more fluid and to combat the various forms of pollution generated: air pollution in the first place, but also noise and visual pollution. These new tools are also seen as an additional guarantee in terms of road safety, which remains a priority. In this context, automation and vehicle connectivity in the broadest sense are also being developed.

As a result, mobility has been undergoing major changes for several years: development of less polluting vehicles, alternatives to the individual vehicle in urban areas (self-service bicycles, free-floating machines, car-sharing), integration of different modes of transport via digital technologies such as Mobility-as-a-Service (MaaS). The trend is towards shared, inclusive mobility that is less and less centered around the individual car. The notion of "mobility" includes a service dimension that is more important than that of "transport", which merely refers to the means or the capacity to travel.

Roads are no exception to this trend. They should now be capable of allowing several forms of mobility (soft and active mobility, electric, thermal and also autonomous mobility) to coexist. This is particularly true in urban areas. Accessibility of mobility is an issue that runs parallel to the many innovations in cities, when a large part of the population has little or no alternative to the private car, and can only rely on the road infrastructure to ensure their journeys and social contacts. The other challenge of mobility is therefore its inclusiveness for the whole population, whether urban, peri-urban or rural.

A state of the art has been drawn up within this publication at the global level on the evolution of mobility and the national or regional strategies proposed. Trends have been observed and a comparative analysis has been made in order to determine what role road infrastructure and its equipment's will play with regards to these increasingly rapid changes. Roads remain a central element of mobility and it is essential that they be integrated into its evolution.

This study is also an opportunity to suggest orientations and a framework of action to the road infrastructure stakeholders in order to meet the challenges that the road infrastructure sector will face in the coming years.

1 / United Nations Population Fund: World population trends. Accessed April 24, 2020.
2 / The World Bank Group: Urban population (% of total population). World Bank Data. Accessed April 24, 2020.

ACKNOWLEDGMENTS

This benchmark study has benefited from the valuable contribution of many organisations: **Business France**, **the International Department of the French Ministry of Transport**, the **World Road Association (PIARC)**, **IFSTTAR**, which has since become the **Gustave Eiffel University**, and the support of many correspondents within the embassy networks, **France Stratégie**, and representatives of international road and road equipment companies. It has relied on the contributions of these actors, which have made this report possible.

We would like to thank them warmly.

We also welcome the interest shown by the **ITF** and the **French PIARC Committee** by providing us with their feedback and recommendations.

FOREWORD

In February 2019, Routes de France signed the new Strategic Sector Contract (CSF) "Industries for Construction" which was signed between the French Government and representatives of the road and construction sectors within the framework of the National Council of Industry, on the topic "Designing roads to meet the multifunctionality of uses and services".

The CSF includes a benchmarking section whose objective is to understand the evolution of mobility uses and their consequences on the road infrastructure and its equipment, by reporting on the state of the art, given experiments and pilots at the European and international level.

In this context, Routes de France, the European Union Road Federation (ERF) and the French Federation for Public Works (FNTP), in collaboration with the Confederation of International Contractors' Associations (CICA) and the European Construction Industry Federation (FIEC) launched an international benchmark in March 2019.

A steering committee representing these organisations was created, whose members are:

François CHAIGNON, President of the Section des Fabricants d'Emulsions Routières de Bitume (SFERB) at Routes de France and Member of the Executive Committee (ERF)

Jean-Baptiste DE PREMARE, General Delegate (Routes of France)

Nicolas GAUBERT, Deputy Director for European Affairs (FNTP) and rapporteur of the Infrastructure Working Group (FIEC)

Simon GIANORDOLI, Project Manager (Routes de France/ERF)

Christine LEROY, Director of Technical Affairs (Routes de France)

Christophe NICODÈME, General Director (ERF)

Jean-Claude ROFFÉ, ERF Ambassador (ERF)

Amélie SCHÄFER, Policy Officer for European and International Affairs (FNTP/CICA)

This report was produced jointly by this committee, under the chairmanship of Jean-Baptiste de Prémare. The members carried out continuous quality control of the report by means of counterchecks.

COVID-19 SITUATION

The information and analyses contained in the document consider information compiled between March 2019 and March 2020. They do not take into account developments related to the global SARS-CoV-2 coronavirus pandemic declared on 11 March 2020 by the World Health Organisation (WHO).

This benchmark will be pursued in a second phase until spring 2021. It will be more focused on European countries and will consider the developments induced by the SaRS-Cov-2 crisis on mobility and road infrastructure.

MOTIVATION & OBJECTIVES

This international benchmark presents an overview of the progress and integration of new mobility in the countries and regions which were studied, looking for potential impacts on road infrastructure and its equipment. The relation between new mobility and road infrastructure is at the heart of this study. It aims to identify trends among the road infrastructure stakeholders and provide food for thought on the current and future role of road infrastructure in the development and evolution of new mobility. In this study, new mobility is referring to autonomous and connected mobility, decarbonised mobility and urban mobility.

Three main objectives can be identified:

1 / Imagine the evolution of mobility in 2030 with all stakeholders: street and road users, project owners (network managers) and operators of mobility services. The aim is to reach a consensus or identify disagreements and conflicts on the changes expected in 2030 concerning uses, services, tools, databases, and the contribution of road infrastructure and its equipment;

2 / Identify the expectations of road authorities, engineers, and users regarding future infrastructure at various territorial and regional levels. These expectations are far from being homogeneous;

3 / Prefigure new forms of partnerships and alliances (ecosystem change).

THE ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT IN THE FUTURE

Firstly, we assume that road infrastructure is at the heart of the development of new mobility. Whatever its nature, be it urban, electric, or autonomous, it will rely on road infrastructure and its equipment to operate efficiently.

As a result, the traditional role of roads will certainly be subject to major changes. Changing expectations and needs in terms of mobility will increase the demands on road infrastructure and lead to a transfer of new competences to road authorities, as well as the development of new partnerships with the private sector.

Infrastructure managers will no longer be considered only as providers of a transport mode, but also as providers and managers of mobility.

Regarding the function of the road infrastructure, it will evolve from a patrimonial approach to a service based approach. Managers will have to be able to meet the technical and energy needs of new vehicles through the provision of a connected and digital road, an ability to exploit the data produced and transmitted, and to regulate traffic more effectively.

A general increase in the role of road infrastructure is expected. It will have to be able to offer multiple support to different modes of transport: intelligent, ecological, safe, adaptable and personalised. A redistribution and a new organisation of road space will be necessary to allow shared mobility, where the road will play a role of a multimodal platform, a fluid and flexible transfer point. In urban environments that are often very dense, the road could participate in inventing new functions for the public space.

THE PARTICIPATION OF THE ROAD INFRASTRUCTURE SECTOR IN THE DESIGN OF NEW FORMS OF MOBILITY

However, the growing role of road infrastructure is not yet considered obvious. Indeed, the development of new forms of mobility often tends to focus on the automotive industry and telecommunication services, sometimes neglecting the fundamental role that the existing road infrastructure already plays. This benchmark is also intended to remind us that the road is and must be at the heart of the reflection, development, and realisation of new mobility services.

To this end, road stakeholders must be aware of the perception of new mobility and its implementation in the short, medium, and long term in their country but also in neighbouring ones. This study aims to assess through different items the practical integration of the new mobility (level of involvement of public authorities, economic ecosystem, role of the industry, social acceptability of users, technological choices, etc.). This assessment allows for national and regional trends to be observed and a comparative approach to be identified.

IN BRIEF

From this state of the art, this benchmark is intended to provide road stakeholders, public decision-makers, mobility operators and users with food for thought and orientations on the key role that road infrastructure and its facilities play in the design of tomorrow's mobility. This work should raise awareness among road stakeholders as well, to know how they can be further involved in the design and shape of new forms of mobility.

METHODOLOGY

This benchmark was conducted between March 2019 and March 2020. Initial preliminary results were presented at the 26th World Road Congress in Abu Dhabi in October 2019.

The countries included in this benchmark were selected on the basis of the interest shown by the Steering Committee and on the basis of existing contact networks. The countries selected are as follows:

- European countries: Austria, Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom;
- Asian countries: China, Japan, Republic of Korea;
- North American countries: Canada, United States.
- Latin American countries: Argentina, Chile, Mexico;
- African countries: South Africa.

A dedicated approach on the European Union has also been retained, given the importance of EU regulations and legislations for its Member States, many of which are referred to in this benchmark.

A qualitative approach in form of questionnaires has been adopted to identify underlying trends among, mainly, road infrastructure stakeholders.

Two questionnaires were drawn up, one targeting the public and academic sector, the other targeting the private sector. A particular contribution of the Business France network is to be appreciated. Business France provided contact information to dedicated advisors in the selected countries. The questionnaires are available in the appendix.

The questionnaires were divided into two parts:

1 / General questions on the role of road infrastructure, its economic environment, and its main actors.

2 / Questions on the role and place of road infrastructure and its equipment in the development of 3 mobility categories: autonomous and connected, decarbonised and electric, and urban, active and soft mobility.

These questionnaires were completed in writing or through telephone meetings. A summary version was sometimes sent to correspondents who lacked the time to complete it. The information received for each country was supplemented by a literature research carried out by the authors.

The interviewees were road administrations, national Ministries in charge of transport and infrastructure issues, research centres and universities, professional associations, and private companies.

All the information gathered led to the development of **a profile for each country**. This profile is based on the 3 forms of mobility (autonomous and connected, decarbonized, electric and urban) and the information obtained is divided into 7 items that were defined by the authors:

Autonomous & connected mobility	Urban, active & soft mobility	Decarbonised & electric mobility
Main issues		
Level of maturity		
Ecosystem and Governance		
Technological choices		
Role of road infrastructure and its equipment		
General access to mobility		
The challenge of data and its control		
Economic and financing model		

Each profile was then supplemented with general and statistical information:

Political Organisation	Economic Indicators	Road infrastructure
Nature of the regime	GDP and ranking level	Quality of road infrastructure
Head of State	GDP growth	Total expenditure on road infrastructure
Head of Government	Structure of the economy (share in GDP of the primary, industrial and tertiary sectors)	Road density (kilometres of road per 100 square kilometres)
	Population of the country	Length of the road network by road categories (motorways, secondary roads, other roads)
	Share of urban population	
	Energy supply by source	

The comparative analysis is based on these country profiles.

Based on the established country profiles, **regional focuses** were then drawn up, as syntheses of the main trends in the countries studied in the same geographical area. The regional focuses cover North America, Latin America, Asia, and Europe. These focuses served as basis for the comparative analysis between the four regions. As far as the African continent is concerned, the data collected, and the feedback received are exclusively from South Africa. The results are presented as a specific overview, but do not provide a synthesis of the continent. Nevertheless, the findings have contributed to the comparative analysis.

These focuses are followed by a **quantitative approach**, which is a brief statistical approach, to enhance the reader's understanding and put into perspective the qualitative findings and responses.

A comparative analysis follows. It includes a comparison between European countries on the different forms of mobility studied and is followed by a comparison of these Europe countries with the other regional focuses. The objective is to deduce lessons learned for road infrastructure actors in Europe through comparison with other regions of the world.

Two aspects have been used to identify guidelines and orientations:

1 / The role of road infrastructure in relation to new forms of mobility;

2 / The contribution of the road infrastructure sector to the objectives of climate neutrality.

The following criteria were used to compare Europe and the other regions studied, to draw up lessons learned and identify orientations for European road stakeholders:

- Triggering factors for new mobility
- Key success factors for new mobility (enabling factors)
- Partnerships
- Barriers to the development of new mobility

The country profiles follow this analytical part and allow a more individual approach to each country studied.

Prior to publication, this approach was proposed for discussion with the International Transport Forum (ITF) and the World Road Association (PIARC) to exchange and take into account comments and suggestions.

RESPONDENTS

It is to be noted that all the respondents' answers were complemented by a literature review.

Countries	Private sector	Public sector	Research institutions
Argentina	• CAMARCO (Argentinian Chamber of Construction)	• Secretary of Transport for the City of Buenos Aires • French Embassy in Argentina (Department for Sustainable Development)	• City on the Move Institute (part of VEDECOM)
Austria	• SWARCO	• Austria Tech	
Belgium	• European Cyclists Federation	• Service Public de Wallonie Mobilité & Infrastructures (Regional Road Administration of Wallonia)	• Belgium Road Research Center (BRRC)
Canada	• Science and Engineering Private Corporation • SNC-Lavalin		
Chile		• Municipality of Santiago • French Embassy in Argentina (Department for Sustainable Development)	• Universidad Diego Portales • CEDEUS: Research Center focusing on urban sustainability (gathering researchers from Universidad Católica & Universidad de Concepción)
China		• France Stratégie	• China Academy of Transportation Sciences (CATS)
Finland	• Finnish Road Association		
France	• Routes de France		
Germany	• Siemens Mobility GmbH • VDA (German car manufacturers association) • ZDB (German construction association)		
Japon	• ITS Japan	• Ambassade de France au Japon (Pôle Développement Durable)	

Countries	Private sector	Public sector	Research institutions
Mexico			• Mexican Institute of Transportation (IMT)
Norway	No responses received. Literature review only.		
Portugal		• Infraestructuras de Portugal	
Republic of Korea		• Korea Expressway Corporation	
Spain	• Confederación Nacional de la Construcción (Spanish Federation of Public Works) • Asociación Española de la Carretera (Spanish Road Association)		• Spanish Road Technology Platform
Sweden	• BIL Sweden (Swedish trade association for manufacturers and importers of cars, trucks and buses)	• Trafikverket: Swedish Transport Administration	
The Netherlands		• Rijkswaterstaat: National Authority for Roads, Waterways, Water protection, Water quality and Traffic Management • Ministry of Infrastructure and Water Management	
United Kingdom		• Transport for London (TfL) • French Embassy UK (Transport Department) • UK Government: Department for Business, Energy and Industrial Strategy	
United States	No responses received. Literature review only.		
Insight : South Africa		• SANRAL (South African National Roads Agency)	

DEFINITIONS

This section outlines all the main ground concepts we refer to in this benchmark study.

ROAD INFRASTRUCTURE

Road infrastructure is "*the indispensable basis for building, maintaining and operating*" land transport. It represents "*all the installations and permanent equipment that condition the operation*"[3] of land transport, being the main means of movement, displacement and physical communication of persons, goods and merchandise by means of vehicles "*between two given geographical points*"[4]. It consists of a road network, representing all the roads in a given geographical area (city, region, country) and is materialised by the road itself and its equipment that contribute to its proper use and operation.

URBAN MOBILITY

Urban mobility refers to the whole of trips generated daily by the inhabitants of a city, and the methods and conditions associated with such trips (modes of transport selected, length of trip, time spent in transport, etc.)[5].

In this study, the vision of urban mobility is based on the European Commission's Sustainable Mobility Plan, in which the reduction of congestion, accidents and pollution are factors in improving mobility in urban areas. The initiatives to be carried out in favour of better urban mobility mainly involve more efficient integration and use of the different modes and infrastructure of transport, the proposal of new mobility services with economically viable models, and the implementation of urban development strategies on a relevant territorial scale (city, conurbation, communities of municipalities, etc.)[6].

Exhibit 1: The present and future of urban mobility

From...	Toward...
Individual car ownership as dominant form of transport	Individual car ownership as one form of multimodal, on-demand, and shared transport
Limited consumer choice and few service levels	More consumer choice and many service levels
Government-funded public transit	Public and private transit operate in parallel
Unconnected, suboptimal, transportation systems	On-demand, connected systems that use data to unlock efficiencies

Source: McKinsey & Company7

3 / Centre National de Ressources Textuelles et Lexicales: Définition du terme « infrastructure ». Accessed May 25, 2020.
4 / Centre National de Ressources Textuelles et Lexicales: Définition du terme « route ». Accessed May 25, 2020.
5 / Foth, Marcus 2008: Urban Informatics: The Practice and Promise of the Real-Time City. IGI Global.
6 / European Commission 2013: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions. Together towards competitive and resource-efficient urban mobility. Brussels, Belgium.
7 / McKinsey & Company 2015: Urban mobility at a tipping point. McKinsey Center for Business and Environment.

Urban mobility includes ridesharing (including carpooling, vanpooling, and real-time or "dynamic" ridesharing services), biking and bike commuting and on-demand ride services, like ride hailing services (e.g. Uber/Lyft)[8]. Urban mobility modes can converge with major technological trends such as vehicle connectivity, electrification and autonomous driving[9]. The sharing concept is of utmost importance in the context of urban mobility. Replacing cars and bus trips in a city with mobility provided through fleets of shared vehicles may be the most relevant factor for reducing congestion and traffic emissions[10].

MAAS

"*The use of a unified digital interface in order to offer a user services that meet mobility needs in an integrated and personalised manner*"[11]. These services include traveller information, possible alternatives to the individual vehicle and incentives to change modes of transport. In this benchmark, the MaaS applies foremost to urban mobility.

DECARBONISED MOBILITY

In this benchmark, decarbonised mobility corresponds to the energy choices made by the countries studied, mainly in the evolution of car fleets. Priority is given to electric mobility, without excluding other choices made by the countries, such as hydrogen.

ELECTRIC VEHICLES (EVS)

EVs use electricity to provide the vehicle's motive power. Electricity can be supplied by an overhead wire, a third rail, a battery, solar cells, fuel cells or an internal combustion engine. Within this study, it is mainly referred to the varieties of EVs that use new battery or fuel cell technologies, as these are most often brought up by respondents.

As of now, many forms of EVs are commercially available. Among them, electric passenger cars, trucks, and buses which are in different stages of pilot testing and commercial deployment. It can be distinguished between different forms of EVs. There are Battery-powered electric vehicles (BEVs) which run strictly on batteries and are limited in range by the size of the battery. Hybrid electric vehicles (HEVs) and Plug-In hybrid electric vehicles (PHEVs) on the other hand, use an internal combustion engine in parallel with the electric motor. Others, such as hydrogen fuel cell vehicles (HFCVs) use a fuel cell to power the electric motor.

Scope

According to information from the International Energy Agency based on sales numbers, the global EV stock in passenger cars increased to more than 2 million EVs from 2010 to 2016 with China having the largest market for EV sales, and the United States having the second-largest market[12].

CONNECTED VEHICLES (CVS)

CVs describe "*connective technologies that can assist human drivers (e.g., by "sensing" nearby objects of features) or allow vehicles to communicate with other vehicles or with technology built into the roadside infrastructure*"[13].

CVs are designed to exchange data and information between each other (V2V communication) and also with the roadside infrastructure and traffic network operators (V2I) in order to improve the safety and efficiency of mobility. CVs can exchange basic information like location, speed, and status, or more sophisticated information like destination, payload, and on-time status.

8 / Deloitte 2015: Smart mobility. Reducing congestion and fostering faster, greener, and cheaper transportation options. Deloitte University Press.
9 / McKinsey & Company 2015: Urban mobility at a tipping point. McKinsey Center for Business and Environment.
10 / International Transport Forum 2016: Shared Mobility. Innovation for Liveable Cities. OECD Publishing, Paris, France.
11 / Ministère de la Transition Ecologique et Solidaire 2020 : Management de la mobilité. Accessed May 25, 2020.
12 / National Academies of Sciences, Engineering, and Medicine 2019: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation. Washington, DC: The National Academies Press.
13 / National Academies of Sciences, Engineering, and Medicine 2019: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation. Washington, DC: The National Academies Press.

Effective communication and interaction in this manner are only possible when all parties involved cooperate. Such systems have previously been referred to as cooperative systems and are now more commonly referred to as cooperative intelligent transport systems (C-ITS)[14].

Connectivity and communication between vehicles can be seen as a key enabler for vehicle automation and various mobility services. It includes V2V, V2I, or a combination of the two (V2X)[15].

Scope

In this study, two forms of CV communication strategy were often identified, which are expressed below in the two right-hand columns:

	Mobile operator's network	Network 5,9 GHz	Mobile operator's network + network 5,9 GHz
Technologies	2G, 3G, 4G, soon 5G	ITS-G5 (derived from WI-FI)	C-V2X (Cellular Vehicle-to-Everything)
Communication mode	Vehicle-to-Network	Vehicle-to-Vehicle Vehicle-to-Infrastructure Vehicle to Pedestrian	Vehicle-to-Network Vehicle-to-Vehicle Vehicle-to-Infrastructure Vehicle-to-Pedestrian

Source : Autorité de Régulation des Communication Électroniques et des Postes (ARCEP)16

The ITS-G5: It is a technology derived from Wi-Fi, considered mature[17]. Dedicated short-range communications (DSRC) transceivers called On-Board Units (OBUs) are installed in vehicles to enable direct short-range V2V and V2I communications along the road in Roadside Units (RSUs). DSRC units are already being integrated by some vehicle manufacturers into new vehicles.

The C-V2X: A more recent technology that can use both short-range communications and mobile operators' cellular networks to enable longer range V2N, V2V, V2I and V2P communications. Based on LTE technology and often referred to as "C-V2X", it is expected to eventually integrate 5G and become "5G-V2X".

14 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.
15 / Voege, Tom 2019: The Future of Transport Services. Inter-American Development Bank.
16 / ARCEP 2019 : Réseaux du futur, Note n°2, Les voitures connectées. Paris, France.
17 / ARCEP 2019 : Réseaux du futur, Note n°2, Les voitures connectées. Paris, France.

AUTOMATED VEHICLES (AVS) / SELF-DRIVING VEHICLES

The five different levels of automatization have been defined by the Society of Automotive Engineers (SAE):

Level	Title	Description
0	No Automation	Zero autonomy. Driver performs all driving tasks.
1	Driver Assistance	Vehicle is controlled by driver, but some driving assist features may be included in the vehicle design
2	Partial Automation	Vehicle has combined automated functions, like acceleration and steering, but driver must remain engaged with the driving task and monitor the environment at all times.
3	Conditional Automation	Driver is a necessity but is not required to monitor the environment. Driver must be ready to take control of the vehicles at all times with notice.
4	Full Automation (Self-Driving)	Vehicle can perform all driving functions under certain conditions. Driver may have the option to control the vehicle.
5	Full Automation (Self-Driving)	Vehicle can perform all driving functions under all conditions. Driver may have the option to control the vehicle.

Source: NHTSA (2017)[18]

Scope

As for now, AVs are merely in the development and pilot testing stage where they are being tested in controlled and monitored situations, often with a human present to intervene. Low-speed shuttle vans without human monitors are currently being pilot tested on low-speed public streets in some of the studied countries[19].

NEW FORMS OF MOBILITY

In this benchmark, new forms of mobility refer to autonomous and connected mobility, decarbonised mobility, and urban mobility.

TECHNOLOGY NEUTRALITY

Technological neutrality is understood here as the willingness of some countries to remain flexible in their technological choices according to the different forms of mobility. Concerning autonomous and connected mobility, some countries prefer to remain neutral with respect to the technology used, whether ITS-G5 or 5G. Concerning decarbonised mobility, others remain neutral with regard to energy sources such as electricity or hydrogen. This neutrality may be explicit or implicit.

18 / National Academies of Sciences, Engineering, and Medicine 2019: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation. Washington, DC: The National Academies Press.
19 / National Academies of Sciences, Engineering, and Medicine 2019: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation. Washington, DC: The National Academies Press.

PART 2

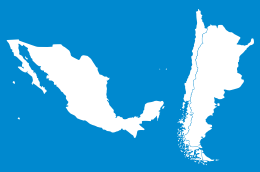
COMPARATIVE ANALYSIS

SUMMARY

1/ CONTINENT FOCUS

FOCUS: LATIN AMERICA

(Chile, Argentina & Mexico)



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Main issues

• **Heterogeneity**: Prevailing in Latin America but also within the studied countries themselves, especially between some major cities and their municipalities. New mobility services are developed and offered in major urban centers such as Santiago in Chile, Buenos Aires in Argentina or Mexico City in Mexico but not necessarily in other parts.

• **Governance**: Distributed decision making between the central government agencies and the different municipalities. This is especially true in Chile where e.g. public transportation is under the responsibility of the Ministry of Transport while local authorities are independent in urban planning. This leads to a fragmented organization which makes it difficult to carry out any infrastructure project that is to be built on the territory of several municipalities.

• **Maintenance and rehabilitation**: Lack of quality infrastructure and road safety. Improving road condition has been identified as a prerequisite to reach the level of infrastructure connectivity required to support new forms of mobility.

• **Investments and fiscal incentives**: Insufficient incentives for new mobility services. Furthermore, due to the economic crisis and the strict currency control, low public and private investments should be available for innovative solutions in Argentina in the short term.

1/ France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

FOCUS

Urban, active and soft mobility

- Urban sprawl, long commutes, high congestion levels and growing number of traffic-related fatalities
- No global coverage of urban mobility initiatives. The promotion of urban mobility is done on city/ municipality level
- Increase in non-motorized transport modes in major cities

Electric and decarbonised mobility

- Focus lies on electrified public transport in major cities (electric buses especially)
- Rather limited industry involvement with exception of Mexico where the EV sales are booming and automotive industries are working on electrification technologies
- Large lithium resources gathered in Chile & Argentina

Autonomous and connected mobility

- No clear regulation exists on testing driverless vehicles
- AVs are not a short-term reality
- However, tests of AVs have been carried out in Mexico (2015) and Argentina (2015) and one AV test is ongoing in Chile in cooperation with the Inter-American Development Bank

Maturity assessment

The main mobility initiatives concern urban mobility services and they are concentrated on major city level.

There is an increase and to some extend already given significant deployment of non-motorized transport modes such as bikes and e-scooters. The main improvements in the short-term can be realized regarding **urban mobility**. Initiatives are taken with attempts to regulate the sharing of street space between all users in favor of pedestrians and cyclists.

Electrification efforts are mainly concentrated on public transport in major city centers.

Autonomous mobility is not a short-term reality.

No regulations do exist regarding testing driverless vehicles on public roads. However, testing of driverless vehicles on private roads was already conducted.

The lack of harmonization in **political regulations** and the difference in mobility advancements among the different cities may hamper the development of different mobility modes.

Industry involvement is rather limited. Chile has no significant automotive industry and is more focalized in services. Due to the lack of fiscal incentives, the Argentine automotive industry has few interests in developing new mobility technologies. The automotive industry that could contribute to focus on new mobility technologies is better represented in Mexico.

Identified needs for the road infrastructure network

All forms of mobility	Rehabilitation of road infrastructure: ensuring quality infrastructure and the reduction of traffic related fatalities
Urban, active and soft mobility	Shaping city's priorities for road use and budget allocation
Electric and decarbonised mobility	Secure funding & subsidies to enable electric bus schemes, enhance fiscal incentives for electric cars (e.g. Chile)
Autonomous and connected mobility	Not a short-term reality

Ecosystem and Governance

ROLE OF PUBLIC AUTHORITIES

Urban mobility initiatives are most supported by governments compared to other forms of mobility.

The studied countries are all working on providing **sustainable mobility options** to road users. Although major initiatives are undertaken, it has to be said that while consistent policies at national level are required, actual developments often depend on the different cities/municipalities within the country.

Providing sustainable mobility options consist in restricting the use of private cars by promoting bike sharing systems, expanding public transport, especially bus rapid transit systems, the modernization of transport fleets and the implementation of energy efficient standards. In Mexico, it is considered to include citizens in the planning, regulation and managing process of the mobility system and incorporate principles of urban resilience and inclusive governance. It is also considered to bring more cohesion to the overall transport systems in the city for social inclusion.

Another common denominator is also that the different sustainability plans shall improve safety throughout the road infrastructure, especially for pedestrians and cyclists.

DID YOU KNOW?

The studied cities account for major urban planning references: It is said that Mexico currently has the second largest bike sharing system in North America and that its widespread bike-sharing system Ecobici is the 5th largest public-bike sharing system in the world. Santiago de Chile has the largest electric bus fleet outside of China.

Concerning the other mobility modes, it is said that for Mexico, recent changes in the Federal Government have slowed down progress nationally in terms of electric and autonomous vehicles. Special **governance issues** affecting new mobility can especially be pointed out in Chile (expected change of the Constitution) and Argentina (economic crisis).

SPECIAL FEATURES: CHILE

Governance problem are prevailing regarding planning of transportation and infrastructure.

Public Works: although public works are managed by the Department of Public Works, minor road improvements/changes are carried out on a local level and are thus highly dependent on different local capacities.

Public transportation is also under the authority of the Ministry of Transport, however, local authorities are independent in urban planning. This fragmented organization makes it difficult to launch intermunicipal projects.

National Electric Mobility Strategy: the Chilean Ministry of Energy defined an electric mobility strategy with insufficient implications of the other public bodies. The declaration has not yet been translated into concrete action plans.

SPECIAL FEATURES: ARGENTINA

The government change in October 2019 has shifted priorities concerning the use and support of clean electric energy production and power generation efficiency.

Since 2015, efforts have been made to reduce importing fees on EVs and hybrid vehicles, to foster capacity development to deliver 8% of electricity from renewable energy sources, increase thermal power generation efficiency and introduce innovative lithium-ion battery storage (cf. National Renewable Law 27.191 since 2016).

In contrast, under the new presidency, mining and oil resources are valued above alternative energy use. Due to the economic crisis, an additional tax applies to luxury vehicles, including *de facto* EVs. Reduced import tax on hybrid and electric vehicles might not be maintained.

It must be mentioned that the importance attached to the energy and mining sector is a common denominator among all political parties in general, as it represents the backbone of the Argentinian industry.

More generally, it can be stated that Argentina is currently in a precarious economic balance. With the local currency having devaluated significantly in 2019, annual inflation is over 50%. Historic volatility of the economic growth and the accumulation of institutional obstacles have impeded the country's development.

ROLE OF INDUSTRIALS

Industry involvement in the development of new mobility is rather limited as the automotive sector is hardly represented.

Urban mobility: Many operators are involved, especially for providing bicycle sharing systems and e-scooters (Chinese Mobike, American system Scoot & Lime, the Mexican system Grin, the Chilean e-scooter system Hop). Foreign companies are also investing in **electromobility**: In Chile Enel and Engie are particularly active and have financed electric buses.

SPECIAL FEATURES: MEXICO

Electromobility is one of the emerging trends closely followed up by the Mexican industry stakeholders. The liberalization of the Mexican electricity market opened to private investment in 2018 is expected to boost private investments. The automotive industry in Mexico is installing regional clusters and research centers working on electrification technology, alternative fuels or emission reduction. Among them Nissan, Chrysler but also Mexican companies such as CIATEQ and CTEV. Currently, electric and hybrid vehicles are imported. However, production started with a small-scale projects of the Mexican company Zacua.

The **US-Mexico-Canada (UMSCA) trade agreement** announced in October 2018 is also aiming to integrate Mexico into Canadian and US American economies. The trade agreement implies that no restrictions will be made on foreign investment, and no customs duties are raised on inputs or spare parts. It was agreed that 75% of locally used vehicle parts should be made within the three countries.

SPECIAL FEATURES: ARGENTINA

The largest **lithium reserves** are in South America. In the border triangle of Bolivia, Chile and Argentina, 70% of the world's lithium deposits are to be stored. Lithium is needed to produce electric car batteries. In times of growing energy transition aspirations, the demand for lithium is growing rapidly. But the extraction of lithium as it is carried out at the moment is said to threaten the livelihood of the indigenous population.

Argentina in general has a great potential in terms of raw materials: it is the fourth largest natural gas producer in Latin America, has the world's second largest shale gas reserve and the fourth largest lithium reserve. Under the current presidency, Argentina will value mining, oil and shale gas resources and their corresponding industries.

Mining companies therefore want to expand production in Argentina. Some Argentinian political representatives are stating that the lithium production in Argentina will even become the key economic industry of the future. The mining company Sales Jujuy is one of the leading lithium producers in the region, a consortium that includes the Australian company Orocobre and the Japanese car manufacturer Toyota.

TECHNOLOGICAL ORIENTATIONS/CHOICES

The main technological orientation will focus on electromobility.

The intention to electrify the entire bus fleet in some major Latin-American cities will imply the development of **Vehicle to Grid infrastructure (V2G)**.

There might be a potential shift in Argentina from thermoelectric capacity (mainly natural gas, fuel oil and gas oil) with 64% in 2018 to a diverse mix of 23% thermo, 35% renewables and 28% hydro. However, the technological orientations may change with the new government recently elected.

USER PERSPECTIVE

Equal access to mobility services in the studied countries mainly means improving the integration and the access to peripheral and rural areas.

There is a need to cover entire cities with network and bus lines in order to minimize the risks of having a city divided into periphery and outlier zone. The objectives currently are to **boost connectivity** to the main rural populations of the country. Infrastructure improvements in low-income areas can be carried-out by establishing a minimum level of service and making funding available to reach minimum equal levels in all territories irrespective of the budget of local governments.

Customized infrastructure will help to develop inclusive mobility services to offer transport that caters specific needs.

On a governance level: equal access to mobility will need a better regional planning approach. Regional planning should be able to visualize the needs of different municipalities and should be capable of coordinating intercommunal projects. The upscaling of successful city initiatives to a broader regional level would also be necessary.

Acceptability of new mobility service in the studied countries is above all determined by cost and the billing such services may imply.

SPECIAL FEATURES: ARGENTINA

Argentina is a heavily unionized country. The union of the truck drivers "Sindicato de Camioneros" is deemed to be a powerful union. Automatization, platooning and other initiatives (billing the use of the road, "polluter pay principle" etc.) may lead to a lack of acceptance and support for new forms of mobility.

SPECIAL FEATURES: CHILE

Chile has been gripped by protests against high living costs and perceived inequality. The protests began in October as the government announced that the metro rush hour prices would rise by 30 pesos ($0.04). This poses the question of social acceptance when talking about pricing and billing new modes of mobility or of the impacts of new mobility on employment and training skills.

Already in 2017, the government has prioritized social sectors such as education and health. According to the OECD, this tendency is consistent with Chile's transition from a middle income to a high-income country. It implies that classical infrastructure investment will increasingly have to compete for resources with the social sectors.

Expectations towards Road Infrastructure and its equipment

In general, road infrastructure should contribute to impulse local and regional economies and connect different areas of the country.

Intermodality	**Customized infrastructure/ Operationalize mobility modes**
The development of infrastructure should have the role to create meeting points for people and gather incentives for people to move around using different mobility modes.	Infrastructure should be able to measure and count people's movements. It will have to offer customized solutions: access may not necessarily be equal, but specific needs could be better met through a variety of solutions (Flexibility in uses).

Although changes in the design of roads are expected, especially in the way of transmitting information to users, changes in signaling, the requirement of spaces for the implementation of ITS, systems for the uninterrupted supply of energy, etc., it is also considered that new methods of transport should insert themselves into preexisting structures. A focus also lies on reducing the accident incidence rates.

Use and protection of Data

The developments in the digital era and also the example of the European General Data Protection Regulation issued by the European Union fostered the need for new legislation in Latin-America on digital governance.

In Argentina as well as in Chile bills or amendments were submitted by the federal government to revisit general concepts such as personal data and sensitive data, and it incorporates new ones, including accountability obligations. In both countries it has also been considered to appoint a data protection authority or special provisions dedicated to the enforcement of the data protection legislation.

SPECIAL FEATURES: MEXICO

In Mexico, the focus lies on the federal government's open data policy. Main axes were to achieve the "Program for a Close and Modern Government 2013-2018". The program has set forth the creation of a **National Digital Strategy (EDN)** with the objective to enable open data, among others.

Regarding the use of technologies to foster smart mobility, nothing specific exists. Nevertheless, the EDN's objectives in terms of Government Transformation and Digital Economy could encompass policies concerning new mobility.

Economic model and financing

Current financing	Ideas for financing and enhancing new mobility services
Chile has been successful in mobilizing private financing for the development of its infrastructure. It has adopted and refined the concessions model for delivering infrastructure. Urban highways are run by private companies, often with direct subsidies from the government. **Argentina:** Problem to attract private capital. Financing is done via **the National Treasury for public works** supplemented in some cases by funds derived from credits from MDBs and the Provincial treasuries for public works. **Mexico** has the following funds to finance projects, which have been used in projects for road transport: • Fund for Climate Change • Sectoral Research Fund • National Financial • National Bank of Public Works and Services • National Infrastructure Fund	**Chile: High investments in the upgrade of road infrastructure** Chile's President Piñera unveiled a program that will involve work on over 17,000km of roads and require more than 7tn pesos (10bn USD) until 2023 with investments in new highway projects and re-tendered old concessions. Another 1.12tn pesos will be used to improve nearly 13,000km of rural and indigenous roads. **Chile: SE Agency in Chile (Agencia de Sostenibilidad Energética/ Environment and Energy Management Agency):** Discussions on how to set up public and private charging networks and better understand the characteristics of electric vehicles. **Argentina:** First, the macroeconomy needs to recover in order to access external credits. For **Mexico**, no information could be found about ideas for future financing of new mobility services.

FOCUS: NORTH AMERICA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Main issues

• **GAFA (e.g. Sidewalk Labs, Waymo etc.)**: The traditional car manufacturers and the transport sector as a whole are being shaken up by the GAFAs which are influencing the demand of new mobility, substituting themselves to traditional road and mobility stakeholders. The new mobility services offered by the players of the digital economy are hardly regulated. Base on the data they collect, they can address users directly and can deliver a global offer with new transport services by integrating information on the entire supply chain.

• **Policy decision making**: Distributed decision making between government agencies are creating fragmented regulations concerning road infrastructure. There is a difference between the federal level and the state/provincial level having own responsibilities in managing road infrastructure.

• **Maintenance and rehabilitation**: Lack of support of needed and given infrastructure assets is prevailing. The current quality of infrastructure might not be able to support new mobility.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

FOCUS

Urban, active and soft mobility

- Urban sprawl and long commutes
- Strong car ownership (77% of commuters in the U.S. and 74% in Canada drive alone to work by car)
- Public transportation is less developed and urban rail is expensive
- Lack of infrastructure investment aimed to improve urban mobility

Electric and decarbonised mobility

- EV sells are on the rise: 81% increase in the U.S. and a 125% increase in Canada from 2017-2018
- Predominance of extremely inexpensive fossil fuels lowering demand for EVs

Autonomous and connected mobility

- Extreme weather conditions as major obstacle for AVs
- Relatively low-tech roads and low 4G coverage
- Fatal accidents in the U.S. have made safety become a priority
- Lead in government-funded AVs for Canada and lead in AV technology and innovation in the U.S.

Maturity assessment

Intrinsic factors such as the geographical as well as the political situation have to be taken into account:

Policy level: There is a lack of harmonization in political regulations prevailing and a clear difference in mobility advancements among the different states or provinces. This may hamper the development of different mobility modes. Especially AV policies do not fit neatly into the current frameworks and each state must work on its own to attract AV businesses via proper regulations and permits.

Geography: Long distances and extreme weather conditions are also impeding the development of soft mobility especially. It is to be noted however, that the emerging soft mobility services such as Lime or Uber have been invented in North America. There is a clear difference between intracity and intercity mobility. The latter is much less developed.

An enormous potential lies in AV and EV technologies. Especially the U.S. can assume a strong leadership in this field through its industry. The U.S. is gathering the world's leading AV companies as well as the pioneering car manufacturers regarding electromobility.

Identified needs for the road infrastructure network

All forms of mobility	Rehabilitation and maintenance of road infrastructure
Urban, active and soft mobility	Intercity infrastructure and mobility of the last mile
Electric and decarbonised mobility	Charging stations (currently unevenly distributed and concentrated in major urban centers)
Autonomous and connected mobility	Strong national approach and a harmonization of political regulations; more high-tech road infrastructure equipment; balance between safe AV systems and encouraging new innovations.

Ecosystem and Governance

ROLE OF PUBLIC AUTHORITIES

All forms of mobility

It is to be noted that the transportation systems of Canada and the U.S. are integrated. Interoperability and the advanced state of development and testing in the U.S. are meant to be reexamined by Canada in order to build upon the U.S. American equivalent.

Both the United States and Canada are federal states with distributed decision-making between the federal and the state/provincial level. The following chart sums-up at which level initiatives are launched when talking about new mobility.

	Federal Level	State/provincial level
Urban, active and soft mobility	Funding programs nationwide: Smart City Challenge funded by the U.S. DoT and a Public Transit Infrastructure Fund across Canada announcing immediate federal investment to improve commutes, cut air pollution etc.	Individual projects on state or city level: electric cargo bikes (e.g. Colibri by the city of Montreal, Quebec), traffic control, public transport management, smart-city initiatives (e.g. Columbus, Ohio).
Electric and decarbonised mobility	Indirect support through reports funded by the federal government on environmentally beneficial technologies (e.g. Transport Canada) as well as investment plans for infrastructure in general.	The promotion of electromobility is also made on state/provincial level through tightening of their respective emission regulations and tax incentives or financial assistance programs for the purchase of EVs and by securing public rapid recharge services for EVs.
Autonomous and connected mobility	There is no federal law expressly permitting, prohibiting or restricting companies or consumers from testing driverless vehicles on public roads. However, policy papers have been issued with the aim to establish federally aligned requirements for AVs. Research papers are being produced to assess innovative technologies and their impact.	Practical tests and experimentations are made on state/provincial level: The legislation generally includes the deployment and operation of AVs on public roads and the creation of a framework for testing AVs (e.g. Government of Quebec for Canada, Colorado/ New York for the United States).

SPECIAL FEATURES: UNITED STATES

It is to be noted that there is a surge in government agencies' involvement in the U.S. regarding autonomous mobility and the related technology: It is argued that the U.S. aims to ensure its strategic position in promoting norms, standards and technology related to AVs. The promotion of the American leadership in advanced manufacturing across all industrial sectors aims to ensure national security and economic prosperity and a clear positioning against other countries which are likely to define and impose their own standards.

The Trump administration recently signaled a strong support for self-driving vehicles releasing a new guidance note: **"Ensuring American Leadership in Automated Vehicle Technology. Automated Vehicle 4.0."** Such policy documents existed before (version 2.0 & 3.0) but are now extended by stressing the protection of American innovation and creativity (e.g. facilitate Americas superiority in 5G technology Plan) among others.

The State Department of Transportation is at the heart of regulating driverless vehicles and components of automated driving systems. Among the policy documents on AVs, recurring common features of automation principles are: prioritizing safety, ensure a consistent federal approach (preempting state laws that conflict with performance and design standards of driverless vehicles set by the federal government), remain technology neutral, modernize regulations, emphasize data security and cybersecurity, enhance mobility and accessibility.

ROLE OF INDUSTRIALS

In North America, the industry offers strong bases to support all mobility modes. The industry involvement is high in all mobility and data sectors and especially in AV technologies as the U.S. gathers the world's leading AV companies. The U.S. companies are also benefitting from pro-growth policies initiated by President Trump aiming to protect the U.S. economic advantage and its innovation capacity in all sectors, including AVs.

Urban, active and soft mobility: The North American region has been a pioneer in offering soft mobility services provided by private operators such as the e-scooters (Lime), e-bikes or car-sharing models like Uber. In North America, the main actors of soft mobility are companies belonging to the digital economy such as Alphabet or Google.

A subsidiary of Alphabet, the parent company of Google, has been selected to carry out an urban design project in Toronto, thus replacing traditional bidders.

Electric and decarbonised mobility: U.S. and foreign car manufacturers are leading the market. Tesla, General Motors, Ford, Toyota etc. are all developing EVs and are also manufacturing their electric models in the U.S. The initiatives of installing charging stations are largely initiated by corresponding car manufacturers. Again, American car manufactures feel the need to position themselves against, among others, China's market influence in the field. Since 30% of global total EV production is sold in China, the U.S. must keep pace with technological progress.

Interoperability agreements are set among the U.S. and Canadian charging network operators to ensure access to public charging stations on both networks.

Autonomous and connected mobility: Led by car manufacturers and also actors of the digital economy (e.g. Uber, Waymo). These car manufacturers are now, in the U.S., bound by specific requirements such as creating cybersecurity plans and privacy plans including descriptions of certain practices regarding the collection, use, sharing and storage of information about vehicle owners and occupants

Identified needs for the road infrastructure network: Roadway infrastructure and vehicular developers need to cooperate much more closely. Pavements engineers and designers are sad to lag behind in developing infrastructure for vehicular traffic.

TECHNOLOGICAL ORIENTATIONS

Canada and the U.S. prepare themselves for mixed use and partially AVs in the medium-term.

The focus lies on narrowly defined use cases by developers and investors which are not taking into account level 5 ubiquitous automatization. There are still huge uncertainties prevailing, depending on the resolution of technology. Especially in the U.S. addressing potentials safety risks has now become the utmost priority in developing AV technology. The main technological challenges in this regard are:

- Perception/hazard recognition (sensor and software challenges, safety and usability require near-zero false negatives).
- Safety Assurance (must be able to demonstrably exceed safety over averaged skilled human driver which is not the case yet).

SPECIAL FEATURES: UNITED STATES

The technological choices are influenced by the prerogative to ensure American manufacturing and industry leadership in contrast to other concurrent players. The so-called **Executive Orders "Buy American and Hire American", "Maximizing Use of American-Made Goods, Products, and Materials"** and **"Maintaining American leadership in Artificial Intelligence"** are part of the U.S. Government commitment to ensure that all federal dollars used for CAVs research will comply with these orders. In this context, the Government will continue its pro-growth policies to protect the U.S. economic advantage and its innovation capacity in all sectors, including AVs.

USER PERSPECTIVES

Equal access to mobility services is defined through various lenses in North America.

Equal access to mobility is defined by ensuring the so-called freedom of the open road, which implies the freedom for North Americans to drive and keep their own vehicles. The support of AVs for example is made in the sense to enhance this freedom by extending access to safe, affordable, accessible and independent mobility options. In this context, one can observe level 4 AV use cases in the U.S. that do consider certain measures such as: low-speed urban first/last mile transit access, buses in protected busways, taxi services in retirement communities or low-density sunbelt suburbs. However, equal access is not a prerogative. It is acknowledged that automated systems notably can help improve the mobility services but eventually money has a role to play. It might thus be impossible to ensure equal access to mobility across all territories, especially for larger countries with low density.

ACCEPTABILITY:

Urban, active and soft mobility	As private car ownership prevails, alternative non-motorized mobility modes are not very popular, except in major city centers where soft mobility initiatives are concentrated.
Electric and decarbonised mobility	Respondents in the U.S. are the most pessimistic about the future of EVs. However, the U.S. plans to grant EVs a high market share by 2030 compared to the global average. The intention to buy an EV is said to be low compared to the world average.
Autonomous and connected mobility	In North America, the acceptability for AVs is scoring rather low. There is a mixed attitude ranging from "irrational exuberance" to adamant hostility. Besides, in the U.S, the Tesla and Uber crashes have shaken public confidence in AVs.

Expectations towards Road Infrastructure and its equipment

All forms of mobility: All design standards will have to be reviewed as they will not fit for the conventional car anymore. The road infrastructure will have to take into account many more road users with different capacities and levels of vulnerability and different vehicle characteristics: According to this scenario, the road will have to become more agile, efficient and safer allowing for multimodal, customized and more user-friendly usages.

Electric and decarbonised mobility: The road will have to prepare for the installation of induction/conduction battery charging. A whole new network of energy supply will have to be developed (electrical outlet stations, solar roofs on vehicles, dynamic charging on electric roads, catenary over highways) and different approaches to energy distribution will have to be considered: upload energy in vehicles and download back unused energy to the grid at different hours of the day.

Road infrastructure could become an energy provider (solar and electric roads, induction systems, bidirectional energy flows between the vehicles and the road).

FOCUS

USA	Canada
Ensure and prioritize safety	Complete redesign of signs and signals to better permit road administrations to modify the network in real-time to better respond to traffic immediate demand (change in lane direction, reverse one-way street, closure of a corridor etc.)

Use and protection of Data

Data privacy issues have been occurring in North America with the rise of the so-called GAFA which are operating mobility services but also urban projects within cities. On the specific project "Quayside" in Toronto operated by Sidewalk Labs, a subsidiary of Alphabet, the parent company of Google, Sidewalk Labs has already been forced to restrict its perimeter of intervention and data collection.

However, one also notes a strong involvement in defining laws protecting personal data and intellectual property issues arising with the use of new mobility. This is especially true in the U.S. providing for instance an **Autonomous Vehicle Privacy Protection Act** assessing the organizational readiness of the Department of Transport to address autonomous vehicle technology challenges, including consumer privacy protections. The U.S. Government has also committed itself to develop and promote physical cybersecurity standards across all data mediums and domains of the transportation system in order to deter, detect and respond to known and evolving risks. This is intended to be done in coordination with developers, manufacturers and service providers of new mobility services.

Economic model and financing

Current financing	Ideas for financing and enhancing new mobility services
Federally funded infrastructure programs come from transportation-related excise taxes on gasoline and diesel fuel. In Canada, federally funded infrastructure programs are structured through bilateral cost-sharing agreements which are made with provinces. In the U.S., ¼ of all public spending for road is financed by the federal government and ¾ are financed by state and local governments (also through private finance). While PPPs are utilized heavily in Canada to fund major infrastructure projects, the U.S. uses relatively little PPPs for transport infrastructure.	**Establish PPPs to improve mobility** By adopting pay-for-success models that specify some mobility outcomes (e.g. setting a goal of a certain year-over-year increase in carpooling's modal share). **Social impact bonds** Contracts with government agencies that are only repaid if certain social benefits are achieved. **High-occupancy vehicle and high-occupancy toll lane projects** In the case a city or state secures funding to create dedicated lanes for shared vehicles, a part of those funds can be dedicated into investments in digital infrastructure. **Pre-tax benefits** Should be expended to urban mobility services.

FOCUS: ASIA (China, Japan & South-Korea)

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Main issues

5G network development: The studied countries have the ambition to position themselves as leaders in the development of artificial intelligence, 5G networks, robotics and Smart Cities. Governments are pushing for technological progress and for the rather soon commercialization of AV level 3 and 4 systems.

Government support: Government funding for AV pilots is high and there are strong government support and incentives for expanding NEVs and AVs. As a consequence, the industry is also pushed to develop AV or NEV supply systems. In China such developments are directly and openly supported by the government and are integrated into State Planning programs.

Pollution: Rapid urbanization favored massive investments in transport infrastructure. These models are now reaching their limits. China is the world's largest emitter of GHG. Strong pollution is prevailing, especially in cities. In Seoul (South Korea) 61,5% of air pollution comes from vehicles. Japan has identified a need to control the heat-island phenomena in cities.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

FOCUS

Urban, active and soft mobility

- Integrated mobility systems based on strong ICT technology and strong support of the 5G neatwork
- Developing intermodal transportation by increasing bus lanes, tidal lanes, signal priority measures for public uses
- Smart-City projects: incorporating new technologies into the social and economic activities of a city
- China: Boom in carsharing and ride-hailing (largest ride-hailing market)

Electric and decarbonised mobility

- Government support to increase share of EVs and hydrogen vehicles and charging stations. The industry is also committed to develop NEVs
- World lead and strong push by China: leading the way in developing and commercializing NEV which is due to a strong state support
- Japan focuses mainly on large-scale hydrogen supply system

Autonomous and connected mobility

- Government funded and supported AV pilots and tests
- Industry is also announcing high investments in the development of AVs
- China: State Planning Programm forecasting that by 2025, 30% of vehicles sold in China will be connected and intelligent

Maturity assessment

There is a strong push for new mobility which is mainly due to strong government support and incentives which are also influencing the respective country industry involvement.

On a **policy level**, the development of new mobility and digitalization is seen as a priority and is integrated into several government programs. The targets of equipping the infrastructure with the needed supply systems is rather ambitious with level 3 and 4 AVs to be circulating by 2030.

The necessary investments are earmarked to develop the needed devices to support all forms of new mobility: energy supply systems, intelligent equipment, 5G networks etc.

The **industry** is carrying out high investments into NEVs and AVs. Industry partnerships are being initiated and, in some cases, are already rather institutionalized. Especially on AVs, a whole ecosystem of industry players is involved, among them: mobile operators, ICT companies and car manufacturers.

Identified needs for the road infrastructure network

All forms of mobility	Equipment infrastructure, create accessible mobility for vulnerable population, natural disaster prevention
Urban, active and soft mobility	Transport connectivity in order to contribute to economic development and poverty alleviation
Electric and decarbonised mobility	Expand the charging station network
Autonomous and connected mobility	5G full deployment

Ecosystem and Governance

ROLE OF PUBLIC AUTHORITIES

All forms of mobility

The studied countries **all have the aspiration to take the lead on the development of new mobility issues and speed up the digital transformation of the road infrastructure**. Strong government support and incentives through deregulations, subventions and heavy investments is also incentivizing the industry to work and invest on new mobility issues. The consequences of such a particularly strong government support are shown in numbers below:

	China	Japan	South-Korea
Urban, active and soft mobility	By 2020, high-speed railway will cover more than 80% of urban population (cf. 13th Five Year Plan).	Smart Mobility Challenges: **28 areas and projects** selected to implement new mobility services initiatives.	Smart City development: Total of **228 Smart City solutions and pilots tested.**
Electric and decarbonised mobility	Ambition to sell **7 million NEVs/year by 2025**. There are now **486 EV manufacturers**, three times as many as two years ago. **Nearly 99% of electric buses** operating worldwide are in Chinese cities and urban areas. **By 2020,** charging infrastructure is expected to reach about 5 million public charging points. Total installed electrical capacity should increase to **2000GW by 2020,** total primary production to **2.8md TOE** (cf. 13th Energy Development Plan). Accounting for **40% of global investments in EVs**.	Political choice to focus on hydrogen with gradual targets: **40,000** hydrogen-powered vehicles by **2020.** **200,000 by 2025** and **800,000 by 2030**. **160** charging stations in **2020** and **320 in 2025**.	Roadmap to increase the share of EV and hydrogen vehicles in the local market by **33%** by 2030. Share of EVs sold on national level has **increased sevenfold** compared to 2019. Plans to install **660** hydrogen recharging stations throughout the country by **2030** (vs. 31 operating currently). Number of hydrogen production facilities will reach **15,000** across the country by **2025,** a threefold increase to the current 5,427 units.

Autonomous and connected mobility	**30**% of vehicles sold in China will be CAVs (cf. 10-year Action Plan on Chinese Manufacturing.)	**Automatic level 4 taxis** should operate on some roads for the Olympic Games by 2020 (postponed). **Level 3 AVs** should travel on roads in Japan **by 2030**. Introduction of advanced highway autopilot system (level 4) for passenger cars and trucks is planned.	Half of the car fleet should be constituted of AVs **by 2030**. Government support of **1,3 billion EUR from 2021-2027.** Self-driving to be tested on a total of **320km designated routes** on five national highways and entire artificial town for AV testing has been built.

SPECIAL FEATURES: JAPAN

Japan has made the political choice to focus on hydrogen in its energy strategy and wants to achieve the so-called "hydrogen society" for the 2020 Olympic Games (postponed). The **Ministry for Economy, Trade and Industry** updated a roadmap in 2016 setting new targets for the deployment of hydrogen technologies in Japan by 2040. Three phases can be identified:

- 2017 - 2030: Widespread use of hydrogen vehicles, hydrogen stations and fuel cells;
- End of 2020 - 2030/2040: Maximize hydrogen production and establish a large-scale hydrogen supply system by 2030;
- By 2040: define a system for supplying decarbonated hydrogen.

ROLE OF INDUSTRIALS

The strong government support for new mobility is impacting the industry in several ways:

Urban mobility: In the context of smart mobility initiatives, innovation funds are granted to start-ups and SMEs developing Smart-City pilot projects.

Electromobility: Is mainly led by the national car manufacturers in the studied countries. In the case of Japan's hydrogen strategy, the government has initiated a MoU among its energy giants to combine their efforts to invest in hydrogen technology with the aim of continuously building hydrogen stations and promoting widespread use of fuel cells. Chinese, Japanese and Korean companies dominate the current global battery market for EVs.

Autonomous mobility: timetable has been set by the respective governments for the deployment of AVs which also involves the commitment of the industry. The main Japanese car manufacturers plan to commercialize AV models, and massive investments, amounting 35 billion EUR, are carried out by Hyundai Motors in South Korea. These investments are supported and even pushed by the Korean government.

Especially on AVs, a whole ecosystem of industry players is involved, among them: mobile operators, ICT companies and car manufacturers. Industry partnerships are made among car manufacturers and ICT players involving telecom operators, IT companies, universities and start-ups. While these partnerships are very common in South Korea, these mergers in Japan are quite new and are part of a restructuring of the Japanese industrial landscape.

SPECIAL FEATURES: CHINA

Chinese companies depend on state subsidies. Initially positive, such support can help local players develop capabilities. Over time, however, the increasing drive toward localization could restrict competition in the sector. Indeed, China is now opening the competition to foreign players. Although China gathers companies that are leading the way in terms of production capacity, they are not competitive in terms of cost and technology. With these initiatives, it is expected that Japanese and South-Korean companies will relaunch their activities and investments in China, especially for electromobility.

BAT (Baidu, Alibaba, Tencent)

The "BATs" can be defined as the equivalent of the American GAFA and are today all involved in many sectors and services, particularly financial services, which also affect the transport sector. **Baidu** is particularly committed to the development of CAV technology by providing software platforms to car manufacturers as an alternative to software developed in-house by car manufacturers/ equipment suppliers themselves but also to supplement Apple (Apple car play) and Google (Android auto).

TECHNOLOGICAL ORIENTATIONS/CHOICES

The focus lies on C-ITS technology development and infrastructure implementations.

Although the deployment of C-ITS technology has an impact on all types of mobility, it is strongly influenced and framed by the deployment of CAVs.

On an urban mobility level, C-ITS would allow mainly for better traffic flow by providing real-time information, eliminating congestion and allowing for the mitigation of the environmental impact but also for reaching the target of zero accidents by forwarding collision warning etc. (Smart-City support).

Concerning autonomous mobility, C-ITS implies the deployment Vehicle to Everything (V2X) technologies, among them: LTE-V2X, Cellular V2X technology and the promotion of 5G and artificial intelligence in coordination with intelligent traffic and traffic management information facilities and equipment, e.g. road change rapid detection update technology for AV driving support.

Concerning decarbonized/electromobility: Japan has focused on hydrogen technology while diversification measures are taken in South-Korea with hydrogen powered cars. China accounts for 40% of global investments in EVs and aims to become the undisputed leader in these technologies.

USER PERSPECTIVE

Equal access to mobility services implies providing equity in regional transport services, counter measuring less public transport availability in rural areas and to some extend contributing to the efforts of poverty alleviation.

China had announced its plan that by 2020 all established villages will have access to paved roads and buses, and the government plans to reduce rural passenger fares and increase frequency of services.

Japan will provide equal access mainly through the development of autonomous mobility and V2X technology.

South Korea will focus on big-data based traffic policy solutions promoting user-customized improvement policies, especially for more vulnerable populations who struggle to get access to mobility services.

ACCEPTABILITY:

Acceptability of new mobility services is quite heterogeneous among the studied countries.

	China	Japan	South-Korea
Urban, active and soft mobility	The emerging middle class is adaptable and very open to new services and products: largest ride-hailing market, culture of carpooling, wider popularity of app-based payments.	In contrast to China, Japan currently has the lowest uses of online ride-hailing.	*« no information »*
Electric and decarbonised mobility	Strong confidence in the future of EVs and intention to buy EVs among the highest in the Chinese population.	Vision of EV slightly more pessimistic than the world average. The intention to buy an EV is on the lowest level compared to the world average.	*« no information »*
Autonomous and connected mobility	Among the most accepting of the concept.	Artificial intelligence and robots generate little mistrust. However, Japan scores low on consumer acceptance of AVs.	Scores rather low on consumer acceptance.

Expectations towards Road Infrastructure and its equipment

All forms of mobility: Changes in the installation/equipment (road signs and signal lights) and maintenance of existing road facilities will be necessary. The road infrastructure would have to support the following new applications and services:

- V2X based stations for road infrastructure and vehicle communication;
- Road traffic information tool;
- Installation and maintenance technology using drones, IoT sensors etc.

FOCUS

Japan: Driver Safety Support System (DSSS)	China: New-generation national road traffic control network and smart highway demonstration project
Japan has integrated several safety-related V2X services into its Universal Traffic Management System. The aim is to prevent and reduce traffic accidents at intersections, lessen the driver's burden of making decisions and to increase driver's awareness about safe driving.	Promoting highway construction, management, operation and maintenance, encouraging the use of new technology such as the IoT, cloud computing, big data. This is aimed to reduce management and energy costs.

Use and protection of Data

Japan and South-Korea score well on the sharing of data (open data). Open data in South Korea indicates that the country is supporting innovation. In Japan citizens can now monitor government IT investments.

In the context of open data, Japan has planned to set up a system to share the data obtained by the experimental testing of automated driving systems. Such a database should be used for the development of AI, the creation of "Local Dynamic Maps" for automated driving and for the sharing of traffic data.

The government will also examine possible privacy issues relating to the use of such data.

South-Korea will allow for industry exemption on Personal Information which enables the use or provision to a third party of anonymous personal information for the development of mobility services (without identifying to whom a piece of information belongs).

SPECIAL FEATURES: CHINA

"Great Firewall of China"

Companies operating in China have to host all their data and digital resources in China. This firewall established since the 2000s prevents access from China to servers hosted abroad, mainly to large digital platforms (Google, Facebook, etc.) competing with the Chinese Internet actors (Baidu, Alibaba, Tencent). Through legislation, China has been creating "cyber-barriers" that obliges Internet sites and applications hosted in China to register to State authorities.

In this context, the **Cybersecurity Act** (2017) states that personal information will have to be stored on Chinese territory. It also introduces the concept of "critical information infrastructure (CII)". CII managers will have the obligation to protect their infrastructure from unauthorized leaks and interference. It can be assumed that CII managers will not have complete freedom to develop and implement software solutions.

In contrast, the Chinese **"Internet +" Plan** encourages innovation based on big data and implies easy data sharing mechanisms.

Economic model and financing

Current financing	Ideas for financing and enhancing new mobility services
China: Traditional Government support plans Under the "Made in China 2025" plan, many innovation support programs were launched by different ministries (Ministry of Science, Ministry of Industry and Information Technology (MIIT), National Development and Reform Commission). Every year, the MIIT publishes a list of several pilot projects on intelligent manufacturing eligible for public financial support.	**China**: Arrival of new State subsidies via technology investment funds. Even if there is no specific targeting on CAVs at this stage, it is likely that certain resources will be allocated to this sector in view of the priorities set out in other government plans (e.g. "Internet +" Plan). **Japan & South-Korea** New and additional business models need to be developed in terms of road infrastructure, e.g. electric charging stations, infotainment, businesses using vehicle data instead of traffic data. **Alternative gas revenue models for road administrations:** New systems are needed such as systems collecting mileages and IDs. **Maintenance:** AVs or advanced driver assisting system which requires road infrastructure support will need new revenue models for building and maintaining the infrastructure. **Earmarking of government's investments:** Government budget earmarked for Smart City development.

FOCUS : EUROPE

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Main issues

Mitigation of climate change: European countries have set **mitigation of climate change** as their main objective. Ambitious climate objectives for the transport sector can be observed in the studied countries. It is also the case at the EU level with the adoption of the EU Green Deal in December 2019 as the keystone of the mandate of the new European Commission.

Deployment of a reliable, dense and efficient charging network: European countries are aware of **the necessary deployment of a reliable, dense and efficient charging network to cope with the expected and upcoming new fleet of vehicles**, mainly electric ones. It is one of the main challenges in Europe. Norway, the Netherlands and Sweden are at the forefront of electromobility, when France, Germany and UK are just behind. In all countries, new policies consider the requirement of a charging network which should be powerful and dense enough to reassure and convince potential customers to choose electric vehicles.

Connected and autonomous mobility: European countries are quite involved. They see these technologies as **a mean to regulate traffic flows, reduce congestion, optimise transport system reliability through ITS or MaaS technologies**. Also, CAM is relying much more on road equipment than on the road itself, and some countries find here a way to solve economic and budgetary issues. In addition, international competition on data and digital technologies, especially in the mobility sector, are considered a vital matter for European countries. The Netherlands and Nordic country are at the forefront, followed closely by Germany. Consumers see CAM mainly as the best way to optimise their journeys **by avoiding congestion and increasing road safety**.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

FOCUS

Urban, active and soft mobility

- Private car modal share must decrease when public transport, active and soft mobility – particularly bicycles – are given more support
- Road infrastructure shall be able to provide multi-modality to host each type of mobility
- **Urban mobility is the field in which we observe a high concentration of electromobility and CAM solutions**

Electric and decarbonised mobility

- It is one of the main challenges in Europe
- As car manufacturers are now proposing a larger range of EV vehicles in order to decrease their fleet emissions within the EU, EV market share is expected to expand quickly
- Current and expected EU legislations intend to foster clean vehicles on a neutral technology basis
- Several European countries favour mainly electric energy but want to remain technologically neutral and are looking into other potential energies, such as hydrogen

Autonomous and connected mobility

- UK, the Netherlands, Sweden, Finland and Norway are world leaders in this field, through very advanced legislation on experimentations and trials
- Technical, regulatory and standardisation aspects should be discussed at the EU and/or UNECE levels
- European countries did not make a clear technological choice between ITS-G5 and 5G, which will probably lead to a hybrid system

Maturity assessment

As stated before, on all mobility aspects, Northern Europe has some advance on its neighbours. Europe is very advanced in urban mobility, favouring active and soft mobility, having already a good public transport network in its large cities. On CAM, Europe already has some leaders and some countries have global car manufacturers (Germany, Sweden, France). Finally, Europe is not left behind in car decarbonisation, if we compare with Americas and Asia and is organising itself to remain a global competitor (e.g. through EU Battery Alliance and EU Industrial Strategy). EU is also seen as the better level in defining standards, even if decision process is longer than in the Unites States or China. Europe has then a good maturity assessment.

Identified needs for the road infrastructure network

All forms of mobility	Ensuring maintenance of the whole ageing network
Urban, active and soft mobility	Redesigning road space and occupancy considering new forms of mobility
Electric and decarbonised mobility	Providing efficient charging solutions
Autonomous and connected mobility	Developing large connected road equipment (MaaS, ITS services) to optimise road traffic and improve road safety

Ecosystem and Governance

ROLE OF PUBLIC AUTHORITIES

In almost all European countries, public authorities – State departments at national/regional scales dealing with the political organisation of each country and the related competences – are very involved in promoting and developing new mobility patterns. Several national Department of Transports (DoTs) or transport agencies are proposing dedicated strategies showing national interest in each new mobility. For example, Austria seems to be much more involved in CAM, whereas Germany is now more focused on the necessary development of a charging network. France recently updated its legislation on mobility development to give more competence to local bodies. As most of European countries are federal or/and decentralised countries, local authorities have an important part to play in new mobility schemes (Länder in Germany, Regions in Spain). **Cooperation is a key word here.**

Cities play obviously a bigger role in urban mobility and concentrate most of the mobility innovations and outcomes (Barcelona, London, Helsinki), such as autonomous shuttles in city centres, definition of low-emission zones, development of MaaS applications, restraining car access, transforming areas for pedestrians...

As stated before, standards and technical discussions take place at the EU and UNECE levels, especially for CAM.

ROLE OF INDUSTRIALS

European countries can count on major car manufacturers and OEMs, especially in Germany, France and Sweden. There are many trials, shared projects, sectors agreements between public authorities and industries in all mobility aspects (German/Swedish cooperation on ERS systems, AV test areas in France/Germany/Luxemburg, BMW-Fiat/Chrysler cooperation). The European Battery Alliance, which has been recently launched, represents an important step for Europeans, involving Member States and large private players (France and Germany among others).

On the one hand, urban mobility developments mostly happen through the reinforcement of public transport networks commonly handled by public transport companies. On the other hand, there are new smart and micro mobility services, which are implemented by European and non-European companies. In smart mobility area, Finland is a world leader in MaaS technology, and ITS services are under development in several countries. In the micro-mobility field, U.S companies are already quite developed (Uber, Lime) and have penetrated European markets.

The industry is becoming aware of the necessary adaptation of road infrastructure to the mobility transformation, especially for connected and autonomous mobility.

TECHNOLOGICAL ORIENTATIONS

Urban, active and soft mobility	Complete support to public transport, active and soft mobility across Europe Reduction of private car modal share
Electric and decarbonised mobility	Going towards electrification, with a technological neutral position Some developments are made in hydrogen technology
Autonomous and connected mobility	Going towards a hybrid system between ITS-G5 and 5G technology. Long decision process in the definition of standards.

USER PERSPECTIVE

Most of European consumers consider connected and automated vehicles as a mean to reduce time in traffic and improve road safety. Level of acceptability of this mobility is growing and a large majority would like to see significant government involvement regarding the development and use of AVs. Liability, legal certainty and cybersecurity are the main concerns of consumers about these vehicles.

Regarding electric vehicles, European consumers stay rather sceptical. They still consider these vehicles as too expensive, with a short autonomy range and point out a lack of charging stations. Despite different perceptions from one country to another, this is a common trend.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Accessibility to new mobility is reflected in different strategies:

- Accessibility to vulnerable groups: elderly people mainly;
- Zone accessibility in urban and rural areas. Some countries indicate that Transport on Demand (ToD) would be a solution in rural areas, such as more flexible transport schemes. In urban areas, digitalisation is rather preferred to increase efficiency and accessibility of daily travels;
- User-centred mobility: propose different mobility solutions to the users - more appropriate to urban areas – through public transport, car-pooling, bicycles etc...;
- Accessibility issue seems to be more addressed in an urban context.

Expectations towards Road Infrastructure and its equipment

Road infrastructure is expected to adapt to new mobility changes in the coming years. As the road network needs to be maintained and upgraded, European countries prefer to act on its equipment for economic reasons. All solutions are made towards two main objectives: **reducing greenhouse gas emissions from road transport and increase road safety.**

Connectivity and digitalisation of road transport is under study. ITS and MaaS technologies are considered as the best options to reduce congestion and optimise traffic management. Some countries are trying to achieve this objective, avoiding major physical changes of road infrastructure. Equipment such as sensors, captors, phone-apps, remote control are given more support. The other objective is to allow to have a readable road for future vehicles under all conditions (as in Finland for example), in order to ensure a high level of **road safety**.

Also, charging infrastructure network should be considered more as a road equipment than road infrastructure itself. There are ongoing trials and experimentations in freight and public transport on induction and catenary systems, in which Sweden, France and Germany are leading the way. The economic potential in this field is being studied.

Concerning Urban mobility, cities need to redesign public space and accessibility. With the reduction of space for cars, cycling infrastructure, pedestrian areas and transport public networks should also be supported through road infrastructure and not only road equipment. Most important road infrastructure changes will rather take place within cities**.**

Use and protection of Data

The European Union is known to have enacted the most protective legislation on personal data in the world in 2018 with the **General Data Protection Regulation (GDPR)**. Considering recent developments from the European Commission, the EU intends to have an ethical policy on the use of personal data and to move towards data sovereignty. Several countries, such as Germany, Nordic countries, France (National data protection agencies, defined objectives in national strategies, more protective national legislations) are concerned by this issue and consider it as a **high priority**. Europeans intend to be leaders in data protection. This section addresses more the CAM field. EU expert groups are currently working on this topic.

Economic model and financing

In all the mobility cases studied, the issue of economic models appears to be the most critical point. As road infrastructure relies extensively on public funds or taxes, public stakeholders have different strategies:

- Proposing blended funds to attract private investments (UK for example). This is mostly the case in urban as well as connected and automated mobility;
- Proposing subsidy schemes for clean vehicle purchase;
- Establish Public-Private Partnerships on some projects (Belgium).

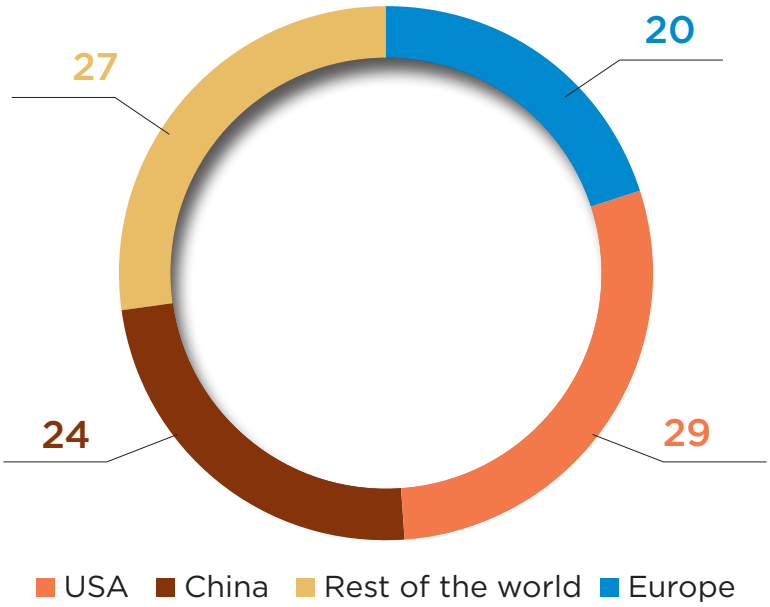
As road maintenance entails extensive costs, European countries prefer to prevent spending large amounts of money in bringing major changes to the road infrastructure. The prefered strategy is to wait for the emergence of more mature technologies and mobility modes.

2/ FACTS & FIGURES

Nota bene: ***The results presented in this benchmark are based solely on the responses obtained from the qualitative approach, meaning from participants and the additional literature researches. They represent trends and may differ from the empirical reality. The elements below are statistical elements and reference points for a better understanding by the reader and to put into perspective, if necessary, the assumptions derived from the qualitative approach.***

AUTONOMOUS AND CONNECTED MOBILITY

Expected self-driving fleet share in 2030 (%) by region



[1]Wagner, I. 2020: *Size of the global autonomous car market 2018-2030*. Statista.com. Accessed May 14, 2020.

638k AVs
expected on roads worldwide in 2022

12%
in car sales expected worldwide to be AVs in 2030

1 / Wagner, I. 2020: Size of the global autonomous car market 2018-2030. Statista.com. Accessed May 14, 2020

ELECTRIC AND DECARBONISED MOBILITY

Electric and decarbonised mobility (2018)	Electric vehicle charging points	Passenger car fleets (BEV/ PEV/PHEV)	EV sales	EV market share or forecast production
Worldwide	**143.502** publicly available **fast** electric vehicle chargers (more than 75% in China)[2]	BEV in use: **3,29 million units**[3]	PEV sales: **2,02 million units**[4]	
European Union (2019)	**164.000 electric charging points**, of which 15.136 are **fast** charging points	BEV fleet: **626.000** PHEV fleet: **517.000**		Electrically chargeable vehicles: **3%** Hybrid electric vehicles: **5,9%** Other alternative vehicles: 1,6%[5]
United States	25.475 electric charging stations for **81.161 charging outlets** (25.874 charging outlets are in California)[6]	**1.1 million** BEV and PHEV in use[7]	PHEV sales: **122.100 units**	
Canada	**7.940 electric vehicles chargers** (7.100 are "slow" chargers and 840 "fast" chargers)[8]		**New registrations of battery electric cars**: 22.600 units[9] **New registrations of plug-in hybrid electric cars**: 21.500 units[10]	

2 / Wagner, I. 2020: Autonomous vehicles - global market penetration 2021-2030. Statista.com. Accessed May 19, 2020.
3 / Wagner, I. 2019: Autonomous-ready vehicle additions worldwide 2020 to 2023. Statista.com. Accessed May 19, 2020.
4 / Wagner, I. 2019: Number of publicly available fast electric vehicle chargers (EVSE) worldwide from 2010 to 2018. Statista.com. Accessed May 18, 2020.
5 / Julia Engelmann 2020: *Electric vehicles in Japan - Statistic & Facts.* Statista.com. Accessed May 18, 2020.
6 / Wagner, I. 2020: *Plug-in electric light vehicle sales* worldwide 2015-2019. Statista.com. Accessed May 18, 2020.
7 / European Automobile Manufacturers Association 2019: *Fuel types of new cars: petrol +11.9%, diesel -3.7%, electric +80.5% in fourth* quarter of 2019. Accessed April 22, 2020.
8 / U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's Vehicle Technologies Office: Alternative Fuels Data Center, Alternative Fueling Station Counts by State. Accessed May 18, 2020.
9 / Wagner, I. 2019: Number of publicly available EVSE chargers, by major country and type. Statista.com. Accessed May 18, 2020.
10 / Wagner, I. 2019: Number of publicly available EVSE chargers in Canada 2012-2018. Statista.com. Accessed May 18, 2020.

China	Around **275.000** publicly accessible electric vehicle chargers[11] Around **100.000** publicly available **fast** chargers	PEV fleet: around **2.3 million units**[12]		EV production forecast 2021: around **6.8 million** BEV and PHEV [13]
South Korea	Over **5.000** publicly accessible chargers for electric vehicles[14] **3.910** publicly available **fast** electric chargers[15]		EV sales: 31.200 units	EV market share: **2,21%**[16] EV production forecast 2021: **632.000 units**
Japan	**7.694** publicly available **fast** electric chargers[17] Approximately 22.000 publicly available chargers[18]	Electric cars in use: **255.000 units**[19] 131.000 BEV units[20] 124.000 PHEV units[21]		EV market share: **1,13%**
Latin America	Approximately **628** public charging points and **66** public **fast** charging points in Latin America [22] **402** public charging points and **23** public **fast** charging stations are located **in Mexico**	Argentina electric and hybrid vehicle fleet share: less than 1.000 over 16 million units[23] Chile electric and hybrid vehicle fleet share: 1.400 units when 5,4 million vehicles were running on classic fuels[24]		

11 / Wagner, I. 2019: New registrations of battery electric cars in Canada 2012-2018. Statista.com. Accessed May 18, 2020.
12 / Wagner, I. 2019: *New registrations of plug-in hybrid electric cars in Canada 2012-2018*. Statista.com. Accessed May 18, 2020.
13 / Wagner, I. 2019: Number of publicly available EVSE chargers, by major country and type. Statista.com. Accessed May 18, 2020.
14 / Wagner, I. 2019: Number of electric vehicles in use by country 2018. Statista.com. Accessed May 18, 2020.
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16 / Won So 2020: *Publicly accessible electric vehicle chargers in South Korea 2011-2018*. Statista.com. Accessed May 18, 2020.
17 / Wagner, I. 2019: Number of publicly available fast electric vehicle chargers (EVSE) in the Republic of Korea from 2010 to 2018. Statista.com. Accessed May 18, 2020.
18 / Won So 2020: Electric vehicles in South Korea - Statistics & Facts. Statista.com. Accessed May 18, 2020.
19 / Wagner, I. 2019: Number of publicly available EVSE chargers in Japan 2012-2018. Statista.com. Accessed May 18, 2020.
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21 / Julia Engelmann 2019: Electric car stock in Japan 2009-2018. Statista.com. Accessed May 18, 2020.
22 / Julia Engelmann 2019: Battery electric car stock in Japan 2009-2018. Statista.com. Accessed May 18, 2020.
23 / Julia Engelmann 2019: *Plug-in hybrid electric car stock in Japan 2009-2018*. Statista.com. Accessed May 18, 2020.
24 / Quiros-Tortos, Jairo & Victor-Gallardo, L. & Ochoa, Luis 2019: Electric vehicles in Latin America: Slowly but surely t*oward a clean transport*. IEEE Electrification Magazine. 7. 22-32. Accessed May 18, 2020.

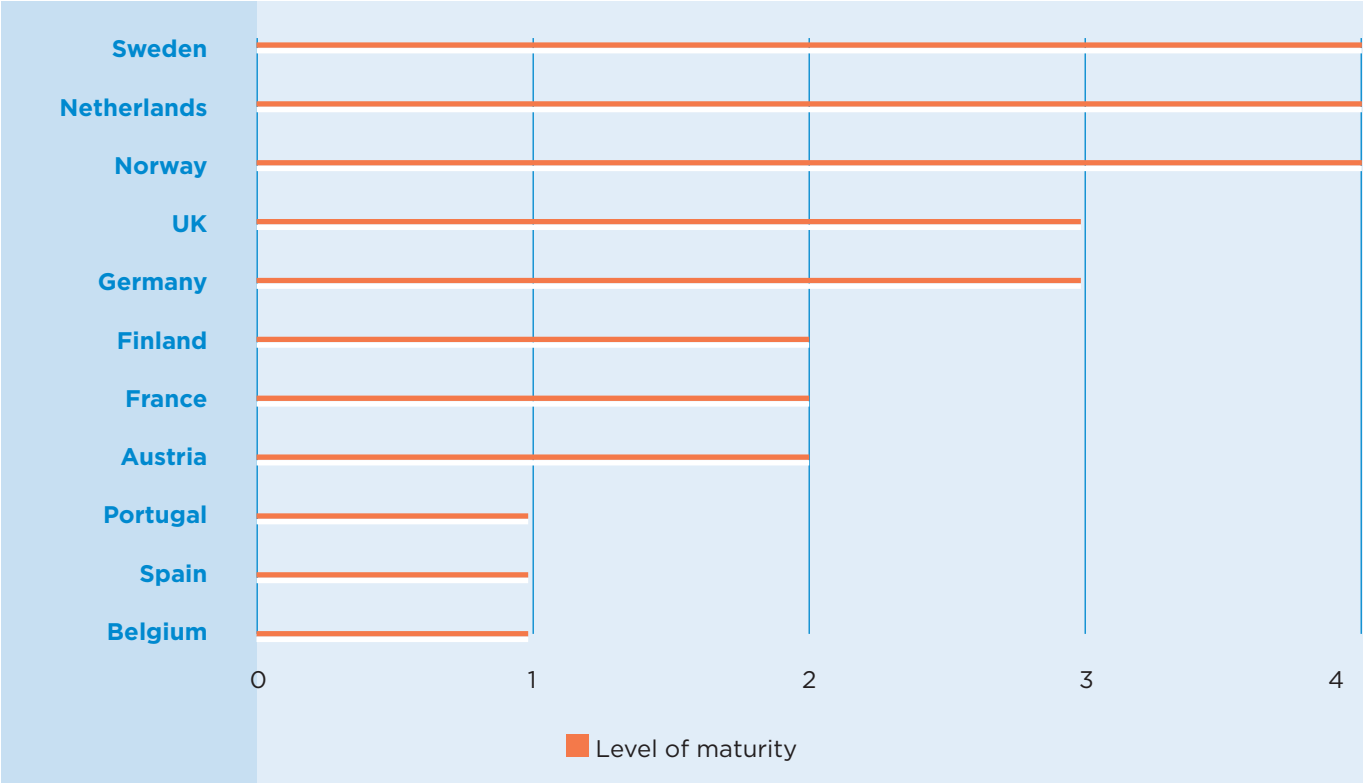
3/ COMPARATIVE ANALYSIS

***Nota bene:* The results presented below are based solely on the answers obtained from the participants and on the additional bibliographical information provided.**

EUROPE

The different European countries have been ranked from 0 to 4 in each mobility studied, in order to reflect the differences in the integration of each of them. This ranking is established by the authors on the basis of the items and answers proposed for each country. **It is not a self-assessment by the correspondents of the countries surveyed**.

DECARBONISED AND ELECTRIC MOBILITY



Within the study, we clearly see that the Scandinavian countries and the Netherlands can be depicted as leaders for this type of mobility.

There are several reasons for this:

• **Norway** has been a **reference country** for several years in electric mobility, having operated a combination of public initiatives since the 1990s (tax reduction, road taxes exemptions, privileged parking, free recharging). Approximately 10% of the Norwegian car fleet is now powered by electricity.

• **The Netherlands** is a leading country in this field, representing **25% of the European Union's network of public charging stations**. The Dutch national strategy and government involvement is characterized by a high level of cooperation between the public and the private sector.

• **Sweden** is also one of the leading countries in electromobility: the market share of electric vehicles in 2018 was 8%, the third highest in the world. Furthermore, **Sweden stands out in road electrification**, experimenting with **Electric Road Systems** for freight and public transport.

The **United Kingdom** and **Germany** are in the second quarter of the ranking for different reasons:

• The **United Kingdom** can count on a **high level of public investment and involvement in the field**. Within the general framework of their industrial strategy, the British public authorities have developed several targeted strategies in the field of electric mobility and with the objective of reducing greenhouse gases in the field of road transport. The emphasis is proactively placed on the development of charging stations and their pricing systems, and on strengthening the maturity of the electric and hybrid vehicle market. The UK's trajectory can be depicted as encouraging provided that the level of public involvement is maintained.

• **Germany** can count on its powerful automotive industry, which has already started to strongly electrify its offer in 2020. In addition, the German government has recently proposed several targets and a **"master plan" for electromobility and hydrogen** in Germany (1 million recharging points in 2030, creation of a national center on recharging infrastructure, production of batteries on national soil).

France, Austria and **Finland** are in the third part of the ranking:

• **France** has set rather ambitious objectives in the electrification of its car fleet and in the deployment of public charging stations. Nevertheless, the French automotive sector is calling for greater government involvement and a discussion on financing this transition is latent. In addition, French players are looking into hydrogen and are organising a national sector, notably to reach the logistics and freight transport sectors. The involvement of public authorities should be more sustained, despite an initial good step forward for the road sector with the passing of **the Mobility Orientation Law at the end of 2019.**

• **Austria** is mainly oriented towards electromobility but is technologically neutral, considering also other energies for the next decade. The country has developed a **new strategy in 2018** with new objectives. The integration of hybrid and electric vehicles is rather encouraging. Nevertheless, **the need for a recharging infrastructure is deemed essential** for the integration of electric mobility in the medium term.

• **Finland** has an average level of integration of electromobility: the share of electric and hybrid vehicles is rather satisfactory, as is the supply of recharging network (nevertheless very low numerically). The new government will propose **a comprehensive transport plan in autumn 2020**. In addition, Finland's targets for reducing emissions can be seen as very ambitious with the objective of being carbon neutral by 2035.

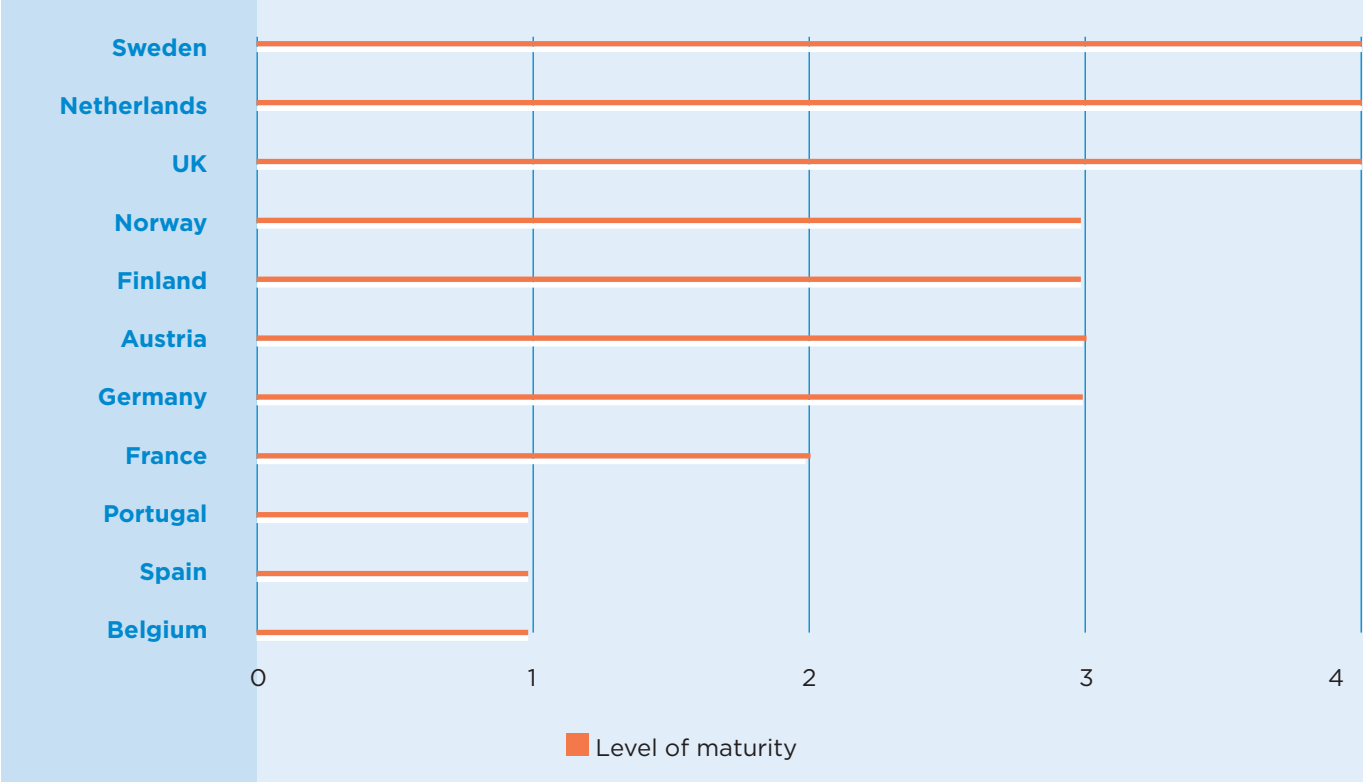
Finally, **Spain**, **Portugal** and **Belgium** are at the bottom of the ranking:

• **Spain** has a relatively low charging network in proportion to its population in the EU (around 4.5% of public charging points). The share EV sales is not yet very high. Moreover, the public authorities do not currently have **a sufficiently ambitious strategy** for developing electric mobility at national level. Nevertheless, it can be pointed out to local initiatives that should be considered in the country's major cities.

• **Portugal** is more ambitious than its Spanish neighbor in terms of electrification of its transport network. The share of electric and hybrid vehicles is also higher. However, its charging network is not yet mature enough with comparable countries and is holding back the development of electric vehicles.

• **Belgium** has less ambitious objectives than its neighbors in this area. Moreover, it suffers from its **highly fragmented mode of governance**, in which the Regions play a predominant role, which makes it more difficult to understand what action is being taken at national level. The Regions do not adopt the same strategies concerning electromobility.

AUTONOMOUS & CONNECTED MOBILITY



Again, and in the context of the study, **the Netherlands** and **Sweden** are among the most advanced countries in this field. The differences are less significant than for carbon-free and electric mobility, with several countries at level 3 and France alone at level 2. Europeans in general can be considered to be among the world leaders in this type of mobility.

Concerning the countries classified at level 4:

• **The Netherlands** are considered to be the world leader in this field according to the available data, having already launched the first **platooning** test in 2016. Autonomous and connected mobility is considered in **the field of logistics and freight**, considering the country's geographical and commercial position in Europe. Also, the country is relying heavily on MaaS and ITS technologies, focusing more specifically for the moment on road equipment than on the road itself.

• **Sweden**: The Scandinavian countries are all very advanced in this type of mobility. However, the level of technical maturity and **strategic thinking** of the Swedish public authorities on many items seems more advanced than in the neighboring countries. Also, Sweden can count on very strong cooperation between its public authorities and its automotive industry.

This level of ranking remains to be confirmed in the coming months.

Concerning the countries classified at level 3:

• **United Kingdom**: As with carbon-free and electric mobility, the United Kingdom can count on a very proactive attitude from public authorities and **one of the most open legislations** in the world on connected and autonomous mobility. The country is multiplying public-private partnerships to create a dedicated ecosystem. Moreover, this mobility is envisaged first and foremost on road facilities.

• **Norway** competes on a similar level with other countries ranked at level 3. The country chose **5G** in its recent national strategy on artificial intelligence. It already has a high level of connected infrastructure and 4G coverage and wants to address road equipment first. In addition, the level of partnerships with the private sector is among the highest. **Its leading position in electromobility also induces an already high level of social acceptability** in favour of autonomous vehicles.

• **Finland** has an **open legislative and regulatory environment** for this type of mobility. The country can also count on its **leadership position in MaaS technology**, which it was among the first to develop. Also, Finland is focusing on road equipment, connectivity and the use of autonomous vehicles in particular weather conditions. Numerous projects are underway with the private sector.

• **Austria** focuses on autonomous and connected mobility. The Austrian authorities are among the most proactive in the world on this mobility, with **a clear and assertive policy framework**. The country is also seeking to form partnerships with its neighbors and foreign multinationals in an effort to cooperate internationally on this issue. The country is particularly interested in the connectivity of road equipment (MaaS, C-ITS).

• **Germany** has been reflecting on this mobility in a concerted manner with private players and the research sector for several years now. It already has a complete strategic framework and its automotive industry is working together to face international competition in this field. The country wants to reach **strategic and regulatory coherence at the national level**, given its federal structure.

• **France** is the only country classified at level 2:

France has proposed a national strategy for 2018 and a large number of experiments have been launched and are underway in the country. An ecosystem between the public authorities, private players and the research sector has enabled the implementation of this national strategy. The country seems to be **more cautious about autonomous mobility** (which types of vehicles, which uses). It should be noted that one of the French automotive groups has indicated that it has no intention to go beyond level 3 AVs. The evolution of the legislative and normative environment is less advanced here than in other countries**. Its level of maturity and reflection is, however, fairly advanced.**

Finally, **Spain, Portugal** and **Belgium** are classified at level 1:

• **Spain's regulatory framework on AV is not as advanced** compared to the other studied countries in Europe and does not have a national strategy at this stage.

Trials are taking place at local level, and large companies in the construction or automotive sector have also produced pilots. An evolution of the regulatory and legislative framework is desirable.

Portugal is facing the same problems as its Spanish neighbor and **does not have a clear regulatory and legislative position** on the testing of these vehicles.

Belgium has a **legislative and regulatory tool** (Code of Practice for Testing Autonomous Vehicles) for conducting experiments on autonomous vehicles and connected technologies, which are carried out in different parts of the country. Here again, the Regions conduct the experiments, in the absence of a defined national strategy.

URBAN, ACTIVE AND SOFT MOBILITY

A ranking has not been established for this type of mobility. The level of maturity and integration is rather similar within the European countries studied, even if some specific cities seem to be more advanced. Besides, the main differences in urban mobility achievements can differ especially within the studied countries themselves (capital city and its suburbs vs. countryside).

Based on the data analysed in this study, the level of maturity concerning the **integration of new mobility in urban areas is the highest in the world in Europe**. The movement takes place in metropolises and large cities, which are often very dense. It should be noted that action is very often decided at local level, and this was even a determining factor in federal or highly decentralised countries such as Belgium, Germany or Spain, where cities and regions have the responsibility for transport and roads.

The Scandinavian countries and the Netherlands remain ahead, closely followed by all the other targeted countries. All European cities and countries are competing with each other in projects to reduce the space for individual thermal cars and to increase soft and active mobility (cycling, walking, public transport). **Cities are also the places where innovation in mobility is concentrated**: MaaS application, electric bus networks, subsidy systems for the purchase of electric two-wheelers, carpooling.

All actions are directed towards cleaner mobility that reduces greenhouse gas emissions and the various forms of pollution: air, noise and visual.

The question of the inclusiveness of the new mobility within the different countries was raised. Indeed, it has been observed that there are sometimes significant differences in the integration of new mobility between very large capital cities such as London and other cities in the country (Birmingham, Manchester). The **proposal of alternatives to the individual vehicle** is often the criterion used. Some countries consider **that collective, on-demand and autonomous mobility can be a solution** in peri-urban and rural areas in the short and medium term.

Concerning road infrastructure, the road is seen as a new space for sharing and coexistence between different forms of mobility that are sometimes in competition: cyclists, motorists, delivery vehicles, pedestrians, etc. Cities are redefining their urban space by giving a larger share to soft mobility via dedicated lanes, for example, or by spatio-temporal regulated traffic (certain vehicles are allowed on certain lanes at dedicated times). **Roads nevertheless remain the intrinsic element of mobility** in cities and are much more taken into account than in the other two forms of mobility studied.

Analysis and orientations within Europe

THE ROLE OF ROAD INFRASTRUCTURE

> The role of road infrastructure is generally underestimated

The European countries studied are more focused on new mobility than road infrastructure itself. The role and weight of physical and existing infrastructure is not often taken into account when assessing new mobility developments. This might even be more critical when talking about urban mobility. The current trend of allowing more space and facilities to 'soft' mobility in urban areas, especially as a post-effect of Covid-19, might bring major changes on the whole urban mobility approach in integrating the role of road infrastructure. This could however represent a **window of opportunity for the road infrastructure sector to demonstrate how these changes are facilitated by adaptations to the existing road infrastructure**.

> Maintenance of road infrastructure is identified as key enabler for new mobility

According to most of the respondents, maintenance and rehabilitation of road infrastructure should be better addressed as **road infrastructure is essential in enabling daily live mobility**. Higher levels of public investment are needed. A new funding model is also to be invented that favours a **logic of allocating revenues to maintenance following the "user pays" or "polluter pays" principles**. Some countries have for example introduced such user revenues or "user pays" systems via **interurban and urban tolls as well as eco-taxes**.

> Major questioning remains regarding the financing of new mobility and the use of road

The future business model of road infrastructure is subject to major questioning. New mobility business models are relying a lot on public support according to the respondents. **However, in addition to optimised user payment, private participation could become an essential lever to meet the expectations of new mobility services**. This could be especially true regarding the installation and management of recharging stations for hydrogen and EVs. The question remains which entity is going to pay for the installation and the maintenance of such new mobility equipments and supplies. The question also arises whether Public-Private Partnerships can be considered for the installation and the maintenance of road infrastructure. The question of who will pay for the use of road could not be answered within this study.

THE CONTRIBUTION OF THE ROAD INFRASTRUCTURE SECTOR TO CLIMATE NEUTRALITY OBJECTIVES

> Decarbonising the road sector will become a key objective in Europe and among road stakeholders

The study has shown that all the studied European countries are heading towards the same direction of **decarbonising the road sector**. The European Commission has already set out a clear vision, through a European Climate Law proposing a legally binding target of net zero greenhouse gas emissions by 2050, but also reflections regarding a common understanding of the characteristics of a sustainable activity (taxonomy), including future delegated acts dealing with low carbon transport. However, for the road sector to contribute fully to the EU decarbonising efforts, several items have to be taken into account:

• More details are awaited, particularly with regards to European regulations on **taxonomy**. Criteria for assessing, for example, the reuse and recycling of materials, emissions from maintenance and construction operations are not yet defined. However, the tools to quantify them already exist: we know how to quantify the impacts of construction and different maintenance sequences over the entire life cycle of the infrastructure. The methods are in the process of being standardised at European level. **The road infrastructure sector's contribution to the climate neutrality objectives can mainly be achieved through actions on infrastructure design, changes in the processes and materials used, and by thinking about the life cycle and resilience of infrastructure. These actions can be partly dissociated from changes in mobility**.

• A clear distinction is needed regarding the contribution of road infrastructure to climate neutrality objectives: **roads themselves are not direct emitters of emissions**, as these are caused by the combustion engine vehicles in circulation. **Roads can contribute to the green transition through the deployment of charging infrastructure for low-emission vehicles. The provision of such equipment is part of the role of road infrastructure**.

> The transformation of road freight transport is a potential vector towards carbon neutrality of the EU

The transformation of freight transport can follow two complementary paths:

- A significant improvement in vehicle energy consumption and the use of decarbonised energy;
- The transfer of parts of this transport to rail and waterways and the creation of interconnected multimodal platforms. Road transport must be combined with rail transport.

The EU Green Deal states that a substantial part of the 75% of inland freight currently carried by road should be shifted to rail and inland waterways. The European examples in this benchmark show **a shared willingness to move road freight transport forward. In addition, specific consideration is being given to urban freight and logistics, particularly in relation to the "last kilometre".**

NORTH AMERICA: WHAT LESSONS FOR EUROPE?

FACTORS THAT TRIGGER NEW MOBILITY IN THE UNITED STATES: THE WEIGHT OF THE INDUSTRY, START-UPS AND THE DIGITAL ECONOMY

According to the findings of this study, the thinking on new mobility in the United States was mainly triggered by the industrial sector, particularly the automotive and advanced technology sector. The United States is home to the leading companies working on alternative driving systems, meaning decarbonised, automated and connected driving systems.

Tesla built 76,000 EVs in 2017 and 100,000 models were planned for 2018. 367,500 were built in 2019.

The commitment to the construction of charging stations comes mainly from the automotive sector: Tesla announced the doubling of the number of charging stations and Volkswagen invested USD 2 billion in charging infrastructure following the Diesel Gate.

We must add **the involvement of the GAFA** and other players of the digital economy in the definition of new mobility services. The activities of traditional road and mobility actors are partly influenced by the GAFA and the assumption can be made that they could replace some activities of traditional road actors (encompassing the owner, engineering companies, construction companies and equipment manufacturers).

Waymo (Google Car) tested its AVs over 16 million km and was able to identify 20,000 different driving situations.

Toronto Sidewalk Labs, a subsidiary of Alphabet, Google's parent company has been appointed to transform one of the last remaining shoreline brownfields in Ontario. In light of the COVID-19 pandemic, this project has however now been cancelled by Google because of the financial uncertainties that may arise.

American start-ups contribute more widely than in Europe to the implementation of new forms of mobility, including autonomous driving systems. They succeed in raising significant financing from large groups and investors. Major technical developments are seen as possible within small promising structures, which is less the case in Europe.

Tesla acquired the start-up DeepScale in order to move from EV to AV technology. DeepScale's market value was estimated around USD 18.5 million.

FACTORS THAT TRIGGER NEW MOBILITY IN CANADA: MODELS OF PUBLIC INITIATIVES

Support for new forms of mobility and alternative driving in Canada for consumers and the private sector comes mainly from state incentives. The Canadian government has decided that **zero-emission vehicles** will be strongly supported by an aid plan. Financial incentives are provided and can be combined with similar provincial aid. Canada has one of the highest state commitments in financing AV pilots.

A total of CAD 320 million is being invested in stations and charging infrastructure. The Canadian government has invested CAD 6 billion in the automotive sector to ensure that a significant portion of the growth in electric vehicle technologies will be devoted to research and development.

PARTNERSHIPS: ENABLING INTEROPERABILITY OF ROAD NETWORKS AND THEIR EQUIPMENT

Because Canada's and the U.S. transportation systems are integrated, interoperability agreements are essential to support mobility. The interoperability agreements identified in this study concern charging stations that allow users to access public charging stations on the networks of both countries, with little change of operators, no additional costs and harmonized standards for the communication of connected vehicles.

FLO and ChargePoint have provided their members with access to public charging stations on networks in Canada and the United States.

BARRIERS TO THE DEVELOPMENTS OF NEW MOBILITY

• The ambiguous role of governance in the United States and Canada in supporting new mobility

The potential for the deployment of new forms of mobility is somewhat hampered by the lack of harmonization of political regulations between the various states and provinces. Both countries suffer from the fragmentation of competences, divided between government agencies and the various federal entities. As a result of this scattering, states are mainly responding downstream to the deployment of new mobility. The security requirement is an example and has been reflected in federal bills and documents in the United States. This security requirement can be explained following the Tesla and Uber accidents related to the vehicle's defective Autopilot driver assistance system.

On the other hand, U.S. and Canadian executives also give strong political and industrial support to the deployment of new mobility.

The U.S. government is committed to ensuring that all federal funds used for CAV research will comply with the "U.S. Buy and Hire Orders" and "Maximize the Use of U.S. Manufactured Goods, Products and Materials" Acts to ensure U.S. growth and leadership in AV technology.

Canada provides one of the world's largest financial supports for the development and testing of AVs.

• The role of road infrastructure: Maintenance is key

Another barrier that can be identified in North America is the lack of support for road infrastructure and its necessary and existing equipment. The current quality of infrastructure may not be able to accommodate new mobility. In terms of equipment, both countries have a low number of recharging points and an uneven spatial distribution of the latter on their territory. These problems are exacerbated in sparsely populated areas with extreme weather conditions. Maintenance must contribute not only to the reception but also to the inclusiveness of new forms and services of mobility. The same question arises in Europe. Traditional road actors, encompassing the owner, engineering companies, construction companies and equipment manufacturers, are likely to gain importance in the rehabilitation and maintenance of the existing network.

Analysis and orientations for European road infrastructure stakeholders

THE ROLE OF ROAD INFRASTRUCTURE

> Support and requirements to the industry sector as an enabler for new mobility

The North American analysis shows that a strong support of the industry can be crucial is ensuring innovations and progress in the development of new mobility. This is coupled by strong requirements, especially related to safety, towards the industrial sectors when issuing new mobility services.

The EU industrial strategy already stresses some aspects in the development of new mobility: development of alternative fuels, raw materials value-chains, sustainability requirements for batteries, building up of new standards for new mobility and infrastructure roll-out.

Compared to North America, **some aspects within the EU should however be reinforced**: level of public investment, development and support of private initiatives (start-ups), EU strategic autonomy in new mobility sectors and the choice of communication technologies as well as the control and data management. These orientations have to be followed-up in the upcoming Sustainable and Smart Mobility Strategy in 2020.

> The road infrastructure sector as a major contributor to road safety in the context of new mobility services

The American example of car accidents linked to deficiencies in the Autopilot Driver Assistance System shows that, in terms of safety, stand-alone technology may not yet be mature enough. This raises the question of regulation and safety thresholds. Here, too, road actors can make a contribution.

These examples highlight the fact **that road safety must be considered in a global way, including all its components, and of course the infrastructure. Driver assistance systems can only be effective if they are backed up by infrastructure capable of providing the elements necessary for safety**, whether physical (various equipment such as markings, signs, restraint devices, sensors and cameras, etc.) or virtual (real-time traffic analysis and management systems, etc.). Where appropriate, these systems must be able to immediately compensate for failures in the assistance systems.

Furthermore, the emergence of new connected or autonomous vehicles must not make us forget that **other users and vehicles (unconnected, non-autonomous) must continue to be able to benefit from traditional road safety equipment**. This point also raises the question of the performance thresholds of this equipment, which must be read, interpreted and understood by both the human user and the assistance systems.

The coexistence of different types of users and new mobility patterns poses new challenges for the road infrastructure sector, which must not only continue to keep pace with developments in mobility, but also anticipate them. In this sense, it is **essential to ensure the maintenance, but also the modernisation, improvement and adaptation of road infrastructure to the new mobility models, by ensuring the necessary funding for this transformation**.

> Lack of road equipment and road maintenance identified as major barrier to the deployment of new forms of mobility

The North American example shows that a lack of equipment (charging infrastructure but also proper road maintenance) may lead to or exacerbate problems of inclusiveness concerning mobility services. Europe may face similar issues.

The European Green Deal addresses some of the issues such as the commitment to support the new deployment of public recharging points, particularly for long distances or in sparsely populated areas. However, other aspects related to road equipment need to be stressed within the EU action plans. That will allow for the road sector to fully contribute in new mobility developments.

Contribute to a sustainable mobility and a better accessibility for road users considering maintenance, upgrade and rehabilitation as key orientations. The major role of road infrastructure in proving a high level of service to users goes through these essential aspects.

Also, roads are more adaptative that other transport infrastructures: they can easily be modified and improved that a railway network, for example.

System interoperability: the contribution of the road infrastructure sector

Research and experimentation is currently underway in many countries in Europe, America and Asia. The solutions developed are first of all national (UBR or roadside units for guiding connected vehicles or electric charging station for example). How can we be sure that equipment located on one side of a border will be operational once it has been crossed? The United States and Canada are working together on the **interoperability of systems, which is indeed a key point to guarantee their effectiveness**.

This interoperability concerns both electric and connected vehicles, as well as autonomous ones soon. They connect to charging stations on the one hand, and to the infrastructure on the other hand, such as markings and vertical signs, which they detect and analyse directly by themselves or through on-board systems. This equipment designed, manufactured and implemented by the road sector companies must be recognised by all vehicles in circulation across EU countries, otherwise these systems would lose much of their interest.

ASIA: WHAT LESSONS FOR EUROPE?

FACTORS THAT TRIGGER NEW MOBILITY IN ASIA: IMBRICATION BETWEEN THE STATE AND THE INDUSTRY

The countries studied are characterized by a **strong involvement of their respective governments** influencing the industrial sector. Government funding for AV pilots is high and there are strong government support and incentives to develop alternative driving systems.

Since 2018, the Chinese government has set quotas for automakers, carbon credit rules and increasingly restrictive standards on GHG emission standards to discourage the development of combustion vehicles.

According to the Korean government, half of the fleet is expected to be composed of AVs by 2030. The government aims to support the development of AV up to EUR 1.3. billion from 2021 to 2027.

In consultation with automakers, the Japanese government has set a timetable for the deployment of AVs in Japan.

The countries studied have a **more global view of mobility**. They have ambitions to position themselves as leaders in digital technologies: artificial intelligence, 5G networks, robotics, Big Data. This is also the case in the field of mobility via the Smart City developments.

It is worth noting the **weight of the digital economy** in China via the BAT (Baidu, Alibaba, Tencent) which represent the equivalent of the American GAFA and are now all involved in the transport sector. Traditional mobility players in Europe are struggling to perform similar service functions.

Baidu CarLife and BaiduMaps present an alternative to software developed in-house by automakers and equipment suppliers and can complement and replace the services provided by its U.S. counterparts.

Behind the general axis of strong government and industry engagement, other triggering elements to new forms of mobility can be identified in each of the studied country:

- Influencing the design, operating rules of AVs as opposed to the United States
- Internationalising Chinese standards
- Helping to reach and integrate rural populations

- Contributing to South Korea's economic development and regional security
- Containing rapid urbanisation and the harmful consequences of overpopulation

- Anticipating population ageing and its economic consequences
- Better anticipating the probabilities of natural catasrophes

JAPAN AND SOUTH KOREA: SOCIAL OBJECTIVES

In Japan, the government's initiative of **Society 5.0** has the objective to address various social challenges by integrating the innovations of the fourth industrial revolution (i.e. IoT, Big Data, artificial intelligence, robots) into economic and social life. A similar approach is developed in South Korea via the Smart City which, according to the definition of the Ministry of Infrastructure and Transport of Korea, is a multi-layered platform where each function is connected by a physical infrastructure or software systems to support city's social and economic activities.

A parallel can be drawn with the European Commission's Reflection Paper *"Towards a Sustainable Europe in 2030"* which describes digital transformation as a catalyst to respond to the Sustainable Development Goals of the United Nations.

KEY SUCCESS FACTORS FOR NEW MOBILITY

• High acceptability

New technologies such as 4G or 5G developments, artificial intelligence and industrial robot technology do not generate much reluctance in the countries studied. In China especially, acceptability is particularly high for all forms of mobility. Data from a KPMG survey show that many of the countries least prepared for AV are the countries that best accept the concept, including China. This shows the demand of people in these countries for greater mobility, particularly in countries where the quality of road infrastructure remains low, such as China, while people in developed countries tend to demand high security for these new vehicles.

• Technological advance

South Korea has the highest Internet penetration rate in the world while Japan has been the leader in the field of 3G and now in the development of 4G (nearly 97% coverage). There are high levels of investment in research and development. Japan is the leading country in terms of stock of declared patents (27%), ahead of the United States (22%) and China (13%) and second in terms of the number of patents granted in 2016, behind China.

BARRIERS TO THE DEVELOPMENT OF NEW MOBILITY: THE QUESTION OF TOO MUCH STATE INVOLVEMENT

Regulatory barriers exist in Japan that limit companies to deploy and export their technologies. On the other hand, Chinese companies' dependence on public liquidity can lead to a lack of viability of enterprises and distortions of competition.

PARTNERSHIPS: TOWARDS A REDEFINITION AND EXPANSION OF TRADITIONAL SECTORS

• Partnerships with ICT stakeholders

This includes partnerships with telecommunications operators, IT companies, the electronic components industry, universities and start-ups. In some cases, these mergers and collaborations are part of a restructuring of the industrial landscape and a redefinition and expansion of traditional sectors.

Nissan announced in 2017 a partnership with mobile internet company DeNA, which will develop information technology systems for autonomous EVs.

China Mobile, China Telecom and China Unicom are currently working on connected vehicles. Chinese operators invest in research and development and conduct a number of autonomous driving demonstrations through partnerships with equipment suppliers and the automotive sector.

• Industrial cooperation

Agreements are reached between the energy, transport and industry sectors. In Japan especially such forms of industrial cooperation are considered to be rather unusual.

A Hydrogen Council including Air Liquide, Engie, Alstom, Total, Honda, Hyundai, Kawasaki, Toyota, Iwatani should promote the global development of hydrogen as an accelerator of the energy transition and work with the Japanese government to remove regulatory or administrative barriers to the deployment of hydrogen.

THE ROLE OF INFRASTRUCTURE AND EQUIPMENT: LEVERAGE BETWEEN THE NEED FOR EQUIPMENT AND ITS SUBSTITUTION BY THE DEPLOYMENT OF NEW TECHNOLOGIES

It is considered in some cases, that technologies such as 5G, IoT etc. can replace equipment on closed circuits such as motorways with the arrival of AVs of the automation level 4 and 5.

The countries studied however also envisage that the road infrastructure will support new services and allow for intermodality and space allocation for users. The equipment of the road is indeed experiencing a growing development at the urban level with for example the development of Smart Cities. Although no concrete action has been revealed, respondents agreed that there will be a need to modify the installation and maintenance of existing road facilities. CAVs will need to communicate with road infrastructure. Equipment such as road signs and traffic lights will be transformed through the deployment of 5G and LTE-V2X technology.

With its territory, demographics and development, China is in great need of infrastructure. It can immediately integrate from the construction phase the elements necessary to support a connected and autonomous mobility.

Analysis and orientations for European road infrastructure stakeholders

THE ROLE OF ROAD INFRASTRUCTURE

> A more global view of new mobility (Big Data, 5G) is needed for the road sector to take part in new mobility developments

New mobility services comprise a broad understanding of smart information technologies in reported cases in Asia. In Europe, the European Green Deal also addresses the necessity of combining digital and sustainability challenges through new technologies. The European Commission commits itself to ensure that digital technologies such as artificial intelligence, 5G, cloud and edge computing and the Internet of Things can accelerate and maximise the efficiency of sustainable policies. **The study shows however that integrating new and digital technologies expressively to new mobility services could be controversial for road stakeholders**. On the one hand, it could be assumed that they may replace traditional road infrastructure and equipment at least in closed circuits. On the other hand, and as in the case of the Korean Smart Cities, traditional road equipment regains momentum in organising space allocation for users in urban areas among the different mobility options. **New and digital technologies may be a catalysator in developing new mobility but road construction has to participate in the definition on how to integrate those in existing infrastructure and how to use these technologies in new construction projects**. This should be done according to a close analysis of the benefits. The integration of new technologies into road infrastructure should not be considered as a *must have* but needs a clear analysis of the benefits, the involvement and support of the road infrastructure sector might be necessary for this assessment.

> The added value of unusual Industrial Partnerships for the road infrastructure sector

According to the Asian example it can be deduced that **the participation in industrial partnerships could be beneficial for the road infrastructure sector in order to fully take part in new mobility developments**. Broad and unusual partnerships are undertaken in Asia to bring various stakeholders from different industry and information technology segments together. The European Union should insist in expanding industrial partnerships and anticipating changes in economic ecosystems. The EU Industrial Strategy proposed the establishment of an Industrial Forum in 2020 to support new alliances in mobility and transport developments. The EU Commission also considers Important Projects of Common European Interest as a suitable solution to build up alliances between EU countries and industries, as with the European Battery Alliance. In this context, a new European Clean Hydrogen Alliance has also been proposed.

THE CONTRIBUTION OF THE ROAD INFRASTRUCTURE SECTOR TO CLIMATE NEUTRALITY OBJECTIVES

> The Sustainable Development Goals should be integrated by the road infrastructure sector

The social and sustainable dimension of new mobility as depicted in the case of Japan or South Korea has also been reflected by the European Union although the technological challenge to achieve the SDGs is more emphasized in the studied countries in Asia.

The “EU Reflection paper towards a sustainable Europe” depicts digital transformation as a catalysator to meet the SDGs. This approach is also applied to the mobility and road sector. The EU paper urges to prioritize clean and affordable transport alternatives, with an objective to have zero emission vehicles on EU roads and make the best use of digital technologies to help reduce fuel consumption. As mentioned beforehand, it should be stressed here that these recommendations by the EU actually relate mostly to the vehicles, the infrastructure itself does not emit.

In this context, **facilitating the recharge of "clean" vehicles is within the role of the infrastructure**, but not the provision of clean transport alternatives as such.

More generally, the social and sustainable dimension within mobility developments such as in Asia poses the question on how the road infrastructure sectot can contribute fully to such developments in the context of new mobility.

The requirements addressed to the road infrastructure sector may not be directly related to mobility services. They may include, for example:

- The revision of public procurement criteria with low carbon criteria, user acceptability criteria (relations with local residents, construction time), or noise-reducing coatings;
- Re-examination of the design and life cycle of road infrastructure, for example by optimising the surfacing;
- Energy sobriety in the relationship between the road and urban lighting, heat islands reducing impacts;
- Integration and use of digital technologies;
- Contribution to special planning and consideration of related infrastructure demands and types of mobility.

OTHER LESSONS FROM LATIN AMERICA AND AFRICA: WHAT LESSONS FOR EUROPE?

According to our correspondents, new forms of mobility are not a priority except for large urban centers. Indeed, most of the countries studied here (Mexico, Argentina, Chile or South Africa) are characterized by a very large heterogeneity on their territory. New mobility services are being developed and offered in major urban centers such as Santiago in Chile, Buenos Aires in Argentina or Mexico City in Mexico, but not necessarily in other regions.

These urban mobility services can be distinguished by their extent and flexibility in uses.

THE SCALE OF URBAN MOBILITY MEASURES

Urban mobility initiatives are being developed strongly in large cities and represent some major references in terms of urban mobility.

Mexico's Ecobici self-service bicycle system is the second largest self-service bicycle system in North America and the fifth largest in the world.

Santiago de Chile has the largest fleet of electric buses outside of China.

FLEXIBILITY IN USE: INFORMAL PUBLIC TRANSPORT NETWORKS

The city's informal public transport networks are also taken into account when travelling. Applications such as "Where Is My Transport" identify the different formal and informal public transport networks in low- and middle-income cities.

It is in this frame that the notions of intermodally and flexibility in usage are most notable in the context of this benchmark. These concepts give an example of how to manage the complexity of cities and dense networks in particular.

RESOURCE EXTRACTION: THE DOWNSIDE OF ELECTRIC MOBILITY

In the border triangle of Bolivia, Chile and Argentina, 70% of the world's lithium deposits are to be stored which are needed to produce electric car batteries. Lithium is needed for the production of EV batteries. The extraction of lithium, as currently practised, would threaten the livelihood of the indigenous population.

Analysis and orientations for European road infrastructure stakeholders

> Intermodality implies rising expectations towards road infrastructure

The examples from the low-and middle-income countries show how expectations towards road infrastructure stakeholders may rise in the future. Infrastructure developments could be extended by the creation of hubs and crossing points for users, favouring multi-modality between different types of mobility and uses.

> Bespoke solutions: Road infrastructure should participate in allowing flexibility in uses

Access to mobility is not necessarily equal, but specific needs could be better met by a variety of solutions (Flexibility in Uses). The integration of this demand by the road infrastructure sector can contribute to this flexibility in uses and share best practices regarding the adaptation of existing infrastructure to new mobility needs (dedicated lanes, hubs, reallocation of urban space, etc.).

> Sustainable raw material supply for clean transport

Although not related to the road infrastructure itself, it is worth mentioning that the Argentine example in particular points to the consequences of extrading lithium for EV batteries. The Green Deal as well as the EU Industrial Strategy address the EU responsibility in supplying sustainable raw material and the use of clean hydrogen, fuel cells and alternative fuels.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PART 3

COUNTRY PROFILES

SUMMARY

CHINA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/ questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

China, given its territory, its demography and development, has a great need for infrastructure. China is not fully equipped with road infrastructure yet and can thus build with the opportunity to integrate aspects that contribute to the development of connected, autonomous and carbon-free mobility.

China is taking advantage of its advanced integrated transport infrastructure network to leverage the comparative advantage of different transport modes by developing intermodal transportation and increasing bus lanes, tidal lanes, signal priority measures for special vehicles such as public buses, bikes and scooters. One also notes a real boom in carsharing and ride hailing services with 40 carsharing operators in the country, most of them using electric cars.

China is the world's largest emitter of greenhouse gases. From 2000 to 2013, CO2 emissions have increased by 9.3% annually in the country. This increase was mainly due to China's booming economic growth and to its coal and oil consumption which is much more CO2-intensive[2]. It can be added that by 2015, China was still overall self-sufficient at 84% from coal resources with vast hydraulic potential, however pollution caused by coal - particularly in northern China – has led China to sign the COP 21 agreements in Paris in September 2016, leading the country to severely restrict the coal component of its energy mix in favor of gas and renewable energies[3].

However, China is leading the way in developing and commercializing new energy vehicles (NEV) in all domains. It is the first market for **electromobility**. This is due to strong state support: Subvention mechanisms for buying, producing and selling EVs, easing of foreign investment restrictions and stricter requirements for fossil-fuel-powered vehicles. The industry is highly committed in releasing NEV and is largely supported by the Chinese government.

As for NEVs, the Chinese government is working on taking the lead in **Connected and Autonomous vehicle** development and to make it a national priority integrated in State Planning Programs. The current Plan forecasts that by 2025, 30% of vehicles sold in China will be connected and intelligent vehicles. It is argued that China will have a major influence on the design, rules of operation and sales of AV vehicles as it is expected that major advances will be determined by Chinese companies. China might in general position itself as a leader in the development of artificial intelligence, 5G networks, robotics and smart cities[4].

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea
2 / Delouche, Charles 2018: *Pollution : La Chine sur la pente déclinante*. Libération. July 6, 2018.
3 / Les Conseillers du Commerce Extérieur de la France 2019: La lettre de La Chine Hors les Murs N°30.
4 / Mirgalet, Clémence 2019: *La Chine en marche pour la domination du marché des véhicules autonomes*. Octobot Consulting. December 9, 2019.

Ecosystem and governance
The role of public authorities in developments

ALL FORMS OF MOBILITY

General Transport Infrastructure Plan 2021-2050

Since April 2019, China has been launching the elaboration of a general transport infrastructure plan 2021-2050. An official publication is still expected.

URBAN, ACTIVE & SOFT MOBILITY

In 2019, the **Chinese Central Government** formally released a guide on establishing a national territorial planning system aimed to supervise the implementation of the future transport and mobility planning. This national territorial planning system shall be defined through a research project.

Urban and Interurban transport

The focus lies on inter-urban mobility with the objective to strengthen the inter-city road infrastructure, and to provide services through the infrastructure to support tourism, poverty alleviation and the development of a corridor economy. Along with the high-speed passenger dedicated lines (PDLs), forming eight horizontal and eight vertical corridors linking all major cities, an inter-city fast charge network for NEV will also be constructed.

The National Scientific and Technological Innovation Planning for the 13th Five Years Plan issued by the State Council indicates, among others, that by 2020, the high-speed railway will cover more than 80% of the urban areas with a permanent population of over 1 million.

China has become leader in innovations for railway transport (e.g. Chinese TGV, Chinese MAGLEV (magnetic levitate train)). China has installed an innovation center for railway transport with investments amounting 7 billion USD in order to define the trains of the future (e.g. high-speed autonomous trains)[5].

Ride-Hailing

China has the world's largest ride-hailing market. Valued at 23 billion USD, its market is bigger than those of the rest of the world combined. 62% of Chinese regularly hail a ride with their smartphone. China's operator **DiDi** alone carried out 10 billion rides with 550 million users in 2018. **DiDi's** global operations are now worth roughly 58 billion USD[6].

China now also has more than 200 million electric bicycles, mostly in cities. E-Scooters are also on the rise[7].

DECARBONISED & ELECTRIC MOBILITY

In general, it can be stated that the Chinese government's ambition is to take the lead on electromobility as a whole, on all new energy vehicles (NEV) including Battery Electric Vehicles, Plug-in Hybrid Vehicles and Hydrogen Fuel Cell Vehicle, through state subsidies. The government's ambition is to sell 7 million NEVs per year by 2025. There are now 486 EV manufacturers, three times as many as two years ago[8].

The **Central Government** has thus actively supported the transition towards EVs. In 2015, the Chinese government banned all thermal two-wheelers in cities[9].

Example: Of the 425,000 electric buses operating worldwide, 421,000 are in Chinese cities and urban areas (nearly 99%)[10]. The two major Chinese operators are **BYD** and **Yutong**[11].

Charging Infrastructure

China is trying to build more charging infrastructure along the urban road, highways and traffic hubs.

In 2020, the charging infrastructure is expected to reach about 5 million public charging points.

China will advance the development of charging infrastructure in the field of public services: give priority to meet the charging need of urban public transport vehicles and accelerate the development of inter-city fast charging networks.

In 2009, the publication of the "China Automotive Industry Adjustment and Boosting Program" paved the way for the era of government subsidies for NEVs and in 2011, the EV market began to take shape.

5 / Corniou, Jean-Pierre 2019: *La Chine en marche vers l'électromobilité*. Technologie(s) et société de la connaissance. September 24, 2019.
6 / International Transport Forum 2019: *China: Explaining Ride-Hailing's rapid rise*. Transport Policy Matters. December 4, 2019.
7 / Corniou, Jean-Pierre 2019: *La Chine en marche vers l'électromobilité*. Technologie(s) et société de la connaissance. September 24, 2019.
8 / Hartemann, Bertrand 2019: *Voiture électrique en Chine : le pari risqué des stations d'échange de batteries*. Asialyst. September 25, 2019.
9 / Corniou, Jean-Pierre 2019: *La Chine en marche vers l'électromobilité*. Technologie(s) et société de la connaissance. September 24, 2019.
10 / Oliver Wyman Forum; Berkeley University of California 2019: Urban Mobility Readiness Index. How cities rank on mobility system development.
11 / Corniou, Jean-Pierre 2019: *La Chine en marche vers l'électromobilité*. Technologie(s) et société de la connaissance. September 24, 2019.

The National Development and Reform Commission (NDRC) and other four departments released in 2015 the EV charging infrastructure development guide (2015-2020).

The 13th Energy Development Plan was published in 2016 by the **NDRC** and the **National Energy Administration.** It provides that the total installed electrical capacity should be increased to 2,000 GW by 2020 and the total primary energy production to 2.8md TOE[12]. In this context, China plans that by 2020, 5 million EVs will be sold within China (total vehicle sales in 2017: 24,7 million)[13].

Since 2018 the Chinese government has set quotas for car manufacturers, rules on carbon credits and increasingly restricting norms on GHG emissions standards in order to discourage from the development of combustion vehicles. 1.1 million electric cars or plug-in hybrids were delivered in China in 2018, all of them by Chinese manufacturers. **BYD** is the leader with 225,000 vehicles delivered.

However, in March 2019, the Chinese government changed its subsidy policy for electric and hybrid cars, reducing them by 50% compared to 2018. In addition, the requirements for vehicles benefiting from purchase premiums are stricter in terms of range and energy consumption.

The government's objective is to stop all financial aid for the development of the NEV market in 2022, considering that by that date production costs should be aligned with those of internal combustion vehicles[14].

Natural Resources

It is to be noted that the extraction and refining of materials needed to manufacture lithium batteries for EVs is highly polluting. China produces most of these resources needed.

Example: The Inner Mongolia Autonomous Region, northwest of Beijing, is devastated by open-pit mining.

China can produce the rare metals it needs. Western countries have for their part relocated their mining pollution and thus paved the way for a monopoly of strategic materials for electric mobility detained by China. China produces 94% of magnesium, 69% of natural graphite and 84% of tungsten consumed in the world.

China is using this position by selling certain resources at up to 20% higher prices to its foreign customers[15].

AUTONOMOUS & CONNECTED MOBILITY

The Notice on China Manufacturing 2025 issued by the **State Council** is the first 10-year action plan aiming to transform China from a manufacturing giant into a world manufacturing power. It is mentioned that it is imperative to grasp the core technologies for low-carbon, information-based, and intelligent automobiles[16].

The objectives for 2025 are, among others

- Establishment of a production line for connected vehicles and infrastructure for intelligent urban transport;
- A Chinese company in the world's top 10;
- Exports of Chinese-designed connected trucks;
- Reduction of accidents by 80% and reduction of CO2 emissions from cars by 20%[17].

"Internet +" is a plan adopted by the **State Council** in July 2015 with the aim to transform the entire Chinese economy through the adoption of this plan in all areas. In this context, the CV is mentioned at several occasions. The objectives concerning the CV are among others:

- Support to strengthen cooperation between Internet companies and car manufacturers;
- The use of mobile Internet to gather information on the use of transport modes and the use of big data to analyze flows and optimize infrastructure.

The Plan also entails the development of certain standards for CAV developments concerning cybersecurity. The aim is to reach an internationalization of Chinese norms for V2X technology pushing for standards which are compliant with those implemented at international level. It is argued that the Chinese government is however pushing to impose a 100% Chinese standard for geolocation services for instance.

In order to deepen the **"Internet +" Plan**, **China's Ministry of Industry and Information Technology (MIIT)** and the **Ministry of Transport** have reached a consensus to accelerate digital and intelligent transformation of road infrastructure. **China's Ministry of Industry and Information Technology** will carry out LTE-V2X city-level connected vehicle demonstration project between 2017-2020.

12 / Les Conseillers du Commerce Extérieur de la France 2019: La lettre de La Chine Hors les Murs N°30.
13 / Ducamp, Pauline 2018: *Comment la Chine se voit en leader de la voiture électrique*. BFM Business. April 25, 2018.
14 /Corniou, Jean-Pierre 2019: *La Chine en marche vers l'électromobilité*. Technologie(s) et société de la connaissance. September 24, 2019.
15 / Pitron, Guillaume; Egloff, Laurence 2018: *Voiture électrique*, une aubaine pour la Chine. Le Monde Diplomatique. August 2018.
16 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
17 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.

The National Scientific and Technological Innovation Planning for the 13th Five Years Plan reaffirms the government's objectives issued in 2015 with the "Made in China 2025" Plan[18] and is designed to foster technological innovation development during the 13th five-year plan (2016-2020). It is stated, among others, that priority shall be given to the development of automated driving technology and driverless vehicle technology[19] but also to upgrade the industrial base and improving China's innovation system[20].

In 2018, the intelligent and connected vehicle branch committee of the **National Standardization Technical Committee** started writing a draft on the standards regarding platooning and invited three vehicle companies to participate in testing platooning in Tianjin with 9 vehicles.

In 2018, the Chinese government allowed first approved AV tests. Autonomous driving will come gradually, on certain routes, streets and highways. That is supposed to give more confidence to developers for developing autonomous driving functions gradually, from easier routes to more complex situations, including AVs coexisting on streets with normal cars[21].

The Ministry of Industry and Information Technology (MIIT) has issued a preliminary version of its 15 years plans **"Development Plan on the New Energy Vehicle Industry"** (2021-2035). The Plans forecast that by 2025, 30% of vehicles sold in China will be connected and intelligent vehicles.

It is argued that China will have a major influence on the design, rules of operation and sales of AV vehicles as it is expected that major advances will be determined by Chinese companies. The Chinese government has pushed for this leadership as it announced at the end of 2017 that developing AV and EV technology would be a national priority. China might also position itself as a leader in the development of artificial intelligence, 5G networks, robotics and Smart Cities[22].

Pilots and AV testing

New permits have been released in 2019 increasing the scenarios of autonomous driving tests. In the area of Jiading, **SAIC**, **BMW** and **DiDi Chuxing** were selected to test 50 AVs in real-time conditions along 5,6km of public road with passengers circulating in the area[23].

The **Beijing Municipal Traffic Commission** announced that the city's first autonomous driving test track will be built in suburban Yizhuang. Meanwhile, Hangzhou has opened an autonomous driving test track and China's AV industry hub of Guangzhou also allowed **Pony.ai** and **JingChi.ai** to test vehicles in certain districts[24].

Shanghai issued its first self-driving licenses in 2018, allowing two automakers to test their AVs on public roads.

On December 2019, **Baidu** announced it was granted 40 road test licenses for passenger-carrying autonomous vehicles by regulators in Beijing[25].

Ecosystem and governance
Weight of industrials

ALL FORMS OF MOBILITY

The dependence of Chinese companies on state subsidies can lead to lack of competition. Initially positive, such support can help local players develop capabilities. Over time, however, the increasing drive toward localization could restrict competition in the sector[26].

DECARBONISED & ELECTRIC MOBILITY

The Contemporary Amperex Technology Co. Limited (CATL) was created in 2011 and specializes in the research, development, production and sale of batteries for EVs and energy storage systems. CATL supplies batteries to automotive manufacturers such as **SAIC**, **Geely**, **ChangAn**, **DongFeng** and other emerging companies in China. CATL develops international cooperation projects with **BMW**, **Daimler**, **Hyundai**, **PSA**, **Volkswagen** and **Volvo**.

18 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.
19 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
20 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.
21 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
22 / Mirgalet, Clémence 2019: La Chine en marche pour la domination du marché des véhicules autonomes. Octobot Consulting. December 9, 2019.
23 / Fusheng, Li 2019: *Shanghai ramps up autonomous driving efforts*. China Daily. September 17, 2019
24 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
25 / China Automotive News 2019: *Baidu wins 40 licenses to test self-driving vehicles carrying passengers*. China Automotive News. December 31, 2019.
26 / Les Conseillers du Commerce Extérieur de la France 2019: La lettre de La Chine Hors les Murs N°30.

Government's implication and support was crucial for the development of CATL. In 2015, the electric vehicle sector was classified by the **China Manufacturing 2015 Plan** as a strategic development area and, in 2016, the **"Battery Supplier Catalogue"** excluded Japanese and Korean producers from the Chinese market. CATL became the world champion in battery sales in 2017 and maintained its leadership position with a production capacity of 21.18 Gw/h in 2018. CATL was also listed on the Shenzhen Stock Exchange in June 2018.

In June 2019, the abolition of the **"Automotive Battery Industry Standard Conditions"** allowed China to begin to open up to the competition from foreign players. Chinese, Japanese and Korean companies dominate the current global market for EV batteries. Although CATL is the champion in terms of production capacity, it is not competitive in terms of cost and technology. With this new Chinese government policy, Korean and Japanese companies will relaunch their activities and investments in China.

At the same time, national competitors such as **BYD**, **Wanxiang Farasis** will accelerate their development.

Digital internet players are also getting involved in EV development. **Tencent** signed an agreement with **Foxconn** in 2015 in order to develop and commercialize EVs[27].

AUTONOMOUS & CONNECTED MOBILITY

Like electromobility, the Chinese government supports the companies working on the deployment and development of AV technologies.

The venture-capital community and major internet players are investing heavily in China in AV technologies. Over the last five years, AV and component companies have received 7 billion USD in funding. The internet giants **Alibaba**, **Baidu**, and **Tencent** have all invested in the sector by participating in funding rounds and establishing partnerships (e.g. **Alibaba** with **SAIC**, **Tencent** with several OEMs (Original Equipment Manufacturers), and **Baidu** with a wide range of players across the value chain[28].

Start-ups aiming to compete globally (e.g. **RoboSense** and **SureStar**) could also contribute to AV developments[29].

Chinese Car Manufacturers

BAIC has launched two strategic partnerships with digital players, one in 2015 with **LeEco**, the other in 2017 with **Baidu** with the objective to launch a vehicle with Baidu telematics and carry out road tests with **BAIC** AV prototypes. **BAIC** also has created in 2015 a research institute dedicated to CVs.

SAIC initiated several partnerships with **Alibaba**. In 2015, **SAIC** and **Alibaba** jointly launched an investment fund dedicated to connected vehicles amounting 1bn RMB (140m EUR). They have also set up a joint venture and presented in 2016 an "intelligent" SUV equipped with a dashboard software platform designed by **Alibaba** and running with the operating system **YunOs** conceived by **Alibaba**. The use of **YunOs** should enable **Alibaba** to provide certain services (fuel purchase, parking space, etc.) and connect with other connected objects equipped with **YunOs**.

SAIC also collaborates with Huawei on technologies related to Long Term Evolution (LTE).

Other Chinese companies are dealing with AVs:

FAW (state-owned company) adopted a 10-year roadmap on the CVs in 2015. **Chang'an** is willing to sell AVs by 2020.

Dongfeng, a joint-venture partner of Renault and PSA also working with Huawei, or **Chery**, Great Wall, a SUV specialist, and **BYD**, the Chinese leader in electric vehicles are all working on AVs.

Also, foreign car manufacturers are benefitting from investments in the Chinese market.

Volkswagen and **FAW** launched in 2017 a special unit dedicated to CVs and digital services.

Qoros, a joint venture between the Chinese company **Chery** and the **Israel Corporation** launched a partnership with Microsoft on CVs.

Renault introduced a 2km testbed for automated ZOE within the eco-district in Wuhan[30].

27 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.
28 / Pizzuto Luca et al. 2019: *How China will help fuel the revolution in autonomous vehicles*. McKinsey&Company.
29 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
30 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.

Chinese mobile operators

China Mobile, **China Telecom** and **China Unicom** are currently working on vehicle telematics, CVs and the wider "Internet of Vehicles". As the mobile and automotive industries move towards 5G and AV technology respectively, Chinese operators are investing in R&D and conducting a number of LTE and 5G autonomous driving demonstrations through partnerships with vendors and automotive players[31].

BAT (Baidu, Alibaba, Tencent)

The BATs which can be defined as the equivalent of the American GAFA are today all involved in many sectors and services, particularly financial services, which also affect the transport sector.

Baidu is particularly committed to the development of CAV technology by providing a software platform called Baidu CarLife and the related content (Baidu Maps) to car manufacturers as an alternative to software developed in-house by car manufacturers/equipment suppliers themselves but also to supplement Apple (Apple car play) and Google (Android auto). Some car manufacturers are already using the platform on some of their models, among them: **BMW**, **VW/Audi**, **Mercedes Benz**, **Ford**, **BYD** and **Hyundai**. Baidu also develops its own range of telematic services, including the possibility to carry out remote diagnostics of the vehicle's condition.

In partnership with **BIAC**, **Baidu** is developing prototypes of AVs and carried out tests in Wuzhen and in California, having in view to produce in mass by 2021.

Tencent has developed software that is compatible with the systems used by several automakers in order to provide and facilitate access to its services like Wechat and QQ.

LeEco has invested huge amounts in the development of a CAV electric vehicle through the US-based company Faraday Future. A prototype has been presented in 2017. However, due to financial difficulties, **LeEco** has stopped the construction of its first production site in the United States.

The remaining difficulties for foreign companies to enter the Chinese market could give local companies an advantage in many areas. Foreign companies face huge difficulties on the Chinese market in establishing high definition cartographic databases relating to the Chinese territory. The isolation of the Chinese Internet since 2000 also has enabled local players to develop and reach the size of their North American counterparts[32].

Ecosystem and governance Acceptability of clients, users, taxpayers

URBAN, ACTIVE & SOFT MOBILITY

The emerging middle class is adaptable and very open to new services and products such as ride-hailing and other forms of multimodal mobility services.

The already existing culture of carpooling in China which goes along with higher than average occupancy rates and lower vehicle ownership, makes Chinese users more open to multimodal mobility services.

Wider popularity of app-based payments such as WeChat Pay, a service offered by China's internet giant Tencent which is used by a 900 million people each month[33].

DECARBONISED & ELECTRIC MOBILITY

According to the Cetelem analysis, the intention among the Chinese population to buy an EV in the coming 12 months scores the highest, with a very strong confidence in the future of EV in China.

Chinese respondents are by far the best informed about the existence of public subsidies. They are also the most convinced of the eco-friendly features of the EV, especially among respondents living in dense urban areas[34].

31 / GSMA Intelligence 2018: 5G in China. The enterprise story. More than another G of speed? GSM Association.
32 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.
33 / International Transport Forum 2019: *China:* Explaining Ride-Hailing's rapid rise. Transport Policy Matters. December 4, 2019.
34 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

AUTONOMOUS & CONNECTED MOBILITY

Consumer survey data from KPMG shows that many of the countries which are least prepared for AVs have people who are most accepting the concept, among them China. This demonstrates that the introduction of CAVs includes the need for massive improvements in personal mobility in countries where the road quality is among the lowest like in China, whereas populations from the more advanced countries in road transport do not see currently high benefits from CAVs[35].

Technological choices

DECARBONISED & ELECTRIC MOBILITY

China already accounts for more than a third of global wind and solar energy investments and 40% of EV investments. The stated aim is to quickly become the undisputed world leader in these technologies. For the sector as a whole, in the period 2010-2016, China ranks fourth with an amount of energy foreign direct investment (FDI) of 355 billion USD, after the United States, Japan and Germany. Most Chinese investors in the sector are state-owned groups[36].

AUTONOMOUS & CONNECTED MOBILITY

Deployment of LTE-V2X and 5G is promoted in coordination with intelligent traffic and traffic management information facilities and equipment.

The Circular on Issuing the Three-Year Implementation Plan for "Internet +" Artificial Intelligence issued by **NDRC** and other authorities, is the action plan that aims to promote the development of artificial intelligence technology and industry in China. It is stated that the development and application of driverless vehicle technology to ensure the gradual maturity of driverless vehicle technology and products shall be encouraged and promoted[37].

Cellular Vehicle-to- Everything (C-V2X)

for remote driving, vehicle platooning and autonomous vehicles – that can be tested and implemented on the most advanced 4G networks with a view to exploit enhanced 5G capabilities in the future[38].

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

Equipment such as road signs and signal lights will be transformed intelligently through the deployment of 5G and LTE-V2X technology.

The road infrastructure would support the following new applications and services:

- Driving Safety guarantee
- Travel information service
- Internet of vehicle service
- Automatic driving support service
- Charging service
- Convenient transfer service
- Tourism service

The New-generation national road traffic control network and smart highway demonstration project was carried out in 2018 and is promoting the level of highway construction, management, operation and maintenance, encouraging the use of new technology such as the IoT, cloud computing and Big Data. This is aimed to reduce management and energy costs.

URBAN, ACTIVE & SOFT MOBILITY

Priorities of the Chinese MaaS system:

- Ensure travel safety (through the Internet of Vehicles, vehicle road coordination, automated driving);
- Improve travel efficiency (expressway, integrated transportation hub for passenger and freight mobility);
- Support travel-related services by expanding transportation infrastructure functions.

General accessibility of new mobility

ALL FORMS OF MOBILITY

In 2016, the **Ministry of Transport of China** released the guide on promoting the integration of urban and rural transport and improving the level of public services. By 2020, all the established villages in China will have access to paved roads and buses, and the government will reduce rural passenger fares and increase frequency of service delivery through financial subsides to narrow the gap between urban and rural areas.

35 / KPMG 2019: Autonomous Vehicles Readiness Index. Assessing countries' openness and preparedness for autonomous vehicles. KPMG International.
36 / Les Conseillers du Commerce Extérieur de la France 2019: La lettre de La Chine Hors les Murs N°30.
37 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
38 / GSMA Intelligence 2018: 5G in China. The enterprise story. More than another G of speed? GSM Association.

Data challenge and control

ALL FORMS OF MOBILITY

The "Great Firewall of China" leads to the fact that companies operating in China have to host all their data and digital resources in China. This firewall established since the 2000s prevents access from China to servers hosted abroad, mainly to large digital platforms (Google, Facebook, etc.) competing with the Chinese internet actors (Baidu, Alibaba, Tencent).

Through legislation, China has been creating "cyber-barriers" that obliges Internet sites and apps hosted in China to register to State authorities.

The Personal Data Protection Law was adopted back in 2013 and aims to provide several guarantees regarding the collection, processing, transfer and deletion of data generated by users and thus limiting their use by companies. This could hamper the development of apps based on the collection of road traffic data by individuals.

The Cybersecurity Act adopted in 2016 and enforced in 2017 states that "personal information and other important data" will have to be stored on Chinese territory. Foreign companies wishing to develop services based on V2X connectivity may not be able to enter the Chinese market, especially smaller companies may not be able to afford to install storage servers in China and as a consequence cannot provide services based on data generated in China from abroad.

The **Cybersecurity Act** also introduces the concept of "**critical information infrastructure (CII)**", covering also transportation and the CV. CII managers will have the obligation to protect their infrastructure from unauthorized leaks and interference, in close cooperation with the authorities. It can be assumed that CII managers will not have complete freedom to develop and implement software solutions.

The "Internet +" plan in contrast, encourages innovation based on big data and implies easy data sharing (open data) mechanisms. In this context, the sharing of traffic data is promoted to enable digital players to develop apps and services[39].

Economic model and financing

ALL FORMS OF MOBILITY

Traditional Government support plans carried out by the **National Development and Reform Commission (NDRC)**, **the Ministry of Industry and Information Technology (MIIT) and the Ministry of Science (MOST):**

Under the **"Made in China 2025"** plan many innovation support programmes were launched by the ministries. Every year, the **MIIT** publishes a list of several pilot projects on intelligent manufacturing eligible for public financial support (63 projects in 2016).

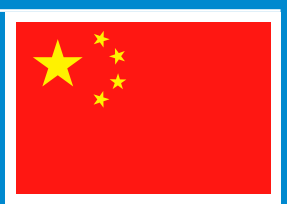
Arrival of new kinds of State subsidies via technology investment funds managed in a "public-private" partnership logic, among them:

- Fund for Advanced Manufacturing: launched in 2016 with an initial budget of RMB 20bn (2.7bn EUR). Partners are notably the State (NDRC/MoF/MIIT), State Development & Investment Corporation, ICBC;
- Internet Investment Fund: launched in 2017 with an initial funding of 100bn RMB. (13bn EUR), involves the State (MoF/Cyberspace Administration of China), ICBC, CDB, Agricultural Bank of China;
- Even if there is no specific targeting about the connected vehicle at this stage, it is likely that a certain number of resources will be allocated to this sector in view of the priorities set out in the **"Internet +" plan**[40].

39 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.

40 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: Chine. La filière de la voiture connectée. Service économique régional de Pékin.

CHINA



POLITICAL ORGANISATION

Nature of the regime: Republic

Head of state: XI Jinping

Head of government: LI Keqiang

ECONOMIC INDICATORS

GDP (2018): 13.608,152 million USD / Rank : 2/205

GDP growth (2018): 6,6%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 7,9 (2015)
- Industry (including construction), value added (% of GDP): 40,5 (2014)
- Services, value added (% of GDP): 51,6 (2017)

Population (2018) : 1,393 billion

Urban population (2018): 59%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (6,4%)/ Coal (63,67%) / Hydro (3,23%)/ Biofuels/Waste (3,7%)/ Oil (18,58%)/ Nuclear (2,1%)/ Wind & Solar (2,27%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 45/141

Total road expenditures (2011): 219.901,644 million USD

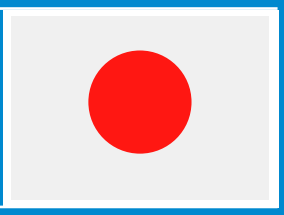
Total length of the road network (2016): 4.696.263 Km

Road density (km per one hundred sq. km) (2016): 49

Network length by road category (2016):

- Motorways: 130.973 Km
- Main / Principal roads: 99.152 Km
- Secondary / Regional roads: 371.102 Km
- Other Roads: 4.095.036 Km

JAPAN



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

A lack of accessible mobility, especially for the aged, disabled and vulnerable population can be identified in Japan. Thus, the focus lies on reducing accidents and congestion, improving efficiency and in providing mobility for older people, particularly in rural areas. Japan also identified an urgent need in establishing natural disaster prevention.

Japan has had a strong technological lead in IoT hardware components and in high-speed internet infrastructure: Japan has been the leader in 3G and now in 4G development (nearly 97% coverage) and already plans to launch its 5G offer by 2020, for the Olympic Games which have however now been postponed to 2021 due to the COVID-19 sanitary crisis. However, Japan's developments in new technologies are being hampered by low productivity. Exchanges and cooperation between industry and the academic sector often remain rather limited. There is currently an insufficient supply of software for IoT, cybersecurity, artificial intelligence and data processing. Also, Japan's demographic decline is leading to a real shortage of experts. **The Ministry of Economy, Trade and Industry (METI)** estimates a shortfall of about 48,000 engineers by 2020. However, Japan wants to push the development of artificial intelligence, cybersecurity and software application technologies as a development priority.

The 2020 Olympic Games were thus being planned as a technological showcase, where several innovations should have been presented, including the autonomous vehicle, hydrogen applications and 5G coverage[2].

Japan's strategy to countermeasure its technological and productivity backlash might have a huge impact on **urban mobility** developments. The government's "Society 5.0" initiative aiming to resolve various social challenges by incorporating the innovations of the fourth industrial revolution into every industry and social life could help develop smart city projects. An example of such a development could be the Toyota Woven City where priority is given to vulnerable users, and pedestrians and only electric and autonomous vehicles will be able to use the main roads.

Concerning decarbonised mobility, the Japanese Strategy lies mainly on hybrid vehicles with strong government involvement. The latter plans to maximize hydrogen production and establish a large-scale hydrogen supply system by 2030. However, regulatory and administrative barriers are still limiting companies to deploy/export their technology. The industry is nevertheless committed to develop hydrogen.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

2 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2019: *Le Japon a-t-il perdu son avance technologique ?* DG Trésor. April 15, 2019.

Autonomous mobility is considered as a priority in rural areas to countermeasure less public transport and less drivers in an aging society but perhaps more importantly to boost technological progress and leadership. There are some barriers for Japanese companies to commercialize AVs, such as, strong regulations but also technical problems caused by snowfall and earthquakes[3]. However, the government is pushing for technological progress in this area and pilot projects are being tested with government support. Also, the main Japanese car manufacturers plan to commercialize an AV model and industry representatives are partnering **with ICT players.** These mergers are a new tendency in the Japanese industrial landscape and within the automotive sector.

Ecosystem and governance
The role of public authorities in developments

ALL FORMS OF MOBILITY

Facing the country's technological and productivity backlash of the past years, the Japanese government has adopted a renewed strategy that aims to carry out the necessary developments to accompany and realize the fourth industrial revolution and the establishment of a "5.0 Society". The strategy relies on the development of Artificial Intelligence, IoT, Big Data, the deployment of 5G and the strengthening of open innovation policies.

The Ministry of Economy, Trade and Industry (METI) launched the **Connected Industries initiative** in 2017 that enables the digitization of industrial processes. The aim is to modernize the industry and facilitate the share and use of data.

An Inter-ministerial roadmap on Artificial Intelligence Technology Strategy was published in 2017. This strategy is based on the integration of AI and other industrial technologies, cooperation between different industries and the free flow of data, with mobility, as one of the priority use cases.

URBAN, ACTIVE & SOFT MOBILITY

The Ministry of Economy, Trade and Industry (METI) and **the Ministry of Land, Infrastructure, Transport and Tourism (MLIT)** initiated the **Smart Mobility Challenge** in April 2019 aiming to support regional cities and areas to develop and implement new mobility services. The two ministries selected 28 areas and projects that they will support. The selected areas will analyze the business feasibility of their own projects and will identify best practices and scale them up to a regional level[4].

DECARBONISED & ELECTRIC MOBILITY

"Hydrogen Society"

Japan has made the political choice to focus on hydrogen in its energy strategy and wanted to achieve the so-called "hydrogen society" for the 2020 Olympic Games in the first place.

Example: The 2020 Olympic Village in Tokyo should have hosted more than 17,000 people. In this "hydrogen city", stationary ENE-FARM fuel cells should have provided electricity and domestic hot water heating. Athletes should have been carried by hydrogen buses, developed by **Toyota** and **Hino**.

The Ministry for Economy, Trade and Industry (METI) published a roadmap back in June 2014 describing how to achieve the "hydrogen society", with 4 main objectives:

- increasing energy efficiency;
- improving energetic security and independence;
- reducing greenhouse gas emissions;
- developing industrial activities in the hydrogen sector.

There was a revision of the roadmap in 2016 setting new targets for the deployment of hydrogen technologies in Japan by 2040. Three phases can be identified:

- 2017 - 2030: Widespread use of hydrogen vehicles, hydrogen stations and fuel cells;
- End of 2020 - 2030/2040: Maximize hydrogen production and establish a large-scale hydrogen supply system by 2030;
- By 2040: Define a system for supplying decarbonated hydrogen.

3 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
4 / Ministry of Economy, Trade and Industry 2019: *Smart* Mobility Challenge Project *launched*. Accessed April 23, 2020

The Japanese government has also announced gradual targets for the deployment of hydrogen stations and hydrogen vehicles:

- 40,000 hydrogen-powered vehicles by 2020; 200,000 by 2025 and 800,000 by 2030;
- 160 stations in 2020 and 320 in 2025.

A **METI Working Group** was established in May 2016 aiming to provide a strategy for a completely carbon-free hydrogen production by 2040[5].

The Ministry of Environment (MOE) committed in June 2018 to reach 100% renewable electricity by 2030 in all its offices and facilities across Japan. This initiative will start in 2020 in 8 different sites. However, it has to be noted that the **Ministry of Economy and Industry** is still very supportive of fossil energy (including coal)[6].

The Cross-ministerial Strategic Innovation Promotion Program (SIP) entails a project to develop and ensure the technologies' compatibility of wireless power transfer running EVs.

AUTONOMOUS & CONNECTED MOBILITY

The Road Transport Vehicle Act administrated by the **Ministry of Land, Infrastructure and Transport (MLIT)** and dealing with vehicle safety standards, was amended in February 2017 to allow the use of driverless AVs on public roads in specified areas.

Public road tests of AVs were carried out. In 2013, **Nissan** carried out Japan's first public AV road test on a highway.

The Japanese government also plans to operate automatic level 4 taxis on some routes for the Tokyo Olympic Games[7].

The Ministry for Land, Infrastructure and Transport (MLIT) started pilot projects in 2017 to demonstrate automated driving services which are expected to assure smooth transportation of people and goods in rural areas where many elderly people live.

Four AVs developed by among others, **DeNA**, **Advanced Smart Mobility Co.**, **Yamaha Motor** and **Asian technologies** have been selected for these demonstrations which will be conducted at 13 different sites, mostly on highway areas across Japan.

The National Police Agency has issued guidelines for testing automated driving systems on public roads.

The 2017 ITS Roadmap sets out 3 pillars for the development of AVs:

- the autonomous private car with the objective of reducing the number of accidents and congestion;
- the autonomous truck meant to improve the efficiency of the freight transport service;
- the AV service to improve mobility, particularly for elderly people in rural areas.

According to the government, the level 3 vehicle should travel on all roads in Japan by 2030[8].

The Cross-ministerial Strategic Innovation Promotion Program (SIP) includes large-scale field operational test for automated driving. The timetable set by the government foresees the introduction of an advanced highway autopilot system (level 4) for passenger cars and trucks and the provision of transport services in rural areas by 2025. There are also some operational tests for V2I communication technology for AVs employing radio antennas and vehicle sensors.

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Ministry of Economy, Trade and Industry (METI) as part of the "**R&D project for social implementation of advanced automatic driving systems**" started demonstration tests of **truck platooning** in 2018. From June 2019 to February 2020 public road demonstration of truck platooning have been carried out in order to improve the technical verification and reliability in various road environments such as tunnels and night driving.

5 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: *La stratégie de développement de l'hydrogène au Japon*. Pôle Développement durable - SER de Tokyo. September 11, 2017.
6 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2019: *Actualités Japon - Énergie, Environnement, Transport, Construction - Décembre 2019 (II)*. Pôle Développement durable - SER de Tokyo. December 19, 2019.
7 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2018: *Le développement du véhicule autonome au Japon*. Pôle Développement durable - SER de Tokyo. April 16, 2018.
8 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2018: *Le développement du* véhicule autonome au Japon. Pôle Développement durable - SER de Tokyo. April 16, 2018.

The Japanese government intends to remove prevailing barriers to the export of Japanese AV models abroad by positioning itself as an international leader in CAV standardization, particularly within the international standard for ITS: ISO/TC204[9].

Ecosystem and governance
Weight of industrials

ALL FORMS OF MOBILITY

Toyota: Woven City

The Woven City will be located at the foot of Mount Fuji. The city will extend over approximately 70 hectares. Its roads will be divided into three categories: fast vehicles, slow vehicles and vulnerable users, and pedestrians only. Within the city, only electric and autonomous vehicles will be able to use the main roads. Transport and deliveries will be provided by e-Pallets and flying drones will also be used for the movement of goods. In the light of the Society 5.0 initiative, it can be stated that Woven City will be constructed mainly by wood building and will mix Japanese craftsmanship and robotics. Natural vegetation and hydroponic crops are planned. The city's electricity network will be powered by hydrogen fuel cells and solar panels installed on the rooftops. The houses will be equipped with various sensors monitoring the health of the inhabitants.

Construction is scheduled to begin in early 2021[10].

URBAN, ACTIVE & SOFT MOBILITY

Toyota Motor Corporation (Toyota) and Park24 Co., Ltd. (Park24) announced their decision in 2018 to start a business tie-up for a trial car sharing service in parts of central Tokyo. Toyota signed an agreement for trial operation with the aim of developing a new service that leverages Toyota's Mobility Services Platform (MSPF)[11].

DECARBONISED & ELECTRIC MOBILITY

The Hydrogen Council has been launched in January 2017 by 13 leaders from the energy, transportation and industry sectors (among them Air Liquide, Engie, Alstom, Total and Honda, Hyundai, Kawasaki, Toyota, Iwatani). The Council should promote the global development of hydrogen as an accelerator of the energy transition and the achievement of climate change objectives. One of the Council's objectives is to work with the Japanese government to remove regulatory or administrative barriers to the deployment of hydrogen.

A **METI Consortium** was created in May 2017 to encourage Japanese energy giants to combine their efforts to invest in hydrogen technology. With the support of the Japanese Development Bank, 11 groups, wishing to acquire a stake in the hydrogen stations consortium, have signed an MoU with the aim of continuously building hydrogen stations and promoting the widespread use of fuel cells. The objective set for this consortium is to pool and coordinate efforts to build 300 hydrogen stations over a 10-year period starting in 2018[12].

AUTONOMOUS & CONNECTED MOBILITY

In consultation with car manufacturers, the Japanese government has set a timetable for the deployment of AVs in Japan, which should be deployed by the start of the Tokyo Olympic Games.

The main Japanese car manufacturers all plan to commercialize an AV model.

Nissan began commercializing a category 2 vehicle in 2016. A level 3 model was launched in 2018 and Nissan claims to have the technology to launch a level 4 car in 2020.

Toyota introduced a level 2 system called **Yui** at the CES in Las Vegas in January 2017 and plans to achieve level 5 empowerment by 2020.

Honda also unveiled its AV at the CES in Las Vegas, which is equipped with an artificial intelligence system, and the Civic LX Sedan models are already equipped with an Advanced Driver Assistance Systems (ADAS) technology.

The Joint development of 3D digital maps for navigation and data sharing in the autonomous vehicle sector is an agreement reached in 2016 between six Japanese car manufacturers, including **Toyota, Honda** and **Nissan**, which were collaborating in a **METI** working group.

This form of industrial cooperation between car manufacturers is a rather unusual practice in Japan. This cooperation is aimed to harmonize Japanese supply standards for export. Japanese automotive companies are also working together on the drafting of international standards for AVs.

9 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2018: Le développement du véhicule autonome au Japon. Pôle Développement durable - SER de Tokyo. April 16, 2018.
10 / Auto Plus 2019: Toyota va construire une ville expérimentale ! Auto Plus. January 7, 2020.
11 / Toyota 2018: *Sharing Service Trial in Central Tokyo. Marks start of exploration into joint cooperation to achieve new mobility services*. Toyota. April 3, 2018.
12 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2017: *La stratégie de développement de l'hydrogène au Japon*. Pôle Développement durable - SER de Tokyo. September 11, 2017.

Partnerships with ICT players involve telecom operators, IT companies, the semiconductor and electronic components industry, universities as well as start-ups. These mergers are part of a restructuring of the Japanese industrial landscape and a redefinition of the automotive sector, which is no longer limited to carmakers and equipment manufacturers.

Example: The Toyota Research Institute (TRI) was created in 2017 by Toyota and is managed by **Gill Prat**, a specialist in artificial intelligence. **TRI** announced to invest up to 1 billion USD in the next five years and is collaborating with MIT, Microsoft and Google. **Toyota** and **KDDI** (telecom operator) also launched a partnership in June 2016 to create a global communication platform that would allow better vehicle connectivity.

Nissan announced in 2017 a partnership with the mobile internet company **DeNA**, which would develop information technology systems for autonomous EVs[13].

A self-driving car service is operated by **Yamaha Motors** since November 2019 in Kamikoani village. **The Ministry of Transport (MLIT)** stated that this is the first regular commercial service in Japan using an AV. The car can carry 5 passengers and travel at up to 12 km/hour. A human driver is on board in case of an emergency. The price is 200 yen/person (0,018 USD)[14].

Ecosystem and governance Acceptability of clients, users, taxpayers

URBAN, ACTIVE & SOFT MOBILITY

Japan currently has one of the lowest uses of online ride-hailing[15].

DECARBONISED & ELECTRIC MOBILITY

In Japan, the vision on the future of EV is slightly more pessimistic than the world average. According to the research institute Cetelem, Japanese respondents report missing information on State subventions when purchasing an EV and on performance indicators about the EV. The intention to purchase an EV in the next 5 years is on its lowest level compared to the world average. A high proportion of people think that EV might be dangerous because of the lithium batteries[16].

AUTONOMOUS & CONNECTED MOBILITY

New technologies such as 4G or 5G developments, Artificial Intelligence and industrial robots' technology generate little mistrust in Japan.

However, the KPMG index shows that Japan rather scores on the mid-table on policy and legislation and consumer acceptance for AVs[17].

Technological choices

ALL FORMS OF MOBILITY

In Japan, the focus lies on ITS which are steadily expanding with the popularization of ETC (Electronic Toll Collection) systems and VICS (Vehicle Information and Communications System). They are deemed to be effective in allowing for better traffic flow by providing real-time information, eliminating congestion at toll gates and mitigating environmental impacts by offering differential toll discounts. ITS have entered the second stage and are now being promoted to solve social issues (e.g. ageing society).

The installation of systems for collecting and providing data and information is being promoted and other systems are being developed to offer drivers a diverse set of services via a single on-board ITS unit[18].

Japan is one of the countries that invests the most in R&D (3.42% of GDP), with most of the investment being made by the private sector (70%). It is also first in terms of the stock of patents declared (27%), ahead of the U.S. (22%) and China (13%) and second in terms of the number of patents granted in 2016, behind China[19].

DECARBONISED & ELECTRIC MOBILITY

Japan relies heavily on hydrogen as a new energy provider, replacing gas, electricity or oil, for uses in transport and buildings. The stated goal is to reduce fossil fuel consumption and improve energy efficiency.

13 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2018: Le développement du véhicule autonome au Japon. Pôle Développement durable - SER de Tokyo. April 16, 2018.
14 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2019: Actualités Japon - Énergie, Environnement, Transport, Construction - Décembre 2019 (II). Pôle Développement durable - SER de Tokyo. December 19, 2019.
15 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
16 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.
17 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
18 / Ministry of Land, Infrastructure, Transport and Tourism 2018: Roads in Japan. MLIT. Tokyo, Japan.
19 / Ministère de l'Economie et des Finances - Trésor Direction Générale 2019: Le Japon a-t-il perdu son avance technologique ? DG Trésor. April 15, 2019.

Role of road infrastructure and its equipment

DECARBONISED & ELECTRIC MOBILITY

Wireless or wired charging for EVs while driving on a dedicated lane is envisaged.

AUTONOMOUS & CONNECTED MOBILITY

In general, there is a need of a trusted infrastructure support transmitting traffic signal status, traffic regulations and road conditions to vehicles. This is seen as essential for ensuring safer and acceptable mobility. CAVs may need communication with roadside infrastructure. Also, road signs for non-automated vehicles may be required.

Driver Safety Support System (DSSS)

Japan has integrated several safety-related X2V services into its Universal Traffic Management System. The aim is to prevent and reduce traffic accidents at intersections, lessen the driver's burden of making decisions and to increase driver's awareness about safe driving[20].

Access to new forms of mobility

ALL FORMS OF MOBILITY

- Countermeasure less public transport and less drivers in aging society through autonomous mobility and V2X connected cars.
- Enhancing the living environment, so that everyone can benefit from improvements such as safe and accessible pedestrian areas.

Data

AUTONOMOUS AND CONNECTED MOBILITY

Strategy for the use of traffic data

The government will set up a system to share the data obtained by experimental testing. It will develop a plan for using data related to automated driving system, such as a database to be used for development of AI, the creation of Location Dynamic Map (LDM) for automated driving and sharing of traffic data. The government will also examine possible privacy issues relating to use of such data[21].

Open Data Barometer

Japan has seen strong improvements in making government data available (e.g. Citizens are now able to monitor government IT investments)[22].

Economic model and financing

ALL FORMS OF MOBILITY

When talking about the use and deployment of EVs it can be considered that less gas taxes will be collected. There is a need for an alternative tax revenue, like a driving mileage tax which may need a new revenue model at road administrations with new technological systems collecting mileages and IDs.

AVs or advanced driver assisting system which requires road infrastructure support will need new revenue models for building and maintaining the infrastructure.

20 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.
21 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
22 / World Wide Web Foundation 2018: Open Data Barometer - Leaders Edition. World Wide Web Foundation. Washington DC, United States.

JAPAN

POLITICAL ORGANISATION

Nature of the regime: Unitary parliamentary constitutional monarchy

Head of state: His Majesty Naruhito

Head of government: Shinzo Abe

ECONOMIC INDICATORS

GDP (2018): 497.091,6 million USD / Rank : 3/205

GDP growth (2018): 0,8%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,1 (2015)
- Industry (including construction), value added (% of GDP): 27,7 (2014)
- Services, value added (% of GDP): 69,1 (2015)

Population (2018) : 126,5 million

Urban population (2018): 92%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (22,73%)/ Coal (26,96%) / Hydro (1,67%)/ Biofuels/Waste (3,36%)/ Oil (39,2%)/ Nuclear (3,96%)/ Wind & Solar (2,09%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 5/141

Total road expenditures (2017): -

Total length of the road network (2016): 349.828 Km

Road density (km per one hundred sq. km) (2016): 16

Network length by road category (2016):

- Motorways: 8.776 Km
- Main / Principal roads: 51.796 Km
- Secondary / Regional roads: 93.040 Km
- Other Roads: 196.216 Km

REPUBLIC OF KOREA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

A need has been identified to improve transport connectivity and regional integrity in the Northeast Asian region in order to contribute to the economic development and regional security of South Korea. Northeast Asia appears to be fragmented and thus misses potentials for prosperity. Infrastructure investment tends to be limited: Financial investors, including Multilateral Development Banks, the USA, Japan and European countries have little interest due to the region's exclusiveness and North Koreas nuclear issues[2].

Within South-Korea itself, **urban mobility** problems caused by urbanization and overcrowding (e.g. pollution, congestion, crime, natural disasters, etc.) can be observed. Housing insecurity and regional imbalance limit urban growth and economic prosperity.

Korea is pushing however, towards integrated mobility; this is especially true on a major city level (e.g. Seoul, Jeju, Sejong). These cities are able to put in place integrated mobility systems based on Korea's ICT technologies and strong support of the 5G network. Progress in ICT is made and there is a growing demand for urban development and competition on Smart City development is growing[3].

Rapid urbanization went hand in hand with massive investment in transport infrastructure to improve connectivity between large cities. The focus laid on road infrastructure after the war (vs. railroad) in order to meet the growing demand of industry for mass traffic infrastructure. Korea's car-centred model is now reaching its limits. Korea has the second highest vehicle density in the OECD, more than 3 times the OECD average[4]. In Seoul for example, 61,5% of air pollution comes from vehicles.

This also means increasing traffic congestion costs[5]. However, there are strong government support and incentives for expanding **decarbonized and electromobility** and for the installation of electric and hydrogen charging stations as well as promoting the sales of electric/hydrogen vehicles. A recent roadmap by government agencies should contribute to increase the share of electric and hydrogen vehicles in the local market up to 33% by 2030. The industrial players, such as the automotive industry are also developing charging models compatible with level 4 AVs.

Concerning **autonomous mobility**, South Korea was limited by rules that only allow pilot driving of level 3 AVs. This has slightly changed. Now, the Korean government is pushing for the industry to develop level 4 AVs. Indeed, government funding

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea
2 / Organization for Economic Cooperation and Development; International Transport Forum; Korean Transport Institute 2018: 2018 KOTI-ITF/ OECD Joint Seminar: Transport connectivity for regional integration in Asia.
3 / Lim, Junghwan 2019: Korea's smart city policy and strategy. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.
4 / Organization for Economic Cooperation and Development 2017: Urban transport governance and inclusive development in Korea. OECD Publishing, Paris.
5 / Seoul Metropolitan Government: Seoul Transportation 2030. Seoul Metropolitan Government.

for AV pilots, industry partnerships and 4G coverage appear to be very high in South Korea[6]. The automotive industry also recently announced high investments (amounting 35 billion EUR/ 37 billion USD) for developing level 4 AVs.

Ecosystem and governance The role of public authorities in developments

ALL FORMS OF MOBILITY

Deregulation benefitting new forms of mobility:

- Provision to a third party of data and personal information (anonymous basis) for the development of mobility services;
- Allow exemption from the Road Traffic Act in case of driving autonomous vehicles for purpose of R&D;
- Introduce special provisions for SMEs to encourage their participation in Smart City projects;
- Simplify the reporting procedure for drone shooting conducted for the purpose of research and development;
- Greater autonomy to local governance;
- Collaboration between individual local governments[7].

A National R&D Project is expected to be implemented in 2020 and is addressing the development of traffic management technology of CAVs.

Focus on Smart City Development[8]

Enactment of the Ubiquitous-City legislation (2008) revised as Smart-City Act in 2017 which defines 228 Smart City Solutions in 11 field including energy, environment, traffic, crime prevention etc.

Presidential Committee on the Fourth Industrial Revolution with the aim to realize a people centered and customized 4th Industrial Revolution.

Smart City promotion strategy and a National Smart City project with pilots in Sejong and Busan.

New Deal for Smart Regeneration is a program where cities are selected each year (now: 6 districts) and receive government support for urban regeneration including a guideline on smart city solutions and consulting on smart governance.

A Smart City Challenge was adopted on the model of U.S. Smart Challenge, a federal contest where mid-sized cities submit ideas for innovative transportation system for federal grants to implement their ideas:

This offers municipalities opportunities to address specific urban issues and would allow Korea to export some of the tested solutions to other countries;

The budget for Korea's Smart Challenge 2019 amounts approximatively 66 million euros.

URBAN, ACTIVE & SOFT MOBILITY

The Sustainable Transportation and Logistics Development Act was established in 2009 (renewable) and includes: transportation demand management and efficient traffic operation; walk and bicycle environment improvement, public transport improvement, green logistics and green technology development, reduction of traffic congestion and commuting time, emission and fine dust reduction for clean city air, fossil fuel use reduction such as gasoline/diesel, parking lot space reduction and use for multiple purposes, traffic accident ratio reduction through self-driving.

Major Korean cities are developing integrated mobility services based on Korea's ICT technologies.

Seoul

- aims to increase its green transportation mode share to 80%. This implies an increase in public transit, walking, and cycling;
- reduce passenger car travel by 30% and reduce average commute time using public transit (increase planned by 30%);
- raise the proportion of "green transportation area", meaning dedicated median bus lanes; bike lanes and sidewalks (increase of 30%).

6 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
7 / Lim, Junghwan 2019: Korea's smart city policy and strategy. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.
8 / Lim, Junghwan 2019: Korea's smart city policy and strategy. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.

Jeju Integrated Mobility Services (JIMO)

- Smart-Grid testbed;
- Goals on power supply (Up to 50% by wind and solar by 2019 and 100% of demand by 2030).

Sejong is a city complex established in 2012 relocating Korea's ministries end executive offices from Seoul to Sejong. The Korean government designated Sejong as a center of administration, research education and high-tech technology to promote balanced regional development[9].

DECARBONISED & ELECTRIC MOBILITY

Government's financial incentives are given to promote charging stations, including fast charging stations on expressways.

However, few projects are underway related to induction, conduction and dynamic battery charging on road infrastructure. In the past, South Korea used to have an electricity production project using piezoelectric sensors on the road, but no significant achievements were made.

Diversification measures are taken by supplementing electric vehicle technology with hydrogen-powered cars. To this end the Korean Government are taken aims to diversify production, transit and storage as well as strengthen subventions and fiscal advantages for the hydrogen car[10].

The Ministry of Trade, Industry and Energy unveiled in October 2019 a roadmap which should contribute to increase the share of electric and hydrogen vehicles in the local market up to 33% by 2030.

The share of EVs sold on a national level has increased sevenfold in 2019 compared to 2016, with sales of hydrogen fuel cell vehicles increasing 34-fold over the same period.

To promote market development, South Korea plans to install about 660 hydrogen recharging stations throughout the country by 2030 in contrast to the 31 hydrogen fueling stations that South Korea operates currently (2019). The number of hydrogen production facilities will reach 15,000 across the country by 2025, a threefold increase from the 2019 5,427 units[11].

AUTONOMOUS & CONNECTED MOBILITY

South Korean Ministry of Land, Infrastructure and Transport (MLIT)

The MLIT has announced in 2019 its plan to create detailed maps for AVs as part of Cooperative Intelligence Transport Systems (C-ITS) which is meant to strengthen the safety of AVs[12].

A National Land Planning Plan was set out in the 2018 Self-driving Government Joint "Innovation Growth Engine Implementation Plan" aiming the commercialization of autonomous driving on highways (level 3) and full autonomous driving by securing world-class AV competitiveness.

The Ministry of Land, Infrastructure and Transport revised the **Automobile Management Act**, making it possible for self-driving vehicles to be tested on a total of 320 km designated routes on five national highways.

Examples: C-ITS pilot section (88km) and autonomous cooperative driving test beds (41km for public roads and 7.7km for test roads) are in operation (Seoul, Daegu, Gwangju, Ulsan, Jeju).

Now, high government investments in autonomous vehicles allow AVs with issued licenses to operate on public roads (two sections of expressways and four sections of regular roads, spanning a combined 320 km), and an entire artificial town for autonomous vehicle testing has been built and inaugurated in December 2018 (K-City).

Korean Transportation Safety Authority (KOTSA) together with the national telecom provider **KT**, launched K-City, an experimental city environment equipped with 5G technology that will be used to test AVs. It was opened in December 2018 and was built in Hwaseong. It will focus on testing and commercializing level 3 AVs (human driver has to take over when required)[13].

Road Management Agencies are participating in technology development through C-ITS pilot projects and autonomous cooperative road systems.

9 / So, Jaehyun 2018: A Korea's approach on integrated mobility services. National Transport Technology R&D Center, The Korea Transport Institute.
10 / Palligiano, Louis 2019: La Corée du Sud mise sur la voiture à hydrogène. Ouest France. March 12, 2019.
11 / Agence de Presse Yonhap 2019: La Corée du Sud accroîtra la part des véhicules électriques et à hydrogène à 33% du marché local en 2030. Agence de Presse Yonhap. October 15, 2019.
12 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
13 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

It can be noted, that the Korean government wants to become world leader in developing AVs by 2030. According to the government, half of the car fleet should be constituted of AVs by 2030. The government thus aims to support the development of AVs by the equivalent of 1,3 EUR billion from 2021-2027. A legislative guide on AVs and related legal issues should be prepared for 2024[14].

Ecosystem and governance
Weight of industrials

ALL FORMS OF MOBILITY

Korea has the world's highest Internet penetration rate and according to the OECD, is the world's second largest producer of information and communication equipment[15].

The new mobility-related businesses participated in the exchange and standardization by organising a **"Voluntary Cooperation Industry Development Council"** organised by the **Ministry of Land, Infrastructure and Transport**.

Programs to be implemented under National Smart City Projects

Ecosystem for Innovation (KRW 1 billion): Offer funding to start-ups and SMEs developing new services/products in pilot projects;

Campaign to Attract Global Businesses (KRW 1 billion): Support campaigns to attract global companies to pilot cities[16].

New mobility is in the middle of a fierce competition of road authorities, automobile companies, ICT companies and telecommunication companies. Telecommunication companies are deemed to have some advantages in business development in terms of data acquisition.

DECARBONISED & ELECTRIC MOBILITY

Kia and **Hyundai** presented their medium-term plan of developing wireless recharging systems for EVs. The vehicle using this wireless recharging system will be equipped with numerous autonomous functionalities. A user could, by using a dedicated app, send his car with a low battery to a wireless charging station in a parking lot. **Kia** and **Hyundai** plan to commercialize this technology once level 4 driverless vehicles are introduced on the market, probably by 2025[17].

AUTONOMOUS & CONNECTED MOBILITY

K-City is an experimental city environment equipped with 5G technology that will be used to test AVs developed among others by national telecoms provider **KT**.

KT tested an autonomous bus at Incheon airport in 2018. The testbed includes changing lanes and stopping at traffic lights.

Samsung released a hardware and software platform for AVs in 2019, following its 8 billion USD purchase in 2017 of a US-connected car company and the establishment of a 300 million USD automotive innovation fund[18].

Hyundai Motors has announced in October 2019 a massive investment plan in the autonomous car amounting approximatively 35 billion EUR (37 billion USD). This is said to be supported and even pushed by the South Korean government, which wants to have a leading position by 2030 in the field of AVs, among others[19].

Ecosystem and governance
Acceptability of clients, users, taxpayers

AUTONOMOUS & CONNECTED MOBILITY

South Korea scores rather low on consumer acceptance of AVs[20].

14 / Mary, Hubert 2019: *Pourquoi Hyundai Motors investit 35 milliards d'*euros dans la voiture autonome. L'Usine Nouvelle. October 16, 2019..
15 / Lim, Junghwan 2019: Korea's smart city policy and strategy. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.
16 / Lim, Junghwan 2019: Korea's smart city policy and strategy. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.
17 / Huvelin, Grégoire 2019: *Kia et Hyundai imaginent une station de recharge sans fil dédiée aux voitures électriques*. Clubic. January 6, 2019.
18 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
19 / Mary, Hubert 2019: *Pourquoi Hyundai Motors investit 35 milliards d'*euros dans la voiture autonome. L'Usine Nouvelle. October 16, 2019.
20 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

Technological choices

DECARBONISED & ELECTRIC MOBILITY

Diversification measures by supplementing EV technology with hydrogen-powered cars are taken into account. The Korean government wants to become a world leader in hydrogen cars[21].

AUTONOMOUS & CONNECTED MOBILITY

- Development of Local Dynamic Map (LDM) and V2X based road systems for autonomous cooperative driving;
- Development of road change rapid detection update technology for autonomous driving support and V2X based truck driving technology development;
- South Korea has established a **C-ITS Master Plan** that includes C-ITS infrastructure implementation, OBU distribution and the target of "zero accidents for 30 years". A range of services has been developed with the project, among them: forward collision warning, intersection right turn conflict warning, road work zone warning[22].

Ministry of Trade, Industry and Energy (MTIE)

South Korea has the world's seventh largest automotive industry. The automotive sector is a key pillar of the economy. The new roadmap published in 2019 by the **MTIE** focuses on the development of legislation and policies that reflect changes in the automotive industry, including those related to insurance for unmanned vehicles.

It will also join forces with local automakers by creating a 60 trillion won (50.6 billion USD) fund to provide an ecosystem for next-generation vehicles[23].

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

Traffic safety management of mixed vehicles (general cars and AVs) goes with the change of operational concepts that can enhance safety and efficiency of traffic-based cooperation with individual vehicles.

Changes in the installation and maintenance of existing road facilities such as lanes and signs are necessary.

V2X based stations for road infrastructure and vehicle communication are needed;

A road traffic information tool will have to be provided;

A traffic management center and forecasting program for efficient traffic management and operation is also envisaged;

Optical communication network for linking large capacity V2X data are needed;

Installation and maintenance technology such as lanes and road signs that can be easily recognized by vehicle sensors will have to be taken into account;

Road maintenance management using drones, IoT sensors etc will be necessary.

General accessibility of new mobility

ALL FORMS OF MOBILITY

Providing equity in regional transport services will remain a challenge, even if innovations in mobility are developed. The price of vehicles adopting advanced technologies such as AV technology may increase the discrimination in mobility. Urban citizens who move out of the city to avoid high land prices are more likely to be affected by mobility restrictions due to increasing traffic congestion.

Actions to be taken:

- Promoting user-customized improvement policies for those at a disadvantage of using mobility services;
- Development of mobility Big Data-based traffic policy solutions including congestion management/ safety/ public transportation/ balanced nationwide development, etc.;
- Revitalize public transportation (public transportation priority system).

21 / Palligiano, Louis 2019: *La Corée du Sud* mise sur la voiture à hydrogène. Ouest France. March 12, 2019.
22 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.
23 / Agence de Presse Yonhap 2019: *La Corée du Sud accroîtra la part des véhicules électriques et à hydrogène à 33% du marché local en 2030*. Agence de Presse Yonhap. October 15, 2019.

Data challenge & control

ALL FORMS OF MOBILITY

New industry exemption on Personal Information

Allow use or provision to a third party of anonymous personal information for the development of mobility services (without identifying to whom a piece of information belongs)[24].

Economic model and financing

ALL FORMS OF MOBILITY

It is necessary to secure a budget for installing and maintaining new infrastructure in order to deploy and apply new mobility.

New business models need to be developed in terms of road infrastructure for new mobility. The development of additional business models (e.g. electric charging stations, infotainment, businesses using vehicle data instead of traffic data etc.) should be followed up.

Focus: Smart City

Government budget earmarked for Smart City will increase in part due to the National Smart City

Projects to be introduced in 2019.

Smart City Budget (million EUR):		
2017	2018	2019
3,8	**10,5**	**52**[25]

24 / Lim, Junghwan 2019: Korea's smart city policy and strategy. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.

25 / Lim, Junghwan 2019: *Korea's smart city policy and strategy*. Ministry of Land, Infrastructure and Transport. Confederation of International Contractors' Associations Seminar, Seoul 2019.

REPUBLIC OF KOREA

POLITICAL ORGANISATION

Nature of the regime: Republic

Head of state: Moon Jae-in

Head of government: Chung Sye-Kyun

ECONOMIC INDICATORS

GDP (2018): 1.619,424 million USD / Rank : 12/205

GDP growth (2018): 2,7%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 2,0 (2015)
- Industry (including construction), value added (% of GDP): 35,9 (2014)
- Services, value added (% of GDP): 52,8 (2017)

Population (2018) : 51,64 million

Urban population (2018): 81%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (16,67%)/ Coal (29,21%) / Hydro (0,1%)/ Biofuels/Waste (2,74%)/ Oil (38,73%)/ Nuclear (12,03%)/ Wind & Solar (0,49%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 9/14

Total des dépenses routières (2015) : 16.538,336 million USD

Total length of the road network (2016): 100.428 Km

Road density (km per one hundred sq. km) (2017): 100

Network length by road category (2016):

- Motorways: 4.438 Km
- Main / Principal roads: 13.814 Km
- Secondary / Regional roads: 4.761 Km
- Other Roads: 77.416 Km

AUSTRIA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Austria is fully involved in autonomous and connected mobility. The public authorities have developed coherent and very proactive national strategies in this respect. **Connectivity and traffic flow management are key elements of the Austrian strategy, notably through C-ITS and MaaS technologies.** In addition, its international cooperation with its neighbours or with foreign groups demonstrates its willingness to develop connected and efficient mobility.

In the same sense, its capital Vienna is in line with many European cities regarding **urban mobility developments:** expansion of the public network, reduction of the space for private cars, promotion of eco-mobility (active and soft mobility), coexistence of different forms of mobility through multi-modal access, dedicated lanes etc.

We note that for both connected and autonomous mobility and urban mobility, **road safety** remains a significant objective.

In order to reduce emissions from the transport sector, Austria is aware of **the need to develop a much denser and more efficient recharging network for electric vehicles throughout its territory**. The country wishes **to remain technologically neutral**, and is also interested in biofuels or hydrogen in the medium term.

Road infrastructure and its equipment remain an important factor in the development of mobility in Austria and remains an essential factor in the evolution of mobility.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility-

MAIN ISSUES

As clearly stated in the **Austrian Action Programme on Automated Mobility 2019-2022**[2] published by the Federal Ministry of Transport, Innovation and Technology (BMVIT), the main issues regarding automated mobility cover the **automation of the Austrian transport system** and the influence of the public sector on it, the **requirements for a digital infrastructure**, the **guarantee of security and reliability of these new systems** - including data protection - and **Austria's position** and strengths in global economic competition on this matter.

The Ministry also published in 2016 the **country's C-ITS deployment strategy for the period 2016-2020**[3], with coordination by BMVIT, **AustriaTech** (subsidiary of the Ministry and consultative agency) and **ASFINAG** (public company managing the motorways) in order to follow-up on this strategy, with the objectives of **better management of traffic flows** and their **greater safety**.

MATURITY LEVEL

Due to the strong involvement of public authorities, the country's level of international cooperation and the willingness to set up public and private partnerships, **Austria's level of maturity can be considered rather high**.

ECOSYSTEM AND GOVERNANCE

BMVIT and public authorities are fully involved in autonomous and connected mobility. As seen above, the Action Programme on Automated Mobility 2019-2022 follows a first Plan for the period 2016-2018, which established **a legal framework for tests or research projects**. According to the KPMG index, BMVIT "*seeks to ensure a sensitive and efficient use of automated mobility in terms of **traffic** as well as to **strengthen Austria's competitive position** on the international stage*"[4]. The new plan is based on 5 guiding principles: safety, systemic access to tests, legal certainty and liability, impact assessment of the technologies and transparent use and management of data.

In 2018, **Austria, Slovenia and Hungary have also joined forces in 2018** to develop a "driverless region" to establish cross-border testing of new automotive technologies including AVs.

The country is very internationally oriented. In 2018, companies from the Austrian Light Vehicle Proving Region for Automated Driving (ALP.Lab) went to Slovenia to discuss cooperation with a government official. Also, the **Austrian-based transport technology group TTTech**, whose investors include Samsung, **signed AV agreements with BMW and China's SAIC** in 2018[5]. Austria has a high score in industry partnerships (0.75 out of 1).

Nevertheless, **the social acceptance of AVs is relatively low in Austria** (0.348 out of 1)[6]. In **the 2019 Deloitte Global Automotive Consumer Study**[7], 58% of Austrian consumers would like to see more government involvement in the development and use of AVs. Government involvement fot AVs scores rather low compared to other countries. Also, the most interesting features for consumers from a connected and/or autonomous vehicle are at **76% "Updates regarding traffic congestion and suggested alternate routes"** and for **71% "Updates to improve road safety and prevent potential collisions**". The main interest is clearly related to travel time and the potential contribution of the vehicle in terms of safety, which is comparable from responses with other European countries.

2 / Bundesministerium für Verkehr, Innovation und Technologie 2018: Austrian Action Programme on Automated Mobility 2019-2022. BMVIT. Vienna, Austria.
3 / Bundesministerium für Verkehr, Innovation und Technologie 2016: C-ITS Strategy Network Drivers, Promote Efficiency and Safety in Transport. BMVIT. Vienna, Austria.
4 / KPMG, 2019 Autonomous vehicles readiness Index, Austria
5 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
6 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
7 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.

TECHNOLOGICAL CHOICES

In the **C-ITS deployment strategy for the period 2016-2020**[8] published in 2016, it is stated that "*... Other communication technologies have other strengths, such as the large data rates in cellular networks. As a first step until 2020,* ***this strategy paper will only refer to C-ITS networking via ITS G5*** *because this standard is seen as the responsibility and domain of the public sector and this technology has been extensively tested and will soon be introduced to the market...*".

In the same document, one of the missions of ASFINAG was "*...The preparation of the next steps* ***in the hybrid communication of traffic information*** *(i.e. under the parallel use of different communication technologies such as ITS G5 and telecommunications networks) ...".*

Finally, in the Action Programme on Automated Mobility 2019-2022, the BMVIT supports a "5G Playground Carinthia", a 5G test region in the south of the country. **Austria is then more oriented towards a hybrid system of communications (ITS-G5 and 5G).**

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to our respondents, the road infrastructure must be digitized to accommodate this new mobility, via C-ITS and MaaS technologies such as real-time traffic management technologies, accurate information from user information services; data exchange between road operators. The introduction of these technologies will imply to create dedicated lanes. **Regarding MaaS technology, road infrastructure is considered essential for its successful development**. The BMVIT stated as well in the **Action Programme on Automated Mobility 2019-2022**[9], that "*...The holistic system comprising vehicle, infrastructure and human behaviour must always be perceived as a whole...".* However, dedicating a huge amount of investments to physical and digital infrastructure to support automated driving is considered as worst-case scenario and would not be ideal.

GENERAL ACCESSIBILITY OF NEW MOBILITY

According to our respondents, demand-based or mixed schemes could be a solution. Also, one of the several challenges for the public sector is setting up a digital infrastructure covering all regions, including rural areas. In one of the measures proposed by BMVIT, funding of EUR 2 million is proposed for a research project on "*Societal issues (mobility-restricted persons and drivers, inclusion/ accessibility, planning bases and tools, acceptance etc.)*"[10].

DATA CHALLENGE AND CONTROL

Data management is a key issue for the Austrian public authorities. Indeed, **it is one of the 5 principles** mentioned above. The creation of minimum standards of data protection is planned, through anonymisation procedures.

The BMVIT, ASFINAG and federal state and government worked since the 3rd quarter of 2019 on the "***Development and implementation of a digital repository (static, dynamic data) to identify the needs in regard to physical and digital infrastructure****, operationalisation of control necessities and classification of Operational Design Domains so as to be able to define the matching technological (functionality and relevant issues such as safety and security), as well as legal and organisational frameworks for the (downstream) regular operation of automated vehicles on the public road network*"[11].

ECONOMIC MODEL AND FINANCING

According to our respondents, **investments at the national and EU level are the main potential sources for the adaptation and financing of road infrastructure**. The creation of new business models could also leave space for public-private cooperation. AustriaTech is working on the development of new Public Private Partnerships, new procurement instruments, and potential European financings[12].

8 / Bundesministerium für Verkehr, Innovation und Technologie 2016: C-ITS Strategy Network Drivers, Promote Efficiency and Safety in Transport. BMVIT. Vienna, Austria.
9 / Bundesministerium für Verkehr, Innovation und Technologie 2018: Austrian Action Programme on Automated Mobility 2019-2022. BMVIT. Vienna, Austria.
10 / Bundesministerium für Verkehr, Innovation und Technologie 2018: Austrian Action Programme on Automated Mobility 2019-2022. BMVIT. Vienna, Austria.
11 / Bundesministerium für Verkehr, Innovation und Technologie 2018: Austrian Action Programme on Automated Mobility 2019-2022. BMVIT. Vienna, Austria.
12 / Bundesministerium für Verkehr, Innovation und Technologie 2018: Austrian Action Programme on Automated Mobility 2019-2022. BMVIT. Vienna, Austria.

Urban, active & soft mobility

MAIN ISSUES

Austria faces the same problems as all European cities: the need to reduce its greenhouse gas emissions, to ensure a multi-modality of transport, to reduce the place of the private car in urban areas. We will focus only on the city of Vienna, for a better understanding.

MATURITY INDEX

In **Politico's Urban Mobility Index**[13] for 2018, Vienna is ranked 11th out of 20 European cities. The city obtains interesting results regarding mass transit use (5th) and bicycle use (8th), with an average level of congestion (10th). The main difficulty lies in the level of air quality (15th).

In the **Here's Urban Mobility Index** for 2018[14], Vienna has rather a good density of EV charging network, a high low emission area coverage, low cost public transport, and an average level of road congestion at peak hours. Public transport has rather high frequency, although put into perspective regarding its geographical coverage. This Index is to be considered in comparison with European cities.

It should be noted that Vienna was ranked once again **as the "most liveable" city in the world** in the "Global Liveability Index", published by The Economist magazine in September 2019[15].

Considering these elements, **the city has a high level of maturity.**

ECOSYSTEM AND GOVERNANCE

In 2015, **the city of Vienna launched its urban mobility plan "STEP 2025"**[16] with a 10-year vision This plan is based on several major objectives such as:

- "***More space for cyclists and pedestrians***" the car share of transport should decrease to 20% in 2025 (near 40% in 2015)
- "***Expanding public transport*** *(tram and bus lines)"*
- "***Active and safe mobility*** *for the youngest"*
- "***Multi-modal transport*** *from door to door"*
- "***Mobility partnerships in the region***"
- CO2 emissions **from the transport sector reduced by 20% compared to 2010 levels**

On these first elements, Vienna is in line with many European cities: expansion of the public network, reduction of the space for private cars, promotion of eco-mobility (active and soft mobility), coexistence of different forms of mobility through multi-modal access, dedicated lanes etc.

The BMVIT has a regulatory role at the national level and has no control over urban mobility, which is devolved at the local level. Nevertheless, the Ministry promotes soft mobility, from the point of view of **road safety** (bike safety issues, adjustment of the Federal Road Traffic Act to the practice of cycling), communication, financing of related projects[17].

In its plan, the City of Vienna indicates that it is in close cooperation with the research community and highlights several projects such as the SMILE project, which is a **MaaS technology project** (digital platform for all modes of transport), a Graph Integration Platform (GIP) for digital traffic data management, and *"...the project "European Digital Traffic Infrastructure". Network for Intelligent Transport Systems" (EDITS) is funded by the European Union; it prepares the ground for cross-border multi-modal traffic information systems..."*[18]

According to our respondents, the expectations of the public to improve the public transportation situation and to invest in respective infrastructure are mainly addressed at the local level in Austria.

13 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: *POLITICO's urban mobility index. The best places in Europe to get around*. POLITICO. April 17, 2018.
14 / Here.com Urban Mobility Index: *Vienna*.Accessed: April 22, 2020.
15 / Vienna Now Forever: *Vienna voted 1st* place again. Accessed: April 22, 2020.
16 / City of Vienna 2015: Thematic concept. Urban Mobility Plan Vienna. Together on the move. Vienna City Administration, Municipal Department 18 (MA 18) Urban Development and Planning. Vienna, Austria.
17 / Bundesministerium für Klimaschutz, Umwelt, Mobilität, Innovation und Technologie 2019: *Bicycle policy related activities of the BMVIT*. . Accessed: April 22, 2020.
18 / City of Vienna 2015: Thematic concept. Urban Mobility Plan Vienna. Together on the move. Vienna City Administration, Municipal Department 18 (MA 18) Urban Development and Planning. Vienna, Austria.

TECHNOLOGICAL CHOICES

The Viennese orientation is to favour eco-mobility, with for 2025 a share of soft modes of transport (bicycle, walking, public transport) of 80% against 20% for the individual vehicle[19].

According to our respondents, the trend is to invest more in public transport and soft modes and to close more and more the urban areas to the vehicles in the country, and therefore to upgrade the respective infrastructure.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

In its plan, the city of Vienna intends to rethink the role of infrastructure and the road network: reorganisation of the urban space, promotion of soft and active modes, application of its urban planning policy to new roads or built-up areas, multi-modality of the road to enable all road users to travel in peace and safety.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Accessibility to mobility, in particular for young people and the elderly, is addressed by Vienna in particular through the reorganisation of the occupation of urban space, in line with what has been seen above.

DATA CHALLENGE AND CONTROL

In its plan, the City of Vienna intends to implement a data sharing system on mobility, for logistics and freight and traffic data in and around the city.

ECONOMIC MODEL AND FINANCING

The economic model remains mainly the financing of mobility through public funds, with testing and innovation in partnerships.

According to our respondents, new tendering schemes enabling collaborative business models and the shift from system-based solutions to service-based solutions to allow new mobility solutions to integrate the market are needed.

Decarbonised & Electric mobility

MAIN ISSUES

Austria intends to reduce its greenhouse gas emissions by 36%[20] compared to 2005 levels, and to be carbon neutral by 2040[21]. The country, like its European neighbours, is seeking to decarbonise its economy and the transport sector.

MATURITY INDEX

In 2019, in terms of charging infrastructure for electric vehicles, **Austria accounts for 2,18% of charging points in the EU**[22]. The country has 34 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 9 Electric Vehicles (PEVs) per public charging point in Austria against 7 in the EU. In terms of alternative vehicles, **the electric-chargeable vehicles represented 2.5% and the hybrid ones 2.2% of the market share of alternatively powered cars in the country in 2018**[23].

In **Lease Plan's EV Readiness Index 2020**[24], Austria is ranked 6th out of 22 European countries.

The level of maturity of the country is thus relatively **good**.

ECOSYSTEM AND GOVERNANCE

By the end of 2018, the Austrian government has proposed an energy and climate strategy for 2030[25]. In this document, several proposals emerge on mobility and transport:

- Greenhouse gas emissions must be reduced in the mobility sector, whose level has increased by 66% since 1990.
- **Priority is given to low-emission vehicles, mainly electrically powered, but also in the longer term by biofuels and hydrogen** (energy under consideration more generally)
- **Optimisation of tax incentive systems for the purchase of electric vehicles**

An acceleration of the installation of electricity recharging infrastructure is needed, including shared recharging stations in urban areas

19 / City of Vienna 2015: Thematic concept. Urban Mobility Plan Vienna. Together on the move. Vienna City Administration, Municipal Department 18 (MA 18) Urban Development and Planning. Vienna, Austria.
20 / Bundesministerium für Nachhaltigkeit und Tourismus; Bundesministerium für Verkehr, Innovation und Technologie 2018: #mission 2030. Austrian Climate and Energy Strategy. BMNT, BMVIT. Vienna, Austria.
21 / Grüll, Philipp 2020: *Austria's new conservative – Green coalition enthusiastic about* climate and Europe. EURACTIV. January 8, 2020..
22 / European Alternative Fuels Observatory: Austria. Accessed: April 22, 2020.
23 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.
24 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
25 / Bundesministerium für Nachhaltigkeit und Tourismus; Bundesministerium für Verkehr, Innovation und Technologie 2018: #mission 2030. Austrian Climate and Energy Strategy. BMNT, BMVIT. Vienna, Austria.

Since Austria is a federal country, many competences are devolved to the local level. The government's strategy makes this clear and points out that cooperation between the federal state and the local regions is necessary, **including in the facilitation of electromobility**.

For Austrian consumers**, only 38% in 2019 still consider an alternative energy vehicle as their next vehicle purchase potential**[26], which shows that they have yet to be convinced of the benefits of these new vehicles.

TECHNOLOGICAL CHOICES

Priority is given to electromobility. Nevertheless, the Government also indicates that traffic management and changes in driving behaviour will contribute to decarbonisation. **Austria wants to be technologically neutral** and is thinking about the introduction of biofuels or hydrogen after 2030, considering the unlikely deployment of these energies in the decade 2020.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The road infrastructure has a role through **the deployment of recharging equipment and fast recharging points according to our respondents**, in order to be competitive with traditional recharging stations. The redevelopment of road space can also play a role in the decarbonisation of mobility, which is similar to what has been mentioned for urban mobility.

ECONOMIC MODEL AND FINANCING

Austria uses **tax incentives** to facilitate access to alternative energy vehicles. In 2019, according to ACEA[27], at the acquisition of the vehicle a VAT deduction and exemption from tax for zero-emission cars applies, and a discount from 1,500 to 3,000 euros at the purchase according to the type of vehicle (until the end of 2020). The government proposes in its climate strategy **to co-finance certain e-vehicles together with the automotive industry[28].**

26 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
27 / European Automobile Manufacturers Association 2019: *Overview – Electric vehicles: tax benefits and incentives in the EU*. Accessed: April 22, 2020.
28 / Bundesministerium für Nachhaltigkeit und Tourismus; Bundesministerium für Verkehr, Innovation und Technologie 2018: #mission 2030. Austrian Climate and Energy Strategy. BMNT, BMVIT. Vienna, Austria.

AUSTRIA

POLITICAL ORGANISATION

Nature of the regime: Federal Republic

Head of state: Alexander Van der Bellen

Head of government: Sebastian Kurz

ECONOMIC INDICATORS

GDP (2018): 455.737 million USD/ Rank: 26/205

GDP growth (2018): 2,7%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,1 (2018)
- Industry (including construction), value added (% of GDP): 25,7 (2018)
- Services, value added (% of GDP): 62,4 (2018)

Population (2018) : 8, 847 million

Urban population (2018): 58 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (22,94%)/ Coal (8,54%) / Hydro (10,03%)/ Biofuels/Waste (19,31%)/ Oil (36,47%) / Wind & Solar (2,6%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 6/141

Total road expenditures (2016): 3.614 million USD

Total length of the road network (2016): 138.696 Km

Road density (km per one hundred sq. km) (2016): 165

Network length by road category (2016):

- Motorways: 1.719 Km
- Main / Principal roads: 10.834 Km
- Secondary / Regional roads: 23.681 Km
- Other Roads : 102.463 Km

BELGIUM

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Belgium's political organisation makes its policy less readable than elsewhere, as **the Regions are the main actors in the development of the transport and mobility sector**.

The Regions are more logically involved in urban mobility with rather ambitious mobility or transport plans for the years to come. The **main problem in Belgium is congestion** and the still **very high modal share of private cars** in the country as a whole. These different plans aim to increase the attractiveness of public transport and alternative modes of transport such as cycling.

The country is carrying out tests and experiments on autonomous and connected vehicles, including public transport shuttles with several foreign players. As an example, a major plan to replace road equipment and motorway connectivity has been launched in the south of the country (Walloon Region).

As far as carbon-free mobility is concerned, the Belgian Regions are more **inclined towards technological neutrality, with a preference for electricity**. Although the market share of electric vehicles is close to other European countries, Belgian consumers are not yet convinced by these new vehicles and a more extensive charging network could contribute to a change of vision. Also, as the incentive policy is different according to the regions and with the large share of company cars in Belgium, a lack of information is to be noted on the consumer side.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility

MAIN ISSUES

Belgium is continuing its research on this type of mobility, after several tests and experiments throughout the country. Its political organisation bases progress on this subject on the Regions, when the Federal State has a limited role and a government that is currently in current affairs.

MATURITY LEVEL

Considering the elements below, the level of maturity of the country is **rather average** compared to its European neighbours.

ECOSYSTEM AND GOVERNANCE

In the **Backer Mackenzie "Global Driverless Vehicle Survey 2018"**[2], it can be seen that there is no legislation dedicated to the autonomous vehicle but a **Code of Practice for Testing Autonomous Vehicles in Belgium**, published by the **Federal Mobility Public Department in 2016**, inspired by the same Code established in the United Kingdom in 2015. This Code lays down the rules for testing and experimenting this type of vehicles in the broadest sense on the Belgian territory.

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Various tests are being or have been carried out in Belgium with the manufacturer Toyota[3], the carrier Keolis or the French specialist manufacturer Navya[4]. Namur is the first Walloon city relying on ITS technologies[5].

WEIGHT OF INDUSTRY

We observe that in connected mobility, the Walloon[6] and the Flemish[7] regions are working on ITS pilots within the European C-Roads platform.

PLACE OF ADMINISTRATIONS AND ELECTED OFFICIALS

Mobility, transport and road safety are regulated at the Federal level. The Regions regulate the Road Traffic Code and the issuance of driving licences[8].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

In **the 2019 Deloitte Global Automotive Consumer Study**[9], 63% of Belgian consumers would like to see a significant level of government involvement in the development and use of AVs, which is an average score comparing to other countries. Also, the most interesting features expected by consumers from a connected and/or autonomous vehicle are for 74% "Updates regarding traffic congestion and suggested alternate routes" and for 69% "Updates to improve road safety and prevent potential collisions". The main interest concerning AVs clearly relates to travel time and the potential contribution of the vehicle in terms of safety.

TECHNOLOGICAL CHOICES

The Belgian authorities have not yet given clear signals regarding 5G[10]. However, a programme to re-equip motorways and trunk roads in the Walloon region intends to place Roadside Units (RSUs) in V2X technology[11].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to our respondents, works are underway to assess the role of road infrastructure in these mobility changes, especially regarding its design.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Work is under way on the accessibility of this mobility and seems to focus more on the urban environment and public transit.

ECONOMIC MODEL AND FINANCING

The economic model is mainly based on public funds. According to our respondents, the allocation of limited public resources to technologies is weighed. Belgium also relies on PPPs (Public-Private Projects) as seen previously in the Walloon region.

2 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
3 / Hérion, Maxime 2019: Les voitures autonomes arrivent en Belgique ! Faut-il en avoir peur ? Gocar.be. July 16, 2019.
4 / Keolis 2018: Keolis lance une deuxième navette électrique autonome en Belgique. Accessed April 22, 2020.
5 / Lejman, Nicolas 2019: Namur s'apprête à vivre une petite révolution: véhicules, voiries... la mobilité devient connectée! RTBF. August 22, 2019.
6 / C-Roads: C-Roads Belgium Wallonia. Accessed April 22, 2020.
7 / C-Roads: C-Roads Belgium/Flanders. Accessed April 22, 2020.
8 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
9 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
10 / Le Soir 2019: 5G en Belgique - Une réglementation modérée pour permettre aux entreprises d'approcher la 5G (Agoria). Le Soir. October 24, 2019.
11 / Wallonie Infrastructures SOFICO 2019: Plan Lumières 4.0 : Démarrage des travaux de modernisation. Accessed April 22, 2020.

Urban, active & soft mobility

MAIN ISSUES

Belgium is a country where the private car is considered the best means of transport and faces **one of the highest congestion rates in Europe**[12]. All the Regions tend to favour public transport and soft and active mobility in order to gradually reduce the place of the private car.

MATURITY LEVEL

We will focus here on the city of Brussels. According to the **Deloitte City Mobility Index**[13], the city of Brussels is not very well ranked: **the modal share of public transport and active modes accounts for 46% of trips, compared to almost 50% for private cars**. Road congestion and air quality are among the biggest issues. However, Brussels benefits from a good mix of public transport (40% of modal share of transportation), **supported by integrated and payment options apps** from the public transport company STIB.

In **Politico's Urban Mobility Index**[14] for 2018, **Brussels is ranked 18th out of 20** European cities. The city obtains average results regarding mass transit use (12th), and bicycle use (10th), with a an average ranking in the cost of single city public transport ticket (11th). The city is at the bottom of the ranking for air quality (15th) and congestion (14th).

In the **Here's Urban Mobility Index** for 2018[15], Brussels scores highest on the percentage of green spaces and low-emission zones indices, has good results concerning the deployment of public bicycles or public transport expense. Nevertheless, the city encounters issues on congestion index. These elements are to be compared with the other European cities included in this Index.

Considering these elements, Brussels has a rather **average level of maturity.**

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

In Belgium, mobility and road infrastructure management lies under the responsibility of the Regions, as the country is very decentralised[16]. The Walloon and Brussels **Regions have both published mobility plans**[17][18] for 2019 setting out several objectives. The Flemish Region has also proposed new concepts for mobility and transport[19]. All the approaches proposed in the three regions are in line with the same policies to various degrees: **promotion of walking, cycling and public transport to the detriment of private vehicles, spatial reorganisation in favour of soft and active mobility**, and **reduction of the environmental impact of the transport sector**.

Most of the initiatives come from public authorities and are coordinated by transport companies, mainly public ones. Proposals for micro-mobility, such as electric scooter dispensers (Lime and Dott), the e-scooter (Felyx) or even bicycles such as JUMP by Uber are part of the urban mobility landscape. MaaS operators such as Whim and BeMobile are also arriving in Belgium.

TECHNOLOGICAL CHOICES

As indicated above, the political orientations and actors deployed on the Belgian territory tend to favour public transport and active and soft mobility, with **the priority objective of reducing the modal share of the private car in the public space,** based mainly on the concern for the environment.

12 / Deloitte 2019: Future of Mobility. A New Deal for Mobility in Belgium. In: Deloitte Belgium.
13 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
14 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
15 / Here.com Urban Mobility Index: Brussels. Accessed: April 22, 2020.
16 / Belgium.be: La sixième réforme de l'Etat. Accessed April 22, 2020.
17 / Wallonie 2019 : Déclaration de politique régionale pour la Wallonie 2019-2024. Wallonie.be.
18 / Bruxelles Mobilité, Service Publique Régional de Bruxelles: Plan Régional de Mobilité. Projet de plan. Accessed April 22, 2020.
19 / Eubelius 2019: Approche renouvelée des transports publics en Flandre : de la mobilité de base à l'accessibilité de base. Accessed April 22, 2020.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to our respondents, the objective assigned to the road infrastructure is that it should enable **an environment adapted to all types of mobility which must share a common space**. By observing the plans proposed in the various regions, the emphasis is placed on the creation of pedestrian zones and the extension of the cycle network, in accordance with the above elements.

GENERAL ACCESSIBILITY OF NEW MOBILITY

The various plans proposed by the Regions focus on the accessibility of transport, especially public transport, and for vulnerable groups (low income, disabled people). According to our respondents, better accessibility also requires more flexible transport in rural areas, especially to reach towns and cities.

ECONOMIC MODEL AND FINANCING

The economic model remains very largely public, although micro-mobility actors are present on the territory. This issue is still under study.

Decarbonised & Electric mobility

MAIN ISSUES

As seen for other mobilities, Belgium's institutional organisation makes the Regions focus on the development of mobility and transport, when the Federal State cannot currently produce a defined national strategy. Also, the fiscal stakes or support for low-emission vehicles are different from one region to another, which divides public action according to the region.

MATURITY LEVEL

In 2019, in terms of charging infrastructure for electric vehicles, **Belgium accounts for 3.33% of charging points in the EU**[20]. The country has 9 fast public charging points per 100 km highway against 7 in the EU. In addition, there were a ratio of 20 Electric Vehicles (PEVs) per public charging point in Belgium against 28 in the EU. In terms of alternative vehicles, **the electric-chargeable vehicles represented 2.4% and the hybrid electric vehicles 2.8 % of the market share of alternatively powered cars in the country in 2018**[21].

In **Lease Plan's EV Readiness Index 2020**[22], Belgium is ranked 10th out of 22 European countries.

Considering these elements, the maturity of the country is **rather average**.

ECOSYSTEM AND GOVERNANCE

Belgium's energy pact has two objectives[23]:

- *"In 2025: 20% of new registrations will be "zero-emission" vehicles. For public authorities and public transport (bus lines), all new purchases of cars and buses will be "zero-emission".*
- *"In 2030, at least 50% of new registrations will be zero-emission vehicles."*

All direct measures concerning the promotion of electromobility, hydrogen or natural gas are carried out by the Regions. The difficulty is to have a national strategy on this type of mobility.

In 2019, according to **the research institute Cetelem**[24], in response to the question "Would you say that there should be more, less or neither more nor less policies (national and local, financial and non-financial) to support the electric vehicle?", 55% of consumers answered "More".

20 / European Alternative Fuels Observatory: Belgium. Accessed April 22, 2020.
21 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed April 22, 2020.
22 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
23 / Bruxelles Mobilité, Service Publique Régional de Bruxelles: Plan Régional de Mobilité. Projet de plan. Accessed April 22, 2020.
24 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

Also, 84% consider that "there are not enough public charging stations for electric vehicles on the road" and 64% consider that "public charging stations for electric vehicles on the road" are not correctly located, which is relatively high when compared to the other studied countries. 60% consider that the electric vehicle is still too expensive.

As a summary, the document states "*As in other Northern European countries,* ***Belgium has a less optimistic view of the future of the EV than the rest of the world****. Respondents acknowledge that they are not well informed about the EV, and the Belgians represent the largest share of the total regarding the lack of knowledge of its functioning. Price is cited as the main disincentive to purchase. It is one of the highest rates in the countries surveyed".*

TECHNOLOGICAL CHOICES

Given the regional plans studied, Belgium appears to be rather technologically neutral, with a slight preference for electric mobility. The Walloon Region for example also wishes to develop a recharging network for natural gas[25].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

"*Belgium aims to deploy 1 publicly accessible recharging point for 10 electric vehicles and will opt for fast chargers along regional roads and motorways."*[26]

ECONOMIC MODEL AND FINANCING

The different regions of the country offer tax exemptions on the purchase of low-emission vehicles, mainly electric vehicles. Due to the large number of company vehicles, the largest tax exemptions are concentrated on this type of vehicle[27] .

25 / Wallonie 2019: Déclaration de politique régionale pour la Wallonie 2019-2024. Wallonie.be.
26 / Bruxelles Mobilité, Service Publique Régional de Bruxelles: Plan Régional de Mobilité. Projet de plan. Accessed April 22, 2020.
27 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed April 22, 2020.

BELGIUM

POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy

Head of state: King Philippe

Head of government: Sophie Wilmès

ECONOMIC INDICATORS

GDP (2018): 531.767 million USD / Rank: 23/205

GDP growth (2018): 1,4 %

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 0,7 (2018)
- Industry (including construction), value added (% of GDP): 19,6 (2018)
- Services, value added (% of GDP): 68,9 (2018)

Population (2018) : 11, 422 million

Urban population (2018): 55 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (29,37%)/ Coal (6,14%) / Hydro (0,04%)/ Biofuels/Waste (7,34%)/ Oil (40,33%)/ Nuclear (14,73%) / Wind & Solar (2,0%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 56/141

Total road expenditures (2017): 656 million euros

Total length of the road network (2016): 155.210 km

Road density (km per one hundred sq. km) (2016): 508

Network length by road category (2016):

- Motorways: 1.763 Km
- Main / Principal roads: 13.229 Km
- Secondary / Regional roads: 1.349 Km
- Other Roads: 138.869 Km

EUROPEAN UNION

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

The new European Commission has focused its mandate on its European Green Deal, a strategic plan to combat global warming with the aim of achieving **carbon neutrality by 2050**.

The European Commission wishes to rely on **both, the potential offered by digitalisation and new communication technologies** such as 5G, and on alternative energy sources to fossil fuels, such as through the **European Battery Alliance** for the independent development of European countries in the field of electric vehicles. The EU also has an **important link with European regions and cities**, making it a valuable platform for cooperation between them. The European authorities promote public transport, active and soft mobility, multi-modal mobility and the reduction of the modal share of the individual thermal car in cities.

The objectives for the transport sector are challenging -**90% reduction in greenhouse gas emissions by 2050**-. ITS, MaaS and 5G technologies are put forward to **reduce congestion** and improve **road safety**. Revised legislation on alternative fuel infrastructure, road pricing and increased requirements for vehicle emissions will also be proposed to meet the targets. It should be noted that standardisation and certification processes are discussed in Brussels.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

The European Green Deal

(December 2019)

The new European Commission took office on 1 December 2019 and launched the **keystone** of the mandate on 11 December through "**The European Green Deal**" Communication[2]. This is a comprehensive and strategic plan to reduce greenhouse gas emissions in the European Union.

Ursula Von der Leyen's Commission proposed several objectives to the European Union:

- To reach **a carbon neutrality objective by 2050**, through a European "Climate Law" in 2020, under which the Union's policies will be placed to achieve this objective;
- **Reducing greenhouse gas emissions by at least 50% to 55% by 2030;**
- **A 90% reduction of greenhouse gases in the transport sector by 2050**, through a strategy for sustainable and intelligent mobility;
- **75% of inland freight road transport must be shifted to rail and inland waterway transport**;
- The proposal for an EU Industrial Strategy to respond to environmental and digital challenges;
- A new plan on the circular economy including a "sustainable products" policy;
- To implement the **Strategic Action Plan on Batteries** and **support the European Battery Alliance** with a proposal for legislation to ensure a battery value chain and enable the growth of the electric vehicle market;
- Action is to be expected on **5G technologies;**
- The Commission will help develop **smart systems for traffic management** and **'Mobility as a Service' solutions**, through its funding instruments, such as the Connected Europe Facility;
- Finalise **a road pricing policy** through the Eurovignette Directive or through alternative measures;
- Revision of the **Alternative Fuels Infrastructure Directive;**
- Commitment to the **deployment of public recharging points**, particularly for long distances or in sparsely populated areas, via a new call for funding;
- Further *revise the CO2 emission performance standards for cars and vans;*
- Consider the **application of the European Emissions Trading Transport to road transport.**

Autonomous & Connected mobility

MAIN ISSUES

Most European Union member countries, including the United Kingdom until recently, have legislation to facilitate the testing and field trials of new vehicles on the road. Numerous working groups are at work in Brussels. **Standardisation, certification and choice of technologies are the issues decided at EU level.**

MATURITY LEVEL

The European Union has a **good level of maturity** if we consider the legislation and the progress of some Member States at the forefront. Autonomous and connected mobility is seen as a sector of the future and a strategic sovereignty issue for the European continent.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Member States have asked the European Commission in 2016 through the "**Declaration of Amsterdam**" to develop a shared European strategy on automated and connected driving, to review the EU regulatory framework if necessary, and to deploy interoperable Cooperative Intelligent Transport Systems.

2 / European Commission 2019: Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European green deal. Brussels, Belgium. December 11, 2019.

The European Commission has expressed its vision for Connected and Automated Mobility in 2018 in a Communication[3]. Several **objectives** are developed:

- Reduction of greenhouse gas emissions;
- Reducing congestion;
- Contributing to Vision Zero: no road deaths on European roads in 2050;
- to make Europe a world leader in the field;
- Autonomous vehicles should begin to become common in 2030.

According to the Communication, **58% of the European citizens are willing to take a ride with driverless cars**.

Several **actions** are recommended:

- Adoption of a strategy for 5th generation (5G) communication networks;
- A strategy on Cooperative Intelligent Transport Systems;
- Regulatory and legislative work (EU vehicle approval framework legislation, EU data protection rules, revision of the General Safety Regulation, international revision framework at the United Nations of the Geneva and Vienna Conventions).

Several **working or expert groups** have been launched[4]:

- The Cooperative, Connected, Automated and Autonomous Mobility (CCAM) Single Platform in 2019 bringing together public and private stakeholders to work on the full range of issues related to autonomous mobility, including the role of infrastructure and data;
- The High-Level Group for the automotive industry: GEAR 2030.

Several **testing and co-financing projects** are underway:

- The C-Roads platform in the field of C-ITS
- The 5G cross-borders corridors

Private actors have also grouped themselves into several bodies:

- European Automotive - Telecom Alliance» (EATA) to promote the wider deployment of connected & automated driving;
- The 5G Automobile Alliance (5GAA).

TECHNOLOGICAL CHOICES/ORIENTATION

The European Commission proposed **a Delegated Act on C-ITS** favouring the default use of ITS-G5, which was rejected by 21 of the 28 Member States in June 2019, as countries also wanted to consider the evolution of 5G technology. The industry is also divided between those two technologies[5].

In its Green Deal Communication, the Commission indicates *"Automated and connected multimodal mobility will play an increasing role, together with **smart traffic management systems** enabled by digitalisation. The EU transport system and infrastructure will be made fit to support new sustainable mobility services that can reduce congestion and pollution, especially in urban areas. The Commission will help develop smart systems for traffic management and '**Mobility as a Service**' solutions, through its funding instruments, such as the Connected Europe Facility"*[6], as such giving hints about its vision.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Road infrastructure is mainly placed on these subjects via the C-ITS Directive, last revised in 2014. As far as autonomous mobility is concerned, new legislation is expected.

DATA CHALLENGE AND CONTROL

At the end of January 2020, the European Commission **launched a toolbox for the deployment of 5G**, in order to prevent possible cybersecurity risks[7]. Also, the **European Data Protection Board has launched a public consultation on the processing of personal data in the context of connected cars and mobility applications**[8]. It should be remembered that the EU adopted the General Protection Data Regulation in 2018, which is commonly considered to be one of the most protective regulation of personal data in the world. Cybersecurity and data protection are also the focus of the expert and working groups discussed above.

3 / European Commission 2018: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions. On the road to automated mobility: An EU strategy for mobility of the future. Brussels, Belgium. May 17, 2018.
4 / European Commission 2020: Connected and automated mobility in Europe. Accessed April 22, 2020.
5 / Dynniq 2019: Volkswagen Golf supports Car2X via ITS-G5, but the EU member states are still divided on which C-ITS standard to use: how to move forward? Dynniq. November 4, 2019.
6 / European Commission 2019: Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European green deal. Brussels, Belgium. December 11, 2019.
7 / European Commission 2020: Secure 5G deployment in the EU: Implementing the EU toolbox - Communication from the Commission. Accessed April 22, 2020.
8 / European Data Protection Board 2020: Guidelines 1/2020 on processing personal data in the context of connected vehicles and mobility related applications Version 1.0. EDBP. Brussels, Belgium.

ECONOMIC MODEL AND FINANCING

The European Union co-finances many projects, tests, actions via the European Funds.

Urban, active & soft mobility

MAIN ISSUES

European cities face several challenges: reducing pollution, fighting congestion, better traffic management and ensuring the coexistence of different modes of transport.

ECOSYSTEM AND GOVERNANCE & TECHNOLOGICAL CHOICES

In its Green Deal Communication[9], the European Commission attaches a certain importance to urban mobility. Indeed, it returns largely to the issue of air pollution, proposing a future zero-pollution action plan (particularly air pollution) and a revision of air quality standards. Also, MaaS and digital traffic management solutions are considered as a solution for urban mobility. Also, the revision of CO2 emission standards for vehicles from 2021 is a way to accelerate the transition to cleaner vehicles and reduce pollution and congestion, with the Communication calling for a strengthening of public transport in urban areas.

In the context of cohesion policy, the Commission has also proposed **a post-2020 memo of the European Urban Initiative** to support the European Urban Agenda and strengthen the link between regions, cities and EU policies and funding [10].

The Urban Mobility and the Sustainable Urban Mobility Packages are under revision. The initiative was followed by an open public consultation at last quarter of 2019.

Also, in **"The Future of Road Transport"**[11] published in 2019 by the Joint research Center provides elements on the Commission's views regarding urban mobility:

- Policies should favor the use of multimodal transport and reduce the need for car-based transport in cities;
- Public transport must be fast, accessible and frequent, which implies an efficient integration between the different available modes, via MaaS for example;
- Ride-hailing, ridesharing and electronic drones could be the solution to the last-mile connection;
- The report recalls the European Commission's Urban Mobility Package and the concept of SUMPs (Sustainable Urban Mobility Plans) through the European Platform on SUMPs.

"The Future of Cities"[12], published in 2019 by the Joint Research Center (JRC), provides some recommendations regarding mobility in cities:

- A reliable, affordable, and safe public transport;
- Fostering walking and cycling;
- Shared transport (vehicle sharing, bikes rentals);
- Connected and automated vehicles in improving road safety energy efficiency, urban accessibility and reduce congestion;
- Investments in charging infrastructure to support electrification of road transport;
- Integrated urban transport solutions by the use of digital platforms;
- Optimising existing infrastructure (cheaper than building new ones).

ECONOMIC MODEL AND FINANCING

From the EU point of view, funding can come from calls for projects or funding

9 / European Commission 2019: Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European green deal. Brussels, Belgium. December 11, 2019.
10 / European Commission 2019: Explanatory memo: European Urban Initiative - Post 2020. Article 104(5) CPR Proposal and Article 10 ERDF/CF Proposal. Luxembourg: Publications Office of the European Union.
11 / European Commission, Joint Research Centre 2019: The future of road transport. Implications of automated, connected, low-carbon and shared mobility. Luxembourg: Publications Office of the European Union.
12 / European Commission 2019: The future of cities. Accessed April 22, 2020.

Decarbonised & Electric mobility

MAIN ISSUES

The EU's very ambitious targets for reducing its greenhouse gas emissions by 2030 and 2050 imply a rapid development of charging stations, mainly electric, to absorb the expected boom in low-emission vehicles. In its Green Deal, the European Commission proposes various legislative options for its term of office.

MATURITY LEVEL

In 2019, the European Union will have **193,686 electrical recharging points** (including 22,000 fast-charge points), 142 hydrogen recharging points, and more than 34,000 Liquified Petroleum Gas (LPG) -of which nearly 75% are concentrated in Germany and Italy-[13] filling stations. In comparison, there were approximately **1.5 million electric vehicles (battery and hybrid) in the EU in 2019**, just over 1,000 hydrogen vehicles, and nearly 8 million LPG vehicles. Focusing on the electric charging infrastructure, the ratio of fast charge points per 100km of motorways is 28 and the ratio of electric vehicles per electric charge point is 7[14]. **2% of all cars sold in 2018 were electrically-chargeable**" and "3.8% of new passenger cars in the EU were hybrid electric"[15].

According to the Global EV Outlook 2019[16], "*The People's Republic of China (hereafter "China") remained the world's largest electric car market* ***with nearly 1.1 million electric cars sold in 2018*** *and, with 2.3 million units, it accounted for almost half of the global electric car stock.* ***Europe followed with 1.2 million electric cars and the United States with 1.1 million on the road by the end of 2018*** *and market growth of 385 000 and 361 000 electric cars from the previous year.*"

Considering these first figures, the European Union has a **high level of maturity** in electromobility and is one of the most advanced regions in the world.

ECOSYSTEM AND GOVERNANCE

At the end of 2019, the European Commission approved the "**European Battery Alliance**" project, which brings together seven countries (Germany, France, Italy, Poland, Belgium, Sweden and Finland) that will contribute **€3.2 billion in public funds**, as well as private players such as **car manufacturers**[17]. The aim of this alliance is to create a European industry and value chain for electric batteries, in order to give the electric vehicle sector a competitive edge in international competition and to be more autonomous in relation to other countries. This Alliance will be supported and reinforced by a legislative proposal within the Green Deal framework.

TECHNOLOGICAL CHOICES

The European Commission wants to be technologically neutral and cites different modes of alternative fuels in its Green Deal communication, namely electric batteries and hydrogen. A revision of the Alternative Fuels Infrastructure Directive is planned.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The European Commission considers that **1 million recharging and refuelling stations will be necessary by 2025** to provide the expected 13 million new vehicles fleet[18] and wants to support the deployment of these stations through a new funding call.

GENERAL ACCESSIBILITY OF NEW MOBILITY

In the Green Deal Communication, *"...The Commission will support the deployment of public recharging and refuelling points where persistent gaps exist, notably for long-distance travel and in less densely populated areas..."*[19], and calls for an accessible mobility.

ECONOMIC MODEL AND FINANCING

From the EU point of view, funding can come from calls for projects or funding. Also, the Commission has proposed in its Green Deal a "green" or dedicated financing for climate issues in various European funds, or through the European Investment Bank. Also, the issue of road pricing is still on the agenda at the European level.

13 / European Automobile Manufacturers Association 2019: Making the Transition to Zero-Emission Mobility - 2019 progress report. Enabling factors for alternatively-powered cars in the EU. ACEA. Belgium.
14 / European Alternative Fuels Observatory: European Union. Accessed April 22, 2020.
15 / European Automobile Manufacturers Association 2019: Making the Transition to Zero-Emission Mobility - 2019 progress report. Enabling factors for alternatively powered cars in the EU. ACEA. Belgium.
16 / International Energy Agency 2019: The Global EV Outlook. Scaling-up the transition to electric mobility. Accessed April 24, 2020.
17 / Moreira, Enrique 2019: L'Airbus des batteries obtient l'accord de Bruxelles. Les Echos. December 9, 2019.
18 / European Commission 2019: Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European green deal. Brussels, Belgium. December 11, 2019.
19 / European Commission 2019: Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European green deal. Brussels, Belgium. December 11, 2019.

EUROPEAN UNION

POLITICAL ORGANISATION

Nature of the regime: *Sui generis* political-economic association

Head of the EU Commission: Ursula Von der Leyen

ECONOMIC INDICATORS

GDP (2018): 18.740,000 million USD / Rank: 2/205

GDP growth (2018): 2,2%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,5 (2018)
- Industry (including construction), value added (% of GDP): 21,6 (2018)
- Services, value added (% of GDP): 66,0 (2017)

Population (2018): 513 million

Urban population (2018): 75 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (24,63%)/ Coal (14,48%) / Hydro (1,59%) / Biofuels/Waste (9,81%) / Oil (32,84%) / Nuclear (13,40%) / Wind & Solar (3,24%) – EU28 Data (UK included)

ROAD INFRASTRUCTURE

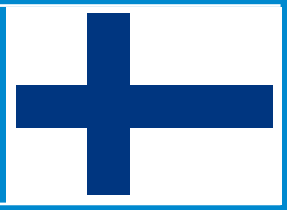
Total des dépenses de maintenance (2017): 9.493.922.033 euros

Longueur totale du réseau routier (2017): 4.817.000 Km

Network length by road category (2017):

- Motorways: 77.396 Km

FINLAND



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

The new Finnish government having taken office at the end of 2019, will propose **a plan for the transport sector in autumn 2020**. In the meanwhile, the new executive has proposed very ambitious climate targets - **carbon neutrality for the country by 2035 and carbon-free transport by 2045**.

Finland's main focus is on urban mobility, connectivity and digitalisation of the transport sector. Its companies are world leaders in MaaS technology. The country is advanced in terms of connected and autonomous mobility, with open legislation**. Road equipment and markings are the integration elements for the digitalisation and connectivity of the road infrastructure**.

Also, Helsinki is **one of the model cities** in the world in terms of new mobility. Its efforts are focused on reducing the share of private cars and increasing the share of clean transport (public transport, cycling and walking). The city also wants to redefine the role of road infrastructure, particularly in the city centre, to focus more on pedestrian accessibility.

Finally, the Finnish government's new plan will leave a share for clean vehicles, with a **technology-neutral approach**. A larger recharging network for electric vehicles would allow for a better integration of this type of vehicle.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

The National Transport Plan 2021-2032

The Finnish Government is currently working on the plan covering the period 2021-2032, which will be presented in October 2020, and a report will be submitted to Parliament at the beginning of 2021.

The Minister of Transport and Communications presented the first targets in January 2020, which are, according to the press release[2]:

- "*The functioning of the labour market areas will be further developed by improving accessibility between urban areas.*
- *The international accessibility of Finnish regions will improve.*
- *The efficiency and reliability of transport will be improved.*
- ***The accessibility of workplaces and services** by means of sustainable transport modes will improve and **the growth of the passenger vehicle kilometrage will level off in urban regions**.*
- *The level of **road safety** will improve and approach the safety level of other modes of transport and the EU's zero scenario.*
- *The socio-economic efficiency of the transport system will improve. **The share of sustainable modes of transport will increase and greenhouse gas emissions from transport are moving towards the national transport emission reduction target**.*
- *The transport system enables the full utilisation of essential information and **new technologies**.*"

Autonomous & Connected mobility

MAIN ISSUES

Finland wishes to develop autonomous and connected mobility considering the particular climatic conditions of its territory, especially in winter[3].

MATURITY LEVEL

Finland is ranked 6th in the KPMG index[4]. According to KPMG's respondents in Finland, the country has a very open test environment, allowing experimentation to any interested entity on the entire road network. The Government has recently passed two laws: **the Transport Service Law** which opens up competition in the taxi market and thus the ride-hailing market, even allowing remote control of a vehicle, and **the Road Traffic Act** which integrates road environment data (road equipment) and its use by AV operators.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The Finnish authorities are very keen on autonomous and connected mobility[5], through very **permissive legislation** concerning experiments. The Ministry of Transport and Communications is responsible from a legislative point of view, in connection with the Agencies such as the Finnish Agency of Transport and Communications (Traficom).

WEIGHT OF INDUSTRY

Operations with private players have multiplied: **research with the Swedish manufacturer Scania for the platooning truck**, tests of the 5G network in the north of the country, introduction of a regular **'Robobus'** service in Helsinki from 2018 to prepare for the introduction of an autonomous and economically viable public transport network in 2021, **association of the local company Sensible 4 with the Japanese company Muji to develop an AV bus resistant to all weather conditions**. This prototype named "Gacha" has been tested in 2019 in Helsinki[6].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

Finnish consumers have **an average autonomous vehicle acceptance level** compared to their European neighbours (0.489 out of 1)[7].

2 / Ministry of Transport and Communications 2020: Preparation of the National Transport System Plan at an important stage – it is time to set the objectives. Press release. Finnish Government. January 14, 2020.
3 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
4 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
5 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
6 / Fouquet, Claude 2019: « Gacha », la première navette autonome qui roule par tous les temps. Les Echos. March 9, 2019.
7 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

TECHNOLOGICAL CHOICE

Finland seems to **be more focused on 5G** for vehicle connectivity. It has already started some tests with this technology. In addition, Finland has expressed to the European Commission its doubts about the proposed Delegated Act on C-ITS in 2019[8], expecting that 5G will be usable as much as ITS G5, in an interoperable mode.

Finland is also very advanced in **the field of MaaS technologies**. Research started in Finland in the early 2010's. Today it has two world leaders in this field: **MaaS Global** (which developed the Whim application in Helsinki) and **Kyyti**, both founded in 2016. An analysis of the development of MaaS technologies was recently produced by the French Centre for Studies and Expertise on Risks, Environment, Mobility and Development (CEREMA) in 2019[9].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Significantly, the Road Traffic Act provides for the integration of precise location data of roads, signs, traffic lights for AV operators[10], and intends to **repaint the continuous yellow lines in white**, as it is easier for autonomous vehicles to detect them.

GENERAL ACCESSIBILITY OF NEW MOBILITY

According to CEREMA, MaaS can play a role both in urban areas (Whim application in Helsinki) and in rural areas (pilot projects launched with public funds). Also, the Helsinki municipality's willingness to offer an autonomous driverless bus service in 2021 is a new mobility offer in the city.

DATA CHALLENGE AND CONTROL

The Data Protection Ombudsman is the national data protection authority and supervises the entire field of data protection in Finland. An additional act to the General Data Protection Regulation (GDPR), **the Data Protection Law of Finland** came into force in 2019[11]. This does not directly concern new mobility but is a general framework that is more protective of personal data than other countries in Europe.

ECONOMIC MODEL AND FINANCING

According to our respondents, the economic potential relies mainly on public funds and public-private or research partnerships.

Urban, active & soft mobility

MAIN ISSUES

Helsinki planned "*making public transport No.1 choice for all travel by 2025 and phasing out private cars by 2050 through shared mobility, demand-responsive transport, and pedestrian-centric urban design*"[12].

MATURITY INDEX

According to the **Deloitte City Mobility Index**[13], the city of Helsinki is rather well ranked: **the modal share of public transport and active modes accounts for 60% of trips, compared to almost 40% for private cars**, whose reduction is one of the municipality's priorities, particularly for improving air quality. It benefits from a diverse mix of public transport, **supported by MaaS apps** such as Whim. Helsinki has also launched self-driving public buses in regular operation.

In **Politico's Urban Mobility Index**[14] for 2018, Helsinki is ranked 1st out of 20 European cities. The city obtains excellent results regarding air quality (2nd), congestion and bicycle use (5th), with an average ranking in mass transit use (10th). The cost of single city public transport ticket is rather high (17th).

In the **Here's Urban Mobility Index** for 2018[15], Helsinki scores highest on congestion indices, has good results concerning the deployment of public bicycles or charging stations for EV, has good coverage and density of the public transport network. These elements are to be compared with the other European cities included in this Index.

Considering these elements, Helsinki has a **high level of maturity.**

8 / Stolton, Samuel 2019: Finland raises concerns in 5G vs WiFi connected vehicle debate. EURACTIV. April 8, 2019.
9 / Cerema 2019: Le MaaS en Europe: enseignements des expériences d'Helsinki, Vienne et Hanovre. Rapport complet de l'étude - Décembre 2019. Cerema Centre-Est.
10 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
11 / Bird & Bird 2018: Finland supplements the GDPR: the Parliament approves the new Data Protection Act. Accessed April 22, 2020.
12 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
13 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
14 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
15 / Here.com Urban Mobility Index: Helsinki. Accessed April 22, 2020.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

According to the communication from the city of Helsinki:

"*...The City of Helsinki* ***strives to raise the share cycling to 15 percent of all modes of transport in the city by 2020***..."[16]

"*.... The City of Helsinki strives* ***to create an extensive and uniform pedestrian core for the centre****. The goal is a pedestrian area made up of pedestrian streets, widened sidewalks and pedestrian-focused streets for public transport...*"[17]

Whim is the reference MaaS application, operating in Helsinki, by the Finnish company MaaS Global. It has exceeded 2 million passengers in 2018 and is currently available in Birmingham, Antwerp and Vienna.

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

According to the Deloitte City Mobility Index[18], "*Helsinki's transportation system scores highly in customer satisfaction, largely due to its ease of use*".

TECHNOLOGICAL CHOICES

As seen in many European cities, Helsinki promotes soft and active mobility, coupled with developed public transport, to reduce the space of the private car.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to the communication from the city of Helsinki : "*...The city is investigating the possibilities for a substantial expansion of the central pedestrian zone in order to further improve the atmosphere and functionality of the central business district, and* ***for building an underground distributor road that would reduce traffic through the city*** *centre as well as heavy transports to the harbours. If implemented,* ***the distributor road would largely be funded through road tolls***..."[19].

This is an interesting example regarding the role of road infrastructure: to better regulate traffic flows and oriented them outside city centres. Our respondents recall **that road infrastructure is the foundation of transport in urban areas, regardless of the transportation use**.

GENERAL ACCESSIBILITY OF NEW MOBILITY

According to our respondents**, new technologies such as MaaS will be essential in sparsely populated country such as Finland**. Also, **the road network has a crucial role to play when talking about accessibility in rural areas**. If we go back to Helsinki, "*public transport is accessible for disabled people*"[20] with low-floor vehicles.

ECONOMIC MODEL AND FINANCING

The development of urban mobility is essentially based on the will of public actors and therefore of public funds. Numerous co-projects with the private sector are underway in Finland, as for example the Jätkäsaari Smart Mobility project[21] in Helsinki.

Decarbonised & Electric Mobility

MAIN ISSUES

In the Finnish Government's communication *"A fair transition towards a carbon neutral Finland – Roadmap for achieving the carbon neutrality target"*[22], the Government intends to make **Finland carbon neutral by 2035**, which is a very ambitious objective. Regarding transport, the government **wants to "*halve emissions from transport by 2030 and achieve carbon-free transport by 2045*"**. The key issue is then the reduction of greenhouse emissions as a main objective.

16 / City of Helsinki 2020: Promotion of cycling. Accessed April 22, 2020.
17 / City of Helsinki 2020: Walking. Accessed April 22, 2020.
18 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
19 / City of Helsinki 2020: Walking. Accessed April 22, 2020.
20 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
21 / Forum Virium Helsinki: Jätkäsaari Smart Mobility – A test area for smart mobility and accelerator for commercialisation. Accessed: April 22, 2020.
22 / Finnish Government 2019: A fair transition towards a carbon neutral Finland – Roadmap for achieving the carbon neutrality target 3 February 2020.

MATURITY INDEX

In 2019, in terms of charging infrastructure for electric vehicles, **Finland accounts for 0,005% of charging points in the EU**[23]. The country has 50 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 15 Electric Vehicles (PEVs) per public charging point in Finland against 7 in the EU. In terms of alternative vehicles, **the electric-chargeable vehicles represented 4.7% and the hybrid electric vehicles 9.8% of the market share of alternatively powered cars in the country in 2018**[24].

In **Lease Plan's EV Readiness Index 2020**[25], Finland is ranked 8th out of 22 European countries.

Finland has an average level of maturity compared to the others EU countries studied.

ECOSYSTEM AND GOVERNANCE

The Finnish government will soon (autumn 2020) **propose a roadmap for transport**, with the main objective of "*Facilitating reform of vehicle propulsion technologies and gradual achievement of a zero-emissions vehicle fleet. The aim is to halve emissions from transport by 2030 and achieve carbon-free transport by 2045*"[26]. This objective appears to be technologically neutral.

Finland is part of the EV30@30 campaign, launched at the Eighth Ministerial Meeting on Clean Energy in June 2017, which redefined EVI's ambition by setting a collective ambitious target of **30% market share for electricity in the total of passenger cars, light commercial vehicles, buses and trucks by 2030**[27]. Moreover, according to the Finnish policies identified by the International Energy Agency, the last developed actions concerned electromobility (Construction of recharging points for housing companies, tender for EV charging infrastructure, development of sustainable batteries technologies)[28].

TECHNOLOGICAL CHOICES

Finland therefore seems more focused on electromobility in decarbonising its transport system, considering the precedent elements.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Taking into account the Government's declared commitment to decarbonise vehicle fleets, **the latest policies developed in this area and Finland's rate of charging stations in the EU**, it is very likely that the development of charging stations will be at the heart of the strategy to decarbonise road transport.

23 / European Alternative Fuels Observatory: Finland. Accessed April 22, 2020.
24 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.
25 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
26 / Finnish Government 2019: A fair transition towards a carbon neutral Finland – Roadmap for achieving the carbon neutrality target 3 February 2020.
27 / Clean Energy Ministerial 2019: EV30@30 Campaign. A campaign launched under the Electric Vehicle Initiative (EVI). CEM Campaign.
28 / International Energy Agency 2019: Finland. Accessed April 22, 2020.

FINLAND

POLITICAL ORGANISATION

Nature of the regime: Republic

Head of state: Sauli Väinämö Niinistö

Head of government: Sanna Marin

ECONOMIC INDICATORS

GDP (2018): 273.961 million USD / Rank: 43/205

GDP growth (2018): 1,7%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 2,3 (2017)
- Industry (including construction), value added (% of GDP): 24,3 (2017)
- Services, value added (% of GDP): 59,6 (2017)

Population (2018) : 5,518 million

Urban population (2018): 85 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (6,75%)/ Coal (12,96%) / Hydro (3,54%)/ Biofuels/Waste (31,48%)/ Oil (25,23%)/ Nuclear (18,40%)/ Wind & Solar (1,61%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 23/141

Total road expenditures (2016): 942.365 million USD

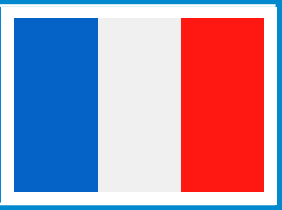
Total length of the road network (2016): 77.988 Km

Road density (km per one hundred sq. km) (2017): 23

Network length by road category (2016):

- Motorways: 881 Km
- Main / Principal roads: 12.575 Km
- Secondary / Regional roads: 13.600 Km
- Other Roads: 51.053 Km

FRANCE



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

France is fully involved in connected, autonomous, decarbonised and active mobility. In November 2019, the French Parliament adopted a **Mobility Orientation Act** whose ambition is to carry out an in-depth reform of all forms of mobility.

It has a **national strategy on the autonomous vehicle** in conjunction with French equipment and vehicle manufacturers, and regulatory and safety validation frameworks. It intends to promote the exchange of data produced by vehicles and to achieve the deployment of infrastructure connectivity. An observatory on the acceptability of AVs has been created. An experimentation framework for AVs has been set up. The local authorities have been asked to carry out experiments for most of the envisaged use cases: autonomous vehicles on separate carriageways, valet parking, transport on demand services in dense urban areas, autonomous buses, fuel stations in rural areas, autonomous delivery vehicles, autonomous shuttles, including in low-density areas, etc. Shared uses of autonomous shuttle-type vehicles are considered more promising than individual uses.

France has set the year 2040 as the deadline for banning the sale of new vehicles using fossil fuels. The deployment of carbon-free mobility will mainly concern electric and/or hybrid vehicles. Faced with the constraints of the French and European public authorities, manufacturers have no other mass choice, especially since the importance of nuclear power gives France an energy mix that is supportive to the reduction of CO2 emissions.

The hydrogen industry is just beginning to get organized. NGV is an energy of fossil origin. Among the alternative fuels, biomass should be mentioned, but it is a niche market.

To ensure this transition to electric mobility, the French government is counting on the Plateforme Automobile (PFA), which brings together the automotive industry in France. The PFA has committed through its strategic 2018-2022 contract to multiply annual sales of 100% electric vehicles by 5 by 2022 and to guarantee a ratio of one charging station for every 10 vehicles on the road (i.e. **100,000 charging stations in 2022 if the sector meets its sales targets for electric and plug-in hybrid vehicles - target of one million vehicles on the road in 2022**). Only 25,000 charging stations were installed in December 2018, and six months later, in June 2019, the number fell to only 26,300.

France is engaged in a project of common European interest with the European Commission to build a **"European battery alliance".**

The mobility orientation law reinforces the possibility for French municipalities to rethink travel and mobility in cities by favouring shared, active or light mobility and by fighting against congestion and solo-driving. **There is a consensus in France on limiting the use of internal combustion vehicles for urban deliveries.**

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility

MAIN ISSUES

Automated and connected mobility in France is seen under the perspective of deploying level 4 and 5 automated vehicles in an undetermined future. Many questions arise alongside the automated and connected vehicle development: road safety, transport inclusivity, business models, regulation of traffic flows, congestion issues, level of automation.

MATURITY LEVEL

France set up a **national strategy in 2018** on the automated and connected vehicle development[2], but remains cautious about the cases of use and the possible levels of autonomy. Shared use of autonomous shuttle-type vehicles is considered more promising than individual use, and the prospects for automation in freight and logistics are seen as a step forward. France has chosen to experiment with use cases -more than 50[3]- with local authorities and to place its action within the framework of European and international work. **Its maturity level is above the average.**

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

A national strategy has been drawn up by the State and the business ecosystem, mainly the automotive industry, mobility operators and public and private experts. Infrastructure players have joined the system more recently. The framework for experimentation makes it possible to integrate mobility organising authorities, road managers, urban planning prescribers and police authorities. However, the involvement of local authorities remains limited, as it is either fragmented or limited to experiments only.

The national associations of elected representatives have difficulty getting involved collectively on the subject, unlike professional federations such as the Union des Transports Publics (Public Transport Union), which brings together all mobility operators such as Keolis, Transdev, RATP, SNCF, the FNTR (Road Transport) or the FNTV (Passenger Transport).

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

If we have a look at the **2019 Deloitte Global Automotive Consumer Study for Europe[4]**, we observe that French consumers agreed by **65% that AVs will not be safe**, **against only 36% thinking the contrary** which follows the same trend than in other countries. As the other Europeans, 62% of them consider that the level of government involvement regarding the development and use of AVs should be “significantly oversight”. Another interesting figure is that French consumers are interested in connected vehicle features mainly for saving time and avoid traffic congestion and expect an improved road safety such as prevention of collisions. The most interesting figure comes from **the monography on automated vehicle realised by the Vedecom Institute[5] in 2019 upon request from the French Department of Transport** it states that independence and safety are the two main factors to be considered within the context of daily car journeys.

TECHNOLOGICAL CHOICES

Connectivity of the vehicle is considered as an essential complement to its perception capacities and embarked sensors. In France, the SCOOP@ program used a WIFI technology, ITS-G5, taking roots on Roadside Units (RSUs) deployed by road operator. This technology can be hybrid using 3G, 4G and 5G in the future. Another technology was standardised to enable V2V, V2I and V2P communications. **A lot is expected in the V2X technology from 5G**. Precision mapping is another essential complement for the safe operation of autonomous vehicles.

2 / Ministère de la Transition Ecologique et Solidaire: 3 examples of uses for self-driving vehicles. Gouvernement.
3 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
4 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
5 / Institut Vedecom 2019: Monographie. Acceptabilité du véhicule automome. Vedecom.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The real role and place of road infrastructure and its equipment, beyond the subject of connectivity, remain today a matter of questioning even if **the players agree that it is important for the successful deployment of the autonomous vehicle,** that roads are properly maintained. There is a need for optimised knowledge of road conditions through redundant information devices or systems.

Road managers (State, Departments, Municipalities) are cautious about **imposing standards** of pavement quality or equipment (e.g. markings) that are compatible with the growth of autonomous vehicles. For most managers, "**the vehicle must adapt to the infrastructure**".

The conviction of operators involved in experiments or of certain experts is evolving in favour of implementing redundancy of on-board systems (ultrasonic sensors, camera, laser, radar, Lidar, geolocation and geo-referencing tools such as GNSS and associated equipment ...) and off-board devices (roadside unit, cameras, intelligent signalling, marking ...). Interfaces between vehicles and infrastructures and their equipment are considered essential. Experiments in progress **confirm at this stage the necessary quality of the pavement**.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Debates in France are currently focusing on the contribution of autonomous collective rather than individual vehicles and on possible solutions for sparsely populated areas. There are high expectations for urban logistics (last kilometre, delivery in town).

DATA CHALLENGE AND CONTROL

The Law on Mobility Orientation (LOM) voted in November 2019 by the French Parliament set up a framework for mobility offers. Mobility-as-a service (Maas) is a data component and a value-sharing component. The law provides **for the opening of public and private mobility data in order to generalise multimodal "door-to-door" journey planners**.

The law details the areas concerned: public transport (stops, lines, disruptions, fares, etc.), traffic data (with history), parking on the road and in structures, self-service vehicles (scooters, scooters, cars, etc.), and the use of the data for the purpose of providing a service. If the mobility organising authorities (AOM) are obliged to offer a calculator, all the data are grouped together on a national access point (NAP) so that all mobility stakeholders, old or new, can easily integrate them.

ECONOMIC MODEL AND FINANCING

This subject is currently under discussion in France

Urban, active & soft mobility

MAIN ISSUES

In France, since 2017, a fundamental movement to reform mobility policies has been initiated. It led to the adoption in November 2019 of **the Law on Mobility Orientation (LOM)**. Mobility issues are distinct in major metropolises and cities and in medium or small towns. In France, 22 metropolitan areas cover 2% of the surface area but are home to 29% of the French population according to INSEE (Institut National de la Statistique et des Etudes Economiques).

77% of home-work flows are carried out by an individual motorised vehicle, with car-sharing and car-pooling still in the minority, and 18% by public transport. Outside the Ile-de-France region, the share of the car for home-work purposes rises to 89%. The use of public transport is in the minority in the provinces (11%, of which 15% in urban areas, 5% in suburban areas and 3% in rural areas; in Paris, public transport accounts for 64% in the inner suburbs and 58% in the outer suburbs).

Walking in the city is a preferred mode of travel. **A quarter of all journeys are made by foot.** Cycling in 2018 accounted for only 1.5% of daily trips in France. Walking is the most efficient mode of transport for journeys of less than 1km and cycling for journeys of less than 5km.

The development of electrically assisted bicycles and the gradual introduction of cycle paths or routes in towns and cities offer interesting prospects for increasing the use of this mode and the distances travelled (possible passage from an average distance of 5 km to 10 km). The Bicycle Plan, presented on 14 September 2018 by the French Government, aims to triple it to reach 9% by 2024.

VTC and urban micro-delivery services are creating new flows in all areas of the country's agglomerations. In the largest metropolises, notably in Paris, Lyon, Marseille and Bordeaux, private free-floating services, not only for bicycles but also for scooters, and cars, are redefining the way in which mobility is viewed. Service providers, first and foremost Google Maps, are competing with organising authorities in their role of integrating different travel solutions. These new uses of mobility also highlight the issue of sharing mobility-related skills, whether for road management (and therefore free-floating) between the city centre and the metropolis, or for the provision of new services.

Reflections are underway in large **urban areas on the future of surface parking and its transformation into a "drop-off" system**, for example in city centres and on the installation of park-and-ride facilities on the outskirts.

It has been noted that **French local authorities do not have competences to manage travel and mobility. This applies to 75% of the french territory, corresponding to 25% of the french population.** The so-called LOM Act introduced the possibility for territories without a mobility authority to choose this competence within existing groupings of municipalities; otherwise, the regions will assume this competence.

MATURITY LEVEL

The level of maturity is high in France on the need to improve everyday travel, to offer those who need to get around a continuous transport chain with a multimodal approach, with the help of MaaS personal mobility assistants, the setting up of data platforms on a regional or local scale, the creation of mobility authorities throughout the country and the transformation of existing transport authorities into mobility authorities.

ECOSYSTEM AND GOVERNANCE

The multiplication and diversification of mobility services is resulting **in a new competition for the use of public space** and in particular road infrastructure. It implies new governance on the part of local authorities in charge of mobility and infrastructure. The sharing of public space is being redefined and requires new rules for coexistence and new infrastructure; some central municipalities have established charters with the new operators. The Law Mobility Act contains provisions relating to the governance of urban mobilities: opening up of data and MaaS, regulation of free-floating, the place of cycling, management of mobility data, etc.

Low-emission zones have already been adopted by 231 European cities and towns. In France, 23 metropolises are now committed to the approach, representing 17 million inhabitants. The City of Paris has included in its climate, air and energy plan the objective of "zero diesel vehicles in 2024 and zero petrol vehicles in 2030".

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Among the main developments in large cities there is a **redefinition of the role of the road system and its sharing**. It is a question of making walkers, individual bicycles, shared uses (bicycle and car sharing) and shared services, motorised personal transport devices (EDPM), public transport trams or buses with a high level of service, motorised vehicles, deliveries... **coexist side by side**. Examples include the development of **dedicated lanes** for the shared use of carpooling or autonomous shuttles, public transport, including on motorways with urban desertification, secure and uninterrupted cycle paths, dynamic spatial-temporal management of road and roadway operations.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Light mobility in free-floating has seen a massive influx of motorised personal transport vehicles, bicycles and scooters in some major French cities and the anarchy observed has **forced municipal authorities to force regulation of the use of public spaces in the form of user licences with constrained specifications**. In metropolises, mass public transport will remain dominant even if its still small market share can only increase outside Paris and Ile de France. Elsewhere the use of cars will remain dominant and measures will be aimed more at limiting car soloing.

DATA CHALLENGE AND CONTROL

The Law on Mobility Orientation (LOM) voted in November 2019 by the French Parliament set up a **framework for mobility offers as a service (Maas) with a data component and a value-sharing component**. The law provides for the opening up of public and private mobility data in order to generalise multimodal "door-to-door" journey planners.

The law details the areas concerned: public transport (stops, lines, disruptions, fares, etc.), traffic data (with history), parking on the road and in structures, self-service vehicles (scooters, cars, etc.), and the use of the data for the purpose of providing a service. If the mobility organising authorities (AOM) are obliged to offer a calculator, all the data are grouped together on a national access point (NAP) so that all mobility stakeholders, old or new, can easily integrate them.

ECONOMIC MODEL AND FINANCING

In France, mobility is financed both by a **transport payment** paid by public and private employers in the territory, **public funds from taxes and a fare structure (25%)**. The user share has been steadily declining for several years.

Some municipalities have opted for free transport. In 2015, the transport payment will account for 60% of the revenue of major transport networks that have neither metro nor tramway, 48% of the revenue of major transport networks that have metro or tramway and 46% of the revenue of networks with 50,000 to 100,000 inhabitants.

In 2019 the transport payment will bring in €8.5 billion.

Light mobility is mostly private initiative, except for shared mobility services for bicycles and cars.

The financing of new mobility services in France has given rise to tense debates in Parliament, with the government refusing to extend the principle of a transport payment to areas that do not yet have a mobility authority.

Decarbonised & Electric mobility

MAIN ISSUES

France has set itself the objective of achieving, by 2050, the complete decarbonisation of the land transport sector (understood on the carbon cycle) and the end of the sale of new passenger cars and light commercial vehicles using fossil fuels by 2040.

As in other European countries, French car manufacturers will no longer have to emit on average more than 95 grams of CO2 per kilometre before 31 December 2020. This is an average for each manufacturer, calculated over its entire range. Other requirements for reducing CO2 emissions from cars have been set at European level by 2030: the reduction in carbon dioxide (CO2) emissions from new cars will have to be 37.5% by 2030 compared with 2021.

The French automobile industry, meeting within the PFA (French Automotive Platform), indicated in December 2019: "If the groups want to respect the limit of 95 grams of CO2 set next year, and then the threshold of 59 grams of CO2 expected for 2030, **one third of electric vehicles and two thirds of hybrid cars will be needed**"[6].

The place of hydrogen is being studied with interest in France by certain manufacturers. In June 2018, the French public authorities adopted **a hydrogen deployment plan for the energy transition**[7]. Hydrogen is seen as a solution for developing clean mobility for cars, road transport, public transport, as well as river, sea and rail links. However, deployment ambitions remain limited because they are realistic: 5,000 light commercial vehicles (LCVs) and 200 heavy vehicles (buses, trucks, TERs, boats) by 2023 with the construction of 100 hydrogen-powered stations in France. By 2028, this would rise to 20,000 to 50,000 LDVs and 2,000 heavy vehicles and between 400 and 1,000 stations.

In 2018 more than 95% of the cars sold in France still used combustion engine, with less than 5% of these cars being hybrids. In 2019 registrations, the diesel share is 34%, the petrol share is 58%, the hybrid share is 5.7% and the electric share is 2%.

At the end of 2018, there were 32 million vehicles registered in France, of which 61% diesel and 38% petrol, 165,000 were electric vehicles (45,000 registrations in 2018).

France is engaged in a project of common European interest in conjunction with the European Commission to build a "**European battery alliance**". The Commission has just agreed that seven Member States will commit €3.2 billion to this objective, including Germany, France, Italy, Poland, Belgium, Sweden and Finland. The French government will mobilise €960 million (the second largest contributor to the project after Germany).

MATURITY LEVEL

French manufacturers are clearly committed to a change in the motorization of their vehicles. However, they are coming up against operational and social realities.

French manufacturers are asking the public authorities for support for the installation of charging stations, solutions on the right to plug in condominiums and the maintenance of State aid in the form of a bonus (€6,000) for the acquisition of an electric vehicle. **The PFA argues that the State has undertaken to increase the number of recharging stations to 100,000 by 2022. However, only 25,000 were installed in December 2018, at the end of 2019 the number rose to 29,600.**

In addition, car manufacturers must have customers! This will be all the easier to consider since EVs will be voluntarily retained for the last few kilometres of goods deliveries in cities, shared fleets of company vehicles or those intended for shared mobility services (car-sharing fleets).

In 2019, in terms of charging infrastructure for electric vehicles, **France accounts for 15.30% of charging points in the EU**[8]. The country has 18 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 8 Electric Vehicles (PEVs) per public charging point in France against 7 in the EU.

In 2018, **electrically chargeable vehicles (ECVs)** and **hybrid electric vehicles (HEVs)** account respectively for 2.1% and 4.2% of the market share in France[9].

6 / EUR Lex 2019: Réduire les émissions de CO_2 des voitures particulières neuves et des véhicules utilitaires légers neufs. Accessed April 22, 2020.
7 / Gouvernement 2018: Hydrogen Plan: "making our country a world leader in this technology". Accessed April 22, 2020.
8 / European Alternative Fuels Observatory: France. Accessed April 22, 2020.
9 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.

In **Lease Plan's EV Readiness Index 2020**[10], France is ranked 13th out of 22 European countries.

Considering these figures, France has **an average maturity level** in electromobility.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The public authorities are discussing developments in terms of carbon-free mobility with the PFA which in France brings together car manufacturers and suppliers. **The PFA and the French government signed a sector contract in 2018**. The PFA is not involved in the choice of the energy mode (it is technologically neutral).

WEIGHT OF INDUSTRY

The French government intends to contribute to the establishment of a hydrogen industry. Two French equipment manufacturers, **Michelin and Faurecia, announced their partnership in November 2019 to produce fuel cells and the creation of a hydrogen campus combining research, development and production**. Numerous parliamentary reports have been or are being published to analyse the consequences of such changes and propose accompanying measures.

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

Social acceptance is still difficult to gain regarding electric vehicles: in the study "**Le mystère de la voiture électrique**"[11] published by the Cetelem Observatory in 2019, to the question "What are all the reasons why you won't be able to choose a 100% electric vehicle if you want to buy a car?", the three main reasons were the range of the vehicle (49%), the cost (60%) and the vehicle charging time (41%).

Moreover, 86% consider there are not enough public charging stations and 69% that they are not well localised. Looking at these figures, the availability of the infrastructure, its efficiency (recharging time), the autonomy time of the vehicle (how many kilometres before recharging), impact on the willingness to buy and the acceptance of the electric vehicle.

TECHNOLOGICAL CHOICES

In France, the deployment of carbon-free mobility will primarily involve electric and/or hybrid vehicles. Given the constraints of French and European public authorities, manufacturers have no other mass choice, especially since the importance of nuclear energy gives France a favourable energy mix to reduce CO2 emissions. The hydrogen industry is only just beginning to organize itself. NGV is an energy of fossil origin. Among the alternative fuels, we should mention biomass, but it is a niche market.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Charging infrastructure is both the key and the lock to carbon-free mobility.

There are not enough hydrogen stations (in 2019, 123 stations are listed: 28 open, 32 under construction or 63 planned), as are gas distribution stations.

The infrastructures for dynamic recharging of electric vehicles (induction, conduction) are still only at the level of demonstrators. In the long term and if feasibility on open roads is demonstrated with an economic model, these dynamic recharging infrastructures will contribute to the development of carbon-free mobility.

Road surfaces are already being used to produce renewable energies (solar road) and experiments are being developed in France on positive energy roads by recovering solar energy through geothermal energy, for example, or by transforming bridges into Pumped Energy Transfer Stations (PETS).

10 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
11 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

GENERAL ACCESSIBILITY OF NEW MOBILITY

The development of electromobility is only worthwhile if all territories are equipped with recharging infrastructures (dense cities, peri-urban areas and sparsely populated areas), if **the economic cost is socially affordable and if the transition period takes into account the nature of the car fleet and its evolution over time**. The main support measures in France focus on incentives and subsidies to reduce the persistent cost gap between EVs and their thermal equivalent.

The **coordination** and **articulation of public policies** at the national and local level - cities and urban centres - are essential in the promotion and development of EVs.

ECONOMIC MODEL AND FINANCING

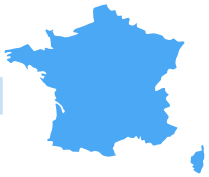
A parliamentary report[12] issued in March 2019 put **the cost of switching to electric cars at up to €500 billion over the next 20 years**. This report published by the Parliamentary Office for the Evaluation of Scientific and Technological Choices considers the financing of the electric vehicle fleet, which is currently heavily subsidised. It says that to boost sales of electric cars, **the €6,000 bonus should be maintained at least until 2030**. The cost would be in the order of 10 billion euros. In addition, the deployment of electric terminals is necessary. With a 100% fleet of electric cars, there would have to be **a network of charging stations throughout the country, whereas there are only 25,000 at present. The cost is estimated at between 30 and 108 billion euros by 2040**.

What resources will the state have tomorrow? Another crucial question for the French State. If electricity substitutes road fuels, where will the money come from to replace the revenue from the taxes that are currently levied on fuels in large quantities? In France, 45% of the TICPE, the domestic consumption tax on energy products, goes to the general state budget, 3.2% goes to the transport infrastructure financing agency and 20% is allocated to an ecological transition account. Fuel taxes brought in around €30 billion in 2018. **The TICPE is the State's fourth largest revenue after VAT, income tax and corporation tax**.

12 / Assemblée Nationale 2019: Arrêt de la commercialisation des véhicules thermiques en 2040. Accessed April 22, 2020.

FRANCE

POLITICAL ORGANISATION



Nature of the regime: Republic

Head of state: Emmanuel Macron

Head of government: Edouard Philippe

ECONOMIC INDICATORS

GDP (2018): 2.777.535 million USD / Rank: 6/205

GDP growth (2018): 1,7%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,5 (2017)
- Industry (including construction), value added (% of GDP): 17,2 (2017)
- Services, value added (% of GDP): 70,3 (2017)

Population (2018) : 66,987 million

Urban population (2018): 80 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (14,64%)/ Coal (3,62%) / Hydro (2,23%)/ Biofuels/Waste (7,07%)/ Oil (27,91%)/ Nuclear (42,92%)/ Wind & Solar (1,58%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 18/141

Total road expenditures (2016): 19.524,188 million USD

Total length of the road network (2016): 1.088.089 Km

Road density (km per one hundred ˢq. km) (2016): 198

Network length by road category (2016):

- Motorways: 12.356 Km
- Main / Principal roads: 8.219 Km
- Secondary / Regional roads: 379.725 Km
- Other Roads: 687.789 Km

GERMANY

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

All German players are fully involved in the development of mobility. Public authorities and industry, mainly automotive, are involved in **a longstanding national strategy in the field of connected and autonomous mobility throughout Germany**, with numerous integrated tests on all available technologies.

Germany's large cities are also moving in the same direction as other European cities in terms of urban mobility: increasing active and soft mobility modes - and an adequate infrastructure accordingly - and increasing the share of public transport in daily mobility. Germany focuses specifically on cycling.

In terms of electric mobility, Germany is doing rather well: its car manufacturers are turning their product range to electric, and **the charging network is a priority for the coming decade**. The country is also looking at other types of energy such as hydrogen.

It is worth noting the high level of involvement of the German authorities on these issues, particularly in terms of public investment.

The country has planned major investments for the decade in its road infrastructure through **"The 2030 Federal Transport Infrastructure Plan"**[2], wich is showing in a very targeted way the crucial role roads have with regards to mobility.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

2 / Bundesminsiterium für Verkehr und digitale Infrastruktur: The 2030 Federal Transport Infrastructure Plan. Accessed April 23, 2020.

Autonomous & Connected mobility

MAIN ISSUES

All the stakeholders - State, regions, the automotive industry, universities - have been fully involved in this mobility for many years. Its objective is to have consistent standards and strategies at the national level, due to the country's strong decentralisation.

MATURITY LEVEL

Germany has had a national strategy coordinated with all the key-players for several years and a strong automotive industry, enabling it to produce and hold a significant number of patents in the sector. The maturity index is high on this mobility, as evidenced by **the KPMG Autonomous readiness Index for 2019**[3].

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Since 2013, the Ministry of Transport and Digital Infrastructure (BMVI) has developed **a progressive and coherent strategy** on autonomous and connected mobility[4]. In 2013, it established the **"Automated Driving" Round Table**, enabling exchanges between the different stakeholders - industry, universities, administration and associations - to identify elements for reflection and build consensus on these topics.

Following this first stage, the Ministry published in 2015 the **"Strategy for Automated and Connected Driving - remain a lead provider, become a lead market, introduce regular operations"**, which targeted five levers of action: the **deployment of a digital infrastructure** enabling high connectivity with vehicles, the development of a **legal certainty** for all players - industry and drivers -, laying down principles, **ensuring innovation** in this sector, in particular through numerous tests and trials for market introduction and penetration, **ensuring connectivity between the infrastructure and vehicles** by working on the data processed, as well as a section on **cyber security and data protection** resulting from this new mobility.

Consequently, amendments to the Road Traffic Act (StVG) were adopted in 2017 to provide "fundamental rules governing the interaction between drivers and motor vehicles with conditional (level 3) or highly (level 4) automated driving functions". The important element is **the rules that apply to drivers and the legal certainty derived from them.**

Significantly, this dossier has also been entrusted to an **Ethics Commission on Automated and Connected Driving** which presented its report in 2017, to "develop ethical guidelines for these technologies".

WEIGHT OF INDUSTRY

Many tests, trials and experiments are taking place on German soil on different themes, including local actors and industry stakeholders (such as the Digital Motorway Test Bed on A9 Motorway). For example, Volkswagen has launched level 4 autonomous vehicle tests in Hamburg in 2019, notably in V2I and I2V communication through connected lights[5].

In addition, **Daimler and BMW formed a strategic alliance in 2019 in the field of autonomous cars**[6]. The German manufacturers want to face international competition together, particularly in level 3 and 4 vehicles, automated parking systems and mobility services.

It should also be noted that this alliance does not prevent the two manufacturers from having already existing partnerships: BMW is working with Fiat-Chrysler on the autonomous vehicle and Daimler is cooperating with Bosch in Stuttgart, for example.

Finally, Germany, France and Luxembourg have come together to create a common test space for autonomous vehicles since 2018[7].

3 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
4 / Bundesminsiterium für Verkehr und digitale Infrastruktur: Automated and Connected Driving. Accessed April 23, 2020.
5 / Corot, Léna 2019: Volkswagen teste des véhicules autonomes de niveau 4 dans les rues de Hambourg. L'Usine Digitale. April 4, 2019.
6 / Houédé, Pauline; Dupont-Calbo, Julien 2019: Sainte alliance BMW-Daimler dans la voiture autonome. February 28, 2019.
7 / Luxembourger Post 2017: Partenariat signé: Des «voitures autonomes» au Luxembourg début 2018. Luxembourger Post. September 16, 2017.

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

In the 2019 Deloitte Global Automotive Consumer Study[8], 59% of German consumers would like the level of government involvement desired regarding the development and use of AVs to be significant, which is one of the lowest score comparing to other countries. Also, the most interesting features for consumers from a connected and/or autonomous vehicle are at 73% "Updates regarding traffic congestion and suggested alternate routes" and 67% "Updates to improve road safety and prevent potential collisions" and "Suggestions regarding safer routes". The main interest in AVs is clearly related to travel time and the potential contribution of the vehicle to safety.

TECHNOLOGICAL CHOICES

Germany has not yet made a policy choice according to ITS-G5 or 5G technologies. It voted against the Delegated Act on Cooperative Intelligent Transport Systems (C-ITS) proposed by the European Commission in July 2019. German car manufacturers are also divided on the issue[9].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

From the point of view of our respondents, **the road will be an important vector of connectivity via V2X technology**, which will allow better operation with road equipment (traffic lights, parking spaces, charging stations, road work information and road signs information). The road will have to technically support the possibilities and systems of new vehicles and technologies. The important point will be the wide diffusion and introduction of a fast 5G network.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Accessibility will be achieved through better integration of the different modes of transport, in particular through the use of travel data.

DATA CHALLENGE AND CONTROL

The German authorities have put forward **several detailed proposals on this issue**[10]: a standardisation of cybersecurity by "...a secure encryption of data and communications..." from automotive manufacturers and components suppliers, proposals of guidelines by the Federal Government to the UN Economic Commission for Europe (UNECE) and an international lobbying, "a greater use of anonymisation and pseudonymisation techniques in the collection, processing and interlinking of the data".

The Ethics Commission on Automated and Connected Driving which presented its report in 2017, makes clear in its 15th proposal that"...It is

the vehicle keepers and vehicle users who decide whether their vehicle data that are generated are to be forwarded and used..."[11]

ECONOMIC MODEL AND FINANCING

Germany has very strong partnerships between public authorities -State and Länder- and companies. As far as road infrastructure is concerned, most of the resources come from road charges and taxes.

Urban, active & soft mobility

MAIN ISSUES

The country is focused on reducing greenhouse gases and improving the quality of life of its inhabitants (77% urban), by improving local public transport and promoting active mobility such as cycling. As the country is highly decentralised, the Federal State has a narrow remit and can provide support from a regulatory and legislative point of view, with the bulk of this type of mobility being provided at local level, by the Länder and the cities.

8 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
9 / Dynniq 2019: Volkswagen Golf supports Car2X via ITS-G5, but the EU member states are still divided on which C-ITS standard to use: how to move forward? Dynniq. November 4, 2019.
10 / Bundesministerium für Verkehr und digitale Infrastruktur 2015: Strategy for Automated and Connected Driving. Remain a lead provider, become a lead market, introduce regular operations. BMVI. Berlin, Germany.
11 / Bundesministerium für Verkehr und digitale Infrastruktur 2017: Ethics commission. Automated and connected driving. BMVI. Berlin, Germany.

MATURITY LEVEL

If we consider the ranking of different German cities in the existing indexes, we find that:

• **The city of Berlin** is where shared and integrated mobility[12] is very advanced in Europe, through a good cycling infrastructure, low road congestion[13], the introduction of a low-emission zone, many electricity charging points and a rather efficient and accessible public transport network. The city tends to reduce air pollution[14], which is more of a national issue, and to improve the connection between different transport hubs - especially airports.

• **The city of Munich** is rather well ranked[15] on an EU level (7th place out of 20) with a good level of air pollution and road congestion (10th and 9th places), a high level of bicycle use (3rd place) and less important for public transport (13th place).

• **The city of Hamburg,** when compared to other cities worldwide within the here.com index[16], has a low level of congestion (9th out of 38), an average public bicycle fleet (17th), and an average density of recharging stations for electric vehicles (13th). The city seems to have a transport network coverage that needs to be improved (34th) as well as its density (25th).

Considering these different results of these 3 cities, **the maturity index for Germany is rather high.**

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

As mentioned above, the Federal state has a reduced capacity to intervene in urban mobility. Nevertheless, the BMVI is preparing a **National Cycling Plan 3.0 to promote cycling**[17] by putting forward several arguments: the definition of the plan based on consultations and deliberations of all the players, the ecological advantage of this mobility, the need for an efficient infrastructure (dedicated lines, parking spaces, optimisation of the transport system), its usefulness in urban logistics (cargo bikes). The BMVI is working on a Vision Zero for cycling, considered as an important element. This plan will be finalised during the year 2020.

Also, **the BMVI recalls the importance of accessibility to mobility for all**[18] through a necessarily efficient local public transport and expresses its legislative support (limited by its competences in this field) to encourage this approach in terms of road safety, energy efficiency, affordable mobility and its important social role.

WEIGHT OF INDUSTRY

The link with the industry, mainly the automotive industry, is generally strong in Germany. For the city of Berlin, for example, the Deloitte index[19] indicates that the city's strength is a "strong network of universities, research labs, and private operators developing new mobility solutions" and a "Growing network of transport startups and a number of meet-up events, indicating rising interest in the sector».

TECHNOLOGICAL CHOICES

From the point of view of our respondents, **Germany is moving towards an expansion of bicycle space, where many cities are expanding their bicycle network and bicycle plans**. Also, multimodal transport via hubs will be necessary to ensure a coexistence of all forms of urban mobility.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The road infrastructure will have to leave more room for active mobility, first and foremost the bicycle. Also, a redefinition and reorganisation of the **spatial occupation of the road follows from this first observation** - parking spaces, separate and dedicated lanes -, as well as its capacity to ensure fluidity between the different types of mobility - car, bicycle, pedestrian, urban logistics -. The main mission of roads in Germany seems to be oriented towards the cycle network.

GENERAL ACCESSIBILITY OF NEW MOBILITY

As mentioned above, the federal government has synthesized its vision of accessibility to mobility, through public transport. This vision is broad and the BMVI states that "the advantages of local public transport are obvious: considerably more people can ride in a single vehicle, and less surface needs to be asphalted", which refers to the **intention to limit car use in urban areas**.

12 / Deloitte 2019:The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
13 / Here.com Urban Mobility Index: Berlin. Accessed: April 23, 2020.
14 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
15 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
16 / Here.com Urban Mobility Index Hamburg. Accessed: April 23, 2020.
17 / Bundesministerium für Verkehr und digitale Infrastruktur 2019: Cycling in Germany is booming.
18 / Bundesministerium für Verkehr und digitale Infrastruktur 2019: Well-connected by public transport. Local public transport. Accessed April 23, 2020.
19 /Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.

From the point of view of our respondents, ride hailing in rural areas can support public transport as well, even if it will need public subsidies.

ECONOMIC MODEL AND FINANCING

As urban mobility is the responsibility of regions and cities, funding is provided through public funds and partnerships with the industry at the local level.

Decarbonised & Electric mobility

MAIN ISSUES

Germany's main need is to strengthen and densify its electric recharging network at a time when the automotive industry is starting to produce and market 100% electric vehicles (e.g. the Volkswagen ID.3 in 2020). Also, the country is seeking clear national coordination on this subject in a highly federated and devolved country. Also, the country adopted "the Climate Protection Plan 2050" drawn up by the German Federal Government, which provides **for a 40-42% reduction in greenhouse gas emissions in the transport sector by 2030**".

MATURITY LEVEL

In 2019, in terms of charging infrastructure for electric vehicles, **Germany accounts for 20.61% of charging points in the EU**[20]. The country has 47 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 7 Electric Vehicles (PEVs) per public charging point in Germany as in the EU. In terms of alternative vehicles, **Germany is the country where the most electrically chargeable vehicles (ECVs), hybrid electric vehicles (HEVs) and fuel cell electric vehicles (FCEVs) were sold in the EU in 2018, representing respectively 2.0% and 2.9% of the national market share**[21].

In **Lease Plan's EV Readiness Index 2020**[22], Germany is ranked 9th out of 22 European countries.

Its maturity index in electro-mobility is relatively high.

ECOSYSTEM AND GOVERNANCE

In 2016, Germany had already developed a **government plan for electromobility**, including grants schemes in the purchase of electric vehicles and the release of funds at federal level to stimulate the installation of recharging stations[23].

German Chancellor Angela Merkel announced at the end of 2019 that the goal is to **reach 1 million electricity recharging points in Germany by 2030**[24]. The federal government, the automotive and energy industries announced that they are working on a "**master plan**" that would include an investment of **3 billion euros by 2023 to boost the network of alternative recharging infrastructure for electricity and hydrogen**. By 2020, 50 million euros would be put on the table to develop private facilities. The criteria for installing charging stations in motorway stations will be specified in 2020.

For better coordination between the different stakeholders in the application of this "master plan", **a national centre for recharging infrastructure** was created at the end of 2019 to pursue the planned strategy[25].

The German Minister of the Economy announced a public contribution of 1 billion euros in the Climate Energy Fund (EFK) for the industrial production of battery cells for mobile and stationary energy storage on German soil[26].

Also, the country is preparing a **new national hydrogen strategy**. Among the objectives, which are mainly concerned with energy issues, the German Minister of the Economy has indicated a target of 60,000 hydrogen vehicles in the country by 2022[27].

Social Acceptance

In 2019, according to **the research institute Cetelem**[28], in response to the question "Would you say that there should be more, less or neither more nor less policies (national and local, financial and non-financial) to support the electric vehicle?", 55% of consumers answered "More".

20 / European Alternative Fuels Observatory: Germany.. Accessed: April 23, 2020.
21 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.
22 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
23 / Bundesministerium für Wirtschaft und Energie: Cadre général et mesures incitatives pour les véhicules électriques et les infrastructures de recharge. Accessed April 23, 2020.
24 / Steiwer, Nathalie 2019: Voiture électrique : le « plan magistral » de l'Allemagne pour les bornes de recharge. Les Echos. November 5, 2019.
25 / National Centre for Charging Infrastructure at Now GmbH 2019: Charging infrastructure is coming! Accessed April 23, 2020.
26 / Bundesministerium für Wirtschaft und Energie: Batterien für die Mobilität von morgen. Accessed April 23, 2020.
27 / Renaud, Ninon 2019: L'Allemagne veut devenir le champion de l'hydrogène. Les Echos. November 5, 2019.
28 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

Also, 81% consider that "there are not enough public charging stations for electric vehicles on the road" and 74% consider that "public charging stations for electric vehicles on the road" are not correctly located, which represents a higher score compared to the other countries. 49% consider that the electric vehicle is still too expensive.

As a summary, the document states "Germany is the country with **the lowest proportion of optimists about the future of EVs in the world**. Germans are the most likely to believe that EVs are only for people living in large cities and for short distances. They are the least likely to request subsidies for EVs and the most sensitive to the limited range and cost of purchasing an EV."

TECHNOLOGICAL CHOICES

The choice is mainly electromobility and, to a lesser extent, hydrogen.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The road infrastructure and its equipment will mainly provide for charging stations wich are necessary for the circulation of EVs. Also, Germany is one of the pioneer countries in Electric Roads Systems (ERS), notably via its cooperation with Sweden, which would make it possible to electrify road freight transport.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Accessibility for this type of mobility is mainly due to the cost factor of the vehicle, and the possibility of recharging it easily and quickly, in line with the elements developed above.

ECONOMIC MODEL AND FINANCING

The economic model is mainly based on public funds or public support systems, for example, for the support of the electric vehicle:

"*Purchase discount of €4,000 for battery powered EVs and €3,000 for plug-in hybrids, up to a maximum of 400,000 vehicles until 2020 or €600 million in subsidies.*

- *Car manufacturers will finance 50% of the subsidy, the government the remaining 50%.*
- *Exemption from road tax for 10 years, then 5 years from 2021.*
- *Tax reduction for company vehicles.*
- *Free local parking and access to bus lines*"[29].

Also, these policies are partly supported by the car manufacturers. The sensitive issue in Germany concerns the financing of the charging infrastructures between the industry and public authorities[30].

29 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.
30 / Steiwer, Nathalie 2019: Voiture électrique : le « plan magistral » de l'Allemagne pour les bornes de recharge. Les Echos. November 5, 2019.

GERMANY

POLITICAL ORGANISATION

Nature of the regime: Federal republic

Head of state: Frank-Walter Steinmeier

Head of government: Angela Merkel

ECONOMIC INDICATORS

GDP (2018): 3.996,759 million USD / Rank: 4/205

GDP growth (2018): 1,5%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 0,8 (2017)
- Industry (including construction), value added (% of GDP): 28,0 (2017)
- Services, value added (% of GDP): 61,4 (2017)

Population (2018) : 82,927 million

Urban population (2018): 77 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (23,62%)/ Coal (22,19%) / Hydro (0,51%)/ Biofuels/Waste (9,92%)/ Oil (32,36%)/ Nuclear (6,44%)/ Wind & Solar (4,82%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 22/141

Total road expenditures (2017): 13,210 million euros

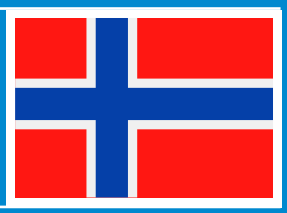
Total length of the road network (2016): 642.970 km

Road density (km per one hundred sq. km) (2016): 180

Network length by road category (2016):

- Motorways: 12.996 km
- Main / Principal roads: 38.068 km
- Secondary / Regional roads: 178.906 km
- Other Roads: 413.000 km

NORWAY



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Norway is one of the countries that sets an example in the field of new mobility. A **pioneer and world leader in the field of electromobility**, the country has demonstrated that the development of electric vehicles is possible with a combination of measures: carbon tax, tax exemptions, free access etc.

One of the country's priority objectives is **the decarbonisation of the transport sector**. This has been underway with the significant development of the electric vehicle. The government has also launched a transport plan running until 2029, with a **strong focus on the development of urban areas** and the promotion of alternatives to the individual vehicle: development of clean public transport, encouraging active and soft mobility.

One of Norway's important development areas is currently **the connectivity and digitalisation of the transport sector**. Indeed, thanks to important assets in this field, a new strategy on Artificial Intelligence and a policy focused on **5G technology**, the country wishes to rely on the connectivity of road equipment, ITS technologies and MaaS technology.

Its transport plan includes **very significant investments in road infrastructure**, particularly on the motorway and cycle networks. The redefinition of urban and road space is also a priority in urban areas.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

The National Transport Plan 2018-2029

The Norwegian government proposed a National Transport Plan for the 2018-2019 period[2], in which the road network is the main priority:

The government plan includes **an investment of 53 billion euros over 12 years in road infrastructure**, i.e. 57% of the overall plan:

- priority is given to **the construction of national motorway networks**, to the amount of nearly 21 billion euros;
- 2.4 billion is also earmarked for securing national motorways and main roads against landslides and avalanches, as well as safe lanes for pedestrians and cyclists;
- The aim is to create 290 kilometres of four-lane motorways and 910 kilometres of other roads;
- A framework for **the maintenance and operation of the national road network is included for more than EUR 10 billion** over the period.

Autonomous & Connected mobility

MAIN ISSUES

Having been a pioneer in the development of the electric vehicle, Norway intends to develop a fleet of autonomous vehicles as public transport, following the example of Ruter, the mass transit provider in Oslo in October 2018[3].

MATURITY LEVEL

In the **KPMG 2019 Autonomous Vehicles Readiness Index**, Norway is ranked 3rd. The country legalised AV testing in January 2018 and is working as well on truck platooning. Connectivity indicators for Norway are high (infrastructure connectivity, 4G coverage), showing a strong capacity to integrate these new technologies.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The country legalised AV testing in January 2018. The Norwegian government published in **January 2020 a national strategy for Artificial Intelligence (AI)**[4], which includes digital infrastructure as well as autonomous vehicles in general. National authorities are therefore quite involved in the developments of this mobility.

WEIGHT OF INDUSTRY

The country has a high level of partnerships with the industry (**0.917 out of 1**)[5] and has a specialist supplier in the field of autonomous transport: Applied Autonomy[6].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

The country is in the top 3 in the use of technology by civil society[7]. Due to the widespread development of electric vehicles over the past decade (50% of the cars sold in Oslo are electric), the population is prepared for the arrival of autonomous vehicles.

TECHNOLOGICAL CHOICES

Norway chooses 5G in its national strategy for AI, stating "*...5G infrastructure will therefore be important for implementing a full-scale realisation of IoT -Internet of Things- with a capacity that cannot be delivered by today's technology...*"[8]. This choice includes many sectors, among which the transport sector.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Norway intends **to deploy an extensive 5G and communications network that makes use of the existing transport infrastructure**. As a result, the country relies on road equipment and its digitalisation[9]. The Government wishes to develop ITS technologies rapidly in its Transport Plan 2018-2029[10].

2 / Norvegian Ministry of Transport 2017: The National Transport Plan 2018-2029A National Transport Plan for better and safer daily travel. Government.no. April 12, 2017.
3 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
4 / Norwegian Ministry of Local Government and Modernisation 2020: National Strategy for Artificial Intelligence. Ministry of Local Government and Modernisation.
5 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
6 / Applied Autonomy: Knowledge, Solutions, and Services for Autonomous Transportation. Accessed April 23, 2020.
7 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
8 / Norwegian Ministry of Local Government and Modernisation 2020: National Strategy for Artificial Intelligence. Ministry of Local Government and Modernisation.
9 / Norwegian Ministry of Local Government and Modernisation 2020: National Strategy for Artificial Intelligence. Ministry of Local Government and Modernisation.
10 / Norwegian Ministry of Transport and Communications 2018: Meld. St. 33 (2016–2017) Report to the Storting (white paper). National Transport Plan 2018–2029. A targeted and historic commitment to the Norwegian transport sector. Norwegian Ministry of Transport and Communications.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Accessibility would be rather viewed from the perspective of public transportation in urban areas with respect to autonomous vehicles. A **MaaS approach in combination with autonomous vehicles was studied by Ruter in 2019 for the city of Oslo**[11], going through different scenarios.

DATA CHALLENGE AND CONTROL

Norway does not have an approach on data specifically related to autonomous vehicles or connected mobility. Nevertheless, in its national strategy for AI, it very clearly recalls the importance of respecting the right to privacy. It recalls the role of European legislation such as the General Data Protection Regulation (GPDR), the Personal Data Act in Norway, and the "*Government announced that it will create a... cooperation forum at national level: Digital Clearinghouse Norway...*"[12], in order to make the processing of consumer data more transparent in general. Norway has also The Norwegian Data Protection Authority (DPA) since 1980 to protect the privacy rights of individuals.

ECONOMIC MODEL AND FINANCING

The role of public authorities and public funds remains important. In the **National Transport Plan 2018-2029**[13], for example, the Government has proposed to use 100 million euros in an innovation and R&D competition for Smarter Transport in Norway, to foster partnerships between local and private actors, and to develop innovation in this field.

Urban, active & soft mobility

MAIN ISSUES

Norway, like the rest of Europe**, is fully committed to reducing CO2 emissions from the transport sector and especially from the road transport**: "*All new passenger cars and light vans sold in 2025 shall be zero-emission vehicles. All new urban buses sold in 2025 shall be zero emitters or use biogas. By 2030, all new heavy-duty vehicles, 75 per cent of new long-distance coaches and 50 per cent of new trucks shall be zero emission vehicles. Furthermore, the distribution of freight in the largest urban centres shall have almost zero emissions by 2030*"[14].

MATURITY LEVEL

The example of Oslo, which represents almost 20% of the Norwegian population and almost one million inhabitants, will be taken as a reference. According to the **Deloitte City Mobility Index**[15], Oslo is a very representative city of the new mobility trends: the modal share of the car in daily trips is limited to 35% considering **that the city is the world capital of EVs**. Oslo has implemented a MaaS system and is moving towards a smartphone-based ticketing system with a trial involving 60 buses. The municipality and Ruter are very involved with a **Ruter's Fossil Free 2020 policy to ensure that the entire public transport network will run only on renewable energy in 2020**. Finally, public satisfaction with mobility in Oslo is very high (4 out of 5).

Taking the Norwegian capital as an example, Norway has a high maturity level compared to other European countries studied.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The Ministry of Transport, in its **National Transport Plan 2018-2029,** focuses on urban transport[16]. Bicycles, pedestrians and public transport -especially railway network- are given priority for urban mobility, as growth in passenger transport is expected in the coming years.

11 / Ruter 2019: The Oslo Study. How autonomous cars may change transport in cities. Report. COWI; PTV on behalf of Ruter.
12 / Norwegian Ministry of Local Government and Modernisation 2020: National Strategy for Artificial Intelligence. Ministry of Local Government and Modernisation.
13 / Norvegian Ministry of Transport 2017: The National Transport Plan 2018-2029A National Transport Plan for better and safer daily travel. Government.no. April 12, 2017.
14 / Norwegian Ministry of Transport and Communications 2018: Meld. St. 33 (2016–2017) Report to the Storting (white paper). National Transport Plan 2018–2029. A targeted and historic commitment to the Norwegian transport sector. Norwegian Ministry of Transport and Communications.
15 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
16 / Norwegian Ministry of Transport and Communications 2018: Meld. St. 33 (2016–2017) Report to the Storting (white paper). National Transport Plan 2018–2029. A targeted and historic commitment to the Norwegian transport sector. Norwegian Ministry of Transport and Communications.

Near **to 6.6 billion EUR** will be invested "*during the plan period to urban areas through urban environment agreements, urban growth agreements and the reward scheme for public transport.*

This includes an ***important contribution to the four largest urban areas through 50 per cent state funding of local public transport projects****, namely the Fornebu Line in Oslo and Akershus, the new Metro Tunnel in Oslo, Light Rail to Fyllingsdalen in Bergen, Super Bus Phase 1 in Trondheim and the Bus Way in the Stavanger area. State subsidies to these projects are estimated to…"* **2.4 billion EUR** *"…in the plan.*

The Government also intends to allocate…" **2.4 billion EUR** *"…to measures for* ***public transport, cycling and walking****. Furthermore, the Government will set aside…"* **1.7 billion EUR** *"…to the* ***reward scheme for public transport and will allow for the use of funds to be spent entirely on the public transport operation***".

We can note that the State, the regions and the municipalities are included in this plan and that the dialogue and coordination between the different entities is clearly set out in these declarations, through the co-financing of projects, for example.

TECHNOLOGICAL CHOICES

Bicycles, pedestrians and public transport -especially railway network- are given priority for urban mobility, as growth in passenger transport is expected in the coming years[17]. In the "**Climate and Energy Strategy for Oslo**"[18] adopted in 2016, half of the propositions were focused on urban development and transport, such as:

To reach the goal of **reducing one-third of car traffic by 2030**, "*the proportion of passenger transport covered by public transport, cycling and walking must be increased considerably while demand for transport must be reduced. These considerations shall be cornerstones for land use planning, transport planning and infrastructure investments*"

"*Densification and development of the city shall occur along the railway, tram and metro networks as well as public transport nodes to ensure sustainable modes of transport.*"

"*Public transport shall only use renewable fuels by 2020.*"

"***The percentage of daily travels by bike shall be increased to 16% by 2020 and 25 % by 2025***."

"*The City of Oslo shall facilitate* ***a city logistics system*** *where traffic demand is reduced, and* ***where all new cars and light freight vehicles in Oslo shall use renewable fuels or be plug-in hybrids from 2020***."

"*The City of Oslo shall facilitate required changes so that* ***at least 20 % of heavy-duty vehicles in Oslo shall use renewable fuels by 2020****. Furthermore,* ***all heavy-duty vehicles and construction machinery shall be able to use renewable fuels by 2030***."

"*The City of Oslo will work with national authorities and transport* ***industry to transfer as much as possible of the freight by heavy duty vehicles over to rail and sea***."

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Ruter conducted a study on **the potential deployment of autonomous mobility in Oslo** considering different scenarios[19]. From this study, "*All scenarios entail a need for investments in infrastructure. This is either new infrastructure to facilitate mobility for a growing volume of traffic and/or investments in* ***redesigning urban streets*** *in a transition from traffic flow and parking availability to facilitating passenger access to the system in an adequate geographical density. The investments might also comprise intelligent transport systems to support traffic flow, access points to the public transport system, etc.*" **We can observe that the redefinition of urban space and the need for infrastructure are targeted by this study.**

17 / Norwegian Ministry of Transport and Communications 2018: Meld. St. 33 (2016–2017) Report to the Storting (white paper). National Transport Plan 2018–2029. A targeted and historic commitment to the Norwegian transport sector. Norwegian Ministry of Transport and Communications.
18 / Oslo Kommune 2016: Climate and Energy Strategy for Oslo Adopted by the City Council in Oslo 22.06.2016 (Proposition 195/16). City of Oslo Agency for Climate.
19 / Ruter 2019: The Oslo Study. How autonomous cars may change transport in cities. Report. COWI; PTV on behalf of Ruter.

If we consider the "Climate and Energy Strategy for Oslo" plan, road infrastructure will have to be redesigned: more space for active and soft mobility, public transport and less space for cars. In this path, the Oslo City launched the "**Car-free Livability Programme 2019**"[20] to reduce space of private cars in the city.

GENERAL ACCESSIBILITY OF NEW MOBILITY

The city of Oslo has more than 200 kilometres of cycle paths and 90 percent of the region's population lives within 300 metres of a public transport service[21], which is a good point regarding accessibility. Also, the National Transport Plan 2018-2029 includes a "*transport plan for children and youth*"[22].

DATA CHALLENGE AND CONTROL

As Oslo is implementing a smartphone-based ticketing system, "*Ruter is working with data authorities to gain approval of its passenger positioning system to make the app responsive to commuters' locations. The trial, now encompassing 60 buses, will need to respect privacy and security concerns*"[23]. The cyber-security is therefore addressed by local authorities.

ECONOMIC MODEL AND FINANCING

The economic model is based mainly on public investment.

Decarbonised & Electric mobility

MAIN ISSUES

Norway, like the rest of Europe, is fully committed to reduce CO2 emissions from the transport sector and especially from the road transport:

"*All new passenger cars and light vans sold in 2025 shall be zero-emission vehicles. All new urban buses sold in 2025 shall be zero emitters or use biogas. By 2030, all new heavy-duty vehicles, 75 per cent of new long-distance coaches and 50 per cent of new trucks shall be zero emission vehicles. Furthermore, the distribution of freight in the largest urban centres shall have almost zero emissions by 2030*"[24].

The country intends to continue the electrification of its transport sector, being a world pioneer in the field.

MATURITY LEVEL

Norway is the country with the highest penetration of electric vehicles in the world[25].

In 2019, in terms of charging infrastructure for electric vehicles[26], Norway would account for 6.4% of charging points in the EU. **The country has 655 fast public charging points per 100 km highway against 28 in the EU**. In addition**, there were a ratio of 24 Electric Vehicles (PEVs) per public charging point in Norway against 7 in the EU**. In 2018, the country counted 195,000 vehicles electric private vehicles and 96,000 hybrid vehicles. "...Almost one out of ten of all vehicles -and almost half of all new vehicles- are now electric..."[27]. In addition, four out of ten of all sold vehicles are electric or hybrid in Norway[28]

20 / Oslo Kommune 2019: The Car-free Livability Programme 2019 What is Car-Free City Life, why are we doing this and what are we doing for you as a citizen of Oslo? City of Oslo.
21 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
22 / Norwegian Ministry of Transport and Communications 2018: Meld. St. 33 (2016–2017) Report to the Storting (white paper). National Transport Plan 2018–2029. A targeted and historic commitment to the Norwegian transport sector. Norwegian Ministry of Transport and Communications.
23 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
24 / Norwegian Ministry of Transport and Communications 2018: Meld. St. 33 (2016–2017) Report to the Storting (white paper). National Transport Plan 2018–2029. A targeted and historic commitment to the Norwegian transport sector. Norwegian Ministry of Transport and Communications.
25 / Baldurssen, Friorik Már; Carlson, Ewa Lazarczyk; von der Fehr, Nils-Henrik 2019: Electric Vehicles Rollout in Europe. Towards an improved regulatory regime. Center on Regulation in Europe (CERRE).
26 / European Alternative Fuels Observatory: Norway. Accessed: April 23, 2020
27 / Baldurssen, Friorik Már; Carlson, Ewa Lazarczyk; von der Fehr, Nils-Henrik 2019: Electric Vehicles Rollout in Europe. Towards an improved regulatory regime. Center on Regulation in Europe (CERRE).
28 / L'Energeek 2019: Electromobilité : vers une couverture universelle des bornes de recharge ? L'Energeek. July 30, 2019.

In **Lease Plan's EV Readiness Index 2020**[29], Norway is ranked 2nd out of 22 European countries, just behind the Netherlands.

The level of maturity of the country **is very high**, being a world leader in electric mobility.

ECOSYSTEM AND GOVERNANCE

Norway has been promoting electric vehicles **since the 1990s** with many purchase incentives such as:

- "*Exemption from purchase tax: 11,600 USD;*
- *VAT exemption on EVs with battery (25% of the price of the front vehicle tax), including for battery powered EVs on a lease;*
- *Purchase discount on Plug-in hybrid vehicles;*
- *Exemption from road taxes, tolls and ferry fees;*
- *Continuation of this EV policy with battery until 2020;*
- *Since 2016, the management of measures free parking for vehicles is controlled by the town halls*"[30].

Also, "...***A number of local governments – especially in major cities – have developed their own policies with regard to electrification of the transport sector***, *including a shift of local transport from conventional to electric vehicles, introduction of electric buses and onshore charging of ships in ports...*"[31]

The combination of these different initiatives over almost 30 years has enabled Norway to develop the electric vehicle, with the results we know today.

According to **the research institute Cetelem**[32], in response to the question asked to Norwegian consumers "Would you say that there should be more, less or neither more nor less policies (national and local, financial and non-financial) to support the electric vehicle?", only 36% of consumers answered "More" and 35% "No more, no less", which is a very low rate (65% are for "more" on average).

Also, 69% still consider that "there are not enough public charging stations for electric vehicles on the road" but only 54% consider that "public charging stations for electric vehicles on the road" are not correctly located, which is near the average scores. 49% consider that the electric vehicle is still too expensive. Despite Norway's lead in electro-mobility, consumer responses are not substantially different from those given in other European countries.

As a summary, the document states "*It is in Norway that the electric vehicle is the most established and democratized. However**, many Norwegians interviewed said they do not believe in its future and the proportion of "intentionism" is decreasing in the next 5 years**. They consider themselves to be well informed and are few and far between asking for more subsidies. This is the country with the highest proportion of people who consider EVs to be cheaper (purchase + use) than a combustion vehicle."*

TECHNOLOGICAL CHOICES

The country seems more focused on **urban mobility**: air quality, reduction of greenhouse gases, transition of logistics and freight fleets, reduction of space occupied by vehicles. Electric mobility is already quite advanced and is still being promoted.

29 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
30 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.
31 / Baldurssen, Friorik Már; Carlson, Ewa Lazarczyk; von der Fehr, Nils-Henrik 2019: Electric Vehicles Rollout in Europe. Towards an improved regulatory regime. Center on Regulation in Europe (CERRE).
32 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Charging infrastructure will have to be improved in the weaker parts of the grid, while electric vehicles do not yet have large capacities[33]. Since 2019, tolls can now charge electric vehicles up to 50% of what internal combustion vehicles pay[34].

ECONOMIC MODEL AND FINANCING

The Government will continue to propose the current fiscal initiatives and municipalities have their own policies on electric vehicles.

"*...The current Government has decided to keep the incentives for zero-emission cars until the end of 2021. The VAT exemption for zero-emission vehicles in Norway has been approved by the EFTA Surveillance Authority (ESA) until the end of 2020. After 2021 the incentives will be revised and adjusted parallel with the market development...*"[35]

The spectacular development of the electric vehicle in Norway has been achieved through a combination of several measures: a significant so-called "carbon" tax on fossil fuels, tax exemption for electric vehicles, exemption from paying tolls, free access to public recharging stations, free parking, and the possibility of using dedicated public transport lanes[36].

33 / Baldurssen, Friorik Már; Carlson, Ewa Lazarczyk; von der Fehr, Nils-Henrik 2019: Electric Vehicles Rollout in Europe. Towards an improved regulatory regime. Center on Regulation in Europe (CERRE).
34 / Norsk elbilforening 2019: Norwegian EV policy. Norway is leading the way for a transition to zero emission in transport. Accessed April 23, 2020.
35 / Norsk elbilforening 2019: Norwegian EV policy. Norway is leading the way for a transition to zero emission in transport. Accessed April 23, 2020.
36 / Desrosiers, Eric 2019: La révolution de la voiture électrique en Norvège. Le Devoir. June 1, 2019.

NORWAY

POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy

Head of state: Harald V

Head of government: Ema Solberg

ECONOMIC INDICATORS

GDP (2018): 434.751 million USD/ Rank: 28/205

GDP growth (2018): 1,3%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,8 (2018)
- Industry (including construction), value added (% of GDP): 31,3 (2018)
- Services, value added (% of GDP): 55,6 (2018)

Population (2018) : 5,314 millions

Urban population (2018): 82 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (20,09%)/ Coal (2,71%) / Hydro (39,53%) / Biofuels/Waste (6,05%)/ Oil (30,49%)/ Wind & Solar (1,09%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 46/141

Total road expenditures (2016): 3,428 million euros

Total length of the road network (2016): 94.642 Km

Road density (km per one hundred sq. km) (2016): 25

Network length by road category (2016):

- Motorways: 392 Km
- Main / Principal roads: 10.695 Km
- Secondary / Regional roads: 44.541 Km
- Other Roads : 39.406 Km

PORTUGAL

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Portugal benefits from an interesting margin of progression. Indeed, some tests of autonomous shuttles are taking place in the country or across the border with its Spanish neighbour, notably within the framework of European projects. **The country is currently working on more open legislation on the testing of autonomous vehicles on its territory**. It is more interested in vehicle connectivity at the moment.

Portuguese consumers are indeed the most positive about electric vehicles and the market share of these vehicles is rather good. An **efficient recharging network** has yet to be deployed to satisfy a growing market.

A redefinition of the urban space is envisaged in particular in the capital Lisbon, where the road space meets certain particularities and where **the modal share of the individual car is still high**. The city has the intention to promote alternative forms of mobility and more environmentally friendly mobility. It should be noted that the Portuguese authorities are fully involved in these matters and in the relevant international organisations.

In terms of mobility as a whole**, the road infrastructure is seen as an essential means of developing new mobility**, particularly in terms of accessibility.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility

MAIN ISSUES & MATURITY LEVEL

The country is establishing some tests and **needs to develop national legislation to generalise the testing of this type of vehicles**.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

An inter-ministerial working group was established in March 2019[2] with the mission of studying the necessary legal amendments to introduce new technologies related to autonomous driving, namely tests. The main mission of this working group is to present:

- A proposal for the regulation to conduct trials on public roads and related security conditions;
- An assessment of the regulatory framework changes needed to introduce automated driving.

Some tests within the framework of European projects are at work via the 5G-Mobix[3] or Optimum[4] projects for ITS and 5G tests.

TECHNOLOGICAL CHOICES

The country does not yet have a clear regulatory stance on autonomous vehicle tests and their deployment.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to our respondents, the road infrastructure has a large role to play in the autonomous and connected mobility developments:

- The necessity to prepare road infrastructure regarding their design, traffic management and C-ITS services, cyber security, transition phase remote and real time infrastructure monitoring and management -asset management-;
- Go through digitalisation and dematerialisation of procedures;
- An asset management optimization based on the use of machine learning tools;
- Connected and automated mobility will probably require public road adaptations;
- Road infrastructure can contribute to enhance C-ITS systems that support MaaS.

ECONOMIC MODEL AND FINANCING

According to our respondents, **new financial sources can be expected from connectivity services of road infrastructure and the large amount of data that they will generate**.

Urban active & soft mobility

MAIN ISSUES

Portugal faces the same problems as all European countries: **the need to reduce its greenhouse gas emissions**, to ensure a multi-modality of transport, to reduce the place of the private car in urban areas. We will focus on the city of Lisbon, for a better understanding.

MATURITY LEVEL

According to the **Deloitte City Mobility Index**[5], the city of Lisbon took Smart City initiatives, performed in carbon dioxide emission scores, and is developing a sustainable transport, even if the **private car still represents more than 50% of the transport mode in the city**.

In **Politico's Urban Mobility Index**[6] for 2018, Lisbon is ranked 10th out of 20 European cities. The city obtains interesting results regarding mass transit use (8th) and air quality (5th), with an average level of congestion (10th). The main difficulty lies in the level of bicycle use (16th).

In the **Here's Urban Mobility Index** for 2018[7], Lisbon has a good density of EV charging network, a high low emission area coverage, and an average index of traffic congestion at peak hours. Public transport has an excellent coverage, although its frequency is relative. The cost of fuel and public transport are rather high in Lisbon. This Index is to be considered in comparison with European cities.

Considering these elements, Lisbon has a **an average level of maturity.**

2 / Ferreira Rui 2019: Governo cria grupo sobre carros autónomos, mas deixa tecnológicas de fora. Dn_Insider. March 19, 2019.
3 / 5G Mobix: Spain – Portugal. Accessed April 23, 2020.
4 / Innovation and networks executive agency: Multi-source Big Data Fusion Driven Proactivity for Intelligent Mobility. European Commission. Accessed April 23, 2020.
5 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
6 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
7 / Here.com Urban Mobility Index: Lisbon. Accessed: April 23, 2020.

ECOSYSTEM AND GOVERNANCE

The decision mainly lies at the level of the municipalities and inter-municipalities, as they are responsible for transport matters. The Central Government defines a political and strategic framework according to the type of mobility considered.

TECHNOLOGICAL CHOICES

In the "**National Strategy for an Active Mobility 2020-2030**"[8], the stated objective is to develop the modal share of bicycle journeys from 0.5% (2011) to 7.5% in 2030 and to develop the cycling infrastructure.

According to our respondents, the country is moving towards:

- The implementation of sharing services (car, bikes, scooters);
- An increase of soft and active mobility (e.g. walk, bikes, scooters) which will require availability of new infrastructures;
- An increase use of active mobility –such as cycles;
- More space for soft and active mobility will have to be provided in urban mobility;
- Intermodal nodes that will have to be reinforced.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to our respondents, at a municipality level, road infrastructure will play an important role in terms of smart mobility and there is a need in construction of missing links (infrastructural access).

In addition, Lisbon has the particularity of having "***narrow, hilly roads, inadequate signage, and limited parking spaces***. *These factors result in traffic congestion and road accidents."*[9]. The city intends to increase pedestrian areas, public spaces and bicycles lanes and to build car parks near public transport stations.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Lisbon has a **real-time information and route management system**. The city is working to make all metro stations accessible for disabled people.

According to our respondents, the deployment of flexible and on-demand mobility services can play an important role both in urban and rural areas.

ECONOMIC MODEL AND FINANCING

According to our respondents, price adjustments for low income families (social access) could play a role. Funding remains largely public.

Decarbonised & Electric mobility

MAIN ISSUES

According to PlanUP[10], which analyses the National Energy & Climate Plans (NECPs) proposed by the Member States of the European Union, **Portugal's plan sets its 2030 greenhouse gas emission reduction target at 45% to 55% compared to 2005 and presents an emissions reduction target for the transport sector of 20% to 2030**. The country intends to focus largely on the electrification of the transport sector and alternative fuels, and the modal shift in freight transport.

MATURITY LEVEL

In 2019, in terms of charging infrastructure for electric vehicles, **Portugal accounts for 1,58% of charging points in the EU**[11]. The country has 12 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 9 Electric Vehicles (PEVs) per public charging point in Portugal against 7 in the EU. In terms of alternative vehicles, **the electric-chargeable vehicles represented 3.4% and the hybrid electric vehicles 3.2% of the market share** of alternatively powered cars in the country in 2018[12].

In **Lease Plan's EV Readiness Index 2020**[13], Portugal is ranked 10th out of 22 European countries.

Considering these elements, Portugal has **an average level of maturity in electromobility**.

8 / República Portuguesa Ambiente e Transição Energética 2019: Estratégia nacional para a mobilidade ativa 2020 – 2030.
9 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
10 / Plan Up 2019: Portugal. Objectives and targets. Greenhouse gas emission target. Plan Up.eu.
11 / European Alternative Fuels Observatory: Portugal. Accessed: April 23, 2020.
12 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.
13 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.

ECOSYSTEM AND GOVERNANCE

The deployment of electro mobility (charging infrastructure) is the responsibility of MOBI.e.

The Government uses tax benefits for the purchase of electric or hybrid vehicles, including VAT exemption[14].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

According to **the research institute Cetelem (2019)**[15], in response to the question "Would you say that there should be more, less or neither more nor less policies (national and local, financial and non-financial) to support the electric vehicle?", 55% of consumers answered "More".

Also, 84% consider that "there are not enough public charging stations for electric vehicles on the road" and 56% consider that "public charging stations for electric vehicles on the road" are not correctly located, which is the higher score comparing to the other countries. 60% consider that the electric vehicle is still too expensive.

As a summary, the document states "***Portugal is the Western European country that believes most in the future of EV***. *The Portuguese strongly perceive it as environmentally friendly and capable of solving the pollution problems of dense urban areas. But respondents find it too expensive to buy. They are therefore among the most numerous in the world to ask for more public subsidies*».

TECHNOLOGICAL CHOICES

Portugal favours the electrification of transport and road transport, and is thinking about hydrogen for heavy-duty vehicles, with a minimal impact, for the decade 2030[16].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to our respondents, **road infrastructure will no longer have a single function**. It will be used beyond its core function of car circulation, boosting new business models, e.g. energy generation and/or supply.

ECONOMIC MODEL AND FINANCING

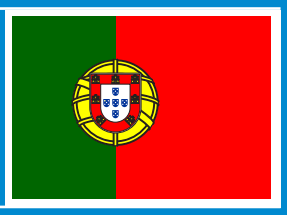
According to our respondents, one of the main barriers to the adoption and massification of technologies (e.g. induction or conduction) is the present high-level cost of investment and maintenance.

The Government incentivises the purchase of electric and low-emission vehicles through tax exemptions, subsidies schemes such as:

- The 2019 Incentive to promote the introduction of low-emissions vehicles including electric bicycles[17];
- Registration Tax Benefit for All-Electric Vehicles[18].

14 / European Automobile Manufacturers Association 2019: Overview – Electric vehicles: tax benefits and incentives in the EU. Accessed: April 22, 2020.
15 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.
16 / Plan Up 2019: Portugal. Objectives and targets. Greenhouse gas emission target. Plan Up.eu.
17 / International Energy Agency 2019: 2019 Incentive to promote the introduction of low-emissions vehicles including electric bicycles. IEA. November 21, 2019.
18 / International Energy Agency 2019: Registration Tax Benefit for All-Electric Vehicles. IEA. October 25, 2019.

PORTUGAL



POLITICAL ORGANISATION

Nature of the regime: Republic

Head of state: Marcelo Rebelo de Sousa

Head of government: António Costa

ECONOMIC INDICATORS

GDP (2018): 237.979 million USD / Rank: 48/205

GDP growth (2018): 2,4%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,9 (2017)
- Industry (including construction), value added (% of GDP): 19,4 (2017)
- Services, value added (% of GDP): 65,2 (2017)

Population (2018) : 10,281 million

Urban population (2018): 65 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (22,78%)/ Coal (12,30%) / Hydro (4,89%) / Biofuels/Waste (13,87%)/ Oil (39,49%)/ Wind & Solar (6,65%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 8/141

Total road expenditures (2013): -

Total length of the road network (2017): 14.313 Km

Road density (km per one hundred sq. km) (2016): 24

Network length by road category (2017):

- Motorways: 3.065 Km
- Main / Principal roads: 6.457 Km
- Secondary / Regional roads: 4.791 Km
- Other Roads: -

SPAIN

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Spain is more focused on urban mobility, especially in its major cities such as Madrid and Barcelona. As local authorities have an important role due to their strong autonomy**, cities seem to be more advanced than national authorities in the development of active and soft mobility**. Also, Spanish metropolises are focused on connectivity and digitalisation of transport.

In the field of decarbonised mobility, despite national subsidy schemes, Spanish consumers seem to be more inclined towards hybrid vehicles, and **the development of more charging networks needs to be carried out**.

On the side of autonomous mobility, **a more open and facilitating legislative framework is expected from private actors**. Due to its large construction companies and the presence of significant car manufacturers, **a number of tests on connected mobility, and more specifically on the link to infrastructure**, are being carried out. Spain is very active in European projects, which allow it to carry out many pilot tests.

The road infrastructure and its equipment remain essential for the development of mobility in Spain, especially because consumers associate the car as an area of freedom much more than their neighbours.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility

MAIN ISSUES

Spain national authorities are interested first in connectivity through a 4-year plan "**Connected Vehicle Platform 3.0**" granted in 2018 that would enable vehicles to connect and exchange traffic information, in order to "*realise a "vision zero" objective of zero fatalities, harm, congestion and emissions*"[2]. Regarding automated mobility, some pilot tests are taking place across the country.

MATURITY LEVEL

Spain seems to lag somewhat behind its European neighbours from a legislative point of view[3], having **authorised the testing of autonomous vehicles by instruction in 2015 but not yet having a sufficiently open legislation on these vehicles**. It seems not having yet a national strategy on connected and autonomous vehicles. However, it is rather the municipal level that takes initiatives in this type of mobility: the Auto C-ITS project for the city of Madrid, a partnership of the University of Valencia for a 5G test site, a collision avoidance system for vehicles and public transport in Barcelona[4].

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The Spanish central government and the regions have shared jurisdiction over transport and road management. Nevertheless, each city oversees its own transport network, whereas the general and administrative norms are established by Madrid on a federal level. Regarding autonomous and connected mobility, **some tests have been carried out under the instruction issued in 2015**. For example, the "Cities Timanfaya" project[5] led by the University of Madrid and the Spanish Road Association aims to bring in autonomous, electric and multimedia buses to run on Lanzarote's tourist route around a volcanic landscape in the National Park of Timanfaya.

However, times for tests are limited (2 years renewable) to the applicants. As far as connected mobility is concerned, the C-Roads Spain[6] project (a European programme that is being implemented in each Member State) is developing C-ITS technologies.

WEIGHT OF INDUSTRY

Large Spanish companies such as Abertis and Cintra, which are motorways operators, are involved with national and international actors in several tests and projects especially on the link between connected vehicles and road infrastructure[7].

In the same way, **the car manufacturer PSA is carrying out tests** with the Galician Automotive Technology Centre and the city of Vigo on vehicle-infrastructure connectivity (V2I)[8].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

According to a survey conducted by a professional association[9] and the university of Valencia, **Spanish consumers share important questions regarding accountability of the driver in case of accident and most think about the legal proceedings and development on this point**. Opinions are heterogenous on the utility of automated vehicle or driving.

TECHNOLOGICAL CHOICES/ORIENTATION

Spanish test pilots are experimenting ITS-G5 and cellular-based communication (V2X).

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Our respondents consider that road infrastructure should incorporate **communication technology for the new vehicles or digital devices / applications, with the provision of adequate road markings.**

ECONOMIC MODEL AND FINANCING

The financing is mainly based on public funds and European projects or funding.

2 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
3 / Prego, Carlos 2019: Qué dice la legislación española sobre los coches autónomos: una instrucción y muchas incógnitas. Xataka. May 13, 2019.
4 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
5 / Cities Timanfaya: Cities Timanfaya. Autonomous and sustainable mobility in the Timanfaya National Park. A commitment to innovation in a strategic tourist environment. Accessed April 23, 2020.
6 / C-Roads: Spain. Accessed April 23, 2020.
7 / Cinco Dias 2018: Ferrovial y Abertis, a un paso de probar el coche autónomo con tráfico real. El Pais Economia. April 2, 2018.
8 / PSA Groupe 2019: CTAG, Groupe PSA and the Spanish city of Vigo test vehicle-to-infrastructure communications in an urban environment to advance the development of autonomous driving. PSA Groupe. July 16, 2019.
9 / Confederation Nacional de Autoescuelas 2018: Estudio sobre la opinión del vehículo autónomo Informe. Enero 2018. CNAE.

Urban, active & soft mobility

MAIN ISSUES

Spanish cities have the upper hand on urban mobility in the country, as the country is quite decentralised. Challenges are different depending on the city. From a general point of view**, accessibility of public transport**, **development of alternative and sustainable means of mobility** -share riding, EVs, bicycle, walking- and **reduction of the use private thermic car** to prevent congestion, air pollution are the main issues in Spanish cities.

MATURITY LEVEL

We need here to distinguish between the 2 main Spanish cities: Madrid and Barcelona.

Regarding Madrid, from the "**HERE Urban Mobility Index**"[10], **the city seems very adapted to car use**. Indeed, compared to 37 other cities in the world, Madrid is the city where the time delay in traffic is the lowest (1st), the congestion index one of the lowest (2nd) as well as the percentage of congested roads (4th). **The public transport system however seems to be left behind** compared to other cities : the ratio time in public transport is way longer than by car (30th), public transport covers only 46% of the city (37th) and its density is low (31st) , which opens issues on accessibility of public transport.

Also, the city provides very few alternative modes of transport: 0.58 public bikes per 1000 inhabitants (24th), low density of EV charging stations (26th) and for the time being no low emissions zones (17th). Considering all the elements, Madrid does not appear as a very advanced city regarding the developments of urban mobility. **These elements are to be put into perspective** because of the differences between the cities compared on all continents, their surface area and their number of inhabitants**.**

The Politico's Urban Mobility Ranking[11] published in 2018 ranked **Madrid at the 5th place among 20 European cities**, considering air pollution, congestion level, percent of cycles, cost of public transport criteria. Madrid still has here a low score regarding public cycles, but a relatively good score concerning air pollution (3rd) and congestion (4th).

As a result, Madrid has an **average** maturity index on urban mobility.

Regarding Barcelona, from the same HERE Index, the city is much more **oriented towards alternative mobility solutions**: in fact, it is in second place with respect to deployment of public bicycles, in fourth place as regards to the automation of metro lines, while appearing in the middle of the table with respect to the density of recharging points for EVs (19th). Regarding traffic congestion (16th), time delay in traffic (15th), and the percentage of congested roads (15th), Barcelona is at the bottom of the first part of the table.

Some elements are corroborated by the **Deloitte City Mobility Index[12].** The journey modal split shows **that alternative modes of transport represent 71%** of used transport -42% walking, 27% in public transit and 2% per cycle-. Also, the Index considers the **Superblocks policy**[13] -reducing car traffic to main streets- as a good example in "giving back" streets to pedestrians and cycles. Nevertheless, it pointed out the necessity to better reduce congestion.

10 / Here.com Urban Mobility Index: Madrid. Accessed: April 23, 2020.
11 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
12 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights.
13 / Numeric Landscape 2019: Avez-vous déjà entendu parler des superblocks de Barcelone ? Numeric Landscape. June 3, 2019.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Public authorities are local governments and transport authorities, which determine urban planning and strategy, both in Madrid and Barcelona, considering that Spain is a decentralised State giving an important autonomy to regions. Spanish cities have come together in the "**Spanish Network of Smart Cities**" to work and move forward collectively for smart cities[14].

From the point of view of our respondents, Spain is fond of new technologies. It intends to reduce congestion and air pollution and to develop alternative forms of mobility. These initiatives are supported by the population, considering them to be important achievements.

TECHNOLOGICAL CHOICES

Barcelona clearly chose to develop walking and cycle mobility, with the support of digital solutions, by maintaining investment in traffic management technologies to reduce congestion and facilitate **Superblocks policy**. Its current challenge is on the development of a large MaaS application to cover all different modes of transport. Also, the city is deeply involved in "smart city" solutions and favours partnerships with large private companies[15].

Madrid has widely developed shared mobility by allowing many companies to operate in the city: carsharing, public service bicycles or shared bicycle companies, scooters, etc. **The city's priority is the reduction of greenhouse gas emissions**: development of electric recharging stations, proposal of a MaaS service application, development of the public bicycle fleet, etc.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Existing road infrastructure will have to be redesigned **to accommodate a multi-modality of uses, including physical (separate lane) or digital (digital or on-board signage) improvements with significant connectivity**. In addition, the adaptation of the infrastructure will have to consider the arrival of electric and autonomous vehicles in urban areas, notably by developing a dense network of charging points. Most of these modifications to the infrastructure and its use are aimed at reducing greenhouse gas emissions.

GENERAL ACCESSIBILITY OF NEW MOBILITY

Through the development of new alternatives in transport, as can be seen in Barcelona, where walking has been favoured, the aim is to provide a wide and **user-friendly choice** (notably through MaaS technologies): shared cars, electric vehicles, bicycles, public transport. Accessibility requires a high level of fluidity in the transfer from one transport mode to another.

DATA CHALLENGE AND CONTROL

The city of Barcelona has launched **the Smart City 3.0[16] project** with the aim of democratizing data and having a "**digital sovereignty strategy**" by opening several open-source platforms to collect and make data public to all actors: citizens, private companies. The city remains the ultimate owner of this data. This plan does not directly target urban mobility but demonstrates Barcelona's willingness to take up the challenge of data control. The city was named 2nd Smart City in 2017 by Juniper Research.

Madrid public transport operator, EMT, is developing the MaaS platform 'MaaS Madrid' which is the result of a public-private collaboration. This very advanced MaaS application seems to ensure strong data protection (geolocation, payments) as it is supervised by the public authorities[17].

14 / Smart City: Objectivos. Accessed April 24, 2020.
15 / Urban Hub: Smart City 3.0 – Ask Barcelona about the next generation of smart cities. Accessed April 24, 2020.
16 / Urban Hub: Smart City 3.0 – Ask Barcelona about the next generation of smart cities. Accessed April 24, 2020.
17 / Bernardo, Enrique Diego 2019: City snapshot: Mobility-as-a-Service in Madrid. Intelligent Transport. November 18, 2019.

ECONOMIC MODEL AND FINANCING

Urban mobility developments and solutions are often the result of public-private cooperation, as seen in the cases of Madrid and Barcelona. This type of solution seems to be preferred in the field of urban mobility.

Decarbonised & Electric mobility

MAIN ISSUES

Spanish National Government launched in 2015 a **National Strategy to promote Energy Alternative Vehicles (VEA)** for the period 2014-2020 in three identified guidelines[18]:

*"To promote **R&D and industrialisation measures regarding vehicles, components and infrastructure,***

*To **promote the demand of alternative energy vehicles** and communication campaigns*

*To **promote recharging and refuelling networks for alternative energy vehicles**"*

In line with Directive 2014/94/EU of 22 October 2014, Spain proposed a National Strategic Framework in 2016, proposing a target of **150,000 electric vehicles by 2020**. The electrification of the transport sector is one of the main issues with ambitious and challenging targets.

MATURITY LEVEL

In 2019, in terms of charging infrastructure for electric vehicles, **Spain accounts for 4.45% of charging points in the EU**[19]. The country has 8 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 5 Electric Vehicles (PEVs) per public charging point in Spain against 7 in the EU.

In 2018, **electrically chargeable vehicles (ECVs)** and **hybrid electric vehicles (HEVs)** account respectively for 0.9% and 5.7% of the market share in Spain[20].

In **Lease Plan's EV Readiness Index 2020**[21], Spain is ranked 16th out of 22 European countries.

Considering these figures, Spain has **not a strong maturity level** in electromobility.

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

The Spanish State launched the **VEA programme in 2015, followed by the MOVALT Vehicles Plan between 2017-2018 to encourage the purchase of alternative vehicles through a subsidy system**.

The deployment of alternative fuels infrastructure goes through city initiatives as well, notably with public-private cooperation: "***The Barcelona City Council** has deployed an electric recharging network of nearly 1,200 points, being the operator and owner of the infrastructure within its "Strategy for the promotion of electric mobility in the city of Barcelona", that defines lines of action for the period of 2018-2024...*"

"*In November 2018, the **City of Madrid** made a call for tenders to transfer charging points to holders entities with free access locations, thus avoiding to devote public land to charging infrastructure*"[22].

According to **the research institute Cetelem** (2019)[23], in response to the question "Would you say that there should be more, less or neither more nor less policies (national and local, financial and non-financial) to support the electric vehicle?", **73%** of consumers answered "More".

Also, 82% consider that "there are not enough public charging stations for electric vehicles on the road" and 64% consider that "public charging stations for electric vehicles on the road" are not correctly located. 49% consider that the electric vehicle is still too expensive.

18 / International Energy Association 2018: Spain. Major Developments in 2018. In: International Energy Association 2018: Hybrid & Electric Vehicle Technology Collaborative Programme 2018. Annual report. IEA.
19 / European Alternative Fuels Observatory: Spain. Accessed: April 23, 2020.
20 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 23, 2020.
21 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
22 / International Energy Association 2018: Spain. Major Developments in 2018. In: International Energy Association 2018: Hybrid & Electric Vehicle Technology Collaborative Programme 2018. Annual report. IEA.
23 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

As a summary, the document states "*In Spain, the automobile is perceived as an incomparable means of freedom, twice as much as in the rest of the world. The Spanish people questioned complain about* ***a lack of information about EVs****, much more so than in other European countries. They have a high level of confidence in its future, even though they are the most numerous in the world to say they prefer hybrid vehicles.*"

TECHNOLOGICAL CHOICES

Spain is mainly interested in supporting the development of the electric vehicle. Nevertheless, in a scoping document for the strategic environmental study of the "**National integrated energy and climate plan 2021-2030**"[24], the Andalusian Energy Agency proposes to broaden the types of vehicles to be promoted, such as zero-emission vehicles, and to take into account other technologies such as hydrogen.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The role of the infrastructure is mainly focused on the provision of **a dense electrical load network throughout Spain**, and on the cooperation between public and private actors in the delivery of this network, mainly to support electric mobility.

ECONOMIC MODEL AND FINANCING

The economic model is based on the MOVALT "Vehicles" and "Infrastructure" plans, which are National Incentives Plans for the Acquisition of Alternative Vehicles and to Promote EV Charging Infrastructure, which are **subsidy schemes**. Otherwise, this is done at **the local level through partnerships** between municipalities, transport operators and private companies.

24 / Ministerio para la Transición Ecológica 2019: Documento de alcance del estudio ambiental estratégico del "Plan Nacional Integrado de Energia y Clima 2021-2020". Ministerio para la Transición Ecológica. Madrid, Spain.

SPAIN

POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy

Head of state: His Majesty Felipe VI

Head of government: Pedro Sanchez

ECONOMIC INDICATORS

GDP (2018): 1.426.189 million USD/ Rank: 14/205

GDP growth (2018): 2,6%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 2,7 (2017)
- Industry (including construction), value added (% of GDP): 21,9 (2017)
- Services, value added (% of GDP): 66,1 (2017)

Population (2018) : 46, 723 million

Urban population (2018): 80 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (21,97%)/ Coal (7,87%) / Hydro (2,42%) / Biofuels/Waste (6,47%) / Oil (43,50%) / Nuclear (11,75%) / Wind & Solar (5,99%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 11/141

Total road expenditures (2016): 3.909,547 million USD

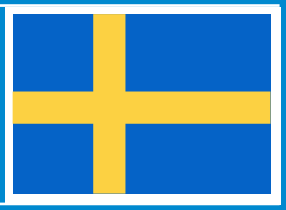
Total length of the road network (2016): 666.536 km

Road density (km per one hundred sq. km) (2016): 132

Network length by road category (2016):

- Motorways: 3.039 Km
- Main / Principal roads: 23.856 Km
- Secondary / Regional roads: 138.588 Km
- Other Roads: 501.053 km

SWEDEN



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Sweden has a high level of maturity in the three forms of mobility studied. Its main objective being the reduction of greenhouse gas emissions, the country has passed a Climate Act that came into force in 2018. Sweden's long-term target is **to have zero net greenhouse gas emissions by 2045 at the latest**[2].

The country is one of **the world leaders in the field of electromobility**, and is actively working on the **electrification of roads** for freight transport, notably in collaboration with German players.

On the side of connected and autonomous mobility, the Swedish authorities have seen the advantages of technologies such as MaaS or shuttle buses in urban areas, and are preparing **legislative innovations that take into account the many elements that this mobility implies, particularly that of data control**. The country has a collaboration between its public institutions and its industrial players, especially the automobile industry.

In urban areas, the national and local authorities **largely favour active mobility** - walking and cycling - as well as public transport to make the city more attractive. Stockholm is very well ranked in relation to its European neighbours.

The road infrastructure remains the focus of transport concerns in Sweden. Indeed, the development of electric road systems (ERS), the digitalisation of roads and their equipment, and the redefinition of road space in urban areas show that **roads will remain a fundamental basis for transport in Sweden in the years to come**.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

2/ Swedish Environmental Protection Agency 2019: Sweden's Climate Act and Climate Policy Framework. Accessed April 24, 2020.

Autonomous & Connected mobility

MAIN ISSUES

The main issue is the **connectivity and interaction between vehicles and road infrastructure** and particularly its equipment, which is the key to the penetration of this type of mobility in the market.

MATURITY LEVEL

Thinking on CAVs is very advanced in Sweden. The 2017 regulation of tests for driverless vehicles testifies to this. In addition, **a report**[3] submitted to the Government in 2018 shows the progress of discussions on autonomous and connected vehicles, as well as the necessary link with the infrastructure and its equipment.

According to a KPMG Index[4], in which **Sweden is ranked 5th out of 25**, "*There is a very good attitude from law- makers and policy-makers in Sweden," says Christoffer Sellberg, Head of Automotive, KPMG in Sweden. "They believe that AVs will improve traffic safety, contribute to the efficiency of the transportation system and be a part of Sweden's sustainable agenda*".

Sweden has therefore a **strong maturity level**.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The Government has a regulatory role in autonomous and connected mobility. The latest proposal submitted in 2018, which has not yet been adopted, proposes legislative regulation as developments occur, in order to allow secure and gradual penetration into the national market. The Swedish Transport Agency and the Swedish Transport Administration are implementing the Government's objectives. Rather, public authorities are seen as having a positive attitude towards this type of mobility, perceiving the potential: better traffic management and support for the general policy of sustainable development.

WEIGHT OF INDUSTRY

Private sector stakeholders were able to send their opinions on this project. Volvo and Scania are obviously well represented in the country. The economic environment here is dominated by car manufacturers, railway companies and regional public transport companies. According to KPMG, "*In September 2018, the agency gave Swedish vehicle maker Volvo permission to begin real-world tests of its self-driving cars in the Gothenburg area. 47 AV truck maker Einride and German logistics group DB Schenker have been piloting use of a 7.5 tonne electric AV truck between two logistics centers since November 2018, and hope to gain regulatory approval for its use on public roads in January*"[5].

The two agencies mentioned above are responsible for long-term transport planning and the issuing of driving test authorizations for autonomous vehicles.

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

The social acceptability of autonomous and connected vehicles is relatively important for sweden and lies, **around 45%**[6]. On the other hand, the country is a leader in preparing for technological change with the Netherlands, which gives it a clear advantage in positively influencing consumer acceptance.

TECHNOLOGICAL CHOICES

Sweden is moving towards V2X (Vehicle to Everything) technology.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Government authorities consider that multi-level and long-term regulations on autonomous, digital and electric mobility are necessary to ensure their secure and sustainable development.

The Swedish authorities consider that autonomous mobility will allow **better management of road infrastructure**, particularly for road works. Better traffic management would allow work to be done on roads at times when traffic is lowest. It would also be a solution in freight transport with vehicles delivering directly to urban and populated areas at the best times. A better management of road capacity wich is made possible by autonomous vehicles would allow for better regulation.

3/ Ministry of Enterprise and Innovation 2018: Inquiry paves way for automated vehicles. Government Offices of Sweden. April 18, 2018.
4/ KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
5/ KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
6/ KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

In the report submitted to the government, several propositions are made. **The introduction of tests for autonomous public works vehicles is recommended** (with a speed limit of 20 or 30km/h) to go in the same direction (night work, traffic and road capacity regulations). On the modification of the infrastructure itself to encourage automation and digitization of the transport system in general, the most recent report invites to carry out investigation, possibly including related legislative changes.

On the equipment side, **two new traffic signs and two new symbols were proposed**:

- mandatory track or lane for automated motor vehicles with more than two wheels and an associated symbol (also applicable to buses or tractors);
- mandatory track or lane for Class II automated road machines (construction or maintenance work vehicles, or small goods transport vehicles).

The development of automated driving systems would ensure the uniformity and sharpness of road markings and signage.

DATA CHALLENGE AND CONTROL

The Swedish authorities have proposed **a framework for the collection and storage of data generated by automated vehicles**.

This question is taken from a liability perspective. For example, this data can be used to determine the driver's responsibility after an accident. This data can be collected to "*prevent, detect, investigate and prosecute crimes and for people to exercise their rights in civil cases*". The manufacturer/supplier of an automated vehicle would be required to collect and store the following data:

- Enabling or disabling automated driving;
- Requests from the vehicle to the driver to return to manual driving;
- Vehicle error messages during automated driving.

For each of the elements, the identity of the vehicle and the time of the incident must be collected and stored at the same time, as must be the speed of the vehicle.

Class II vehicles (small construction or goods delivery equipment) are proposed as exempt from permits or licenses in the report, in the sense that no driver will be required. This is not the case for private vehicles where a driver would remain mandatory.

The data should be stored outside the vehicle but in the European Economic Area, being accessible from Sweden. Car manufacturers will have to ask third parties to expedite storage.

When the vehicle is registered, a decision must be made on who collects, stores and operates the required data (the storage controller will be the car manufacturer). An importer of vehicles will be considered as a manufacturer. A license/permit will be required to collect and store personal data, otherwise the use of the vehicle in automatic driving mode must be prohibited. These personal data may not be stored for more than 6 months, and subsequently destroyed, unless requested by the competent authorities. The obligations of organisations, technical and administrative means of all these provisions will be the responsibility of the car manufacturers. The Swedish Data Supervisory Authority is the public body responsible for monitoring these obligations.

Urban, active & soft mobility

MAIN ISSUES

The main issue is **the development of low-carbon mobility in urban areas** to meet ambitious carbon targets.

MATURITY LEVEL

The country is considered **mature** on these issues. Many initiatives are taking place in this direction from a national perspective[7]. We will focus here on the city of Stockholm. According to the **Deloitte City Mobility Index**[8], the city of Stockholm is very well ranked: **the modal share of public transport and active modes accounts for 77% of trips, compared to 23% for private cars**, whose road space is becoming an issue. The city launched MaaS apps and introduced self-driving shuttle in 2018 under a public-private partnership.

In **Politico's Urban Mobility Index**[9] for 2018, **Stockholm is ranked 2nd out of 20** European cities. The city obtains good results regarding congestion (6th), bicycle use (6th) and mass transit use (8th), with the lowest ranking in the cost of single city public transport ticket (20th). The city is ranked first regarding air quality level.

In the **Here's Urban Mobility Index** for 2018[10], Stockholm scores well on the percentage of green spaces and low-emission zones indices, has good results on congestion indexes. These elements are to be compared with the other European cities included in this Index.

Considering these elements, Stockholm has a rather **strong level of maturity.**

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The State has **exclusive competence in the planning of the road network**, the regional level has competence in the organizations of public transport, the **municipality has competence in the maintenance of its local road network**, health and environmental protection (the protection of nature and the environment is also a competence of the prefect, at a "regional" level. The State may define ecological and sustainable transition policies or objectives. Nevertheless, municipalities directly implement the corresponding types of mobility, with freedom of action on their territory[11].

TECHNOLOGICAL CHOICES

Sweden chooses to **promote public transport and active and soft mobility** as much from a national point of view as in a large city such as Stockholm.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The State proposed a National Strategy for Pleasant Cities in 2018. This Strategy sets **the use of public transport, cycling and walking for Swedes at 25% by 2025**. Transport infrastructure must therefore turn to soft and ecological mobility. Also, a significant part of the vehicle fleet will be electric (related charging infrastructure).

GENERAL ACCESSIBILITY OF NEW MOBILITY

The city of Stockholm has for example planned a metro expansion in the urban areas, and the main transport company *''enhanced all public transport modes to become 100 percent disabled-friendly under its 2011-2021 Accessibility Program"*[12].

ECONOMIC MODEL AND FINANCING

The main operator UbiGo in Stockholm, which was the first to implement MaaS in Sweden, offers packages including limited use of several types of mobility (shared car, taxi, car rental whose price depends on the distance) and unlimited access according to the choice of package. Concerning public transport or active mobility, the initiative is mainly public, although cities such as Stockholm are recognised as very innovative and co-operative with the private sector.

Decarbonised &Electric mobility

MAIN ISSUES

Sweden is one of the leaders in electromobility and is the first country to have launched electric road tests. The country seems to be focused on electricity as a "low-carbon" mobility. Indeed, 54.5% of Swedish energy consumption comes from renewable energies, (and 80% of electricity production comes from nuclear and hydroelectric energy)[13].

7 / Ministry of the Environment 2018: Strategy for Liveable cities - short version. Government Offices of Sweden. June 29, 2018.
8 / Deloitte City Mobility Index 2018: Stockholm. Deloitte Insights.
9 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
10 / Here.com Urban Mobility Index: Stockholm. Accessed: April 24, 2020.
11 / Arsenault, Line 2005: Décentralisation. Portrait de la Suède. Ministère des Affaires Municipales, du Sport et des Loisirs (Québec).
12 / Deloitte City Mobility Index 2018: Stockholm. Deloitte Insights.
13 / Sweden Sverige: Energy use in Sweden. Accessed April 24, 2020.

MATURITY LEVEL

In 2019, in terms of charging infrastructure for electric vehicles, **Sweden accounts for 4,34% of charging points in the EU**[14]. The country has 48 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 23 Electric Vehicles (PEVs) per public charging point in Sweden against 7 in the EU. **Electric-chargeable vehicles represented 8.0% and hybrid electric vehicles 5.8 % of the market share of alternatively powered cars in the country in 2018**[15].

In **Lease Plan's EV Readiness Index 2020**[16], Sweden is ranked 5th out of 22 European countries.

Considering these elements, the maturity of the country is **strong**.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Sweden is part of the EV30@30 campaign, which **aims to achieve a market share for electric vehicles for passenger cars, light commercial vehicles, buses and trucks 30% by 2030**[17]. The EV30@30 campaign is supported by 13 of the EV30 members: Canada, China, Finland, France, Finland, Finland, India, Japan, Mexico, Netherlands, Norway, Mexico and Sweden.

Sweden was **the first country to launch a test of electric motorways for freight transport** in 2016, in a Scania-Siemens partnership[18]. The country also created **the world's first dynamic electric road** in 2019, particularly for buses and trucks[19]. Sweden is very interested in the electrification of roads, where it plans to invest EUR 3 billion. Car manufacturers Volvo and Scania play a key role in this area.

Sweden and Germany signed a partnership in 2017 for the development and study of electric highways (eHighway) with a cooperation of institutional, research and industrial players[20]. **A similar partnership between Sweden and France** is underway since 2017 on electric highways and batteries[21].

TECHNOLOGICAL CHOICES

Sweden has clearly opted for electromobility. The market share of battery electric vehicles is 8% in 2018[22], making it the world's third largest share. Extensive research into the electrification of roads, particularly for freight transport, also supports this trend.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Road infrastructure is the means to electrify transport, especially freight transport in Sweden. Partnerships with German and French players, the investment of agencies in charge of these subjects, and the share of electric vehicles show that the road will serve as a technological vector for the electric transition. Charging stations will also play a role for light vehicles.

ECONOMIC MODEL AND FINANCING

Sweden has a bonus system for company vehicles or for the purchase of clean vehicles[23], as well as subsidy systems for the installation of recharging stations[24] or all types of electric vehicles[25].

14 / European Alternative Fuels Observatory: Sweden. Accessed: April 24, 2020.
15 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.
16 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
17 / International Energy Agency 2019: The Global EV Outlook. Scaling-up the transition to electric mobility. Accessed April 24, 2020.
18 / Business Wire 2016: Scania: World's first electric road opens in Sweden. Business Wire. June 22, 2016.
19 / Rébillion, Hervé 2019: La route électrique à recharge par induction en mouvement. TRM 24. January 2019.
20 / Ministry of Enterprise and Innovation 2017: Sweden and Germany in unique innovation partnership. Government Offices of Sweden. January 31, 2017.
21 / Ministry of Enterprise and Innovation 2019: Next phase in innovation partnership between Sweden and France now begins. Government Offices of Sweden. June 7, 2019.
22 / International Energy Agency 2019: The Global EV Outlook. Scaling-up the transition to electric mobility. Accessed April 24, 2020.
23 / European Automobile Manufacturers Association 2019: Overview – Electric vehicles: tax benefits and incentives in the EU. Accessed: April 22, 2020.
24 / International Energy Agency 2019: Ordinance (2019:525) on state aid for the installation of charging points for electric vehicles. Accessed April 24, 2020.
25 / International Energy Agency 2019: Ordinance (2017: 1317) on grants to private individuals for the purchase of electric bikes, mopeds, motorcycles and outboard motors. Accessed April 24, 2020.

SWEDEN

POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy

Head of state: His Majesty Carl XVI Gustaf

Head of government: Stefan Löfven

ECONOMIC INDICATORS

GDP (2018): 551.032 million USD / Rank: 22/205

GDP growth (2018): 2,3%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,1 (2017)
- Industry (including construction), value added (% of GDP): 22,2 (2017)
- Services, value added (% of GDP): 65,2 (2017)

Population (2018) : 10,183 million

Urban population (2018): 87 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (20,31%)/ Coal (4,47%) / Hydro (10,75%) / Biofuels/Waste (24,79%) / Oil (20,11%) / Nuclear (34,83%) / Wind & Solar (2,99%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 20/141

Total des dépenses routières (2017): 2.374 million euros

Total length of the road network (2016): 214.905 Km

Road density (km per one hundred sq. km) (2016): 131

Network length by road category (2016):

- Motorways: 2.118 Km
- Main / Principal roads: 13.576 Km
- Secondary / Regional roads: 156.920 Km
- Other Roads: 42.291 Km

THE NETHERLANDS

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

The Netherlands is **one of the world leaders in the development of mobility**. In the international rankings as a whole, the Netherlands is often ranked first.

In terms of connected and autonomous mobility, the country is aware of its strategic position in freight transport and was the initiator of tests in **platooning for trucks**. The Dutch legislative framework is evolving rapidly, and a **specialised driving licence is under consideration for automated or autonomous vehicles**.

Also, connectivity, digitalisation of road transport, both in cities via MaaS technology and on major roads, is the current point of development in the Netherlands. ITS technologies are deployed with numerous tests throughout the country.

In the field of electromobility, the country represents more than 25% of the European Union's network of charging stations, making it the densest network in the world. The country wishes to continue on this path in order to be in line with its climate objectives.

It should be noted that relations are fluid between the public authorities and the private sector, making the Netherlands an important pole of innovation in new mobilities, particularly urban ones. Moreover, public authorities are very involved and proactive.

The road infrastructure will have to adapt on several points: **a significant digitalisation of road equipment** to improve traffic flow and reduce congestion, a reinforced **recharging network for clean vehicles**, and **an increase in road space for soft and active mobility**, first and foremost the bicycle.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility

MAIN ISSUES

The Dutch government aims to continue the autonomous and connected mobility developments mainly in freight and logistics, considering the strategic geographical position of the Netherlands. Being **the European leader in the development of this mobility**, the country is a laboratory of ideas for its neighbours.

MATURITY LEVEL

The country is the **European leader and one of the world leaders in autonomous and connected mobility**, being ranked first consecutively in 2018 and 2019 by the KPMG Autonomous vehicles readiness Index[2].

The country passed the "*Experimenteerwet zelfrijdende auto*" (law governing the experimental use of self-driving vehicles) which was approved by the House of Representatives in April 2018 and the Dutch Senate in September. It allows **experiments with AVs on public roads without drivers inside the vehicles**, although they must be monitored remotely. With effect from 1 July 2019, public road tests involving self-driving vehicles are allowed under strict conditions. These experiments can involve vehicles whose drivers are located outside the vehicle, such as a remotely operated self-driving minibus.

The Netherlands are also preparing a dedicated **Driving License for automated vehicles**. This is being developed in cooperation between the Dutch Vehicle Authority (RDW), the main road authority (Rijkswaterstaat) and the central office for driving exams (CBR). The approach focuses on the extent to which a vehicle can produce safe and predictable automated driving behavior that aligns as closely as possible to human performance in an open traffic system.

Finally, the Netherlands are working on a "**Vehicle Safety & Security Framework (VSSF)**" to be able to assess the robustness of in-vehicle software.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Public authorities are very involved in the development of connected and autonomous vehicles, strongly promoting experiments for light vehicles and trucks.

The implementation of ITS (Intelligent Transport Systems) and all connected infrastructure is of prime importance for the authorities. Also, the Ministry of Infrastructure and Water Management has worked together with seven regions to develop seven nationally scalable MaaS pilot projects[3].

WEIGHT OF INDUSTRY

The country has been at the initiative of the **European Truck Platooning Challenge 2016** "*to promote platooning by bringing truck convoys to public roads for the first time*"[4]. This has led to cooperation with several truck manufacturers. The project has been followed up at European level and continues to be followed-up together with actors from freight transport[5].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

In **the 2019 Deloitte Global Automotive Consumer Study**[6], 73% of Dutch consumers would like to see a significant involvement of the government in the development and use of AVs, which is the highest score comparing to other countries. When asked about their expectations from customers regarding connected and / or autonomous vehicles, 76% of the consumers mention "Updates regarding traffic congestion and suggested alternate routes" and "Updates to improve road safety and prevent potential collisions". The main interest for AVs is related to travel time and the potential contribution of the vehicle in terms of safety.

2 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
3 / Ministry of Infrastructure and Water Management 2019: MaaS Pilot Projects. Optimising mobility. Ministry of Infrastructure and Water Management. The Hague, Netherlands.
4 / European Automobile Manufacturers Association 2016: What is the European Truck Platooning Challenge? Accessed April 24, 2020.
5 / ERTICO 2019: European truck platooning challenge: Building 2022 vision. ERTICO. November 19, 2019.
6 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.

TECHNOLOGICAL CHOICES

The country wishes **to promote the full range of ITS and MaaS technologies**. Also, public authorities will provide some 5G tests[7].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The country has some of the **best road infrastructure in the world**. It considers that the roads **will have to adapt** on several points: the development of roadside information infrastructure for C-ITS (fibre, road side stations), synchronization of physical roads signs and their digital form - gradual reduction of physical road information- as well as uniformity, reliability and functional redundancy will be the principle in any future infrastructure adaptations.

Also, the country is very involved in MaaS technologies considering that road infrastructure is an important modality within MaaS and that this technology can contribute to a better usage of the existing road infrastructure and provide digital infrastructure.

GENERAL ACCESSIBILITY OF NEW MOBILITY

The Netherlands consider that **Transport on Demand (ToD) and MaaS** technologies can contribute in ensuring access to new mobility in the short and medium terms, as well as automated driving in the long term.

DATA CHALLENGE & CONTROL

Infrastructure will be and is already a supplier and user of data in the development of new mobility. Also, data generated by MaaS can offer a way to change from supply and infrastructure driven policy to a data driven policy. The country is focused on data control within the European Union through the GDPR.

ECONOMIC MODEL AND FINANCING

It appears that the Netherlands uses **many public-private partnership projects to test and promote autonomous and connected mobility**. Our respondents also indicate that public funding from the State in cooperation with the regions still plays an important role.

Urban, active & soft mobility

MAIN ISSUES

The Netherlands has some of the highest quality road infrastructure in the world, and **its major cities are role models in the field of new mobility**. However, reducing the modal share of car use and congestion remain a challenge in all cities across the country. Also, the affordability of transport is an element that needs to be addressed in order to allow greater accessibility for the entire urban population.

MATURITY LEVEL

According to the **Deloitte City Mobility Index**[8], the city of Amsterdam and the urban metropolis Rotterdam-The Hague are exemplary in all the criteria of this Index, especially Amsterdam. Considering these, the Dutch maturity **is very high in this field.**

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

The central government mainly provides national strategic frameworks, but urban mobility is implemented concretely by municipalities and cities. The central government intends to promote the use of cycling and walking[9] in the coming years, where cycling already accounts for 27% of journeys in the country[10].

Taking the examples of Amsterdam and the Rotterdam-Hague urban area, both have a **very high density of recharging points for electric vehicles**, allow multi-modality in journeys (this is less the case in the Rotterdam area), have an **excellent cycling infrastructure**, have a strong modal inclusiveness of transport and are rather well placed regarding sustainable and environmental measures. Rotterdam-Hague, because of its geographical position, still faces problems of congestion (port of Rotterdam) and an important **modal share of car travel (43%).**

7 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
8 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights. Accessed April 24, 2020.
9 / Government of the Netherlands 2019: Basics up to par: additional funding for maintenance of roads, waterways, and railroads. Government of the Netherlands. September 17, 2019.
10 / Government of the Netherlands: Ways of encouraging bicycle use. Accessed April 27, 2020.

WEIGHT OF INDUSTRY

Partnerships with private actors are important in Dutch cities, which are known for their ability to innovate[11], as Smart City Program in Amsterdam shows[12]. This is the case of the initiatives **ECOTAP and ALLEGO - charging station applications -** [13], or through **the Innovation and Acceleration Programme Electric Mobility (IAP)** which includes more than 200 associated companies[14].

TECHNOLOGICAL CHOICES

The choice made in the Netherlands is to promote clean vehicles and increase the modal share of cycling, in a country where this cycling culture is already important in urban areas. Here, multi-modal use is favoured, particularly via digital or MaaS-type solutions.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Road infrastructure is seen as the means to enable this multi-modality: increase in cycle lanes, promotion of low-emission vehicles, digital interaction to fluidify traffic flows, broad digital information as the Talking Traffic partnership[15].

GENERAL ACCESSIBILITY OF NEW MOBILITY

The Netherlands focus mainly on soft mobility and digital solutions such as Transport on Demand (ToD) to increase the accessibility of new mobility, as well as on the improvement of public transport coordinated between the central government, provinces and municipalities[16].

DATA CHALLENGE AND CONTROL

What we can quote regarding Amsterdam is that: "*One thing that makes the city different is that it has changed its City Data into an open source platform. This means anyone can easily access the data or even add datasets to the existing collection of the data. Amsterdam's City Data is available online. It is easy to find it online, download and connect to your own system*"[17].

ECONOMIC MODEL AND FINANCING

It appears that the Netherlands uses many public-private partnership projects. Also, our respondents indicate that public funding from regions and municipalities still plays an important role.

Decarbonised & Electric mobility

MAIN ISSUES

Like all European countries, the Netherlands is making the fight against climate change a priority. The Climate Act proposed in 2018 has set a target of **reducing greenhouse gas emissions by 49% by 2030** - mainly CO2 emissions - compared to 1990 levels[18]. The transport sector accounts for 25% of CO2 emissions[19].

MATURITY LEVEL

In 2019, in terms of charging infrastructure for electric vehicles, **the Netherlands accounts for 26.05% of charging points in the EU**[20], with a very dense network. The country has 35 fast public charging points per 100 km highway against 28 in the EU. In addition, there were a ratio of 4 Electric Vehicles (PEVs) per public charging point in the Netherlands against 7 in the EU.

In 2018, **electrically chargeable vehicles (ECVs)** and **hybrid electric vehicles (HEVs)** account respectively for 6.7% and 4.6% of the market share in the Netherlands[21].

In **Lease Plan's EV Readiness Index 2020**[22], the Netherlands are ranked 1st out of 22 European countries.

Considering these figures, it can be stated that the Netherlands have **a high level of maturity** in electromobility.

11 / The Green Village: Projects. Accessed April 24, 2020.
12 / Amsterdam Smart City: Discover projects in the region and add yours. Accessed April 24, 2020.
13 / International Energy Agency 2017: Charging station application in 23 municipalities. Accessed April 24, 2020.
14 / International Energy Agency 2019: Innovation and Acceleration Programme Electric Mobility (IAP). Accessed April 24, 2020.
15 / Partnership Talking Traffic: What if traffic regulates traffic? How the Dutch authorities and business community join forces to improve everyday traffic. Accessed April 24, 2020.
16 / Ministry of Infrastructure and Water Management et al. 2019: Public Transport in 2040 Outlines of a vision for the future. The Ministry of Infrastructure and Water Management. The Hague, Netherlands.
17 / Smart City Press 2017: Amsterdam – A Data-driven City Of Europe. Smart City Press. September 23, 2017.
18 / Government of the Netherlands: Climate Policy. Accessed April 24, 2020.
19 / Government of the Netherlands 2019: Basics up to par: additional funding for maintenance of roads, waterways, and railroads. Government of the Netherlands. September 17, 2019.
20 / European Alternative Fuels Observatory: Netherlands. Accessed: April 24, 2020.
21 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.
22 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.

ECOSYSTEM AND GOVERNANCE

The Dutch government intends **to provide 1.8 million charging points** for electric vehicles in 2030, *"among which will be "smart charging points" that improve the capacity of the power grid"*, as well as "*greener fuel will be available for petrol or diesel cars*[23]. In the National Agenda on infrastructure for alternative fuels[24], the intended objective is that "***all new cars emission-free by 2030 at the latest*** *can be translated into a fleet of 1.9 million electric passenger vehicles*".

This plan is operational through **the support of the National Agenda for Charging Infrastructure (NAL)**: "*A large part of the agreements from the NAL are implemented at provincial or municipal level. In the NAL it has been agreed to place project offices within regional partnerships. These offices support the municipalities in the roll-out of charging infrastructure. In this way, a common framework is created, and knowledge is exchanged. National reports and 'lessons learned' are sent to the municipalities via the partnerships*"[25].

The Netherlands set up a comprehensive plan, especially on electromobility for the next decade, where all stakeholders -State, regions/ provinces and private parties- are involved. This is also the case through the initiatives of **ECOTAP and ALLEGO -charging station application-**[26], or through **the Innovation and Acceleration Programme Electric Mobility (IAP)** which includes more than 200 associated companies[27].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

For Dutch consumers, only 46% in 2019 still consider an alternative energy vehicle as their next vehicle purchase[28], which shows that they have yet to be convinced of the benefits of these new vehicles.

TECHNOLOGICAL CHOICES

The country is heading mainly towards electromobility solutions, and the reinforcement of cycling from a national perspective[29]. Hydrogen is also a potential option, as for taxis fleets[30].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

The role of the road infrastructure will mainly involve the construction of charging points and the increase of road space for cycling, both in terms of parking spaces and traffic lines.

GENERAL ACCESSIBILITY OF NEW MOBILITY

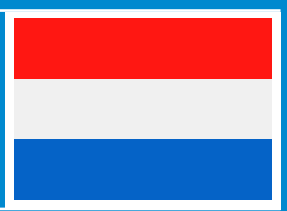
The accessibility of carbon-free mobility depends on the accessibility of recharging points. The latter is an essential factor in the development of electric mobility, as well as sufficient space for each mobility, in particular via mobility hubs on different scale-levels (neighbourhood, district, ring-roads).

ECONOMIC MODEL AND FINANCING

It appears that the Netherlands use many public-private partnership projects to test and promote decarbonised/electric mobility. Our respondents also indicate that public funding from the State in cooperation with the regions still plays an important role.

23 / Government of the Netherlands 2019: Basics up to par: additional funding for maintenance of roads, waterways, and railroads. Government of the Netherlands. September 17, 2019.
24 / Government of the Netherlands: Nationale Agenda Laadinfrastructuur. Government of the Netherlands.
25 / Netherlands Enterprise Agency: Nationale Agenda Laadinfrastructuur (NAL). Accessed April 24, 2020.
26 / International Energy Agency 2017: Charging station application in 23 municipalities. Accessed April 24, 2020.
27 / International Energy Agency 2019: Innovation and Acceleration Programme Electric Mobility (IAP). Accessed April 24, 2020.
28 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
29 / Government of the Netherlands 2019: Basics up to par: additional funding for maintenance of roads, waterways, and railroads. Government of the Netherlands. September 17, 2019.
30 / Lauraux, Matthieu 2019: 35 Toyota Mirai pour une flotte 100% hydrogène aux Pays-Bas. Automobile Propre. July 3, 2019.

THE NETHERLANDS



POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy

Head of state: His Majesty King Willem-Alexander

Head of government: Mark Rutte

ECONOMIC INDICATORS

GDP (2018): 913.658 million USD / Rank: 17/205

GDP growth (2018): 2,6%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,9 (2017)
- Industry (including construction), value added (% of GDP): 17,4 (2017)
- Services, value added (% of GDP): 70,3 (2017)

Population (2018) : 17,231 million

Urban population (2018): 91 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (43,25%)/ Coal (11,45%) / Hydro (0,008%) / Biofuels/Waste (5,96%) / Oil (36,09%) / Nuclear (1,29%) / Wind & Solar (1,93%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 2/141

Total road expenditures (2010): 1 468 586 million USD

Total length of the road network (2016): 184 119 Km

Road density (km per one hundred ˢq. km) (2016): 443

Network length by road category (2016):

- Motorways: 7 163 Km
- Main / Principal roads: 5 935 Km
- Secondary / Regional roads: 3 507 Km
- Other Roads: 167 514 Km

UNITED KINGDOM

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

The United Kingdom is **one of the most advanced countries in Europe** in terms of new mobility.

The authorities have been involved in the field of autonomous mobility for several years, and have provided **one of the most open legislative frameworks** for testing and experimentation in the world, with a review of this framework by 2021. It should be noted that the authorities would not want substantial physical changes to the road infrastructure, but rather **efficient connected equipment and digitalisation of roads**.

The country's low carbon objectives and strategy also shows an interesting development in the field of electromobility, with the awareness of **the need for the development of a satisfactory charging network** across the country, despite some scepticism of British consumers for these vehicles.

In urban mobility, a clear distinction must be made between large cities and London, which have different issues. Other British cities seem to have more difficulties in the evolution of the mobility paradigm. Nevertheless, the public authorities, particularly at national level, have developed a strategy largely **favouring active and soft mobility**, with the aim of reducing the share of the private car in urban space and then **congestion issues**. The role of road infrastructure remains important for **the coexistence of different forms** of mobility and **better traffic management**.

Finally, it should be noted that the public authorities and the private sector work in a spirit of cooperation, particularly through agreements or sector strategies.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

Autonomous & Connected mobility

MAIN ISSUES

The United Kingdom is in a leading position from a legislative and policy point of view on this type of mobility. Nevertheless, some improvements from the infrastructure side is needed to foster its development[2].

MATURITY LEVEL

The United Kingdom has **a high maturity level on autonomous and connected mobility**, regarding legislative and policy developments. This mobility is seen as strategic by public authorities.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Public authorities are very involved in the area of AVs:

- The Parliament passed **the Automated and Electric Vehicles Act in 2018,** which imposes a compulsory insurance on AVs and their driver;
- The **Law Commissions of England, Wales and Scotland are reviewing the legal framework on AVs**, which will be completed in 2021;
- The Department of Transport developed a **Code of Practice for testing–drive less cars in 2015**, currently under review;
- **UK's government created the Centre for Connected and Autonomous Vehicles (CCAV)** to supervise and coordinate all the tests in this area between Departments and the private sector;
- The automation is seen as **an enormous potential in new mobility:** public authorities refer to it in several reports (freight transport, MaaS, urban mobility).

WEIGHT OF INDUSTRY

There is a good cooperation between national authorities and the private sector. The '***Automotive Sector Deal***" and "***Construction Sector Deal***" were signed in 2018. They set partnerships and commitments from both sides, in order to "*create a world-leading testing environment for Connected and Autonomous Vehicles*"[3]. For example, some proposed industry actions to support the automotive sector are:

- *"£56m funding for the CAV collaborative R&D projects to date*";
- "*Match funding for the £100m CAV testing infrastructure*"[4].

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

Regarding acceptability of CAVs, UK's government set up a public dialogue on this subject: "*CAV public acceptability dialogue Engagement report*"[5]. Respondents mainly express their concerns on **reliability of the vehicle, data protection, accountability and insurance schemes**.

It is coherent with results extracted from "**2019 Deloitte Global Automotive Consumer Study – Europe**"[6], where 48% of the consumers in UK think that AVs will not be safe (73% in 2017), and 61% would like a significant oversight from the government involvement regarding the development and use of AVs.

TECHNOLOGICAL CHOICES

According to our respondents, Roadside Units (RSUs) will be needed for receiving and distributing information if ITS-G5 technology is chosen. Tests and experiments were launched in 2019 regarding 5G technology as well[7].

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

According to **the Draft Road Investment Strategy 2**[8], which describes the Government objectives for the second road investment strategy (RIS2) for the 2020-2025 period, there are several objectives, where Highway Englands should be "empowered to develop the infrastructure standards of the connected and autonomous era":

2 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
3 / HM Government 2018: Industrial Strategy: Automotive Sector Deal. Open Government. London, UK.
4 / HM Government 2018: Industrial Strategy: Automotive Sector Deal. Open Government. London, UK.
5 / Traverse 2019: CAV public acceptability dialogue. Engagement report. Department for Transportation. London, UK.
6 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
7 / Prabha, Anil 2019: UK's first 5G autonomous vehicle test bed launches. Techhq. February 18, 2019.
8 / Department for Transport 2018: Draft Road Investment Strategy 2. Government objectives. Moving Britain Ahead. Open Government. London, UK.

- "Making smart motorways suitable for regular use by automated *vehicles as soon as possible in RP2, to meet* ***the Government's ambition to see fully self-driving cars, without a human operator, on UK roads by 2021***";
- "*Making all-purpose trunk roads suitable for regular use by automated vehicles* ***without the need for major upgrades to their physical infrastructure***".

The final RIS 2 proposal will be released in 2020.

GENERAL ACCESSIBILITY OF NEW MOBILITY

The Government published a report regarding Mobility As A Service (MaaS) technologies[9], in which it was stated : "*..MaaS potentially offers* ***a paradigm shift from transport being fundamentally provider-led*** *(i.e. where fixed capacity is provided to serve a predictable demand),* ***to being a fully user-led system whereby the level and type of transport supply continually adjust in response to the specific desires of individual travellers****."*

It provides some recommendations as well to policy makers: *"the Government has an important role to play in* ***setting open data policies and frameworks*** *and creating the right ecosystem and conditions to attract business and users to use and share data"*. This document would serve as a basis for further developments.

DATA CHALLENGE AND CONTROL

Considering the same draft proposal RIS 2[10] :

- "*Supporting vehicle manufacturers as they work to create the right flows of data and information to and from connected and autonomous vehicles*";
- "*Continue with existing provision of data, and ensure an open architecture that allows software developers to provide users with new services*";
- "*...making available Highways England data that can help freight operators schedule their journeys better...*".

The Laws Commission of England, Wales and Scotland are currently working on the revision of the Automated and Electric vehicles Act voted in 2018. A first wave of responses from a public consultation was published in 2019[11] and **many actors are concerned about the management of data from** CAVs:

- From vehicles and emergency services: "*This should include real time safety measures, route updates and* ***interaction with a central database which transmits information*** *such as temporary speed limits, diversions, major incidents, weather warnings and traffic congestion*";
- From the advocates: "many systems would be designed to ***interoperate with other vehicles, traffic lights and other road infrastructure***";
- Transport companies: "*Transport for the West Midlands (TfWM) thought that the body responsible for supporting AV infrastructure should be clearly defined and their liability understood:* ***This would extend to roadside infrastructure, digital legal records and rules of the road enforcement issues***";
- Chartered Institution of Highways and Transportation (CIHT) stated "*We need to ensure that the proper legal framework is available* ***to promote and require the sharing of data between highways authorities and vehicle providers to provide the best experience*** *to all users of the network*".

A summary was made by the authors out of these responses: "*Issues around data management arose at each stage of the project. Many respondents thought that we should do more to consider how data produced by automated vehicles would be stored and shared, particularly with insurers, highway authorities and regulators*".

Data management is at the core of the development of CAVs and in all the relevant discussions for many sectors, including the road infrastructure.

9 / Enoch, Marcus 2018: Mobility as a Service (MaaS) in the UK: change and its implications. Government Office for Science Foresight Future of Mobility project.
10 / Department for Transport 2018: Draft Road Investment Strategy 2. Government objectives. Moving Britain Ahead. Open Government. London, UK.
11 / Law Commission; Scottish Law Commission 2019: Automated Vehicles: Analysis of Responses to the Preliminary Consultation Paper. Open Government. London, UK.

ECONOMIC MODEL AND FINANCING

The modes of financing are rather of public initiative, for example via cross-cutting funds to attract private investment. As the legislative framework is very open in the United Kingdom, this also allows for broader experiments and questioning of the economic models to be considered.

Urban, active & soft mobility

MAIN ISSUES

Regarding urban, active and soft mobility, it is important to distinguish between London and other towns in the United Kingdom, as London is a specific case.

Different issues are: congestion in cities - because of the still major share of the private car in daily mobility if London is not taken into account-, air pollution, the implementation of digital mobility services such as MaaS, the development of zero-emission vehicles and shared mobility.

MATURITY LEVEL

Compared to other European cities ranked in the "**2019 Deloitte City Mobility Index**"[12], on the Future of Mobility (FoM) capability ranking, Birmingham (10th), Manchester (15th) and Belfast (19th) are in the second half of the ranking. London is ranked 2nd.

In **Politico's Urban Mobility Index**[13] for 2018, London and Manchester are ranked respectively 15th and 14th out of 20 European cities. London encounters more difficulties on congestion levels (17th) where Manchester has the reverse issue in mass transit use (19th).

There is therefore a significant gap in the ranking between the British megacity - nearly 9 million inhabitants - and other large cities - Manchester and Birmingham have more than 2.7 million inhabitants or an intermediate city like Belfast -670,000 inhabitants-.

This reinforces the choice to **consider the London case separately from other cities in the United Kingdom** in order to have a more accurate analysis of the country in the development of new urban mobility.

By processing this way, the UK's maturity index for this type of mobility is **average** compared to the rest of European cities in this study.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

At a national level, the Department of Transport (DoT), Highways England and the National Infrastructure Commission determine UK's action in mobility and road transport. There are dedicated organisations such as Transport for Scotland, Highways England managing the strategic roads.

At a local stage, local roads and mobility issues are owned and managed by Local Authorities in all the UK -partly by Transport for London (TfL) in London area, which is a specific case.

The DoT launched in 2019 a new national "**Urban Strategy**"[14], part of the "Future of Mobility" Grand Challenge set out by the Industrial Strategy.

It mainly encompasses 4 objectives:

- "***Implementing a flexible regulatory framework***": new areas to focus on micro mobility vehicles, MaaS, data sharing and bus/taxi/private hire vehicle legislation;
- "***Supporting industry and local leaders***": several actions in order to work with the local communities, fostering the adaptation of the automotive industry, working up on shared data -particularly on traffic management data-;
- "***Ensuring Government decision-making is robust***": having a strategic and planning mind on the necessary updates of the transport system and anticipate new technologies developments, with an awareness of what are the public perceptions on new urban modes of transport;
- "***Technology-specific programmes***": Support new vehicles technologies: zero-emissions vehicles, connected and self-driving vehicles, drones and future flight by reconducting or implementing new dedicated funds which have an incentive role.

12 / Deloitte 2019: The 2019 Deloitte City Mobility Index. Gauging global readiness for the future of mobility. Deloitte Insights. Accessed April 24, 2020.
13 / Posaner, Joshua; Solletty, Marion; Ginger, Hervey; Murphy, Connor 2018: POLITICO's urban mobility index. The best places in Europe to get around. POLITICO. April 17, 2018.
14 / Department for Transport 2019: Future of Mobility: Urban Strategy. Moving Britain Ahead. Open Government. London, UK.

TECHNOLOGICAL CHOICES

According to the national "*Urban Strategy*", different modes and mobility features were promoted:

- These new modes have to be **safe and secure;**
- New mobility should be made available to **all parts of the UK;**
- **Active modes of mobility** -walking, cycling- "*must be the best options for short urban journeys*";
- **MaaS technology** has a central role to play for the efficiency of the transport system;
- New mobility should promote the **transition to zero-emissions;**
- New mobility must help **reduce congestion** and improve the use of the **road space** through sharing rides or consolidated freight;
- The marketplace for new mobility must be open;
- New mobility systems must include **open-data** policy.

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Referring to our respondents' feedback and the documents studied, road infrastructure in urban areas will have to adapt to several elements:

- **Redefining road space and its occupation**: cities - especially in London - favour active modes of mobility, reducing the role of the individual car – for example through urban tolls - and zero-emission mobility;
- **Different traffic management**: the objective is to **reduce congestion** and the way road space is used - peak hours or parking. By reducing the use of private cars by a single person, **MaaS technologies will enable users to choose their mode of transport more fluidly** and provide digital traffic management tools to anticipate and facilitate traffic flow;
- Allow for the **coexistence of different types of mobility**: British cities face the same problems as many European countries: increase soft and active mobility in cities, and allow smooth and peaceful traffic via dedicated lines, for example.

GENERAL ACCESSIBILITY OF NEW MOBILITY

The city of London has set similar objectives, adding that it would be necessary to include Demand Responsive Transport (DRT) to give access to all and in all parts of the UK to new transports modes.

DATA CHALLENGE AND CONTROL

This item is more linked to self-driving vehicles in urban areas. This topic is covered more generally in the global framework.

ECONOMIC MODEL AND FINANCING

The UK Government and major cities favour incentive funds to develop projects and tests in order to work effectively with the private sector to promote these new modes of travel.

Decarbonised mobility & Electric mobility

MAIN ISSUES

UK is paving the way to a decarbonised mobility, by setting huge ambitions. It launched in 2017 the **Clean Growth Strategy**, part of which concerned transport. In its report, the International Energy Agency (IEA)[15] resumed UK's Strategy:

"*Accelerate the shift to low-carbon transport by working with industry under the Automotive Sector Deal, **ending the sales of new conventional petrol and diesel cars and vans by 2040**, **developing a charging network across the UK**, including through public funding and legal obligations under the **Automated and Electric Vehicles Bill**, as well as **supporting the take-up of ultra-low emission vehicles (ULEV)** and low-emission taxis and buses, based public funding, including GBP 1 billion to support consumers to afford a ULEV*"

The main issue for the United Kingdom is then the take-up of electromobility.

MATURITY LEVEL

In 2018, **electrically chargeable vehicles (ECVs)** and **hybrid electric vehicles (HEVs)** account respectively for 2.0% and 4.0% of the market share in the UK, placing the country in second and fourth place in the EU[16].

15 / International Energy Agency 2019: Energy Policies of IEA Countries. United Kingdom 2019 Review. International Energy Agency.
16 / European Automobile Manufacturers Association 2019: Sales of zero- and low-emission cars highly unbalanced across EU, alerts auto industry. Accessed: April 22, 2020.

UK's share represents **more than 14%** of the charging points in the EU[17]with 27,000 charging stations. Regarding the **Plugins Electric Vehicles (PEV) ratio per public charging point** in 2019, the UK's ratio is 10 PEV per charging point where the EU's one is 7. Finally, in 2019, **the fast-public charging points per 100 km highway ratio** was 130 in UK, where it was only 28 in the EU.

In **Lease Plan's EV Readiness Index 2020[18]**, UK is ranked 3rd out of 22 European countries.

Considering these figures, UK has a **strong maturity level** in electromobility.

ECOSYSTEM AND GOVERNANCE

THE ROLE OF PUBLIC AUTHORITIES IN DEVELOPMENTS

Public authorities are pushing on electromobility. UK's government proposed as part of its Industrial Strategy a "**Road to Zero**"[19] plan in 2018, in order to clean the road transport, which encompasses:

- A long-term objective of ending the sale of new conventional petrol and diesel cars and vans by 2040;
- Fostering the development of a charging infrastructure and grants schemes to cover home-charging, in-street-charging points -especially in urban areas-, workplace charging points and install new charging points in new buildings.

More recently, in November 2019 **the Office for Low Emissions Vehicles published a 'league battle' of data showing the availability of public car charging infrastructure across the country**[20] and warned about gaps in provision. It was the occasion to recall the different grants schemes for electromobility in 2019/2020:

- "*On-street residential charge point scheme (£5 million);*
- *Workplace charging scheme (£500 per charge point socket and £10,000 per business);*
- *Electric vehicle home charge scheme (£500 per charge point socket);*
- *UK's Government announced a £400 million charging infrastructure investment fund, which aims to catalyse private investment in charging infrastructure*"[21].

Different public funds have been proposed in the Automotive Sector Deal to stimulate private investment as for example "*a new £400m Charging Infrastructure Investment Fund (£200m from the government to be matched by private investors); and providing £200m Office for Low Emission Vehicles R&D funding over the current spending review period*"[22]

ACCEPTABILITY OF CLIENTS, USERS, TAXPAYERS

In the same Deloitte study[23] as mentioned above, we observe that 37% of the consumers would choose an alternative powertrain for their next vehicle in 2019 where only 27% had the same opinion in 2018. The "**UK perspectives from Deloitte's Global Automotive Consumer Study**"[24] published in 2018 showed that consumers biggest concerns in purchasing an electric vehicle are the driving range (26%), the cost/price premium (24%) and the lack of electric vehicle charging infrastructure (22%).

According to **the research institute Cetelem (2019)**[25], in response to the question "Would you say that there should be more, less or neither more nor less policies (national and local, financial and non-financial) to support the electric vehicle?", 47% of consumers answered "More" and 46% "No more, no less". These scores are almost identical than the ones for US consumers, but rather differ from the rest of the European countries.

17 / European Alternative Fuels Observatory: United Kingdom. Accessed: April 24, 2020.
18 / Lease Plan 2019: EV Readiness Index 2020. A comprehensive analysis of the preparedness of 22 European countries for the electric vehicle revolution. Lease Plan.
19 / Department for Transport 2018: The Road to Zero. Next steps towards cleaner road transport and delivering our Industrial Strategy. HM Government. London, UK.
20 / Department for Transport 2019: Electric vehicle charging devices by local authority. Government UK. October 2019.
21 / Department for Transport et al. 2019: New 'league table' reveals electric car charging availability across UK as Transport Secretary calls on local authorities to do more. Government UK. November 2, 2019.
22 / HM Government 2018: Industrial Strategy: Automotive Sector Deal. Open Government. London, UK.
23 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
24 / Deloitte 2019: 2019 Deloitte Global Automotive Consumer Study. Advanced vehicle technologies and multimodal transportation. Europe. Deloitte Development LLC.
25 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

Also, 76% consider that "there are not enough public charging stations for electric vehicles on the road" and 66% consider that "public charging stations for electric vehicles on the road" are not correctly located, which is the higher score comparing to the other countries. 49% consider that the electric vehicle does not have an acceptable range.

As a summary, the document states " ***The British are the least confident in the future of VE. Yet, paradoxically, they attribute to it a larger market share in 2030 than the world average.***"

TECHNOLOGICAL CHOICES

As seen above, UK prioritises mainly the take-up of electromobility.

Nevertheless, it also expresses some interest in hydrogen: In "**Road to Zero**"[26], the ability of hydrogen to reduce greenhouse gas emissions from the transport sector is clearly stated: "*Hydrogen fuel cell electric vehicles also have zero tailpipe emissions. Like battery electric vehicles, their well-to-wheel greenhouse gas emissions depend on the method of energy production".*

In this path, the UK's Government proposed in 2017 **an active £23 million Hydrogen Transport Programme** until 2020 and found a successful consortium: "*which includes Shell, ITM Power, Toyota, Hyundai and Honda as well as fleets users such as the Metropolitan Police and Green Tomato taxis. It will see four new Hydrogen Refuelling Stations being built, upgrades to five existing stations and the deployment of 193 FCEVs (hydrogen fuel cell electric vehicles)*".

ROLE OF ROAD INFRASTRUCTURE AND ITS EQUIPMENT

Here, the focus is much more on road equipment. Indeed, the need **to develop the charging network for electric vehicles** as well as for other types of vehicles - such as hydrogen - is the major challenge to be met to enable this market to take off. Most of the government's strategy is focused on this type of mobility.

ECONOMIC MODEL AND FINANCING

The United Kingdom uses incentives through subsidy or bonus schemes for the purchase of a vehicle or the installation of charging stations to support this market. They also use financing funds to attract investors in different types of low-carbon mobility, mainly in electromobility.

26 / Department for Transport 2018: The Road to Zero. Next steps towards cleaner road transport and delivering our Industrial Strategy. HM Government. London, UK.

UNITED KINGDOM

POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy

Head of state: Her Majesty Queen Elizabeth II

Head of government: Boris Johnson

ECONOMIC INDICATORS

GDP (2018): 2.825.208 million USD / Rank: 5/205

GDP growth (2018): 1,4%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 0,6 (2017)
- Industry (including construction), value added (% of GDP): 17,9 (2017)
- Services, value added (% of GDP): 70,6 (2017)

Population (2018) : 66,488 million

Urban population (2018): 83 (% of the total population)

Energy supply /Total primary energy supply by source (2018):

Natural Gas (38,73%)/ Coal (4,55%) / Hydro (0,26%) / Biofuels/Waste (8,68%) / Oil (34,60%) / Nuclear (9,67%) / Wind & Solar (3,46%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 36/141

Total des dépenses routières (2016) : 11.954,937 million USD

Total length of the road network (2016): 422.097 Km

Road density (km per one hundred sq. km) (2016): 173

Network length by road category (2016):

- Motorways: 3.764 km
- Main / Principal roads: 48.902 Km
- Secondary / Regional roads: -
- Other Roads: -

ARGENTINA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Argentina is working to reach the level of infrastructure connectivity required to support new mobility. A lack of investment, financing and of quality infrastructure is prevailing. There is a huge difference between major cities and the rural areas which may lead to different trajectories when analyzing the development of new forms of mobility. Most initiatives are taken on metropolitan city level.

Historical volatility of economic growth and the accumulation of institutional obstacles have impeded the country's development. Back in 2018, Argentina went through a series of external and internal factors including a severe drought, global financial volatility in emerging markets following the Fed's adjustment of the interest rate, and market perceptions on the pace of fiscal reforms. Together with the International Monetary Fund (IMF), Argentina announced a program worth 57 billion USD which was supposed to stabilize public accounts to reach a primary fiscal balance by end of 2019. This target has not been reached yet. The current economic balance in Argentina is rather precarious. The local currency devalued significantly in 2019, annual inflation is over 50% and GDP has contracted 2.5% in 2018, and another 2,5% in the first half of 2019[2].

The priority in Argentina thus lies on safety and on improving the road condition. The deteriorated road infrastructure needs improvements in order to reduce the accident rate and impulse local and regional economies. However, on a major city level, **urban mobility** initiatives are being promoted and progress is being made to attribute more space to public transport, cyclists and pedestrians.

At the COP22 Argentina considered the scenario to reduce GHG emissions of 18% by 2030. The transport sector accounts for 12% of the total GHG of the country. This implies that, Argentina will have to promote the **electrification of its transport**[3]. In general, a rather slow development can be noticed. New forms of mobility, such as electromobility, autonomous mobility or MaaS, are under study but are still not a short-term reality. There are notably a few electric buses circulating in Buenos Aires and Mendoza.

Concerning **autonomous mobility**, the focus lies on legalizing ride sharing in major cities and creating a solid foundation for the anticipated commercial introduction of AVs in the next four to five years[4].

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea
2 / The World Bank Group 2019: *The World Bank in Argentina. Overview*. Accessed: April 22, 2020.
3 / Ubogui, Matias E.; Turturro, Gaston A.; Jofré, T. Fernando; Deuschle, Federico A. 2017: Impact Assessment of Electro Mobility development in Buenos Aires City on GHG emissions, energy efficiency and noise levels. EVS30 Symposium. Stuttgart, Germany.
4 / Bloomberg Philantropies; The Aspen Institute 2017: *Buenos Aires, AR is preparing*. Acessed: April 22, 2020.

Ecosystem and governance
The role of public authorities in developments

URBAN, ACTIVE & SOFT MOBILITY

Buenos Aires' Sustainable Mobility Plan (2011)

Within the framework of this plan, several road works have been carried out in order to meet the objective of prioritizing public transport modes. The City of Buenos Aires has implemented two key projects to contribute to sustainable transport:

• The first Bus Rapid Transit (Metrobus)

It was launched in May 2011 and it is the first bus rapid transit system in the city and in the country. It operates 24 hours a day, 365 days a year. Fares are equal to those of regular buses within the city. A reduction in travel time and an increase in the number of passengers has been noted so far. Car traffic has dropped in the city center by 85% and annual CO2 emissions went down by 5.612 tons.

• The first Bike Sharing System (Mejor en Ecobici)

The city has also developed the on-street bike lane network across the city's central area, connecting key transport hubs, office buildings and universities.

To ensure cyclists' protection, the city also implemented bike lanes segregated from car traffic (added 192 km of bike paths). Bicycle stations are also located throughout the city along roads and near public buildings. At the very beginning of the project, the system had already grown to 700 bikes (now 4000), 20 stations (now 400), an average of 2,500 daily bike trips (now 30 000), and 25,000 users (now 435 000)[5].

Urban mobility projects in Buenos Aires have been carried out. In 2015, a **Sub-secretariat for Sustainable Mobility** has been created within the **Transport Secretariat of Buenos Aires**. Main priorities of the sub-secretariat were, among others, the development of the bicycle as a "self-sufficient" transport mode.

The Sub-secretariat has fixed the aim of developing around 25 km of cycle paths per year and of strengthening the public bicycle system[6].

Sustainable Urban Mobility Plan in Cordoba

Within the framework of the Euroclima+ Programme, financed by the European Union, the French Development Agency (AFD) and the Municipality of Córdoba have signed a non-refundable cooperation agreement amounting 600,000 EUR in 2019.

The project's objectives are to update the current Sustainable Urban Mobility Plan and formulate Mobility Strategies for the city center of Córdoba. This is supposed to help establish a transport offer adapted to the inhabitants' needs and to combat climate change[7].

DECARBONISED & ELECTRIC MOBILITY

Projection of electric car penetration is estimated at 5% of sales by 2025 and 25% in 2030.

Since 2015, the Argentinian power generation sector has been showing the first intentions to drive a change in the technology mix and in the path of adding new capacity to the grid[8]. However, these intentions can be put into perspective as no concrete policy action is taken to support those changes.

The Argentinean Government published a resolution in May 2017 aiming at reducing the importing fee for electric, hybrid and fuel cell vehicles, from 35% to 5%, 2% or 0% depending on the vehicle category. This measure is expected to boost the demand for EVs. However, the resolution expires in mid-2020 and it is unclear whether it will be renewed. So far, this resolution hasn't contributed to many changes.

The National Government has also signed contracts to start the construction of one new nuclear power plant and two hydro power plants with a total capacity of 1.740 MW, which will deliver 5.100 GWh/year when reaching the commercial operation date.

5 / United Nations Sustainable Development Goals Knowledge Platform: *Sustainable Transport Award - Buenos Aires*. Accessed: April 22, 2020..
6 / Buenos Aires Ciudad 2.0 2016: *3 questions à Paula Bisiau*. Accessed: April 22, 2020.
7 / Ambassade de France en Argentine 2019: *Le Plan de Mobilité Urbaine Durable à Córdoba : une initiative conjointe de l'*AFD et l'UE. Accessed: April 22, 2020.
8 / Ubogui, Matias E.; Turturro, Gaston A.; Jofré, T. Fernando; Deuschle, Federico A. 2017: Impact Assessment of Electro Mobility development in Buenos Aires City on GHG emissions, energy efficiency and noise levels. EVS30 Symposium. Stuttgart, Germany.

The National Energy and Mining Ministry (MinEM), together with the Wholesale Electricity Market Administrator launched a tender package with the aim of adding high-efficiency thermal units.

The National Renewable Law 27.191 in force since 2016 was aiming at fostering capacity deployment to deliver 20% of renewable energy by 2025[9]. The new government elected in October 2019 seemed to have abandoned this target as the new priority is to develop shale gas and oil.

The City of Buenos Aires committed itself in 2015 to substitute a total of 40.000 buses for cleaner ones by 2020, although it is not yet clear whether the new vehicles will be electric or just using an alternative fuel other than diesel.

Government change: Impact on the use of fuel

Under the former President Mauricio Macri

Environmental spending nearly reaches 0.1% of GDP. Macri had undertaken a major step towards renewable energy, launching over 150 projects (around a third operational) which have contributed to double the share of the national energy grid to 8% with a full potential of 15%. These initiatives have however been held back due to the austerity measures over the last years.

Under the new elected President Alberto Fernández elected in October 2019

The creation of a Mining Ministry offering tax breaks has been announced. Fernández implied to submit environmental policy to a federal pact between the national government and the provinces, many of which value mining and oil resources above alternative energy use.

It can be said that the importance attached to earnings from agricultural, energy and mining exports (sectors accounting for about 91% of the country's pollution) is a common denominator among the political parties[10].

AUTONOMOUS & CONNECTED MOBILITY

The government of the City of Buenos Aires announced its support to the local development of new technologies, including those impacting the automotive industry.

No regulations related to driverless vehicles have been issued yet. However, in July 2015, the Government of the City of Buenos Aires tested driverless vehicles manufactured locally in a closed circuit belonging to the Argentine Automobile Club (which is not a public road)[11]. Since 2015 however, not much information is issued on this initiative.

Initiatives do exist on capital city level: Buenos Aires is, among 10 other cities, participating in the **Bloomberg Aspen Initiative on Cities and Autonomous Vehicles**. These cities are working together to ensure that cities can maximize the benefits, and minimize the risks, of autonomous vehicles. In 2017, Buenos Aires hosted the world's first autonomous auto race, also called the **Roborace**. Beyond the racetrack, Buenos Aires is proceeding with caution in deploying AVs[12].

Ecosystem and governance
Weight of industrials

ALL FORMS OF MOBILITY

Argentina is the world's largest exporter of soy-derived products and the world's third largest producer of such products. Soy and sugar cane are extensively cultivated for bio-fuel production. As a result, the country is the world's largest exporter and fourth largest producer of biodiesel.

Rich in energy resources, Argentina also has a great potential in terms of raw materials: it is the fourth largest natural gas producer in Latin America, has the world's second largest shale gas reserve and the fourth largest lithium reserve[13].

9 / Ubogui, Matias E.; Turturro, Gaston A.; Jofré, T. Fernando; Deuschle, Federico A. 2017: Impact Assessment of Electro Mobility development in Buenos Aires City on GHG emissions, energy efficiency and noise levels. EVS30 Symposium. Stuttgart, Germany.
10 / Iglesias, Eugenia 2019: *Climate* changing faster than politicians. Buenos Aires Times. October 19, 2019.
11 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
12 / Bloomberg Philantropies; The Aspen Institute 2017: Buenos Aires, AR is prepar*ing*. Acessed: April 22, 2020.
13 / Société Générale 2019: Argentinia: The *Market*. Accessed: April 22, 2020.

Under the current presidency, Argentina will value mining, oil and shale gas resources and their corresponding industries.

DECARBONISED & ELECTRIC MOBILITY

In the border triangle of Bolivia, Chile and Argentina, 70% of the world's lithium deposits are to be stored. Lithium is needed to produce electric car batteries. In times of growing energy transition aspirations, the demand for lithium is growing rapidly. But the extraction of lithium, as it is carried out at the moment, threatens the livelihood of the indigenous population.

It is to be noted that the largest lithium reserves are in South America and demand is growing rapidly. Mining companies therefore want to expand production in Argentina. Some Argentinian political representatives are stating that the lithium production in Argentina will even become the key economic industry of the future.

The mining company **Sales Jujuy** is one of the leading lithium producers in the region - a consortium that includes the Australian company **Orocobre** and the Japanese car manufacturer **Toyota**[14].

Ecosystem and governance Acceptability of clients, users, taxpayers

ALL FORMS OF MOBILITY

Argentina is a heavily unionized country. The union of the truck drivers "Sindicato de Camioneros" is deemed to be a powerful union.

Automatization, platooning and other initiatives (billing the use of the road, "polluter pay principle" etc.) may lead to a lack of acceptance and support for new forms of mobility.

Technological choices

DECARBONISED &ELECTRIC MOBILITY

The potential shift from a strong dependent thermoelectric capacity (mainly natural gas, fuel oil and gas oil) with 64% in 2018 to a diverse mix of 23%, 35% and 28% of thermo, renewables and hydro respectively can be observed. This change would be in line with the above mentioned 27.191 Law, with Argentina's commitments for COP 22 and mainly with the decarbonization pathway[15].

However, the technological orientations may change with the new government recently elected.

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

The role of road infrastructure and its equipment would be to impulse local and regional economies and to connect different areas of the country.

- Reduce accident incidence rates.
- Regulate and generate conditions in which new methods of transport can insert themselves into preexisting structures.

Customized infrastructure

Infrastructure will have to offer customized solutions: access may not necessarily be equal, but specific needs could be better met through a variety of solutions.

New designs of roads would be needed considering the idea of flexibility in uses.

14 / Götze, Susanne 2019: *Lithium-Abbau in Südamerika*Kehrseite der Energiewende. Deutschlandfunk. April 30, 2019

15 / Ubogui, Matias E.; Turturro, Gaston A.; Jofré, T. Fernando; Deuschle, Federico A. 2017: *Impact Assessment of Electro Mobility development in Buenos Aires City on GHG emissions, energy efficiency and noise levels*. EVS30 Symposium. Stuttgart, Germany.

Access to new forms of mobility

ALL FORMS OF MOBILITY

- Need to cover entire cities with network and bus lines in order to minimize the risks of having a city divided into periphery and outlier zone (aim to remove invisible barriers);
- Need to ensure safe and comfortable travel experiences;
- Understand resident's travel patterns and aggregate information from various transport methods in order to offer transport that caters specific needs (on demand).

Data challenge and control

ALL FORMS OF MOBILITY

The former President Mauricio Macri submitted to National Congress a bill aiming to replace in its entirety the Personal Data Protection Law in force since 2000. The bill was submitted in a context in which international legislations, and more particularly those in Latin-American countries, are being revisited. The digital era and the European General Data Protection Regulation (GDPR) fostered the need for new legislation which:

- revisits general concepts such as personal data and sensitive data, and it incorporates new ones;
- includes accountability obligations and eliminates the requirement of the registration of databases containing personal data;
- acknowledges for the first time the right to be forgotten;
- incorporates new regulations in connection with sensitive data;
- includes an obligation to notify data breaches (in line with the GDPR provisions);
- includes the obligation to appoint a data protection officer for: public agencies, processing of sensitive data as a principal activity and Big Data activities[16].

Economic model and financing

ALL FORMS OF MOBILITY

There are four channels of funding infrastructure projects in Argentina:

- National Treasury for public works on the national interconnection network, with an annual budget approved by an Act of Congress (1.500 million USD/year). In some cases, this is supplemented by funds derived from credits from MDBs. This total amount can be reduced (and will not grow next year), due to zero primary deficit commitments with the IMF;
- Provincial treasuries for public works in provinces, with annual provincial budget (300 million USD/year);
- Fund formed by a contribution on fuels, called Sisvial. At this time and for several years to come, the expected flow of this fund is committed to the repayment of PPP road projects, contracted in 2018 (approximatively 500 million USD/year);
- Payments for (partial) availability and (partial) user tolls in PPP projects. Currently only 6 road projects are contracted, with payments for future availability, guaranteed by the SISVIAL.

The outlook is deemed to be rather moderate, at least until the macroeconomy recovers and external credit can be accessed to finance PPP programs.

16 / Fernandes, Diego 2018: *Argentina's new* Bill on Personal Data Protection. International Association of Privacy Professionals, Inc. 2018. October 2, 2018.

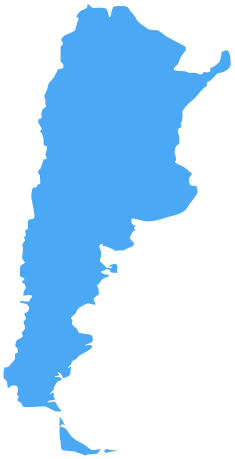
ARGENTINA

POLITICAL ORGANISATION

Nature of the regime: Federal Republic (24 provinces)

Head of state: President Alberto Fernández

Head of government: President Alberto Fernández



ECONOMIC INDICATORS

GDP (2018): 518.475 million USD / Rank: 23/205

GDP growth (2018): -2,5%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 25,6 (2017)
- Industry (including construction), value added (% of GDP): 21,8 (2017)
- Services, value added (% of GDP): 56,8

Population (2018) : 44,49 million

Urban population (2018): 92%

Energy supply /Total primary energy supply by source (2017):

Natural Gas (53,43%)/ Coal (0,97%) / Hydro (4,05%) / Biofuels/Waste (4,62%) / Oil (34,91%) / Nuclear (1,91%) / Wind & Solar (0,06%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 92/141

Total road expenditures (2017): 304.584 million USD

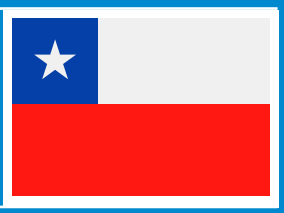
Total length of the road network (2016): 241.038 Km

Road density (km per one hundred sq. km) (2016): 09

Network length by road category (2016):

- Motorways: -
- Main / Principal roads: 39.938 km
- Secondary / Regional roads: 201.100 km
- Other Roads: -

CHILE



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In Chile, governance and the division of competences regarding planning of transportation and infrastructure is highly centralized but fragmented. There is a lack of regional planning and coordination between planning departments (transport, urban planning, public works).

The current social unrest in Chile has led, among a part of the population, to put in question the Chilean economic system as a whole. Although protest broke out because of a rise in the metro rush-hour price, the main problem crystallizes around education and pensions[2]. This may change the government's political and economic priorities and allocation of revenues. There is also awareness that urban and transport issues need to be better integrated into current policies.

There has been a quick increase in non-motorized mobility modes such as bikes and e-scooters from 2018 on in major cities. However, there is no global policy promoting **urban mobility** as the provision of bicycle stations etc. is done by municipalities themselves. There is thus no global coverage of urban mobility initiatives. Also, it is argued that Chile is not moving fast enough in terms of making cities more livable and less car orientated.

The transport sector is the second largest contributor to Chile's greenhouse gas emissions, behind electricity production, which still comes mainly from fossil sources. Transport accounts for 24.1% of the country's emissions, with 26.9 Mteq CO2 in 2016. Transport emissions have increased faster than other sectors with an increase of 191.8% since 1990, compared to 114.7% for Chile's overall emissions. The government is involved through the release of its **electric mobility** strategy, but concrete actions are slow to materialize.

Also, except for taxis, Chile does not grant incentivizing subsides for the purchase of EVs. However, Chile has the intention of electrifying mobility services and public transport, especially buses with the aim to have a 100% electric bus fleet by 2040. Industry involvement is rather limited since Chile does not have an automotive industry that could drive mobility changes within the country.

No clear regulation exists on **autonomous vehicles**. However, an agreement between the Ministry of Transport and Telecommunications (MTT) and the Interamerican Development Bank (IDB) for the testing of autonomous vehicles in Chile was signed in July 2019. The test phase has already been launched. Through this pilot experiment, the MTT should be able to acquire more knowledge of AVs in order to establish future regulations.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

2 / Louis, Jean-Philippe 2019: *Le Chili, une économie dynamique aux fortes inégalités*. Les Echos. October 22, 2019.

Ecosystem and governance
The role of public authorities in developments

ALL FORMS OF MOBILITY

Urban Transport Planning

Urban transport planning in Chile's 25 largest urban areas is under direct responsibility of the **Transport Planning Secretariat (Sectra)**. While transport plans (including cycling lanes) are conceived by Sectra, they are not binding for municipalities. This could change, but that will depend on the revision of the Constitution. Municipalities are thus developing their own policy in this area without necessarily creating cohesion with neighboring municipalities.

Major road infrastructure is managed by the **Department of Public Works (MOP)**.

Local governments have little authority over roads. Minor changes in roads however (extensions, improvements) are funded and managed at a local level and are thus subject to different budgetary realities, meaning that districts with larger budgets are more capable of carrying out changes.

Urban Planning Rules

Municipalities adopt municipal regulatory plans, which define roads and urban planning rules. The frequency of updates of these plans varies according to the technical and financial capacities within municipalities.

Public Transportation

Public transportation in large cities is under the direct authority of the **Ministry of Transport and Telecommunications**. Local authorities have little autonomy in this area but are largely independent in urban planning. This highly fragmented organization makes it difficult to carry out any infrastructure project that is to be built on the territory of several municipalities. The authorities are aware of the problem but are still struggling to find an appropriate solution[3].

URBAN, ACTIVE & SOFT MOBILITY

The National Action Plan on Climate Change 2017-2022 (PANCC-II) contains several measures relating to transport. It provides for the updating of urban transport plans and the improvement of Santiago's public transport system as well as adoption of energy efficient standards and the increased use of more efficient modes of transport. This plan also aims to reduce GHG emissions associated with urban planning (via soft mobility) and the reduction of pollutants (generated by freight transport).

The Ley de Convivencia was recently established, attempting to regulate the sharing of the street-space between all users (vehicle, bikes, scooters, pedestrians).

A quick increase in e-scooters has been noticed from 2018 onwards as well as in bikes and cycling lanes which have doubled in Santiago from 2% in 2006 to 4% in 2012 and are now estimated at 7%.

Side-walk extensions are carried out for pedestrians and bike paths.

Free Floating

Providing charging stations or bicycle stations falls under the responsibility of **municipalities**, which independently negotiate with companies/ suppliers. There is therefore no global policy to promote the development of alternative modes of transport in, for example, the Greater Santiago, which includes 34 municipalities.

Example: The Greater Santiago has several self-service bicycle systems with partial coverage of the territory for each system **(e.g. BikeSantiago)**. Two other free-floating systems do exist: the **Chinese Mobike** and the American system **Scoot**. These systems operate mainly in the wealthy municipalities. They negotiate with each municipality about their conditions of operation.

Electric scooters

Four electric scooter systems are operating within the Great Santiago. Lime (United States), Scoot (United States), Grin (Mexico) and Hop (Chile)[4].

3 / Suphanvorranop, Ekkaphol, Conseiller développement durable pour le Cône Sud, Service économique régional - Ambassade de France à Buenos Aires.
4 / Suphanvorranop, Ekkaphol, Conseiller développement durable pour le Cône Sud, Service économique régional - Ambassade de France à Buenos Aires.

Ecosystem and governance
The role of public authorities in developments

DECARBONISED & ELECTRIC MOBILITY

The Chilean Ministry of Energy defined an electric mobility strategy but without the other public bodies being consulted. Even though the subject is included in **Chile's Energy Policy 2050**, the declarations have not yet been translated into concrete actions. Skills and initiatives are fragmented.

In the absence of sufficient subsidies for the acquisition of private vehicles, the development of electric cars and charging networks is slower.

197 vehicles were sold in 2018 and the target for 2022 is also rather limited, with 2430 vehicles circulating (including buses).

There is currently no tax advantage for the purchase of EVs, apart from the aid granted by the **Ministry of Transport** for the renovation of taxis under the "Renueva tu colectivo" programme (around 7500 EUR). Nevertheless, due to the lack of information and publicity, it still fails to attract interest from taxi owners.

However, under the **National Electric Mobility Strategy**, Chile has a target of 100% electric public transport by 2040 and 40% share of EVs by 2050.

Santiago now has the largest fleet of electric buses outside China. A system has been set up for the 411 electric buses that the Metropolitan mobility network (RED) will have by the end of 2019. The Greater Santiago bus network was divided into 7 lots, with the operators also owning the buses. However, the low quality of vehicle maintenance and the problems encountered by some operators led the Regional Public Transport Division (DTPM) to separate the operation from bus ownership. In the long term, the 6,500 buses should be managed by 10 to 12 different operators.

The first call for tenders for the supply of buses is underway and the operators' call for tenders should be launched in 2020 to be commissioned by 2021.

The SE Agency (Agencia de Sostenibilidad Energética/ Environment and Energy Management Agency) is an agency of the **Ministry of Energy** responsible for setting up pilot projects and making recommendations on public policies. Funding is provided by the **Ministry of Energy** and by the **Ministry of Transport.** The SE Agency notably acts as an accelerator by encouraging and supporting companies in the deployment of EVs.

The Ministry of Transport and Telecommunications (MTT) plans to extend the development scheme for electric buses to the whole country by encouraging regional governments to make better use of the funds available to them[5].

AUTONOMOUS & CONNECTED MOBILITY

An agreement between the **Ministry of Transport and Telecommunications** and the **Interamerican Development Bank (IDB)** for the testing of autonomous vehicles in Chile was signed in July 2019. The agreement provides a three-month closed-circuit trial funded by 320,000 USD via the IDB. The tests have been carried out[6].

Ecosystem and governance
Weight of industrials

DECARBONISED & ELECTRIC MOBILITY

Electric Buses

The first electric buses have been financed by companies such as Enel and Engie.

Less than 100 electrical vehicles are currently operated by car hiring and private transport companies. A change of scale would require more incentives from the public sector.

It should be noted that Chile does not have an automobile industry and therefore imports all the vehicles.

5 / Suphanvorranop, Ekkaphol, Conseiller développement durable pour le Cône Sud, Service économique régional - Ambassade de France à Buenos Aires.
6 / Suphanvorranop, Ekkaphol, Conseiller développement durable pour le Cône Sud, Service économique régional - Ambassade de France à Buenos Aires.

Ecosystem and governance Acceptability of clients, users, taxpayers

ALL FORMS OF MOBILITY

Social divide on the evolution of the costs of mobility services

Chile has been gripped by protests against high living costs and inequality. The protests began in October as the government announced that the metro rush hour prices would rise by 30 pesos (0.04 USD).

A student-led demonstration against transport fares began although the transport price for students didn't change[7].

This poses the question of social acceptance when talking about pricing and billing new modes of mobility or of the impacts of new mobility on employment and training skills.

Already in 2017, in response to public demands, the current government has prioritized social sectors such as education and health. According to the OECD, this tendency is consistent with Chile's transition from a middle income to a high-income country. It implies that classical infrastructure investment will increasingly have to compete for resources with the social sectors. While it may not result in an overall reduction in infrastructure investment, Chile may experience a shift in the types of infrastructure being built, with perhaps a greater focus on social infrastructure (schools, hospitals) and fewer major transport projects and this might be especially true in the current climate of contestation[8].

Technological choices

ALL FORMS OF MOBILITY

Chile has a target of 100% electric public transport in 2040 and 40% share of electric cars in 2050.

This implies the development of V2G systems (vehicle to grid).

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

Operationalize mobility modes

Infrastructure should be able to measure and count people's movements. The development of infrastructure should have the role to create meeting points for people and gather incentives for people to move around.

Actions undertaken by the SE Agency

- Discussions on how to set up public and private charging networks and better understand the characteristics of EVs;
- Interoperability and V2G systems;
- Enel charging station powered by solar panels is installed at the SE Agency[9].

General accessibility of new mobility

ALL FORMS OF MOBILITY

- Better differentiation between the needs of different municipalities is needed. A regional planning approach should be adopted. Regional planning should be able to visualize the needs of different municipalities and should be capable of coordinating intercommunal projects.

- Future infrastructure needs will be more localized and will require a greater ability to identify and respond to needs at a local level[10].

- Upscaling of city initiatives to a broader regional level: Municipalities do elaborate "Mobility Plans" for their city and suburbs but these are rarely scaled-up to the regional level.

- Carry out infrastructure improvements in low-income areas by establishing a minimum level of service and making funding available to reach minimum equal levels in all territories irrespective of the budget of local governments.

7 / McGowan, Charis 2019: *Chile protests: What prompted the unrest?* Aljazeera. October 30, 2019.
8 / Organization for Economic Cooperation and Development 2017: Introduction to public infrastructure in Chile, in Gaps and Governance Standards of Public Infrastructure in Chile. Infrastructure Governance Review. OECD Publishing, Paris.
9 / Suphanvorranop, Ekkaphol, Conseiller développement durable pour le Cône Sud, Service économique régional - Ambassade de France à Buenos Aires.
10 / Organization for Economic Cooperation and Development 2017: Introduction to public infrastructure in Chile, in Gaps and Governance Standards of Public Infrastructure in Chile. Infrastructure Governance Review. OECD Publishing, Paris.

Data challenge and control

ALL FORMS OF MOBILITY

In 2018, the **National Congress of Chile** amended article 19 (on data protection) of the Constitution to include the protection of personal data as an individual right. However, this **Law No. 19.628** which defines what personal data is and how it should be processed by third parties, does not cover the processing of information through digital media and does not put any proper supervisory mechanisms in place. As a consequence, at present time, Chile does not have a data protection authority dedicated to the enforcement of its data protection legislation, but it does have a bill to modify **Law 19.628** to include provisions regarding the protection and processing of personal data. The creation of a data protection authority has also been put forward[11].

Economic model and financing

ALL FORMS OF MOBILITY

High investments in the upgrade of road infrastructure

Chile's President Sebastián Piñera unveiled a program that will involve work on over 17,000km of roads and require more than 7tn pesos (10bn USD) until 2023. Of the total, 6.21tn pesos will be invested in new highway projects and re-tendered old concessions. Another 1.12tn pesos will be used to improve nearly 13,000km of rural and indigenous roads[12].

Chile has also been successful in mobilizing private financing for the development of its infrastructure. Chile has adopted and refined the concessions model for delivering infrastructure. This explains the speed with which it has been able to build its extensive highway network.

Urban highways are run by private companies, often with direct subsidies from the government.

11 / Coos, Andrada 2019: *Data Protection Regulations in Latin America*. Endpoint Protector. March 28, 2019..
12 / Bnamericas 2019: *Chile unveils US$10bn road infrastructure plan*. Bnamericas. May 27, 2019.

CHILE

POLITICAL ORGANISATION

Nature of the regime: Republic

Head of state: Sebastian Piñera

Head of government: Sebastian Piñera

ECONOMIC INDICATORS

GDP (2018): 298.231 millions USD / Rank : 41/205

GDP growth (2018): 4%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 3,8 (2017)
- Industry (including construction), value added (% of GDP): 30,0 (2017)
- Services, value added (% of GDP): 57,6 (2017)

Population (2018) : 18,73 million

Urban population (2018): 88%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (12,84%)/ Coal (18,07%) / Hydro (5,08%) / Biofuels/Waste (19,97%) / Oil (41,53%) / Wind & Solar (2,48%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 25/141

Total road expenditures (2009): 1.473,011 million USD

Total length of the road network (2016): 82.134 Km

Road density (km per one hundred sq. km) (2016): 11

Network length by road category (2016):

- Motorways: 3.305 Km
- Main / Principal roads: 7.704 Km
- Secondary / Regional roads: 70.787 Km
- Other Roads: -

MEXICO

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

According to the World Bank, Mexico faced an intense urbanization process over the last 25 years implying unsustainable land-use leading to a twofold increase in its urban population and a sevenfold increase in its urban footprint. This has affected the city's and population's mobility patterns resulting in limited accessibility to public transport, especially in sub-urban areas and insufficient and deteriorating pedestrian infrastructure.

Low residential density and high downtown employment density is still a reality in most Mexican cities. In addition, Mexico has experienced a significant increase in private car ownership. Urban sprawl and higher motorization rates resulted in longer commuting times and led to an increase in transport-related emissions. Mexico is among Latin America's most carbon-intensive economies, and its transport sector is largely made responsible for it. This tendency is going to worsen as the Mexican vehicular fleet is expected to increase from 35 to 70 million units by 2030[2].

Urban mobility issues are well explained with the example of Mexico City: the city has increasing congestion levels and high levels of air pollution despite widespread use of public transport and despite the fact that Mexico has the second largest bike sharing system in North America. However, advancements in terms of urban mobility depend on the different cities/municipalities. The lack of urban mobility improvements is said to be the result of lax road safety guidelines and an inefficient monitoring system. The city's congestion has resulted in a growing number of traffic-related fatalities; 80% of those injured are pedestrians or cyclists[3].

Electromobility however might be the biggest boom in the country. The electric vehicle sale has increased and automotive companies developing EVs in Mexico are consolidating and see potentials in the Mexican market. The number of stations for recharging vehicles has grown significantly in the last two years. An electric corridor has been built between Mexico City and San Luis Potosí. A **National Electromobility Strategy** is also being developed on the government level.

Autonomous vehicles are not a short-term reality. The country's current economic and political condition creates barriers for taking actions in order to adopt AVs in the near future.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea
2 / The World Bank 2017: *Preparing Mexico's Urban Transport Sector for a Low-Carbon Transition*. April 6, 2017..
3 / Deloitte City Mobility Index 2018: *Mexico City*. Deloitte Insights..

Ecosystem and governance
The role of public authorities in developments

ALL FORMS OF MOBILITY

The **Ministry of Communications and Transportation** is responsible for transportation at the federal level and State Governments are responsible for transportation in cities. The transport service is provided through private companies, parastatal companies and through concessions to individuals for public transport services in cities.

The new US-Mexico-Canada (USMCA) trade agreement announced in October 2018 is expected to integrate Mexico into Canadian and US American economies and as those two countries' manufacturers invest in AVs, Mexico is likely to be involved. The USMCA agreement requires that 75% of locally used vehicle parts are made within the three countries by 2023.

However, recent changes in the Mexican Federal Government have slowed down progress nationally in terms of electric and autonomous vehicles, and road infrastructure is generally weak. Local administrations are more likely to get back to the basics, like in the case of **Mexico City**, which is pledging for a better and cleaner transport[4].

URBAN, ACTIVE & SOFT MOBILITY

Currently, Mexico has the second largest bike sharing system in North America[5]. However, maturity in terms of soft mobility depends on the different cities/municipalities:

Example: Mexico City

Since the **Transport and Roadway Law of 2002**, Mexico City is working on providing sustainable mobility options by restricting the use of private cars and expanding metro lines. It has also created the Metrobús, a bus rapid transit (BRT) system, the ECOBICI public bike-share system, zero emissions corridors, and pedestrianized thoroughfares.

While these measures are said to have improved sustainable mobility options and air quality within the city, they were deemed to be not sufficient enough to meet the mobility targets set by the city's **Transport and Roadways Law[6]**.

However, such initiatives have been widened on city and national level:

Sustainable Transport

Currently work is being carried out under the lenses of sustainable transport with various strategies to reduce energy consumption and emissions. Strategies consist in the implementation of energy efficiency standards, the modernization of transport fleets for cargo and passengers, etc. However, these initiatives are merely concentrated in a few cities/municipalities.

Programa Federal de Apoyo al Transporte Urbano Masivo (PROTRAM)

In 2008, the **Mexican Federal Government** created this program to support urban mass-transit projects with the aim to address greenhouse gas emissions through better integration of different mobility solutions in urban development and transport plans, beginning with four Mexican metropolitan areas: Ciudad Juárez, Monterrey, León, and Puebla.

Financing from the **Global Environment Facility (GEF)** and an active **Urban Transport Transformation Program** loan from the **World Bank** were used[7].

The Mobility Law 2014 recognizes mobility as a fundamental right of Mexico City's residents. As such, the law prioritizes including citizens in the planning, regulation, and managing processes of the mobility system, and incorporates principles of urban resilience, inclusive governance, and active transport.

The Law prioritizing pedestrians and cyclists establishes a mobility hierarchy that shapes the city's priorities for road use planning and budget allocation. Pedestrians are at the top of the pyramid, followed by cyclists, public transport users, and transport providers. Owners of private cars are at the bottom of the hierarchy.

4 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
5 / Deloitte City Mobility Index 2018: *Mexico City*. Deloitte Insights.
6 / Smart Cities Dive 2017: *Mexico City's New Mobility Law Shifts Focus Towards People, Not Cars*. Accessed April 29, 2020.
7 / The World Bank 2017: *Preparing Mexico's Urban Transport Sector for a Low-Carbon Transition*. April 6, 2017.

Consolidating operations for social inclusion

The new law establishes the groundwork for the creation of a regulatory body for mass transit corridors and transport operators, thus bringing more cohesion to overall transport systems in the city. This regulatory body, running since January 2015, will also be charged with protecting citizens' rights to high-quality public transport and helping public transport services to become more efficient, safe, and inclusive. The new regulatory body will also establish and enforce standards for the quality and safety of transport services.

The Road Safety Integrated Plan should improve traffic safety throughout the city. The Plan focuses on saving lives by prioritizing improved safety for pedestrians and cyclists through improvements to infrastructure design and increased road safety regulations (e.g. additional regulations for driving licenses or permits). The law also places an emphasis on resilience to extreme weather events, holding that mobility systems must be able to respond quickly, efficiently, and at little or no cost to the citizens in the event of a disruption[8].

ECOBICI is the fifth-largest public bike-sharing system in the world, with 6,800 bicycles, 480 stations, and more than 100,000 users. More than 40 million trips were made, and it was reported that EcoBici had reduced 8% of taxi use and 5% of private car use.

Ride-hailing is another major industry that shapes Mexico's modal split. However, it is reported that the explosive growth of ride-hailing services has negatively impacted public transportation in American cities. **Mexico City's 2014 Mobility Law** ensures a planning approach to impede that ridesharing platforms do compete with public transit and thus increase congestion[9].

DECARBONISED & ELECTRIC MOBILITY

Proposal from the Law on Income Tax

All persons who file tax return can deduct up to 400,000.00 pesos (21 455 USD) in the purchase of hybrid and electric vehicles regardless of the form of payment.

The Federal Electricity Commission is working on the construction of recharging centers for EVs and carries out the necessary research for the introduction of this technology in road systems.

Cities Finance Facility (CFF): Electric Bus Corridors

The CFF is supporting the cities of Mexico City, Guadalajara, Monterrey and Hermosillo to set up one of the CFFs first national clusters, focused around electrification of their public transport systems (objective: better quality of life to a city, emitting zero carbon emissions and pollution, very little noise pollution and a better ride experience). The CFF will work with officials in each of the cities to secure the necessary funding to turn the plans for new electric bus schemes into reality on the streets of Mexico. The skills developed during this process shall make it easier for the four cities to prepare and deliver future sustainable infrastructure projects and provide the knowledge for other cities to follow[10].

AUTONOMOUS & CONNECTED MOBILITY

The Mexican legislation does not include regulations, rules, or any other provisions regarding testing driverless vehicles on public roads. There are no standards or approval processes issued by government agencies regarding testing driverless vehicles.

There are neither regulations prohibiting, limiting, or restricting individuals or corporations from using driverless vehicles. In fact, the legislation does not make any reference to driverless vehicles.

Testing of a driverless vehicle was conducted in Mexico in 2015 by the Freie Universität Berlin and University of Nevada, Reno. The vehicle transited 2,400 km from the Mexico-US border to Mexico City[11].

Mexico scores low regarding government-funded AV pilots[12].

8 / Smart Cities Dive 2017: *Mexico City's New Mobility Law Shifts Focus Towards People, Not Cars*. Accessed April 29, 2020.
9 / ICLEI Local Governments for Sustainability 2018: EcoMobility Alliance Report Phase 2018. Bonn, Germany.
10 / C40 Cities Finance Facility 2019: Mexico - Electric Bus Corridors. Accessed April 27, 2020.
11 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
12 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

Ecosystem and governance
Weight of industrials

ALL FORMS OF MOBILITY

Many private companies have begun to develop mobile applications for smartphones offering mobility-related services. Three main categories of mobile apps may be distinguished in this regard: private taxi, point-to-point routes, and public transit. As public transit is not fully mapped by a public entity, private entities often need to supplement or create information. The business model of these apps makes the service free for the user and revenue is obtained from advertising on the apps themselves[13].

DECARBONISED & ELECTRIC MOBILITY

Mexico is considered to be "best-cost producer" especially for the North American market. However, the Mexican market is moving up the range:

The automotive industry is installing regional clusters and research centers where they are working on new vehicle components, electrification technology, alternative fuels or emission reduction.

Among them:

Development Centre of Nissan Technology in Toluca (State of Mexico), **Chrysler's automotive engineering research, development and testing facility** based in Mexico City, but also Mexican organizations such as the **CIATEQ** in Querétaro, and the **CTEV** in Guadalajara and the **Delphi Technical Center** in Chihuahua, etc.

Electromobility is one of the emerging trends closely followed-up by the Mexican industry. Companies with large fleets are particularly interested in EVs. Currently, electric and hybrid vehicles are imported and introduced by **Nissan, BMW, General Motors, Honda and Renault**.

Concerning production, a small-scale project of the Mexican company **Zacua** has been launched: the production of 100 small EVs (M2 and M3 models) has been launched in 2019, production should double to reach a capacity of 2,000 units per year in the medium-term[14].

Companies such as Nissan Mexicana and BMW Group Mexico reached the milestone of 500 installed chargers.

Liberalization of Mexico's electricity market, opening it to private investment by the end of 2018 is expected to boost the process of private investments[15].

However, there is a strong critic of the **2013 energy reform** that opened the energy market to private investment. The current President of Mexico has taken a more defensive stance against the private sector with regard to the oil industry. He also plans to reduce the country's reliance on imported oil derivatives by constructing a new refinery, and to increase the role of the state-owned oil company **Pemex** in the sector[16].

AUTONOMOUS & CONNECTED MOBILITY

Tesla is extending its network of charging points in Mexico. However, it can be noted that industry investments in AV are low.

Industry partnerships

The development of AV technologies implies industry partnerships between vehicle makers and technology suppliers essentially. However, Mexico does not score high on establishing industry partnerships[17].

Ecosystem and governance
Acceptability of clients, users, taxpayers

DECARBONISED & ELECTRIC MOBILITY

Mexico is one of the most optimist countries together with Brazil when assessing the future of EVs.

Mexicans' purchase intention of an EV within 5 years scores among the highest; however, it is low on a short-term period (purchase in the next 12-month).

Mexico has the largest share of respondents who find EVs too expensive, even though they are the most willing to pay extra cost to buy an EV instead of a thermal vehicle[18].

13 / British Embassy Mexico City; ITDP 2016: Smart Mobility. Diagnosis of the present situation in Mexico. ITDP Mexico.
14 / Comité des Constructeurs Français d'Automobiles; Business France 2018: Fiche Pays. Mexique. CCFA; Business France.
15 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
16 / Coface 2019: Latin America: Brazil and Mexico's oil industries – opposite policies? Coface Economic Publications.
17 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
18 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

AUTONOMOUS & CONNECTED MOBILITY

Mexico scores high on consumer acceptance although there are currently no test areas of AVs in Mexico and the exposure to AV is very low[19].

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

Geometric changes on roads and the updating of design standards are required to ensure that these new vehicles can circulate.

Changes in the design of roads are expected with regard to the way of transmitting information to users, the changes in signaling, the requirement of spaces for the implementation of ITS, systems for the uninterrupted supply of energy, etc.

Access to new forms of mobility

ALL FORMS OF MOBILITY

The objectives currently are to boost connectivity to the main rural populations of the country, so that they have a paved road that can be traveled every day of the year, in accordance with current government policies and sustainable development goals (SDGs).

National laws are required to create the legal framework of operation for the different future mobility strategies, and regulations so that cities can operate and use these systems in an approved way throughout the country.

Data challenge & control

ALL FORMS OF MOBILITY

Plan Nacional de Desarrollo (National Development Plan, PND) 2013-2018 is the federal government's open data policy. Main axes were to achieve the "Program for a Close and Modern Government 2013-2018".

The program has set forth the creation of a **National Digital Strategy (EDN)** with the objective to enable open data, among others.

The National Digital Strategy Coordination (CEDN) was created as the leading institution on this matter.

Regarding the use of technologies to foster smart mobility, nothing specific exists. Nevertheless, the EDN's objectives in terms of Government Transformation and Digital Economy can encompass policies concerning new mobility.

Data openness has not developed as much for mobility at local and state levels as at the federal level. This is due partly to the fact that no law exists to incentivize or compel the generation of standardized data or information sharing, that there is a lack of technical capability and of technical skills of public servants as well as a lack of resources to purchase technology and training[20].

Economic model and financing

ALL FORMS OF MOBILITY

Mexico has the following funds to finance road transport projects:

- Fund for Climate Change
- Sectoral Research Fund SEMARNAT-CONACYT
- National Financial (NAFIN)
- National Bank of Public Works and Services (BANOBRAS)
- National Infrastructure Fund (FONADIN)

19 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
20 / British Embassy Mexico City; ITDP 2016: Smart Mobility. Diagnosis of the present situation in Mexico. ITDP Mexico.

MEXICO

POLITICAL ORGANISATION

Nature of the regime: Federal State

Head of state: Andrés Manuel López Obrador

Head of government: Andrés Manuel López Obrador

ECONOMIC INDICATORS

GDP (2018): 1.223,809 millions USD / Rank : 15/205

GDP growth (2018): 2,0%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 3,4 (2017)
- Industry (including construction), value added (% of GDP): 30,0 (2017)
- Services, value added (% of GDP): 60,9 (2017)

Population (2018) : 126,19 million

Urban population (2018): 80%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (37,52%)/ Coal (6,55%) / Hydro (1,52%) / Biofuels/Waste (5,10%) / Oil (44,92%) / Nuclear (1,94%) / Wind & Solar (2,41%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 49/141

Total road expenditures (2016): 3.368,369 million USD

Total length of the road network (2016): 393.451 Km

Road density (km per one hundred sq. km) (2017): 20

Network length by road category (2016):

- Motorways: 9.796 Km
- Main / Principal roads: 40.681 Km
- Secondary / Regional roads: 95.855 Km
- Other Roads: 247.119 Km

CANADA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Canada has the 7th largest road network and 37th largest population in the world. It is stated that Canada has a fragmented economic environment with no national roadway authority. The highway infrastructure in Canada is maintained by the Provincial Highway Agencies and Municipal Agencies. The Federal Government provides occasional funding programs. For the most part, mobility is addressed by individual municipal agencies in their jurisdiction.

Besides, there is no tax base to support given infrastructure assets. Some publications mention that there is a lack of strategic focus by federal infrastructure programs and that the given structure is rather unsustainable. Responsibility is transferred to provinces and municipalities and some of them lack internal capacity to assess the state of their infrastructure. Thus, there is a lack of infrastructure investments aimed to improve **urban mobility** and transport. However, this trend depends on the different provinces/municipalities' resources and capacities and can vary among the different Canadian provinces[2].

Canadian cities struggle with the urban sprawl phenomena. Cities have been growing at a rapid rate, but investment in public transit has not kept pace. This has led to more traffic congestion, and long commutes.

The gridlock that results has serious financial impacts through a loss in productivity each year and is impacting the environment negatively[3]. This also results in a lack of mobility services for the "last mile" and intercity infrastructure.

The urban sprawl some cities are experiencing, has created huge distances between major urban centers making intercity rail very expensive to construct and the lack of ridership makes it difficult to fund. Urban mobility initiatives such as bikes or public transportation are handled on city-level. However, only major cities are able to carry out such initiatives.

The transportation sector is currently responsible for around 25% of Canada's GHG emissions. Over 12 million Canadians choose to use cars to get to work: 74% of commuters drive a private automobile. Heavy-duty trucking is the fastest growing sub-sector of transportation emissions[4]. 12% of Canada's GHG emissions is generated by private car use only. It has been decided that **EVs** will be heavily supported by a government assistance plan. As acceptance for EVs is rather high and financial incentives given, it is expected that EV sales will rise by 10% in 2025 and by 30% in 2030[5].

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea

2 / DOERN, G. Bruce; COLEMAN, John; PRENTICE, Barry E. 2019: Canadian Multimodal Transport Policy and Governance. McGill-Queen's University Press.

3 / Infrastructure Canada: Building Strong Cities Through Investments in Public Transit. Government of Canada.

4 / Clean Energy Canada et al. 2016: Reducing GHG Emissions in Canada's Transportation Sector. Submission to the Mitigation Measures Working Group. Pan-Canadian Framework on Climate Change and Clean Growth.

5 / Neexti 2019: *Le gouvernement canadien adopte un plan d'envergure pour le développement de véhicules électriques*. Neexti. July 11, 2019.

In Canada, **autonomous vehicles** may not be able to interpret properly potholes and other pavement defects. Weather conditions will also be a major issue (e.g. snow for Nordic countries). Canada scores among the highest when measuring commitment for government-funded AV pilots. However, road infrastructure is still relatively low tech presently and it scores low on 4G coverage. There is no current federal law backing automated driving. Legislative power for laws on automated driving principally arises at the provincial/territorial level[6]. Some provinces are already testing automated driving systems (Ontario) or issuing regulations allowing tests on public roads (Québec, Alberta).

Ecosystem and governance
The role of public authorities in developments

ALL FORMS OF MOBILITY

Currently road infrastructure is mainly publicly owned and managed. 70% of the road infrastructure in Canada is maintained by municipalities. With the increase of means and modes of transportation, it will become more complex to manage. Most likely, in the future the involvement of the private sector will increase and eventually the users themselves will take control of the networks. Decisions will be user driven rather than decided by public bodies and administrations.

Investing in Canada is a plan through which the federal government is spending more than 180 billion CAD (137 billion USD) over 12 years on a range of infrastructure.

In 2018, Canada ran a specific **Smart Cities Challenge** competition for localities. The federal government has also supported research into how AVs will change Canada's economy and job market[7].

Transport Canada is conducting an eco-technology initiative focused on studying new and environmentally beneficial technologies, including automated vehicles[8].

URBAN, ACTIVE & SOFT MOBILITY

The Public Transit Infrastructure Fund aimed to improve and expand public transit systems across Canada. The budget for 2016 announced immediate federal investments of up to 3.4 billion CAD in public transit, starting in 2016 - 2017 to be provided through a new Public Transit Infrastructure Fund.

These investments should help to improve commutes, cut air pollution, strengthen communities and grow Canada's economy. Projects include:

- Upgrades of subway tracks, bridges, signals and switches for the Montreal Metro;
- Fleet replacement, including the purchase of new subway cars, low-floor buses, and street cars by the Toronto Transit Commission;
- Accelerated design, implementation and construction work for new large-scale projects, such as new light rail transit lines in Greater Vancouver and Ottawa.

To get projects moving quickly, the government have been funding up to 50% of eligible costs for projects[9].

Mobility for the "last mile" and increase in intercity infrastructure

Recently there has been an uptake of urban rail in centers such as Vancouver, Calgary, Edmonton, Kitchener, Toronto and Montreal. 90% of the Canadian population lives within 100km of the US border. Distances between major urban centers are significant making intercity rail very expensive to construct and the lack of ridership makes it difficult to fund. Mobility for the "last mile" has thus become an interest for many communities.

Colibri project in Quebec is a 1-year pilot project in Quebec of electric cargo bikes and other zero-emission vehicles, with the aim to reduce congestion and pollution impacts of last-mile deliveries[10].

6 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
7 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
8 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
9 / Infrastructure Canada: *Building Strong Cities Through Investments in Public Transit*. Government of Canada.
10 / Ingram, Katie 2019: Zero-emission "last-mile" deliveries come to Montréal. Electric Autonomy Canada. September 30, 2019.

DECARBONISED & ELECTRIC MOBILITY

In September 2018, Canada announced that at least 30% of new vehicles sold will be EVs by 2030. However, Canada is ranking low on EV charging stations[11].

The Ministry for Innovation, Science and Economic Development Canada has however announced in April 2019 the Canadian government's national investment initiative to develop the market for zero-emission vehicles.

The government assistance plan will be available for any new or used vehicle purchase or leasing made after May 1, 2019, for a car that meets national safety standards, that is used on public roads, and is purchased on Canadian territory. Eligible cars are battery EVs, hydrogen fuel cell vehicles, and plug-in hybrids. National subventions can be cumulated with similar provincial aids. Consumers could therefore benefit from up to 10,000 CAD (7547 USD) in cumulative subventions and aids.

In the United States, 361,307 EVs were sold in 2018, an 81% increase over 2017. In comparison, the Canadian market grew by 125% in 2018.

In June 2019, 2.5% of vehicle sales in Canada were electric. This shows a positive trend: from 7,471 vehicles sold in 2015 to 18,614 in 2017. With the new national investment initiative, Canada wants to achieve a 10% of sales in 2025, to reach 30% in 2030. This would represent 825,000 zero-emission vehicles in service by 2025[12].

It is to be noted that the maturity levels differ among the different provinces.

The Government of British Columbia (BC) announced in December 2018 a "Vision Zero Emissions" standard to help achieve progressive sales targets, with the goal that all vehicles sold in the province will have zero emissions by 2040, as set out in the **CleanBC climate strategy**. BC Hydro, in collaboration with the BC government and with the support of **Natural Resources Canada**, has expanded the rapid charging network in the province, which serves 7 highways for a total of 3000 km accessible to EVs.

The City of Laval launched a financial assistance program for the purchase of EVs in 2018. Residents are eligible for a rebate of 2,000 CAD for the purchase of a 100% electric vehicle and 400 CAD for an electric bicycle. As of October 2018, Laval had received 163 requests for EV assistance and 221 requests for bicycle assistance. Although this type of funding is common in Europe, this is a first for a Canadian municipality.

The Government of Quebec unanimously adopted in June 2018 the Act to Promote the Establishment of a Public Rapid Recharge Service for EVs. This new law authorizes **Hydro-Québec** to finance the installation of rapid-recharge stations from revenues generated by the increase in electricity sales generated by recharging, which is mainly done in homes of electric vehicle drivers and therefore has no impact on electricity rates[13].

AUTONOMOUS & CONNECTED MOBILITY

The Federal Budget 2016 approved the disbursement of 7.3 million CAD over two years to support the development of a regulatory framework that is tasked with monitoring emerging transportation technologies, including AVs.

The National Innovation Agenda announced in the 2017 budget that the Canadian Innovation and Skills Plan should become an ambitious effort to make Canada a world-leading center for innovation, to create well-paying jobs and to help the middle class to strengthen and grow[14].

Autonomous vehicles

There is no current federal law enabling automated driving. Legislative power for laws on automated driving principally arises from the provincial/territorial level based upon constitutional law interpretations[15].

Transportation Association of Canada (TAC) 2019

A "Discussion Paper on Connected and Automated Vehicles" intended to inform efforts by the **TAC** related to CAVs. **TAC** activities are primarily concerned with the infrastructure and road user systems rather than the vehicle system. The arrival of CVs and AVs however, requires **TAC** to expand its role as expert in addressing transportation challenges related to the infrastructure and road user systems.

11 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.
12 / Neexti 2019: *Le gouvernement canadien adopte un plan d'envergure pour le développement de véhicules électriques*. Neexti. July 11, 2019..
13 / Mobilité Electrique Canada 2018 : Rapport annuel. Mobilité Electrique Canada.
14 / Cutean A. 2017: Autonomous Vehicles and the future of work in Canada. Information and Communications Technology Council (ICTC). Ottawa, Canada.
15 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

Interoperability with US standards

It is interesting to note that CV communication standards (e.g. Dedicated short-range communications vs. 5G) are an important issue that will likely be determined by the **US Federal Communications Commission** through legislation. Since the transportation systems of Canada and the US are integrated, the same communications standards will apply to both countries. Interoperability and the advanced state of development and testing in the United States require a re-examination of TAC guidelines and best practices documents that build upon their American equivalents[16].

The Motor Vehicle Safety Group of Transport Canada and the National Highway Traffic Safety Administration have a working group under the **Regulatory Cooperation Council (RCC)** to conduct joint research and testing with the intention of introducing aligned requirements or directives in the longer term on automated driving.

The Canadian Council of Motor Transport Administrators AV Working Group is a secretariat representing all transport ministries in Canada and **Transport Canada**. The objectives of the working group are to increase knowledge and educate committee members about CAVs with a specific focus on the role of jurisdictions and to develop a roadmap to help Canadian jurisdictions plan a nationally harmonized regulatory framework.

Ontario Pilot Project

The only law enabling automated driving is in Ontario via the **Ontario Pilot Project** with the province of Ontario having taken a particular lead in issuing permits for AV testing on public roads.

Under the **Ontario Pilot Project,** manufacturers of AVs, along with technology companies, academics and research institutions, auto parts makers, and automated systems companies may apply to the **Ministry of Transportation** for the opportunity to test their AVs within the test project.

The following three companies applied to participate in the Ontario Pilot Project:

- The **University of Waterloo** will be operating a Lincoln MKZ hybrid sedan, dubbed Autonomose;
- The **Erwin Hymer Group**, an international automaker with a research center in Waterloo, will be testing a Mercedes-Benz Sprinter Van;
- **BlackBerry QNX** will test a 2017 Lincoln and will be developing its software in association with the pilot project[17].

The **Province of Quebec** (2019) has used the AV framework from the federal government to implement legislation that will allow for AV testing on public roads. The **province of Alberta** is also in the process of updating their regulations to allow for AV testing on public roads. In other provinces, legislation for CV and AV testing is being developed[18].

Keolis Canada and the City of Candiac, supported by the **Québec Government** via the **Ministry of Transport, Sustainable Mobility and Transport Electrification**, and in collaboration with **Propulsion Québec**, the Cluster for Electric and Smart Transportation and the **Technopôle IVÉO** have set up a pilot project of a 100% electric autonomous shuttle on public roads, a first in Canada. Financial assistance of 350,000 CAD was made available by the **Ministère de l'Économie, de la Science et de l'Innovation (MESI)** through the **Innovation Program** to support demonstration projects[19].

Ecosystem and governance
Weight of industrials

ALL FORMS OF MOBILITY

Roadway infrastructure and vehicular developers need to cooperate much more closely (pavement engineers and designers are said to lag behind in developing infrastructure for vehicular traffic).

16 / Transport Association Canada 2019: Report: Discussion Paper on Connected and Automated Vehicles. IBI Group.
17 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
18 / Infrastructure Canada: *Building Strong Cities Through Investments in Public Transit*. Government of Canada..
19 / Keolis Canada 2019: *A 100% electric autonomous shuttle on public roads*. Accessed April 22, 2020.

Toronto Sidewalk Labs

Public Waterfront Toronto joined forces in 2017 with Sidewalk Labs, a subsidiary of Alphabet, the parent company of Google, which is entrusted to transform one of the remaining wastelands on the Ontario shoreline within a project called Quayside[20].

Issues have been raised concerning data management and concerning the risk of substitution of other traditional industrial companies.

DECARBONISED & ELECTRIC MOBILITY

In October 2018, **FLO and ChargePoint** announced an interoperability agreement that will simplify the charging experience for EV drivers across North America. The interoperability allows members of the **FLO** and **ChargePoint** networks to access public charging stations on both networks in Canada and the United States without having to create multiple accounts and without incurring additional fees.

In March 2018, Ontario's first charging station plant opened in Markham. **Autochargers.ca**, a national electric vehicle equipment company, plans to manufacture 40,000 charging stations annually starting in 2019 and create 100 jobs over the next three years. The new plant has a production capacity of 60,000 terminals per year[21].

The Canadian government's national investment initiative was designed to develop the market for zero-emission vehicles announced in April 2019 by **the Ministry for Innovation, Science and Economic Development.** This initiative also includes tax compensations for companies when purchasing zero-emission vehicle.

Joint work between the public sector and manufacturers is announced to ensure that production meets the expected growing demand for EVs. In all, a total of 320 million CAD is being invested in stations and charging infrastructure.

The Canadian government has invested 6 billion CA in the automotive sector with the aim to ensure that a major part will be dedicated to R&D, in order to ensure a continuous development in EV technologies[22].

AUTONOMOUS & CONNECTED MOBILITY

General Motors committed to hire several engineers to work on AVs in Ontario. Similar commitments were made by policymakers but also industry leaders like **Ford** or **QNX**[23].

Other involved players setting up pilot projects: **Propulsion Québec**, the **Cluster for Electric and Smart Transportation** and the **Technopôle IVÉO**.

Ecosystem and governance Acceptability of clients, users, taxpayers

DECARBONISED & ELECTRIC MOBILITY

64% of the country's consumers are in favor of a car fleet composed of a majority of EVs. The Canadian population would globally be in favor to purchase EVs and to develop dedicated infrastructure, as opposed to the 28% of the population studied who consider it unlikely (or even improbable) that most of the world's car fleet will become electric[24].

AUTONOMOUS & CONNECTED MOBILITY

Scoring low on consumer acceptance[25].

Technological choices

ALL FORMS OF MOBILITY

Light rail

Mobility changes such as light rail will be and has already been installed at the expenses of existing roadway infrastructure in order to fit in.

One can notice an increase of demand for both freight and passenger air transportation within and over urban areas (delivery of parcels with drones and flying taxis are being developed).

AUTONOMOUS & CONNECTED MOBILITY

Partially AVs (and not fully AVs) will be required to allow mixed use of vehicles on the road infrastructure. A period of transition will be required between the current systems and the deployment of fully AVs.

20 / Brillet, Frédéric 2019 : *Toronto : la smart city fait polémique*. Les Echos. December 12, 2019.
21 / Mobilité Electrique Canada 2018 : Rapport annuel. Mobilité Electrique Canada.
22 / Neexti 2019: *Le gouvernement canadien adopte un plan d'envergure pour le développement de véhicules électriques*. Neexti. July 11, 2019.
23 / Cutean A. 2017: Autonomous Vehicles and the future of work in Canada. Information and Communications Technology Council (ICTC). Ottawa, Canada.
24 / Neexti 2019: *Le gouvernement canadien adopte un plan d'envergure pour le développement de véhicules électriques*. Neexti. July 11, 2019.
25 / KPMG 2019: 2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks. KPMG International.

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

All design standards will have to be reviewed:

- The design "for the car" will become obsolete. Road experts will have to take into consideration many more users with different capacities and levels of vulnerability as well as different vehicle characteristics (weaving and breaking distances, lane width, number of lanes required, parking need etc.);
- Complete redesign (or even withdrawal) of signs and signals which are made for human interaction;
- Standards for roadways and the installation of induction/conduction battery charging;
- Parking requirements will be completely transformed with AVs;
- The removal of "human signalization" will permit road administrations to modify the network in real time to better respond to traffic immediate demand (change in lane direction, reverse one-way street, closure of a corridor etc.).

Network of energy supply

- A whole new network of energy supply will have to be developed (electrical outlet stations, solar roofs on vehicles, dynamic charging on electrical roads, catenary over highways etc.);
- Different approach to energy distribution: Upload energy in vehicles and download back unused energy to the grid at different hours of the day;
- Road infrastructure could become an energy provider (solar and electric roads, induction systems, bidirectional energy flows between the vehicles and the road, etc.).

The Réseau de transport de Longueuil (RTL) will be offering its users the opportunity to test a new digital display technology in bus shelters, powered by solar panels and operating on a wireless network. The goal of this initiative is to evaluate new signage technologies and test an innovative solution that meets the need for more information at bus stops.

Developed in collaboration with **X-TELIA** and the **Technopôle IVÉO**, the variable message signs will remain in place for six months to test the technology and collect data and user comments[26].

General accessibility of new mobility

ALL FORMS OF MOBILITY

More agile, efficient, safer and multimodal uses are required being more user-friendly and generating more capacity.

Automated systems can help improve the service but eventually money has a role to play. It might thus be impossible to ensure an equal access to mobility across all territories, especially for larger countries with low density, such as Canada.

Data challenge and control

ALL FORMS OF MOBILITY

Toronto: Sidewalk Labs

Innovations that have been proposed by Sidewalk Labs are not universally accepted, as they require Sidewalks Labs (subsidiary of Alphabet, the parent company of Google) to collect a growing amount of data. By cross-referencing them with data already available from Google's other services, Quayside's residents, workers and visitors would become the most closely watched in America.

These concerns led Waterfront Toronto to renegotiate the contract. In order to remain a stakeholder in the project, which is awaiting its final validation in March 2020, Sidewalks already had to restrict its perimeter of intervention and data collection[27].

26 / RTL Agglomération de Longueil 2018: *Enhanced user experience: Pilot* project on digital signs in bus *shelters*. RTL Agglomération de Longueil..
27 / Brillet, Frédéric 2019 : *Toronto* : la smart city fait polémi*que*. Les Echos. December 12, 2019.

Economic model and financing

ALL FORMS OF MOBILITY

Federal taxes, including the excise tax on gasoline and diesel fuel help sustain a number of federal programs. Federally funded infrastructure programs funding highways and roads are structured through bilateral cost-sharing agreements with specific provinces and territories.

Canada has not made significant use of tolls/ congestion charges and other road pricing mechanisms.

Canada appears to heavily utilize PPPs to fund major infrastructure projects, including roads and highways[28]. Canada has actually been a leader in the development of road infrastructure under PPP with PPP projects completed in almost all the provinces. Most of the new highways in the country have been constructed under PPPs with concession periods ranging from 25 - 99 years.

28 / Library of Congress: *National Funding of Road Infrastructure Canada*. Accessed April 22, 2020.

CANADA

POLITICAL ORGANISATION

Nature of the regime: Constitutional monarchy - Federal State

Head of state: Her Majesty Queen Elizabeth II of Canada, represented by the Governor General Julie Payette

Head of government: Justin Trudeau

ECONOMIC INDICATORS

GDP (2018): 1.712,510 millions USD / Rank : 10/205

GDP growth (2018): 1,9%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,7 (2015)
- Industry (including construction), value added (% of GDP): 27,5 (2014)
- Services, value added (% of GDP): 66,7 (2017)

Population (2018) : 37,58 million

Urban population (2018): 81%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (37,36%)/ Coal (4,88%) / Hydro (10,85%)/ Biofuels/Waste (4,42%)/ Oil (32,87%)/ Nuclear (8,64%) / Wind & Solar (0,96%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 30/141

Total road expenditures (2016): 12.295,152 million USD

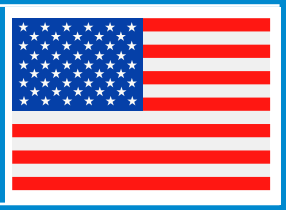
Total length of the road network (2016): 1.126.000 Km

Road density (km per one hundred sq. km) (2016): 11

Network length by road category (2016):

- Motorways: -
- Main / Principal roads: 38.049 Km
- Secondary / Regional roads: -
- Other Roads: -

UNITED STATES



This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

The traditional U.S. car manufacturers and the transport sector as a whole are being shaken up by the GAFA (Google, Apple, Facebook, Amazon). The GAFA have a sort of monopole through their platforms, algorithms and the data they are able to generate. They can address users directly and can deliver a global offer with new transport services (e.g. Uber, Lyft) by integrating information on the entire supply chain. These new services do have an impact on **urban mobility**. Uber and Lyft commissioned a study to measure the real impact Uber and Lyft drivers have on traffic in 6 large American cities. It showed that Uber and Lyft are responsible for 1.9 to 12.8% of the total number of kilometers travelled per vehicle[2].

Anyhow, the use of the car in the U.S. is already very widespread. In the U.S., suburban but also urban households now have at least two cars and 77% of Americans drive to work alone. Carpooling today is often associated with lower-income workers with limited resources and doesn't appear to be a very attractive solution. Most communities lack good biking infrastructure, and US commutes tend to be longer than those in other nations, which can discourage bike commuters and the use of alternative, non-motorized devices[3].

The boom in SUVs and the recent stop of the train project between Los Angeles and San Francisco also show the lack of attractiveness of non-motorized mobility modes in the U.S.

Continued investment in fossil fuels and their low price might slow-down development of **electrification** of the vehicle fleet in the U.S. As a result, cars with an internal combustion engine may be more popular than electric/hydrogen cars. Hybrid vehicles accounted for 2.1% of total sales in 2017, while electric cars only made up 0.6% of total sales. It is assumed that the focus will continue to lie on hybrid models until at least 2030. However, due to a reduction of the battery cost and economies of scales, the manufacturing costs of EVs is decreasing. In general, sales forecasts for EVs in the U.S. should increase in all vehicle classes.

Charging stations in the U.S. are very unevenly distributed. The densest network is located on the west coast, along the highways and in major cities. According to the US Department of Energy, there are approximately 16,000 public and 3,000 private charging stations nationwide. Private car companies have also committed themselves to install charging stations, among them Tesla and Volkswagen[4].

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea
2 / Corot, Léna 2019: *[Etude] Quel est l'impact d'Uber et Lyft sur la congestion dans les grandes villes ?* L'Usine Digitale. August 6, 2019.
3 / Deloitte 2015: *Smart mobility. Reducing congestion and fostering faster, greener, and cheaper transportation options*. Deloitte University Press.
4 / Stark, Alexander 2018: *Analysis of Electromobility in Six Countries— Where to Invest Next*. Spotlightmetal. May 25, 2018.

There is currently no law that expressly regulate **driverless vehicles** on a federal level. However, both the House of Representatives and the Senate have proposed legislation which should regulate certain aspects of highly automated vehicles. Legislation is also currently underway in some 40 States[5]. It is mentioned that roadway surface must be rehabilitated to support new mobility services and to achieve a target of 0 road accident rate. Recent AV accidents have shown that the U.S. has to find a delicate balance between protecting the public from unsafe and immature AV systems and encouraging new innovations. Although the U.S. is gathering the world's leading AV companies, it lacks a strong national approach that could facilitate to attract even more businesses[6].

Ecosystem and governance The role of public authorities in developments

URBAN, ACTIVE & SOFT MOBILITY

Strong car ownership prevails: 75% of U.S. consumers still see the personal car as their preferred mode of transport. Consequently, alternative mobility modes, such as biking, are not very popular among Americans. Only 0.6% of commuters currently bike to work in the urban areas. However, since 2015 bike commuting in America is growing by about 7.5% annually. Bike-sharing can especially be observed in Portland, Oregon, Chicago, and Washington DC, and is beginning to materialize in suburban satellite communities as well.

One can also note a growing popularity of carsharing as an alternative to the private car since the latter is unlikely to be replaced anytime in the foreseeable future[7].

The U.S Department of Transportation initiated a **Smart City Challenge** in 2016 which was won by **Columbus Ohio**. Their 40 million USD prize money was invested in realizing their proposed plan for integrated mobility in their city. A main focus in the Columbus plan was to involve the private sector in the city's transformation and collect data to ensure that planned improvements would be valuable for residents and visitors (e.g. real-time decision making for numerous areas of city life, from public transport management and traffic control to health care, water, and waste management)[8].

DECARBONISED & ELECTRIC MOBILITY

Some states are tightening their emission regulations. In addition, the purchase of electric and hybrid vehicles is going to be promoted by tax incentives[9].

In California, EVs accounted for about 9% of vehicle sales in 2018. EVs are allowed to use carpool and "high occupancy" lanes. In addition, many U.S. companies offer their employees free recharging of EVs at their workplace. The establishment of Low Emission Zones (LEZs) will also benefit EVs as they prohibit certain categories of polluting vehicles from circulating during certain hours of the day[10].

It has to be noted that the EV market is particularly developed on the West Coast of the U.S., and especially in California, mainly because of the legislation granting sales quotas for EVs compared to gasoline-powered cars[11].

AUTONOMOUS & CONNECTED MOBILITY

Federal law level

The federal law level does not expressly permit, prohibit, or restrict companies or consumers from testing driverless vehicles on public roads. There is an overlapping between federal and state responsibilities. It can be stated that AV policies do not fit neatly into the current framework.

The National Highway Traffic Safety Administration (NHTSA) originally published its own preliminary policy on levels of AVs in 2013.

The "Automated Driving Systems 2.0: A Vision for Safety" is a new policy issued by the Trump administration in 2017 updating the **Federal Automated Vehicle Policy** released by the **National Highway Traffic Safety Administration (NHTSA)** in September 2016. According to the updated policy, **NHTSA** will focus on enforcing compliance with federal performance and design standards, in order to regulate driverless vehicles.

5 / Challenges 2019: *Aux Etats-Unis, la voiture autonome se fait attendre malgré les promesses*. Challenges. December 11, 2019.
6 / KPMG 2019: *2019 Autonomous Vehicles Readiness Index. Ranking 25 countries in the race for driverless cars and trucks*. KPMG International.
7 / Deloitte 2015: *Smart mobility. Reducing congestion and fostering faster, greener, and cheaper transportation options*. Deloitte University Press.
8 / Here Mobility 2019: *Smart City Mobility. Smart cities, mobility, and the road in between*. Accessed April 24, 2020.
9 / Stark, Alexander 2018: *Analysis of Electromobility in Six Countries— Where to Invest Next*. Spotlightmetal. May 25, 2018..
10 / Mosquet, Xavier; Pélata, Patrick 2019: *Mission sur la filière automobile. Renforcer l'attractivité et la compétitivité de la France dans l'automobile et la mobilité de demain*. Gouvernement. Paris, France.
11 / Wackenheim, Hugo 2020: *Retour sur les rencontres internationales de l'automobile*. Wavestone Transportshaker. January 16, 2020.

SELF DRIVE Act

It was passed by the **House of Representatives** in September 2017 which introduces significant responsibilities that should be bared by the **United States Department of Transportation (USDOT)** with respect to regulation of driverless vehicles, automated driving systems and components of automated driving systems.

The **USDOT** will be required to create a publicly available electronic database of vehicles exempt from federally mandated design and performance standards. In this context, the **Federal Trade Commission** is granted enforcement authority.

The **SELF DRIVE Act** also requires that the **Secretary of Transportation** creates a methodology for describing the capabilities of driverless vehicles for the purpose of informing consumers. The **Secretary of Transportation** is also entitled to develop a safety assessment certification process that requires entities developing driverless vehicles to address the safety of their respective driverless vehicles, including fail safe features.

Safely Ensuring Lives Future Deployment and Research in Vehicle Evolution Act (SELF DRIVE Act)

It was introduced by the **House of Representatives** in September 2017 and is regulating certain aspects of highly automated vehicles by, among others, preempting state laws that conflict with performance and design standards of driverless vehicles set by the federal government to promote uniformity federally.

American Vision for Safer Transportation through Advancement of Revolutionary Technologies Act (AV START Act)

It was presented by the **Senate** on September 2017 and also regulates aspects of highly automated vehicles and anticipates state laws that may conflict with performance and design standards of driverless vehicles set by the federal government.

The **AV START Act** requires that each manufacturer introducing a highly automated vehicle or system to provide a safety evaluation report to the **Secretary of Transportation** which shall include information concerning system safety, data recording, cybersecurity, human-machine interface, crashworthiness, capabilities and limitations, post-crash behavior, the account of applicable traffic laws, and automation function performance.

Such reports are meant to be made public by simultaneously guaranteeing and protecting manufacturer's trade secret.

It is said that the updated policy of 2017 mentioned above may conflict with certain provisions stated in the **SELF DRIVE Act**, which is based on the 2016 version of **NHTSA** Federal Automated Vehicles Policy.

Example: safety assessment letters are voluntary under the 2017 new updated policy but would become mandatory if the **SELF DRIVE Act** is signed into law in its current form[12].

The policy **"Preparing for the Future of Transportation: Automated Vehicles 3.0 (AV 3.0)"** builds upon "**Automated Driving Systems 2.0: A Vision for Safety"** and expands the scope of AVs to all surface on-road transportation systems[13]. The six automation principals are to:

- Prioritize safety
- Remain technology neutral
- Modernize regulations
- Encourage a consistent regulatory and operational environment
- Prepare proactively for automation
- Protect and enhance the freedoms enjoyed by Americans[14]

It is to be noted that the **Trump administration** recently signaled a strong support for self-driving vehicles as it released new guidance from federal agencies at the annual CES tech conference. The so called **4.0 policy document** will adopt and promote "flexible, technology-neutral policies that will allow the public, not the federal government or foreign governments, to choose the most economically efficient and effective transportation and mobility solutions."

12 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
13 / U.S. Department of Transportation 2018: Preparing for the Future of Transportation: Automated Vehicles 3.0. U.S. Government. Washington, DC.
14 / Daus, Matthew 2019: Connected and Automated Vehicle Regulation – The U.S. Perspective. Socio-economic Impacts of Automated & Connected Vehicles. World Road Congress Abu Dhabi.

The **National Highway Traffic Safety Administration** is now reviewing how it can remove regulatory barriers to self-driving cars[15]. The main principles were broadened compared to the 3.0 policy:

- Prioritize safety
- Emphasize security and cybersecurity
- Ensure privacy and data security
- Enhance mobility and accessibility
- Remain technology neutral
- Protect American innovation and creativity
- Modernize regulations
- Promote consistent standards and policies
- Ensure a consistent federal approach
- Improve transportation system-level effects

Other agencies:

The National Highway Traffic Safety Administration (NHTSA) is responsible for enforcing compliance with federally required performance and design standards as well as managing recalls for defective vehicles.

The Federal Trade Commission (FTC) may be in charge for ensuring that automobile manufacturers accurately describe the capabilities and limitations of their driverless vehicles.

The Federal Communications Commission (FCC) may be responsible whenever a driverless vehicle uses the radio frequencies for its operation. The **FCC** could have an interest in promulgating regulations in this regard[16].

The Facilitate America's Superiority in 5G Technology Plan (also known as the 5G FAST Plan) released in June 2018 by the **FCC** includes three key components: (1) pushing more spectrum into the marketplace; (2) updating infrastructure policy; and (3) modernizing outdated regulations and support Vehicle-to-Vehicle (V2V) and Vehicle-to-Everything (V2X) environment data exchange.

The National Science and Technology Council (NSTC) released in October 2018 a **Strategy for American Leadership in Advanced Manufacturing** which presents the Administration's vision for American leadership in advanced manufacturing across industrial sectors to ensure national security and economic prosperity[17].

State Level

Twenty-one States and the District of Columbia have currently issued laws related to highly automated driving: Alabama, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Louisiana, Michigan, Nevada, New York, North Carolina, North Dakota, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, and Vermont.

The legislation generally includes the deployment and operation of highly automated vehicles (e.g. Colorado), the creation of a framework for testing highly automated vehicles (e.g. New York), the authorization for the platooning of highly automated vehicles (e.g. South Carolina), or merely the creation of committees tasked with conducting studies related to driverless vehicles (e.g. Alabama). In Arizona, executive orders have been issued by the state governor to permit the testing of AVs, as such bypassing the state legislature[18].

Many entities are carrying out tests of highly automated vehicles at different automation levels, among them:

- **The California Department of Motor Vehicles** has issued "Autonomous Vehicle Testing Permits" to 44 entities.
- **Waymo** conducted public trials of its driverless vehicles on public roads in several cities within the United States.
- **The Contra Costa Transportation Authority** in California is testing driverless vehicles that do not have a human operator physically inside the vehicle.
- **The University of Michigan** conducts studies related to driverless vehicles at Mcity, an urban test facility[19].

15 / Shepardson, David 2020: *U.S. outlines strong support for self-driving cars at CES*. Reuters. January 8, 2020.
16 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
17 / National Science & Technology Council; United States Department of Transportation 2020: Ensuring American Leadership in Automated Vehicle Technology. Automated Vehicle 4.0. U.S. Government. Washington, DC.
18 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
19 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.

- **The Sate of Rhode Island** has launched its pilot project Little Roady. Six EVs navigate a 5-mile loop in regular traffic and steer themselves into 10 curbside stops without driver. Little Roady follows a limited route, where onboard computers take data from the sensors and cameras to learn the lay of the land. Little Roady should become replicable in other States[20].
- **The Start-up Nuro** recently has been given the permition for the very first autonomous delivery vehicle. The so-called R2 model will deliver food and hot meals to stores and restaurants in the State of Texas. Nuro raised 940 million USD in financing from Japan's SoftBank Group. **The Ministry of Transport's** regulatory authority said in a statement that it had granted Nuro a temporary exemption from certain requirements for slow-moving vehicles to allow the R2 to operate on public roads[21].

Ecosystem and governance
Weight of industrials

DECARBONISED & ELECTRIC MOBILITY

U.S. car manufacturers are investing billions of dollars in the development of alternative drive systems. It is said that U.S. car manufacturers have to position themselves against China's market influence in the field. Since 30 % of global total production is sold in China, the US must keep pace with technological progress.

Tesla has been positioning itself as a pioneer amongst US car manufacturers. The Model 3 is intended to enter the mass market. According to the company, Tesla built 76,000 EVs in 2017. By 2018, this number was expected to be around 100,000. It is interesting to note that the Tesla Model 3 consumed over four billion USD in development costs. Tesla has also installed charging stations at 375 locations and wants to double the number of charging stations in the medium term.

General Motors developed its Chevrolet Bolt and also plans to launch a total of 20 battery-powered vehicle models by 2022.

Ford also releases its e-models which will be on display in the salesrooms from 2020. The Focus Electric, C-Max Energi and Fusion Energi models are already in production.

Fiat Chrysler Automobiles also produces its Pacifica minivan as a plug-in hybrid version.

Nissan also produces electric cars in the U.S. Annual sales of the Leaf II are expected to level off at between 40,000 and 60,000 units in the foreseeable future.

Volkswagen would like to manufacture its I. D. Crozz in the U.S.

Mercedes will have an electric SUV rolling off the production lines at its Tuscaloosa plant in Alabama.

Toyota is still considered to be the industry leader selling on average 200,000 hybrids and 21,000 plug-in hybrids annually in the U.S. This corresponds to a market share of 60 and 24 %, respectively.

Private car companies have also committed themselves to install charging stations, among them Tesla (double the number of charging stations) and especially Volkswagen (investment of 2 billion USD) as a consequence of the Diesel Gate[22].

Chinese companies (or companies supported by Chinese capital) are also entering the U.S. American market (among them Pony.ai and Roadstar.ai)[23].

AUTONOMOUS & CONNECTED MOBILITY

The U.S. vehicle makers are working on establishing an AV fleet and ride-hailing services.

Different regulations on State levels do impact this development.

Tesla has just acquired the Californian start-up **DeepScale**, which is working on artificial intelligence that allows cars to take better account of their surroundings. This technology should enable Tesla to move from EVs to autonomous vehicles. Although the financial terms of the operation have not been disclosed, the start-up is worth 18.5 million USD. Tesla announced its intention to offer a platform for self-service car reservations by 2020. Based on the same model as Uber, the app will allow users to order an autonomous Model 3, a Model S or a Model X[24].

20 / Lindblom, Mike 2020: *Autonomous Vehicle Test in Rhode Island Shows Promise for Other Cities*. Transport Topics. January 24, 2020..
21 / Rébillon, Hervet 2020: *Les US autorisent un premier véhicule autonome de livraison*. TRM24. February 2020.
22 / Stark, Alexander 2018: Analysis of Electromobility in Six Countries— Where to Invest Next. Spotlightmetal. May 25, 2018.
23 / Wackenheim, Hugo 2020: *Retour sur les rencontres internationales de l'automobile*. Wavestone Transportshaker. January 16, 2020.
24 / FrenchWeb 2019: *Tesla met la main sur DeepScale pour transformer ses véhicules électriques en taxis autonomes*. FrenchWeb. October 2, 2019.

Waymo has been testing AVs on more than 16 million kilometres to date, which has allowed Waymo to detect more than 20,000 different driving situations. The exploitation of this data through machine learning techniques allows it to improve its recognition and decision-making programs. Waymo is also conducting several tests in more than 25 cities in the U.S., e.g. AVs to transport volunteers on demand in Phoenix (Arizona) for more than a year, sometimes without an emergency driver. Waymo received the authorization to test the same in California.

General Motors and its subsidiary **Cruise** are conducting trials on open roads. Its budget is approaching 1 billion USD a year and its workforce 2,000, including staff dedicated to adapting the GM Bolt to automation.

Aptiv (equipment manufacturer, formerly Delphi) operates, in collaboration with Lyft in Las Vegas, around 70 vehicles with security drivers. **Aptiv** employs several hundred developers dedicated to AVs, after acquiring Ottomatica in 2015 and NuTonomy in 2017.

Uber and Continental are also developing the complete system required for driverless driving.

Valeo is focusing on sensors and on Advanced Driver Assistance Systems.

Ford with Argo.AI, **BMW**, **Renault-Nissan**, **Toyota** and **Volvo-Geely** with **Zenuity** are also developing respectively their own technology for AVs (levels 3 then 4 and 5). The latters appear to be at a less advanced stage of development than the other manufacturers mentioned above.

The U.S. also has 3 major innovation hubs facilitating research on AVs. Among them:

- Silicon Valley (electronics and software ecosystem and the universities of Stanford and Berkeley);
- Boston and MIT;
- Pittsburgh, where an ecosystem has been built around Carnegie Mellon University and its leading robotics laboratory[25].

AV START Act

Is supposed to engage the industry. The AV START Act requires the **Secretary of Transportation** to establish a **Highly Automated Vehicles Technical Committee** to provide a forum for stakeholders to discuss, prioritize and make technical recommendations for highly automated vehicles and automated driving system safety. It requires manufacturers of highly automated vehicles and automated driving systems to create cybersecurity plans, which must meet the requirements of the **AV START Act** and must be submitted to the **Secretary of Transportation** for inspection.

The SELF DRIVE Act prohibits manufacturers from selling any highly automated vehicle unless the manufacturer has developed a privacy plan that includes descriptions of certain practices regarding the collection, use, sharing, and storage of information about vehicle owners or occupants[26].

Ecosystem and governance Acceptability of clients, users, taxpayers

URBAN, ACTIVE & SOFT MOBILITY

As private car ownership prevails, alternative non-motorized mobility modes are not very popular in the U.S. The personal car remains the preferred mode of transport.

DECARBONISED & ELECTRIC MOBILITY

Respondents in the U.S. are the most pessimistic about the future of EVs. However, the U.S. plans to grant EVs a high market share by 2030 compared to the global average.

U.S. citizens are among the least convinced that the EV has an environmentally positive impact and their intention to buy an EV in the coming 12 month or even 5 years is among the lowest compared to the world average[27].

25 / Mosquet, Xavier; Pélata, Patrick 2019: Mission sur la filière automobile. Renforcer l'attractivité et la compétitivité de la France dans l'automobile et la mobilité de demain. Gouvernement. Paris, France.
26 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
27 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.

AUTONOMOUS & CONNECTED MOBILITY

By prioritizing safety measure in the development of AVs, the U.S. Government intends to strengthen public confidence in AV technologies.

Currently, there is a mixed attitude prevailing in the U.S. ranging from "irrational exuberance" to adamant hostility towards AVs.

Also, the Tesla and Uber crashes have shaken public confidence.

Example: The **National Highway Traffic Safety Administration (NHTSA)** announced in January 2020 that it has launched an investigation on an incident involving a Tesla 2016 model S. According to U.S. authorities, Tesla's AV ran a red light in Los Angeles and killed two passengers.

According to Reuters, this is the 12th investigation of **NHTSA** about a Tesla crash that could be linked to the vehicle's Autopilot driver assistance system[28].

Technological choices

AUTONOMOUS & CONNECTED MOBILITY

Despite fatal accidents involving semi-autonomous cars, testing of the technology continues.

The National Transportation Safety Board (NTSB) investigated the Uber accident of March 2018 resulting in the death of a pedestrian in a crash with an Uber Technologies Inc test vehicle, the first-ever attributed to a self-driving car. The NTSB blamed the distracted back-up who failed to intervene when the vehicle did not properly identify the pedestrian, and also Uber's safety standards[29].

The U.S. has to find a delicate balance between protecting the public from unsafe and immature AV systems and encouraging new innovations.

Software safety engineering is in its infancy (e.g. V2V is deemed to be extremely costly and inefficient).

The focus lies on narrowly defined use cases by developers and investors which are not taking into account Level 5 ubiquitous automatization. There are still huge uncertainties prevailing, depending on the resolution of technology. Especially in the U.S. addressing potentials safety risks has now become the utmost priority in developing AV technology.

The main technological challenges in this regard are:

- Perception/hazard recognition (sensor and software challenges, safety and usability require near-zero false negatives);
- Safety Assurance (must be able to demonstrably exceed safety over averaged skilled human driver which is not the case yet).

Executive Order 13788 (Buy American and Hire American) & Executive Order 13881 (Maximizing Use of American-Made Goods, Products, and Materials)

The U.S. Government has announced in its **4.0 Policy on automated vehicles** to proactively facilitate coordination of AV research, regulations, and policies across the Federal Government.

The U.S. Government has committed itself to ensure that all federal dollars used for CAV research, grants, and any other federal funding opportunities will comply with **Executive Order 13788 & Executive Order 13881** in order to ensure American growth and leadership in AV technology.

In this context, the U.S. Government has announced its willingness to continue to advance pro-growth policies to protect the U.S. economic advantage and their innovation capacity and to prioritize America's innovative and creative capacity in all sectors, including AVs.

The Executive Order 13840 Maintaining American Leadership in Artificial Intelligence (AI) signed on February 2019 by President Trump launched the American AI Initiative which implements a whole-of-government national strategy in collaboration and engagement with private and public stakeholders The initiative should enable Federal agencies to pursue a multipronged approach to advance AI, including: promoting sustained AI R&D investment, enhancing access to high-quality cyberinfrastructure and data, removing barriers to AI innovation, providing education and training opportunities to prepare the American workforce for AI, and fostering an international environment favorable to American AI innovation[30].

28 / ZDNet 2020: *Un nouveau crash jette un froid sur le pilotage automatique des voitures Tesla*. ZDNet. January 3, 2020.
29 /Shepardson, David 2020: *U.S. outlines strong support for self-driving cars at CES*. Reuters. January 8, 2020.
30 / National Science & Technology Council; United States Department of Transportation 2020: Ensuring American Leadership in Automated Vehicle Technology. Automated Vehicle 4.0. U.S. Government. Washington, DC.

Role of road infrastructure and its equipment

AUTONOMOUS & CONNECTED MOBILITY

The priority for the current U.S. Government lies on enabling the safe integration of AV technologies by addressing potential safety risks and enhance the life-saving potential of AVs.

AVs can be used in certain areas such as university campuses where the speed limit is low and there is little interaction with other vehicles, pedestrians and cyclists. The big problem that remains concerning AVs is "perception", i.e. the software's ability to process data sent by motion sensors (other vehicle, pedestrian, animals, cyclist...) on the car's environment. The AVs are yet not able to predict the future actions of these other actors and adapt their own behavior accordingly. Part of the "perception" is still unresolved. In 15% of problem situations the car can hit objects or people, kill or damage them[31].

General accessibility of new mobility

ALL FORMS OF MOBILITY

The U.S. Government wants to ensure the so-called freedom of the open road, which implies the freedom for Americans to drive their own vehicles.

The support of AV vehicles is made in the sense to enhance this freedom by providing additional options for consumers to access goods and services, allowing individuals to live and work in places that fit their families' needs and expanding access to safe, affordable, accessible, and independent mobility options to all Americans including those with disabilities[32].

In this context, one can observe Level 4 AV use cases in the U.S. that do take into account certain measures such as: low-speed urban first/last mile transit access, buses in protected busways, taxi services in retirement communities or low-density sunbelt suburbs.

Data challenge & control

ALL FORMS OF MOBILITY

Autonomous Vehicle Privacy Protection Act of 2015

This bill requires the **Government Accountability Office** to make publicly available a report that assesses the organizational readiness of the **Department of Transportation** to address autonomous vehicle technology challenges, including consumer privacy protections. The bill is meant to protect consumer privacy during the development and use of AV technologies[33].

The U.S. Government has committed itself to develop and promote physical and cybersecurity standards across all data mediums and domains of the transportation system in order to deter, detect, protect, respond, and safely recover from known and evolving risks. To this end, the Government has announced to work together with developers, manufacturers, integrators, and service providers of AVs and AV services to ensure the successful prevention, mitigation, and investigation of crimes and security threats targeting or exploiting AVs, while safeguarding privacy, civil rights, and civil liberties.

The U.S. Government will continue working on sensitive emerging technologies by simultaneously ensuring protection and enforcement of intellectual property rights - patents, trademarks, copyrights, and trade secrets - technical data, and sensitive proprietary communications. It has also announced its willingness to prevent other nations from gaining unfair advantage at the expense of American innovators[34].

31 / Challenges 2019: *Aux Etats-Unis, la voiture autonome* se fait attendre malgré les promesses. Challenges. December 11, 2019..
32 / National Science & Technology Council; United States Department of Transportation 2020: Ensuring American Leadership in Automated Vehicle Technology. Automated Vehicle 4.0. U.S. Government. Washington, DC.
33 / Congress.Gov 2015: *H.R.3876 - Autonomous Vehicle Privacy Protection Act of 2015114th Congress (2015-2016)*. Accessed April 24, 2020.
34 / National Science & Technology Council; United States Department of Transportation 2020: Ensuring American Leadership in Automated Vehicle Technology. Automated Vehicle 4.0. U.S. Government. Washington, DC.

Economic model and financing

ALL FORMS OF MOBILITY

The Highway Trust Fund finances most federal government spending for highways and mass transit. Revenues for the trust fund come from transportation-related excise taxes, primarily federal taxes on gasoline and diesel fuel.

Most spending from the **Highway Trust Fund** for highway and mass transit programs is through federal grants to state and local governments. The federal government accounts for about 1/4 of all public spending on roads and highways, with the remaining 3/4 financed by state and local governments[35].

Significant private finance is raised for local road investment funds through the sales of state and municipal bonds.

Public-Private Partnerships (PPPs)

Relatively little use of PPPs for transport infrastructure but PPPs may see a significant increase in the volume of transactions in the future[36].

URBAN, ACTIVE & SOFT MOBILITY

Establish public-private partnerships to improve mobility

It can be envisaged that jurisdictions could expand their use of PPPs by adopting pay-for-success models that specify some mobility outcomes (e.g. setting a goal of a certain year-over-year increase in carpooling's modal share in a particular area).

New kinds of partnerships with automakers, ridesharing companies, and stakeholders could thus be built allowing to explore for new mobility services.

Social impact bonds

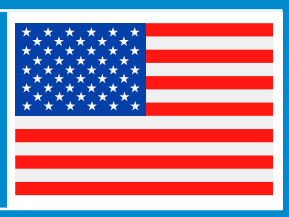
Contracts with government agencies that are only repaid if certain social benefits are achieved.

High-occupancy vehicle (HOV) and high-occupancy toll (HOT) lane projects should be applied to real-time ridesharing initiatives. A city or state secures funding to create managed lanes, a part of those funds can be dedicated into investments in digital infrastructure.

Pre-tax benefits should be expended to urban mobility services. It is currently available for parking and transit passes[37].

35 / Tax Policy Center: Key Elements of the U.S. Tax System. Accessed April 24, 2020.
36 / Library of Congress: *National Funding of Road Infrastructure: Comparative Summary*. Accessed April 24, 2020.
37 / Deloitte 2015: Smart mobility. Reducing congestion and fostering faster, greener, and cheaper transportation options. Deloitte University Press.

UNITED STATES



POLITICAL ORGANISATION

Nature of the regime: Federal State

Head of state: Donald Trump

Head of government: Donald Trump

ECONOMIC INDICATORS

GDP (2018): 20.545,343 million USD / Rank : 1/205

GDP growth (2018): 2,9%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 1,1 (2015)
- Industry (including construction), value added (% of GDP): 20,1 (2014)
- Services, value added (% of GDP): 75,9 (2015)

Population (2018) : 326,2 million

Urban population (2018): 82%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (31,70%)/ Coal (14,24%) / Hydro (1,13%)/ Biofuels/Waste (4,82%)/ Oil (36,21%)/ Nuclear (9,85%) / Wind & Solar (2,01%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank : 17/141

Total road expenditures (2014) : 204.628,772 million USD

Total length of the road network (2016): 6.645.709 Km

Road density (km per one hundred sq. km) (2017): 68

Network length by road category (2016):

- Motorways: 77.002 Km
- Main / Principal roads: 29.599 Km
- Secondary / Regional roads: 1.910.057 Km
- Other Roads: 4.629.051 Km

INSIGHT: SOUTH AFRICA

This international benchmark study was launched by Routes de France, the ERF and the FNTP in spring 2019 as part of the Strategic Sector Contract "Industry for Construction" of the National Industry Council. This study is being carried out in 19 countries[1] in conjunction with the World Road Association (PIARC), the French Ministry of Transport, the European Construction Federation (FIEC) and the Confederation of International Contractors' Associations (CICA). It benefits from the scientific support of the University Gustave Eiffel and the technical and financial support of Business France. Its objective is to analyze the way countries approach new forms of mobility - connected and autonomous, carbon-free and urban mobility - and to identify the place of road infrastructure and its equipment in these developments. Each country fact sheet aims to describe how the ecosystem intervenes, the role of public authorities, private players and local authorities, to measure their levels of maturity, their choices, their prospects, the acceptability of their users and possible economic models. This sheet is based on interviews/questionnaires with public or private stakeholders present in the studied countries and were complemented by a bibliographical analysis.

Concerning road infrastructure, South Africa can be regarded as "developed" in some areas (metropolitan centers) and "developing" in the rural and tribal areas of the country. These two conditions imply different needs and challenges:

- Within metropolitan areas: reduce congestion through efficient traffic monitoring;
- In remoted areas: Lack of ITS system in place, address road safety and allowing activity in a controlled way for pedestrians also referred to as vulnerable road users[2].

The main road challenges for South Africa concern **urban mobility**. One of the main priorities that can be identified is reducing congestion, enhance the use of public transport, ensuring road safety and reducing road fatalities which are particularly high in South-Africa.

It has been recognized by road authorities that current ITS technologies used should be extended to C-ITS technologies including V2I, V2V and V2X in order to also reach remoted areas where traditional ITS systems are not practical or economically viable to install[3].

Concerning other forms of mobility, South Africa seeks to become an innovation hub in Africa, testing mobility solutions in emerging markets. Indeed, Cape Town is the first African city to use EVs within its public transport system.

1 / France, Germany, Netherlands, Norway, Finland, Sweden, Belgium, Austria, Spain, United Kingdom, Portugal, Mexico, Argentina, Chile, Canada, United States, China, Japan, South Korea
2 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.
3 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.

Ecosystem and governance
The role of public authorities in developments

ALL FORMS OF MOBILITY

The main priorities when talking about new mobility is road safety which involves a need for improved road user attitude and behavior, as well as addressing the safety of the vulnerable road users.

South Africa has among the highest road crash fatality rates in the world with 25-30 fatalities per 100,000 population. The cost of road accidents is approximately 3,4% of GDP.

Appropriate road infrastructure is identified as key contributor to improve road safety but changing road user's attitude remains a major problem. Awareness programms already launched by South Africa's National Road Agency (SANRAL) may not be enough in addressing road fatalities. The need to implement smart technology that can better assist in influencing road user's attitude has been recognized by road authorities.

SANRAL is said to have an efficient **Freeway Management System (FMS)** (part of South Africa's first ITS system established in 2006) which is however limited to 2,3% of the national road network as it is only operational in 3 major urban centers (Johannesburg/Pretoria, Cape Town and Durban). The FMS is expected to reduce congestion, improve road safety and keep motorists informed of travel conditions. As many incidents are happening in remote rural areas, where road safety being a bigger problem than congestion, the FMS has to be readapted and upgraded with the integration of C-ITS technologies as pointed out in the item "Technological choices" below[4].

A lack of collaboration can be identified between the various stakeholders. A universal agreement on the rules of the game and consistent application of these rules among the different regions would be necessary.

Regional cooperation would be needed to allow for seamless movement across borders. There would be a need of a combined effort in setting standards and harmonizing legislation between regions for greater safety and for reducing the carbon print.

Due to limitations in local government planning in most cases, developments are allowed without SANRAL's consultation or adherence to general design principles.

URBAN, ACTIVE & SOFT MOBILITY

Urban sprawl

Residential areas and informal settlements are developing on the cities' edges and the remote rural tribal areas are located adjacent to national roads creating road safety challenges[5].

Public transport is expensive; some commuters spend more than 20% of their earnings on transportation. Due to sprawling low-density areas without viable public transport systems, the average work commute is 52 minutes[6].

In general, there would be a need to develop non-motorized forms of transport (pedestrian, cyclists) and a Public Transport Corridor plan for national roads. There is a need to retrofit the road environment to provide a safe place to walk/cycle and a safe place to cross. Greater space should also be made available for mass transit.

Major city level: The city of Cape Town[7&8]

Cape Town is referred to as the most congested city in South Africa. Narrow roads but also the lack of public transport and its use are made responsible for high congestion levels within the city. People are refraining from using public transport as the city gathers multiple operators across different modes, which results in uncoordinated routes and a lack of integrated ticketing and payment systems. Metrorail's ridership is 70% above total capacity and suffers from high crime rates and vandalism.

4 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.
5 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.
6 / Deloitte City Mobility Index 2018: Johannesburg. Deloitte Insights.
7 / Creamer Media's Engineering News 2018: Joburg and Cape Town pave major investment for mobility access and infrastructural developments. Creamer Media's Engineering News. October 3, 2018.
8 / Deloitte City Mobility Index 2018: Cape Town. Deloitte Insights.

In 2015, Cape Town initiated its **Congestion Management Program** to reduce traffic problems and plans to spend more than 57 million USD over five years on road infrastructure projects.

The **2032 City Vision** adopted in 2017 plans to integrate different modes of public transportation to form a seamless system. In this context, it is planed to add a new bus hub and new rail lines within the city's network and increase the number of bus lanes. The city also plans to invest in technologies to facilitate a convenient, secure, and cost-effective fare system that works across all modes.

The **Transport and Urban Development Authority** intends to counter the low share of active modes. Despite having 450 kilometers of cycle lanes across the city, very few people use bicycles to get around. The Transport and Urban Development Authority's objective is to increase bicycle commuters from 1% to 8% by 2030.

Cape Town has allocated more than 106 million USD to modernize **the Bus Rapid Transit (BRT)** routes. These new routes should allow for five times the number of passengers currently using the BRT network. BRT services will also include minibus taxis.

The city of Johannesburg[9]

In Johannesburg, congestion is also a major issue. According to the Deloitte City Mobility Index, infrastructure improvement projects are underway in order to address the congestion problem and the resulting air pollution. It is said that defected traffic lights as well as aging traffic flow control systems contribute to congestion. A high use of the private vehicles resulting among others from an unreliable public transport system is one of the biggest sources of air pollution in the city. Besides, the lack of reliable transport lead commuters to use unregulated minibus taxis. These may handle last-mile connectivity but increase congestion.

The City of Johannesburg wants to respond to those challenges by expanding its BRT system, improving its roads, and promoting active modes of transportation. Ridesharing services could be promoted digitally to save costs.

In this context, the City of Johannesburg has initiated its Spatial Development Framework 2040 to accommodate and take into account a population rise estimated to reach 7 million by 2040. Its goal is to build a compact, polycentric city with an urban core linked through efficient "Corridors of Freedom." These Corridors should enable accessible public transport options and enhance the safety of neighborhoods to promote walking and cycling.

Informal urban mobility: Where Is My Transport

Where Is My Transport is an app mapping the world's largest low- and middle-income cities, among them Cape Town. The objective of the app is to get the right information to the right people at the right time taking into account the formal but also the informal public transit networks[10].

DECARBONISED & ELECTRIC MOBILITY

The national uYilo eMobility Programme (2013) is an initiative of the Technology Innovation Agency (Act 26 of 2008) to enable, facilitate and mobilize electric mobility in South Africa. It is a multi-stakeholder programme. Hosted by the Nelson Mandela University, the programme seeks to prepare South Africa for the introduction of electric mobility technologies[11].

Cape Town is the first African city to use EVs within its public transport system by investing in a fleet of electric buses.

Johannesburg is one of the first municipalities in South Africa to issue a green bond (110 million USD) for environmental and social sustainability projects, such as the procurement of 150 hybrid-fuel buses[12].

9 / Deloitte City Mobility Index 2018: Johannesburg. Deloitte Insights.
10 / Where Is My Transport: Empowering people everywhere to get where they want to go. Accessed May 22, 2020.
11 / UYilo E-Mobility Programme: Enabling, Facilitating & Mobilizing the South-African e-mobility Ecosytem. Accessed May 14, 2020.
12 / Deloitte City Mobility Index 2018: Johannesburg. Deloitte Insights.

Opportunities for Electric Road Systems (ERS)

According to PIARC, the undeveloped nature of road networks, as it may be the case in South Africa, may provide opportunities to include ERS when constructing new roads. In contrast to high-income countries having already established networks and were a readaptation of the existing road would be necessary, this would be more cost-effective. However, some challenges remain. In some low- and middle-income countries housing construction (often illegal) alongside the road would make it difficult to install roadside equipment (e.g. gantries for the overhead systems and electricity sub-stations). The lack of maintenance of conventional roads and new installations and equipment would also represent a major issue[13].

AUTONOMOUS & CONNECTED MOBILITY

The testing of a driverless vehicle on a public road is not specifically restricted. However, as driverless cars will fall under the meaning of 'motor vehicle' under the National Road Traffic Act (NRTA), the provisions applicable to motor vehicles under the NRTA will also apply to driverless cars. The legislation provides that to operate a motor vehicle on a public road, such vehicle must be registered and licensed[14].

Sandton's Gautrain station (2018) is a test site for public AV trials[15].

Ecosystem and governance Acceptability of clients, users, taxpayers

URBAN, ACTIVE & SOFT MOBILITY

Currently, people are refraining from using public transport because of uncoordinated routes and a lack of integrated ticketing and payment systems. These factors are coupled with security concerns: Metrorail's ridership is 70% above total capacity and suffers from high crime rates and vandalism[16].

DECARBONISED & ELECTRIC MOBILITY

South Africa has a rather optimistic vision about the future of EVs in comparison to the world average. South Africa foresees an equivalent market share of EVs by 2030 to the world average. According to the research institute Cetelem study many respondents stated that no public subsidy exists for the EV[17].

Technological choices

ALL FORMS OF MOBILITY

The development of Cooperative intelligent transport systems (C-ITS) encompassing V2I, V2V, V2X communication (in the South-African case X referring especially to vulnerable road users) is deemed necessary to strengthen the operation and management of the road system and to better meet road user's needs.

Devices such as DSRC could be an effective solution especially in reaching rural and remoted locations within the country in contrast to Variable Message Signs (VMS) installed alongside the roadway.

C-ITS technology could also assist in ensuring road safety by capturing crash data through V2I, V2V, V2X communication as South-Africa's current FMS only covers 3 major urban centers.

C-ITS technology is also expected to ensure security of infrastructure (vulnerable to vandalism) and ensure the security of road users[18].

13 / World Road Association (PIARC) 2018: Electric Road Systems. A solution for the future? A PIARC special project. World Road Association. Paris, France.
14 / Baker McKenzie 2018: Global Driverless Vehicle Survey 2018. Baker McKenzie.
15 / Deloitte City Mobility Index 2018: Johannesburg. Deloitte Insights.
16 / Deloitte City Mobility Index 2018: Cape Town. Deloitte Insights.
17 / L'Observatoire Cetelem 2019: Le mystère de la voiture électrique. Cetelem. Groupe BNP PARISBAS.
18 / World Road Association (PIARC) 2019: Connected Vehicles. Challenges and opportunities for road operators. Task Force B.1 Road design and infrastructure for innovative transport solutions. World Road Association. Paris, France.

Role of road infrastructure and its equipment

ALL FORMS OF MOBILITY

Maintenance will have to be carried out not only on the road itself but on the communication equipment installed (measuring/detecting equipment).

In general, road infrastructure will weigh as a determinant of the well-being of the country and more competences will be forwarded to road infrastructure. Road agencies/organization will not only be seen anymore as providers of physical road infrastructure but also as managers of the infrastructure (how it is used). Road infrastructure will also have to assist in influencing road user attitude and behaviour to road safety.

As such, new mobility will not necessarily lead to a rethinking of governance but to a change concerning the competence of the infrastructure.

DECARBONISED & ELECTRIC MOBILITY

Roads authorities could play a significant role in generating energy to contribute to a particular grid.

General accessibility of new mobility

ALL FORMS OF MOBILITY

A risk of transport poverty is given: "Vulnerable" road users are those who are at greater risk because of insufficient physical protection or because of relative high speed differences with potential conflicting nodes: Many situation exist when pedestrian are either forced to walk along freeway sections, even cross it, or do so as it is more convenient.

General accessibility forms a dilemma that requires more consideration by including appropriate government intervention to ensure equal access.

In Johannesburg, the BRT system is being extended to increase accessibility in historically segregated areas[19].

Data challenge and control

ALL FORMS OF MOBILITY

As of 2017, there have been 17 countries in Africa that have enacted comprehensive personal data protection legislation and South Africa is one of them. The **African Union (AU)**, also adopted the **AU Convention on Cybersecurity and Data Protection** (AU Convention) in June 2014. As of 2017 it had not taken effect yet as it had only been ratified by 15 out of the 54 AU member jurisdictions. Nonetheless, the AU Convention does provide a personal data protection framework which African countries may potentially transpose into their national legislation.

South Africa is mentioned as an example of having rather high standards of personal data protection compliance. South Africa's Protection of Personal Information Act of 2013 (POPI) is modelled on the EU's personal data protection framework[20].

Economic model and financing

ALL FORMS OF MOBILITY

- Traditional sources (tax-based revenues) will still play a major role.
- The use of green bonds, to fund green infrastructure projects has been established in Johannesburg[21].
- Incentivising public transport usage via higher parking charges (Cape Town).

19 / Deloitte City Mobility Index 2018: Johannesburg. Deloitte Insights.
20 / Deloitte 2017: Privacy is paramount. Personal Data Protection in Africa. Deloitte.
21 / Deloitte City Mobility Index 2018: Johannesburg. Deloitte Insights.

INSIGHT: SOUTH AFRICA

POLITICAL ORGANISATION

Nature of the regime: Republic

Head of state: Cyril Ramaphosa

Head of government: Cyril Ramaphosa

ECONOMIC INDICATORS

GDP (2018): (2017) : 348,872 million USD / Rank: 32/205

GDP growth (2018): 0,8%

Structure of the economy:

- Agriculture, forestry, and fishing, value added (% of GDP): 2,3 (2017)
- Industry (including construction), value added (% of GDP): 25,9 (2017)
- Services, value added (% of GDP): 61,5 (2017)

Population (2018) : 57,78 million

Urban population (2018): 66%

Energy supply /Total primary energy supply by source (2018):

Natural Gas (3,20%)/ Coal (74%%) / Hydro (0,05%) / Biofuels/Waste (5%) / Oil (14,13%) / Nuclear (2,78%) / Wind & Solar (0,75%)

ROAD INFRASTRUCTURE

Quality of road infrastructure (2019): Rank: 6/141

Total road expenditures (2017) : -

Total length of the road network (2016): 349.828 km

Road density (km per one hundred sq. km) (2014): 16

Network length by road category (2016):

- Motorways: 239 km
- Main / Principal roads: 2,887 km
- Secondary / Regional roads: 60.027 km
- Other Roads: 300.978 km

PART 4

APPENDIX

SUMMARY

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Executive Summary

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LIST OF ABBREVIATIONS

3G: Third generation of communication networks

4G: Fourth generation of communication networks

5G: Fifth generation of communication networks

5GAA: 5G Automobile Alliance

ACEA: European Automobile Manufacturers' Association

ADAS: Advanced Driver Assistance System

AFD: Agence Française pour le Développement

AI: Artificial Intelligence

AOM: Autorité Organisatrice de Mobilité (France)

ARCEP : Autorité de Régulation des Communication Électroniques et des Postes (France)

AU: African Union

AV / VA : Autonomous Vehicle / Véhicule Autonome

BANOBRAS: Banco Nacional de Obras y Servicios Públicos (Mexico)

BAT: Baidu, Alibaba, Tencent (China)

BEV: Battery-powered electric vehicle

BMVE: Bundesministerium für Wirtschaft und Energie (German Federal Ministry of Economics and Energy)

BMVI: Bundesministerium für Verkehr und digitale Infrastruktur (German Federal Ministry of Transport and Digital Infrastructure)

BMVIT: Bundesministerium für Verkehr, Innovation und Technologie (Austrian Federal Ministry of Transport, Innovation and Technology)

BRCC: Belgium Road Research Center

BRT: Bus Rapid Transit

C40: Cities Climate Leadership Group

CAMARCO: Cámara Argentina de la Construcción (Argentine)

CATL: Contemporary Amperex Technology Co. Limited (China)

CATS: China Academy of Transportation Sciences (China)

CAV: Connected and Automated Vehicle

CCAM: Cooperative, Connected, Automated and Autonomous Mobility

CCAV: Centre for Connected and Autonomous Vehicles (United Kingdom)

CCFA: Comité des Constructeurs Francais d'Automobiles (France)

CDB: China Development Bank (China)

CEDM: The National Digital Strategy Coordination (Mexico)

Cerema: Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement (France)

CERRE: Centre of Regulation in Europe

CES: Consumer Electronics Show (United States)

CFF: Cities Finance Facility

CICA: Confederation of International Contractors' Associations

CIHT: Chartered Institution of Highways and Transportation (United Kindgom)

CII: Critical Information Infrastructure

C-ITS: Cooperative Intelligent Transport Systems

CNC: Confederación Nacional de la Construcción (Spain)

COP: United Nations Climate Change Conference

CO2: Carbon Dioxide

CSF: Contrat Stratégique de Filière

CV2X: Cellular Vehicle-to- Everything

DG: Direction Générale

DPA: Norwegian Data Protection Authority

DSRC: Dedicated short-range communications

DSSS: Driver Safety Support System

EATA: European Automotive - Telecom Alliance

EEE: European Economic Area

ECV: Electrically Chargeable Vehicle

EDITS: European Digital Traffic Infrastructure

EDN: National Digital Strategy (Mexico)

EDPM: Engin de déplacement personnel motorisé (France)

EFK: Klima-Energie-Fonds (German Climate Energy Fund)

EFTA: European Free Trade Association

ERF: European Union Road Federation

ERS: Electric Road System

ESA: EFTA Surveillance Authority

ETC: Electronic Toll Collection

EV / VE : Electric Vehicle / Véhicule Électrique

EVI: Electric Vehicle Initiative

FCC: Federal Communications Commission

FCEV: Fuel Cell Electric Vehicle

FED: Federal Reserve (United States)

FIEC: European Construction Industry Federation

FMS: Freeway Management System (South Africa)

FNTP: Fédération Nationale des Travaux Publics

FNTR: Fédération Nationale du Transport Routier (France)

FNTV: Fédération Nationale des Transport de Voyageurs (France)

FoM: Future of Mobility criteria (Deloitte City Mobility Index)

FONADIN: Fondo Nacional de Infraestructuras (Mexico)

FTC: Federal Trade Commission (United States)

GAFA: Google, Apple, Facebook, Amazon

GDP: Gross Domestic Product

GDPR: General Data Protection Regulation

GEF: Global Environment Facility

GHG: Greenhouse Gas Emission

GM: General Motors

GNSS: Global Navigation Satellite System

GPDR: General Data Protection Regulation (European Union)

GWh: Gigawatt hours

HEV: Hybrid-Electric Vehicle

HFCV: Hydrogen fuel cell vehicle

HOT: High-occupancy toll

HOV: High-occupancy vehicle

ICBC: Industrial and Commercial Bank of China Limited (China)

ICT: Information and Communication Technology

ID: Identification

IDB: Inter-American Development Bank

IEA: International Energy Agency

IMF: International Monetary Fund

IMT: Instituto Mexicano del Transporte (Mexico)

INEA: Innovation and Networks Executive Agency

INSEE: Institut National de la Statistique et des Etudes Economiques (France)

IoT: Internet of Things

IRF: International Road Federation

ISO: International Organization for Standardization

ITDP: Institute for Transportation and Development Policy (United States)

ITF: International Transport Forum

ITS: Intelligent Transport Systems

ITS-G5: Intelligent Transport System, which operates in the 5GHz range

JRC: Joint Research Center (European Commission)

KOTI: The Korea Transport Institute (Korea)

KOTSA: Korean Transportation Safety Authority (Korea)

KPMG: Klynveld Peat Marwick Goerdeler

LCV: Light commercial Vehicle

LDM: Local Dynamic Map

LDV: Light Duty Vehicle

LEZ: Low Emission Zone

LIDAR: Light Detection and Ranging

LOM: Loi d'Orientation des Mobilités (France)

LPG: Liquified Petroleum Gas

LTE-V2X: Long Term Evolution Vehicle to Everything

MaaS: Mobility-as-a-Service

MAGLEV: Magnetic Levitate Train (China)

MDB: Multilateral Development Bank

METI: Ministry of Economy, Trade and Industry (Japan)

MIIT: Ministry of Industry and Information Technology (China)

MinEM: National Energy and Mining Ministry (Argentina)

MLIT: Ministry of Land, Infrastructure and Transport (Korea)

MLIT: Ministry of Land, Infrastructure, Transport and Tourism (Japan)

MOE: Ministry of Environment (Japan)

MoF: Ministry of Finance of the People's Republic of China (China)

MOP: Ministerio de Obras Públicas (Chile)

MOST: Ministry of Science and Technology (China)

MSPF: Mobility Services Platform

Mteq: CO2 Equivalent

MTIE: Ministry of Trade, Industry and Energy (Korea)

MTT: Ministerio de Transportes y Telecomunicaciones (Chile)

MW: Megawatt

NAFIN: Nacional Financiera (Mexico)

NAP: National Access Point

NDRC: National Development and Reform Commission (China)

NEV: New Energy Vehicle

NGV: Natural Gas Vehicle

NHTSA: National Highway Traffic Safety Administration (Unites States)

NRTA: National Road Traffic Act (South Africa)

NSTC: National Science and Technology Council (United States)

NTSB: National Transportation Safety Board

OBU: On-Board Units

OECD: Organization for Economic Co-operation and Development

PANCC: Plan de Acción Nacional de Cambio Climático (Chile)

PHEV: Plug-In hybrid electric vehicle

PEV: Plugin Electric Vehicles

PETS: Pumped Energy Transfer Stations

PFA: Plateforme Française de l'Automobile

PIARC: World Road Association

PND: Plan Nacional de Desarrollo (Mexico)

POPI: Protection of Personal Information Act (South Africa)

PPP: Public Private Partnership

PROTRAM: Programa Federal de Apoyo al Transporte Urbano Masivo (Mexico)

RATP: Régie Autonome des Transports Parisiens (France)

RCC: Regulatory Cooperation Council (Canada)

R&D: Research and Development

RED: Red Metropolitana de Movilidad (Chile)

RSU: Road Side Units

RTL: Réseau de transport de Longueuil (Canada)

SANRAL: South African National Roads Agency

SDG: Sustainable Development Goal

SE: Agencia de Sostenibilidad Energética (Chile)

SECTRA: Secretaria de Planificación de Transporte (Chile)

SFERB: Section des Fabricants d'Emulsions Routières de Bitume

SIP: Cross-ministerial Strategic Innovation Promotion Program (Japan)

SME: Small and Medium Enterprise

SNCF: Société Nationale des Chemins de Fer Français (France)

SUMP: Sustainable Urban Mobility Plan

TAC: Transportation Association of Canada (Canada)

TER: Train Express Regional (France)

TfL: Transport for London

TfWM: Transport for the West Midlands (United Kingdom)

TICPE: Taxe intérieure de consommation sur les produits énergétiques (France)

ToD: Transport on Demand

Traficom: Finnish Agency of Transport and Communications

TRI: Toyota Research Institute

UNECE: United Nations Economic Commission for Europe

ULEV: Ultra-Low Emission Vehicle

USDOT: United States Department of Transportation (Unites States)

USMCA: US-Mexico-Canada trade agreement

VDA: Verband der Automobilindustrie/German Association of the Automotive Industry

VMS: Variable Message Signs

V2G: Vehicle to Grid

V2I: Vehicle to Infrastructure

V2P: Vehicle to Pedestrian

V2V: Vehicle to Vehicle

V2X: Vehicle to Everything

VA / AV Véhicule Autonome / Autonomous Vehicle

VAC: Véhicule Autonome Connecté

VAT: Value Added Tax

VE / EV: Véhicule Électrique / Electric Vehicle

VICS: Vehicle Information and Communications System

VTC: Voiture de Transport avec Chauffeur

VSSF: Vehicle Safety & Security Framework (the Netherlands)

WI-FI: Wireless Fidelity

WHO: World Health Organisation

X2V: Everything to Vehicle

ZDB: Zentralverband Deustches Baugewerbe (German Construction Federation)

APPENDIX

Questionnaire "Road infrastructure and new mobility"

PRIVATE STAKEHOLDERS

IMPORTANT: This questionnaire is part of the benchmark study carried out by Routes de France, European Union Road Federation and the French Federation for Public Works (FNTP). The information collected is intended to enrich this study for publication in October 2019. **No personal information will be made public without the consent of the participants**.

What is new mobility?

The notion of "new mobility" or "emerging mobility" aggregates innovations of various kinds, relating to motorization, autonomy, mode of ownership, or type of travel. These innovations also have consequences for freight transport traffic.

Heavy vehicles and car decarbonisation, autonomous and connected mobility offers are all systems based on the "vehicles infrastructures, uses" approach, making the road of tomorrow a system of systems.

The following observations can be made during the initial work:

- **New mobility is profoundly changing value chains**, with digital players potentially shaking up the current practices;
- Several horizons are set out: total electro mobility, a totally autonomous vehicle, shared use and the end of vehicle ownership. The technological and economic viability of the solutions that could contribute to reaching these objectives is still too uncertain to envisage massive deployments in the short or medium term.
- **The business model of these solutions is based on a dual choice of public decision-makers and consumers**, making their deployment difficult to predict over time.
- **The development of these technologies is at the heart of strategic global industrial challenges**.
- **The infrastructure is at the heart of these tensions.**
- That includes soft mobility and free floating, scooters, gyro pods, bicycles, as well as buses and vans.

Your vision matters.

Share with us your vision of new mobility. Thank you very much for your participation!

Country / State / Area	
Person completing the questionnaire (please indicate first name, family name, organization and position, email address and/or phone number)	
Description of your organization	

***

1. General Questions		
Question		**Answer**
(a)	(i) According to you and considering the new mobility, what would be the most important changes in the countries you work with?	
(b)	(ii) Is there any economic environment study on changing behavior of road users of the fields of new mobility?	

(c)	(iii) What type of new mobility is currently the most studied in your company, and why?	
(d)	(iv) How do you see the role of road infrastructure and road equipment link with new mobility?	
(e)	(vi) Does new mobility lead to a rethinking of the governance structure and competence of road infrastructure?	

(f)	(vii) Does new mobility create new economic models to be developed for road infrastructure?	
(g)	(viii) How can the combined actions on infrastructure, automotive technology and new usages help coping with the future traffic evolution while meeting road safety, mobility and environmental objectives?	
(h)	(ix) What are the potential financial sources for the adaptation and upgrades of road infrastructure to cope with new mobility?	
(i)	(x) Are there experimentation or test centers for new mobility (new vehicles, adaptation of road technology) in the countries you work with?	
(j)	(xi) Do public authorities encourage financially full-scale tests and experiments? If so, please specify how.	

(k)	(xii) Do you think that changes in mobility will have an impact on employment, training skills and new management skims in the road construction and infrastructure sector, and why?	

2. Specific Questions		
Question		**Answer**
a) Role and place of road infrastructure and its equipment in the development of the autonomous and connected vehicle and their respective interactions	(i) What initiatives or projects are being studied on road infrastructure with regard to the upcoming arrival of the connected and autonomous vehicle?	
	(ii) What are the current initiatives or projects concerning platooning?	

	(iii)	What are the necessary adaptations to road infrastructure and equipment, considering the upcoming of these new vehicles and new technologies?	
b) Role and place of road infrastructure in the deployment of electro mobility	(i)	What initiatives or projects are being studied on road infrastructure for the deployment of electro mobility (induction, conduction, dynamic battery charge, hybrid, catenary…)?	
	(ii)	How can we ensure that vehicle and infrastructure can cope with specific vehicle	

		requirements in 10 years' time?	
c) New road infrastructure functionalities for the ecological and energy transition?	(i)	What initiatives or projects are under study on road infrastructure considering sustainability and energy issues?	
d) New infrastructure challenges in the face of changing usages and services needs	(i)	What are or will be the changes in the services offered by the infrastructure, considering the change in usages and needs (including energy generating storage)?	
	(ii)	What are the expected changes in mobility usage in the countries you work with?	

	(iii)	What initiatives or projects are underway or under consideration in this regard?	
	(iv)	What changes or adaptations to public space/roads are necessary in view of the diversity of urban/interurban mobility?	
	(v)	What role do you think road	

		infrastructure will play in the development of MaaS (Mobility as a Service)?	
e) Geographical and territorial impacts of new mobility on road infrastructure	(i)	What would be the most appropriate decision-making level according to the different types of future mobility?	
	(ii)	How to ensure an equal access to mobility across all territories (dense urban areas / rural areas)?	

	(iii) What about interconnectivity between countries (EU, outside EU)?	

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Questionnaire “Road infrastructure and new mobility”

PUBLIC ACTORS

IMPORTANT: This questionnaire is part of the benchmark study carried out by Routes de France, European Union Road Federation and the French Federation for Public Works (FNTP). The information collected is intended to enrich this study for publication in October 2019. **No personal information will be made public without the consent of the participants**.

What is new mobility?

The notion of "new mobility" or "emerging mobility" aggregates innovations of various kinds, relating to motorization, autonomy, mode of ownership, or type of travel. These innovations also have consequences for freight transport traffic.

Heavy vehicles and car decarbonisation, autonomous and connected mobility offers are all systems based on the "vehicles infrastructures, uses" approach, making the road of tomorrow a system of systems.

The following observations can be made during the initial work:

- **New mobility is profoundly changing value chains**, with digital players potentially shaking up the current practices;
- Several horizons are set out: total electro mobility, a totally autonomous vehicle, shared use and the end of vehicle ownership. The technological and economic viability of the solutions that could contribute to reaching these objectives is still too uncertain to envisage massive deployments in the short or medium term.
- **The business model of these solutions is based on a dual choice of public decision-makers and consumers**, making their deployment difficult to predict over time.
- **The development of these technologies is at the heart of strategic global industrial challenges**.
- **The infrastructure is at the heart of these tensions.**
- That includes soft mobility and free floating, scooters, gyro pods, bicycles, as well as buses and vans.

Your vision matters.

Share with us your vision of new mobility. Thank you very much for your participation!

Country / State / Area	
Person completing the questionnaire (please indicate first name, family name, organization and position, email address and/or phone number)	
Description of your organization	

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1. General Questions		
Question		**Answer**
(a)	(i) According to you and considering the new mobility, what would be the most important changes in your area /country concerning road infrastructure?	
(b)	(ii) What is the economic environment and who are the main actors in the field of mobility and transport in your area/country?	
(c)	(iii) What type of new mobility is currently the most studied in your country, and why?	

(d)	(iv) How do you see the organization and role of road infrastructure in the future from a territorial point a view? Please specify at which territorial level (State / region / municipality).	
(e)	(v) What are the objectives assigned to road infrastructure in your country for the next decade?	
(f)	(vi) Do new mobility lead to a rethinking of the governance structure and competence of road infrastructure?	
(g)	(vii) Do new mobility create new economic models to be developed for road infrastructure?	
(h)	(viii) How can the combined actions on infrastructure, automotive technology and new usages help coping with the future traffic evolution while meeting road safety, mobility and environmental objectives?	

(i)	(ix) What are the potential financial sources for the adaptation and upgrades of road infrastructure?	
(j)	(x) Are there experimentation or test centers for new mobility (new vehicles, adaptation of road technology) in your country?	
(k)	(xi) Do public authorities encourage financially full-scale tests and experiments? If so, please specify how.	
(l)	(xii) Do you think that changes in mobility will have an impact on employment, training skills and new management skims in the road construction and infrastructure sector, and why?	

2. Specific Questions			
Question			**Answer**
a) Role and place of road infrastructure and its equipment in the development of the autonomous and connected vehicle and their respective interactions	(i)	What initiatives or projects are being studied on road infrastructure with regard to the upcoming arrival of the connected and autonomous vehicle?	
	(ii)	What are the current initiatives or projects concerning platooning?	
	(iii)	What are the necessary adaptations to road infrastructure and equipment, considering the upcoming of these new vehicles and new technologies?	
b) Role and place of road infrastructure in the deployment of electro mobility	(i)	What initiatives or projects are being studied on road infrastructure for the deployment of electro mobility (induction, conduction, dynamic battery charge, hybrid…)?	
	(ii)	How can we ensure that vehicle and infrastructure can cope with specific vehicle requirements in 10 years' time?	

c) New road infrastructure functionalities for the ecological and energy transition?	(i)	What initiatives or projects are under study on road infrastructure considering sustainability and energy issues?	
d) New infrastructure challenges in the face of changing usages and services needs	(i)	What are or will be the changes in the services offered by the infrastructure, considering the change in usages and needs (including energy generating storage)?	
	(ii)	What are the expected changes in mobility usage in your area/country?	
	(iii)	What initiatives or projects are underway or under consideration in this regard?	
	(iv)	What changes or adaptations to public space/roads are necessary in view of the diversity of urban/interurban mobility?	

	(v)	What role do you think road infrastructure will play in the development of MaaS (Mobility as a Service)?	
e) Geographical and territorial impacts of new mobility on road infrastructure	(i)	What would be the most appropriate decision-making level according to the different types of future mobility?	
	(ii)	How to ensure an equal access to mobility across all territories (dense urban areas / rural areas)?	

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