Quantifying the investments to upgrade the European motorway network and assessing their socioeconomic impact

December 2024

Report prepared for:

ASECAP

Tolls are a crucial mechanism for developing a transport system that is more sustainable, secure, digitalized, and resilient to future challenges

The **European motorway network is a cornerstone of connectivity, accessibility, and mobility** within the European Union. As a vital component of the EU's internal market, it underpins economic growth, facilitates trade, and promotes social, territorial, and economic cohesion across regions. Beyond linking cities and countries, the motorway network plays a key role in bridging economic disparities by unlocking the potential of less developed and remote areas, fostering inclusivity and equal opportunities.

Nevertheless, the road transport sector faces a pivotal moment. While its **infrastructure remains essential for enabling economic activity** and sustaining daily life, it is also one of the **largest contributors to greenhouse gas emissions**. The urgency of **decarbonising road transport** has never been greater. Meeting this challenge requires a unified and coordinated effort at both European and national levels to **modernise road infrastructure and accelerate the transition toward sustainable, resilient, and efficient transport systems.**

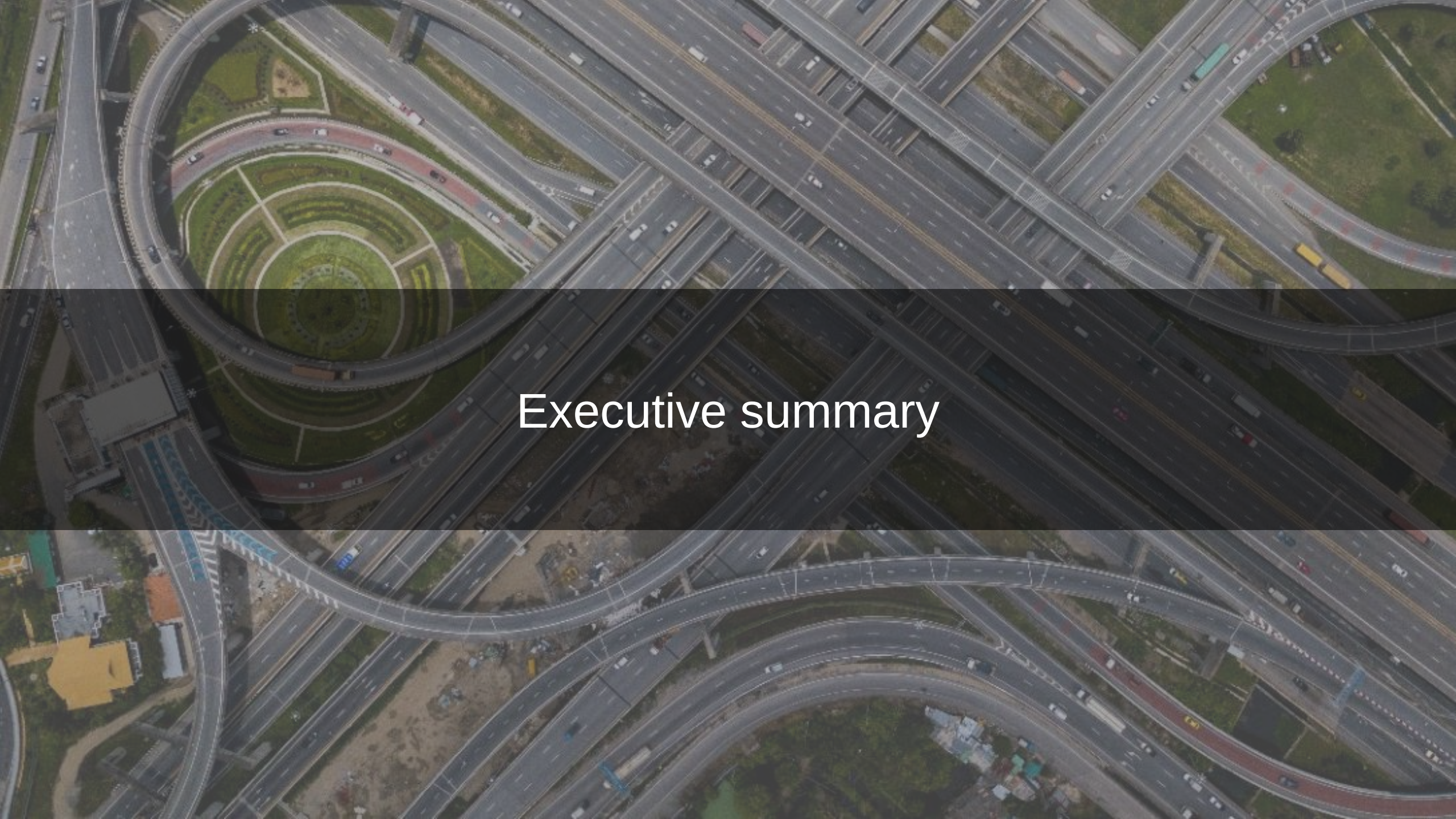
Despite its importance, investment in transport infrastructure across the EU has declined over the years. **Insufficient funding has hindered the modernisation of motorways**, limiting their capacity to address critical challenges such as climate change, road safety, and digital transformation. Reversing this trend is imperative for achieving the EU's Green Deal objectives and advancing the ecological transition.

Toll roads emerge as a fundamental solution to these challenges. Beyond generating much-needed revenue, **tolling systems enable the financing of safer, modernised infrastructure** while supporting the adaptation to cleaner vehicles and **internalising the external costs of road use**. They can play a strategic role in the ecological transition, funding initiatives that improve the environmental performance of transport, enhance road safety, and promote sustainable mobility. In line with this vision, the **European Commission advocates for earmarking road user charges to finance projects** that directly benefit the transport sector and align with broader sustainability goals.

The future of infrastructure financing, however, stands at a critical juncture. **Many road concession contracts across the EU will reach their end terms within the next decade.** Without proactive planning and strategic decisions, there is a **risk that dedicated funding mechanisms will disappear**. The removal of toll systems, as demonstrated in certain cases, transfers the financial burden of maintenance, upgrades, and operations to taxpayers, jeopardising environmental targets and long-term sustainability efforts.

In this context, ASECAP has commissioned this report to assess the **investment required to upgrade the European motorway network and analyse its broader socioeconomic impact.**

By addressing the interdependencies between infrastructure, financing, and sustainability, this report aims to provide valuable insights into **how the motorway network can serve as a key enabler of the EU's long-term objectives.** The findings presented here underscore the critical role of modern, well-financed infrastructure in building a **transport system that is safer, greener, and more resilient to future challenges.**



Executive summary

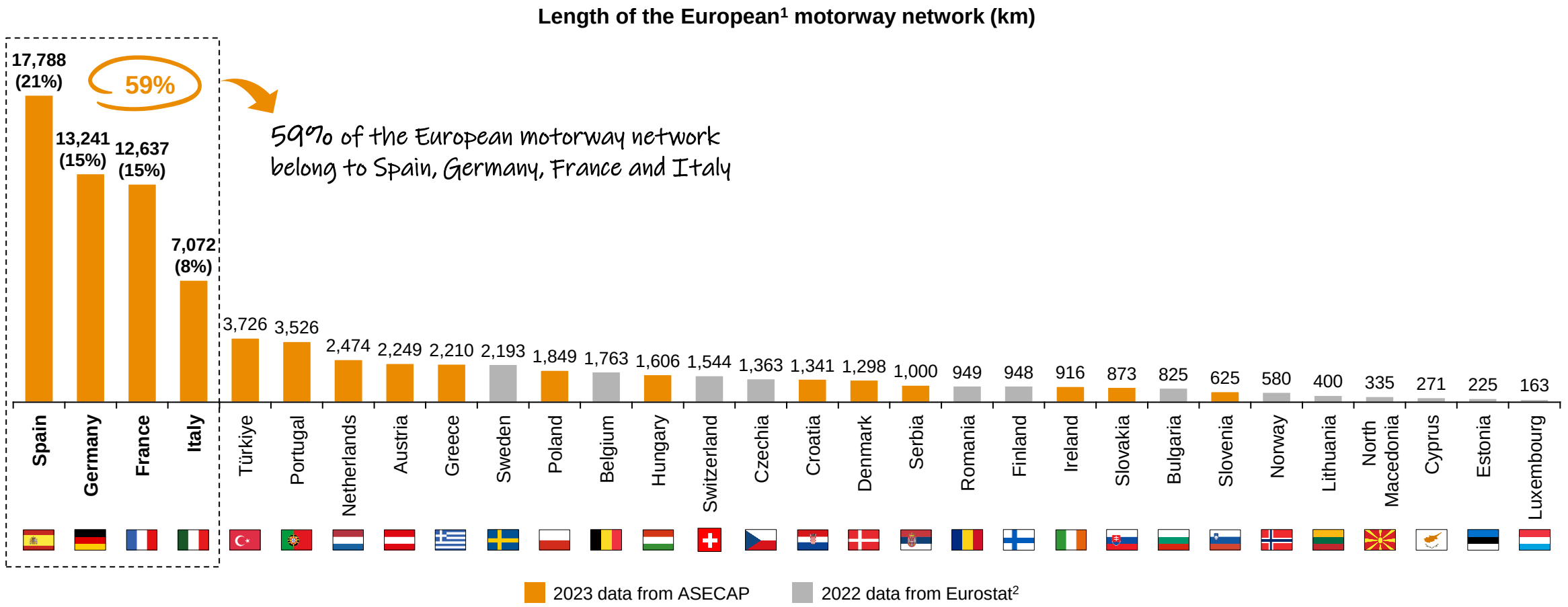
Motorways play a vital role in modern economies, serving as the backbone of road transport, the most widely used form of inland transportation

- At the dawn of the 20th century, motorways did not exist. Today, however, extensive **motorway networks** span the globe, representing one of the **most significant infrastructure achievements** in history
- These networks have become indispensable to modern economies, **enabling efficient transportation and fostering connectivity and trade**
- Within the EU-27, road transport remains the most utilized mode of inland transportation. Over the past two decades, **road freight transport has increased by 38.6%,** while **passenger transport**[1] has grown by **15.0%**
- These trends highlight the **essential role of road networks** in meeting transportation demands and driving economic activity

Growth of road transport for passengers and goods in the EU-27 (2000-2021)

(1) In the case of passengers, it has been considered road passenger transport: Passenger cars, powered two-wheelers, buses & coaches
Source: PwC analysis with information from “EU Transport in Figures - Statistical pocket book 2023”, European Commission (2023).

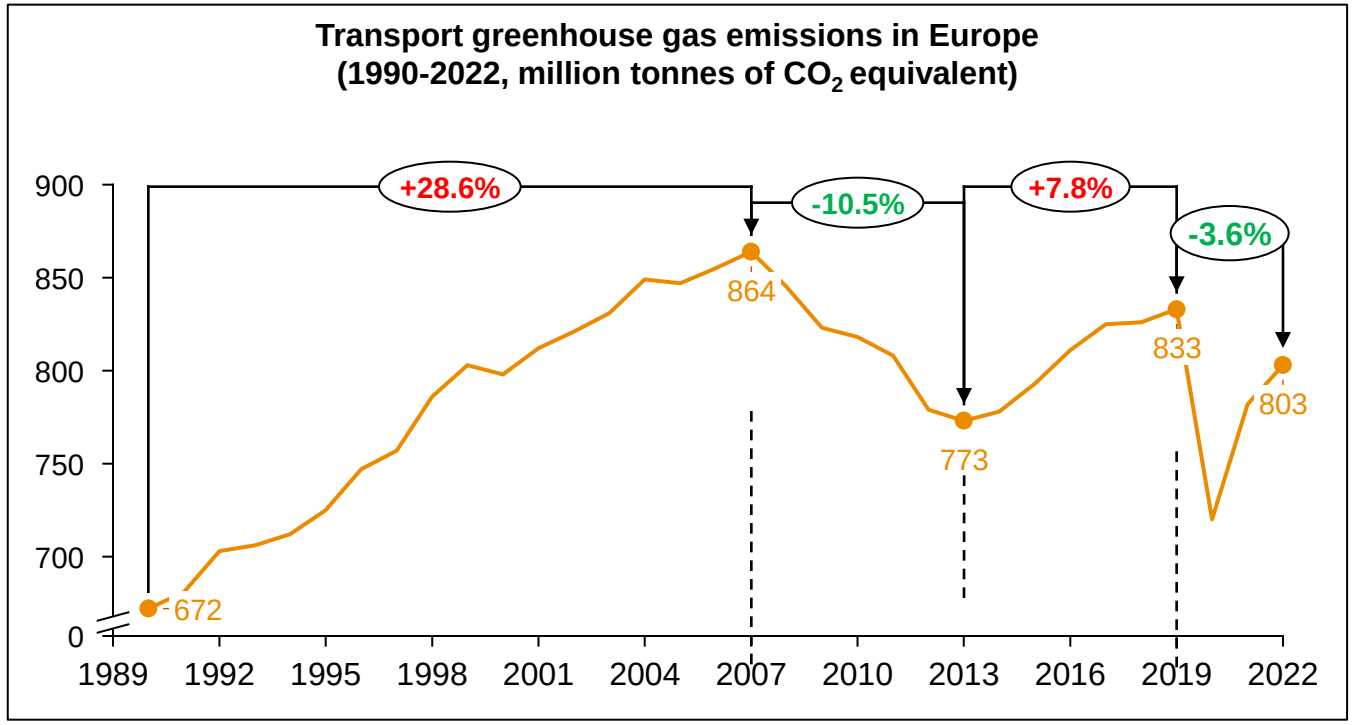
Currently, the European motorway network spans nearly 86,000 kilometers, with Spain, Germany, France, and Italy contributing to 59% of the total length

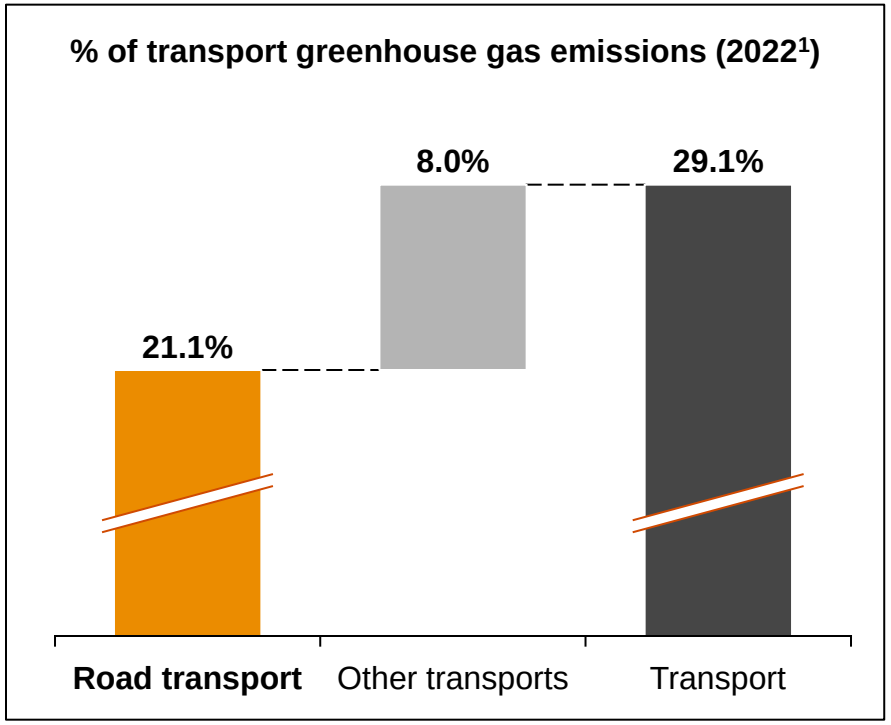


(1) The term 'European countries' refers to 27 EU countries, 3 EFTA countries (Iceland, Norway, and Switzerland), and 4 EU candidate countries (Montenegro, North Macedonia, Serbia, and Türkiye).
(2) The most recent data available, from 2022, has been utilized. For Belgium, data from 2021 has been used. There was no data available for Iceland, Latvia, Malta, and Montenegro.
Source: PwC analysis with information from ASECAP and Eurostat. The differences between the databases are approximately 4%.

The road transport sector faces significant challenges as it is responsible for 73% of transport-related emissions and 21% of total emissions in Europe

- Despite its critical role, the road transport sector faces significant challenges. Since 1990, emissions from road transport have steadily increased, now accounting for **73% of transport-related emissions and 21% of total emissions in Europe**
- The **urgency to decarbonize road transport** has never been greater. Addressing this challenge requires a unified and coordinated effort at both European and national levels to **modernize road infrastructure and accelerate the transition to sustainable, resilient, and efficient transport systems**. This transition is vital for achieving the EU's climate goals and meeting the objectives of the European Green Deal



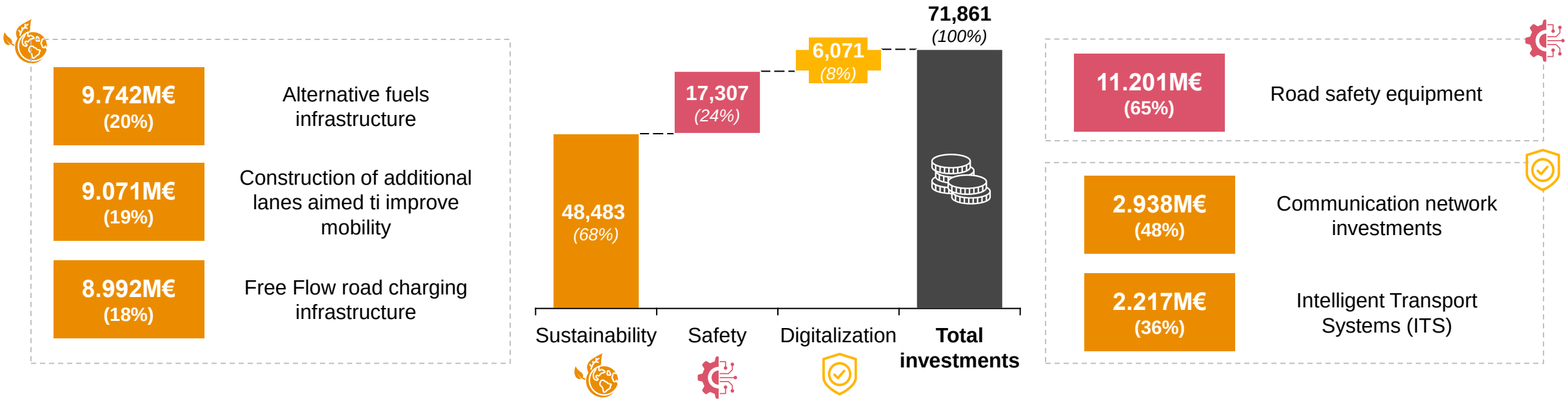


(1) Including emissions from international bunkers.
Source: PwC analysis with information from the European Environment Agency.

The modernization of the transport network to transform the mobility sector requires significant investments in sustainability, safety, and digitalization

- In this context, ASECAP (the European Association of Operators of Toll Road Infrastructures) has commissioned a report to **quantify the investments needed to upgrade the European motorway network and assess their socioeconomic impact.**
- To estimate these investments, a comprehensive **survey was conducted** among ASECAP member associations and their concessionary companies.
- Based on the survey data, it is estimated that an **investment of €71,861 million**, in addition to current motorway obligations, is necessary to upgrade the motorway infrastructure to tackle the current challenges.

Identified investment needs to improve the motorway network in ASECAP member countries, broken down by investment area (M€, 2025-2035[2])



(1) Alternative fuels infrastructure includes charging points for electric vehicles, hydrogen charging points and dynamic recharging systems.
(2) According to the survey 27% of the responses indicate that they would carry out the investments in less than three years, 19% in three to five years, 43% in five to ten years, and 10% in more than ten years. The period "2025-2035" has been defined assuming that the investments will begin in 2025 and takes into account only 10 years, since 90% of the responses fall within that period.

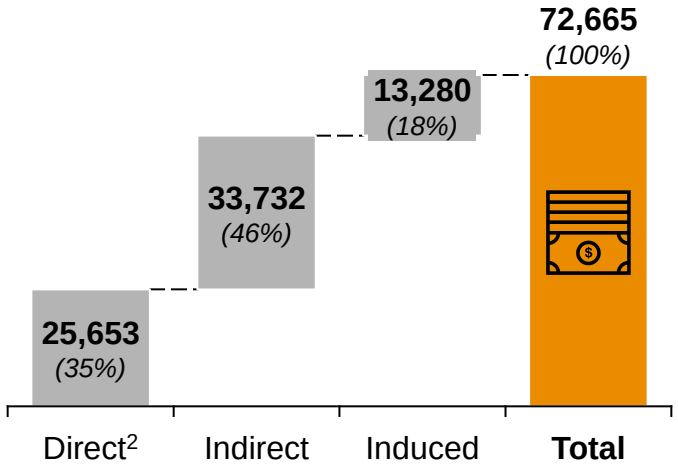
PwC Sources: PwC analysis with information from a survey conducted with ASECAP member associations.
For more information see the methodological annex.

These investments would yield significant socioeconomic benefits for the EU, enhancing GDP, boosting employment, and increasing tax revenue

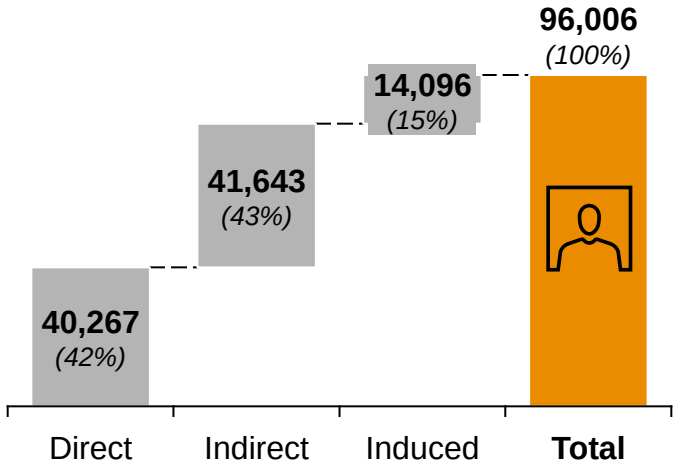
These investments will have a substantial socioeconomic impact on the EU, contributing to **GDP, employment, and tax revenue**. Furthermore, they will help to **reduce greenhouse gas emissions, alleviate congestion, lower noise pollution, and improve road safety.**

Contribution of investments in the European motorway network to the…

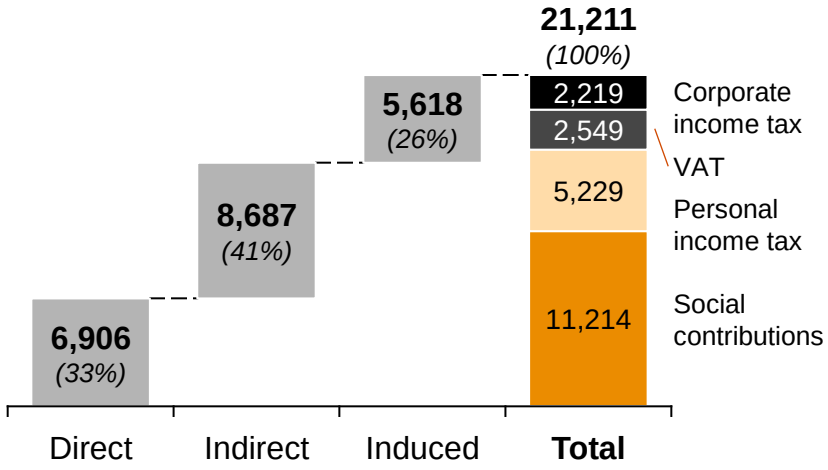
…GDP of the EU-27 (€M)



…employment of the EU-27 (FTE/year jobs)



…tax revenues of the EU-27 (M€)



72,665 M€[1]
GDP (2025-2035)

96,006
Jobs (FTE/year)[3] (2025-2035)

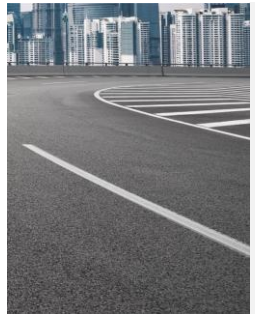
21,211 M€[1]
Tax revenue (2025-2035)

(1) Data in current euros for 2024.
(2) The investments required to improve the European motorway network of 71,861 million euros would generate a direct impact on GDP of 25,653 million euros in the EU-27, with the remainder being mainly intermediate consumption.
(3) They have been calculated taking into account a period of 10 years, since 90% of the responses indicate the investments would be carried out in less than 10 years.
Sources: PwC estimates using Input-Output Methodology and Eurostat data.
For more information see the methodological annex.

The comprehensive upgrades to the motorway network are expected to make a substantial contribution to the EU-27 economy, equivalent to…

Socio-economic impact of the investments to upgrade the European motorway network

The total contribution of 72.655M€ to the GDP is equivalent to…



…93.2% of the subsidies allocated in the EU for road construction between 2007 and 2020
(78,000 M€)

…14.4% of the public investment on Gross Fixed Capital Formation in the EU in 2022
(505,432 M€)

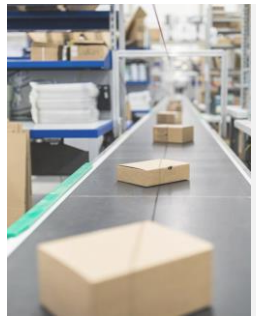
The total contribution of 96.006 jobs is equivalent to…

…0.9% of the employment of the transportation sector in Europe in 2023
(10,691 thousand employees)

…0.7% of the employment of the construction sector in Europe in 2023
(13,645 thousand employees)

The total contribution of 21.211M€ on tax revenues is equivalent to…

…24.8% of the total taxes on imports[1] in the EU in 2022
(85,690 M€)

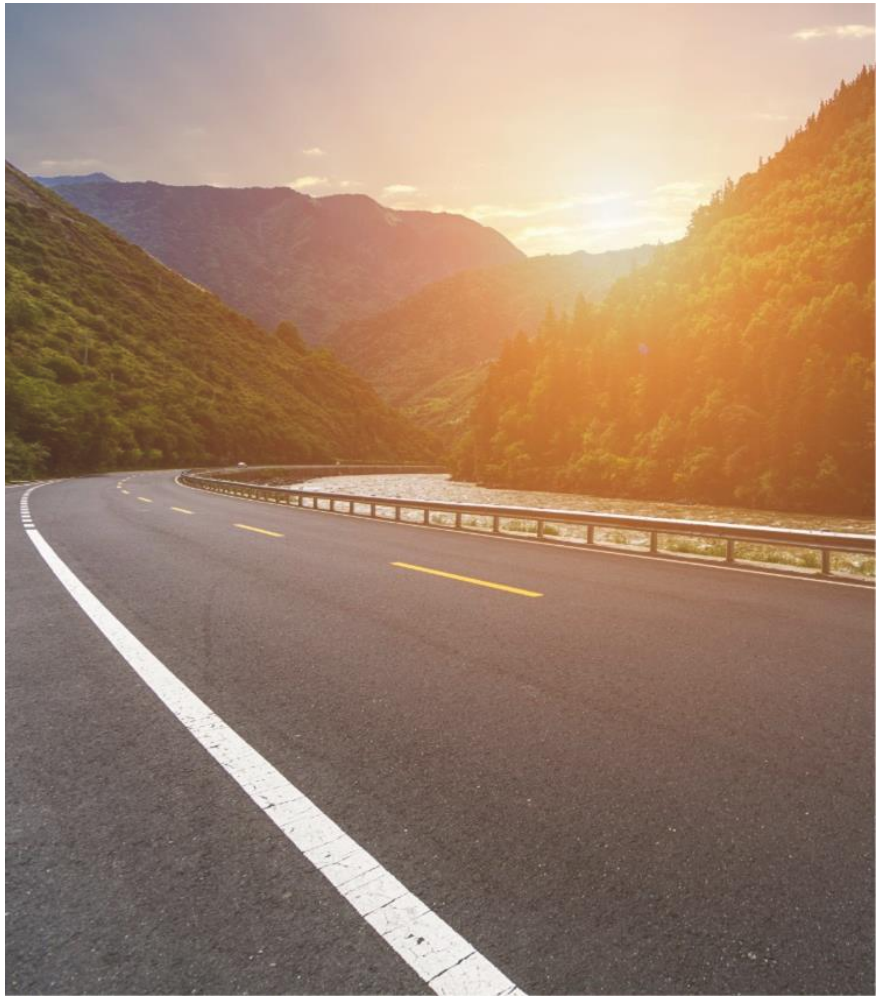


…4.4% of the total taxes on products[2] in the EU in 2022
(484,413 M€)

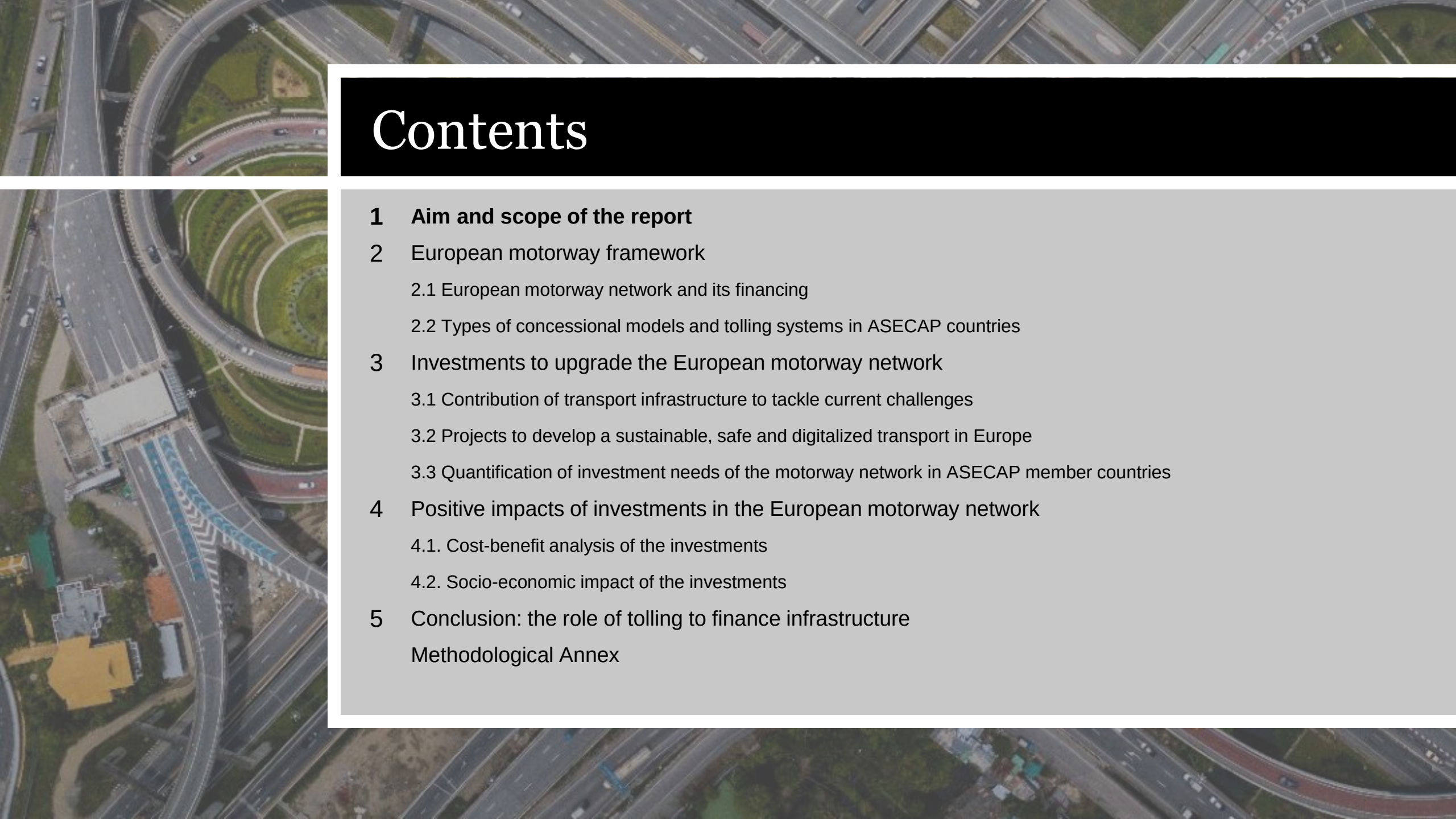
Sources: PwC estimates using Input-Output Methodology and Eurostat data.
(1) Excludes VAT
(2) Excludes VAT and import duties

To enable these investments, using funding sources like tolls is essential for a stable infrastructure development and maintenance

- Despite the benefits, **sufficient funds must be raised to implement these upgrades**. Traditionally dominated by public sector investment, infrastructure financing now faces challenges from persistent public deficits, short-term planning, shifting political priorities, and constrained public budgets. These factors have resulted in **unreliable and insufficient funding for infrastructure development**.
- To address these challenges, the EU and its Member States must explore alternative financing solutions. Among these, the **user-pays principle** stands out as a promising approach. This principle not only helps finance new investments but also aligns with the internalization of **the polluter-pays principle**, making it a **key tool for achieving the ecological transition in road transport** in accordance with **the EU Green Deal objectives**
- Implementing **tolls** based on the **user-pays principle** can substantially contribute to the Green Deal's aims. Tolls provide a **mechanism for funding enhanced and safer infrastructure**, and adapting to cleaner vehicles, which is vital for meeting both current and future demands. This approach can ensure that **public funds remain protected**, allowing Member States to allocate budgets to other essential public services
- The European Commission advocates for **earmarking road user charges to benefit the transport sector and promote sustainable mobility**. Such charges should fund projects that improve pricing efficiency, reduce pollution, enhance CO2 and energy performance, develop alternative infrastructure, optimize logistics, and boost road safety
- **Integrating tolls into the financing strategy will not only increase transport efficiency but also encourage the use of clean vehicles and intelligent transport behavior**. As countries advance towards cleaner and smarter transport systems, tolls will be a crucial financial tool, generating revenue for public budgets while promoting zero-emission vehicles and smart transport solutions
- By building on existing policies, **tolls offer a pathway to making road transport both cleaner and more efficient, aligning with broader sustainability and efficiency goals**



Sources: PwC analysis with information from “ASECAP Proposals reaching net zero carbon mobility tools for sustainable mobility solutions”, ADECAP (2023), “The Economic Impacts of Road Tolls”, Transport & Environment (2017) and “Building Resilience New Strategies for Strengthening Infrastructure Resilience and Maintenance”, OECD (2021).



Contents

The aim of this report is to quantify the investment needs for upgrading the European motorway network and to estimate its impacts

Aim of the report

- EU motorways have been constructed with the highest quality standards and significant efforts are continuously made to maintain the network in optimal conditions, however **substantial investments are still required** to adapt it to the **new mobility trends and Environmental, Social, and Governance (ESG) goals**
- The **increasing demand for efficient and sustainable mobility**, coupled with growing expectations for **reducing environmental footprints** and enhancing the quality of life for citizens, drive the **need for modernization and optimization of the European motorway infrastructure**
- This report aim is to identify the **needed investments** to meet these environmental and sustainability challenges, and assess the **positive impacts** of their implementation in the sustainability, safety, and digital areas
- By addressing these needs, the report will offer a **comprehensive perspective on the future investment needs to upgrade the European motorway network**, ensuring that the road network supports **global sustainability and smart urban development goals**
- **These investments are not included in the current concession contracts[1],** nor do they represent a commitment for the concessionaires

Analysed topics

European motorway network

Provides an overview of the **European motorway network**, a detailed explanation of the **concept of tolls**, and an in-depth analysis on the various **types of concessional models and tolling systems** employed throughout Europe

Investments to upgrade the EU motorway network

Address the essential contributions of **transport infrastructure to current challenges**, outlines **key projects** aimed at developing **sustainable, safe, and digitalized transport** across Europe, and quantifies the **investment requirements** for the motorway network in ASECAP member countries

Positive impacts of investments in the EU motorway network

Explores the **cost-benefit analysis** of necessary investments, examines the **socio-economic impacts** of these investments, and **states the essential role of tolling in financing** the required infrastructure

(1) The investments are proposed for the entirety of the kilometers of the motorway network in the full member countries of ASECAP in 2023 (60,317 km), not just for the kilometers under toll.

This report provides a Europe-wide analysis, with a special focus on the 15 European countries full members of ASECAP

- ASECAP is the **European Association of Operators of Toll Road Infrastructures** and its network is comprised by **18 countries** (15 full members and 3 associate members)
- Its purpose is to **defend and develop the system of motorways and road infrastructures in Europe applying tolls** – the user pays principle - as a powerful tool to **ensure the adequate financing of their construction, maintenance and operation**

15 ASECAP full members

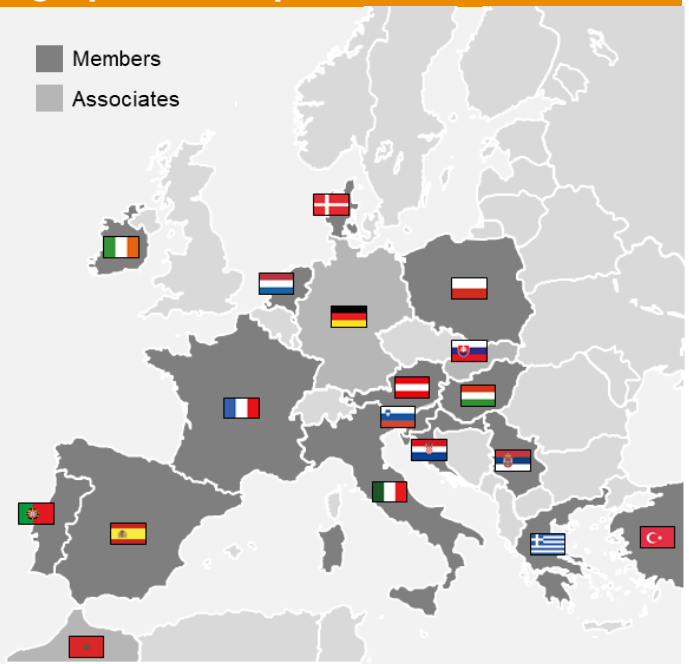
DARS · Public Enterprise Roads of Serbia · seopan · Westerschelde Tunnel · Polskie Autostrady Koncesyjne · ICA · Aiscat · Hellastron · Asfinag · apcap · HUKA · Sund & Bælt · ITIA · ASFA · AKA M5 Motorway

3 ASECAP associates

Toll Collect – service on the road · الطرق السيارة بالمغرب Autoroutes du Maroc · Národná diaľničná spoločnosť

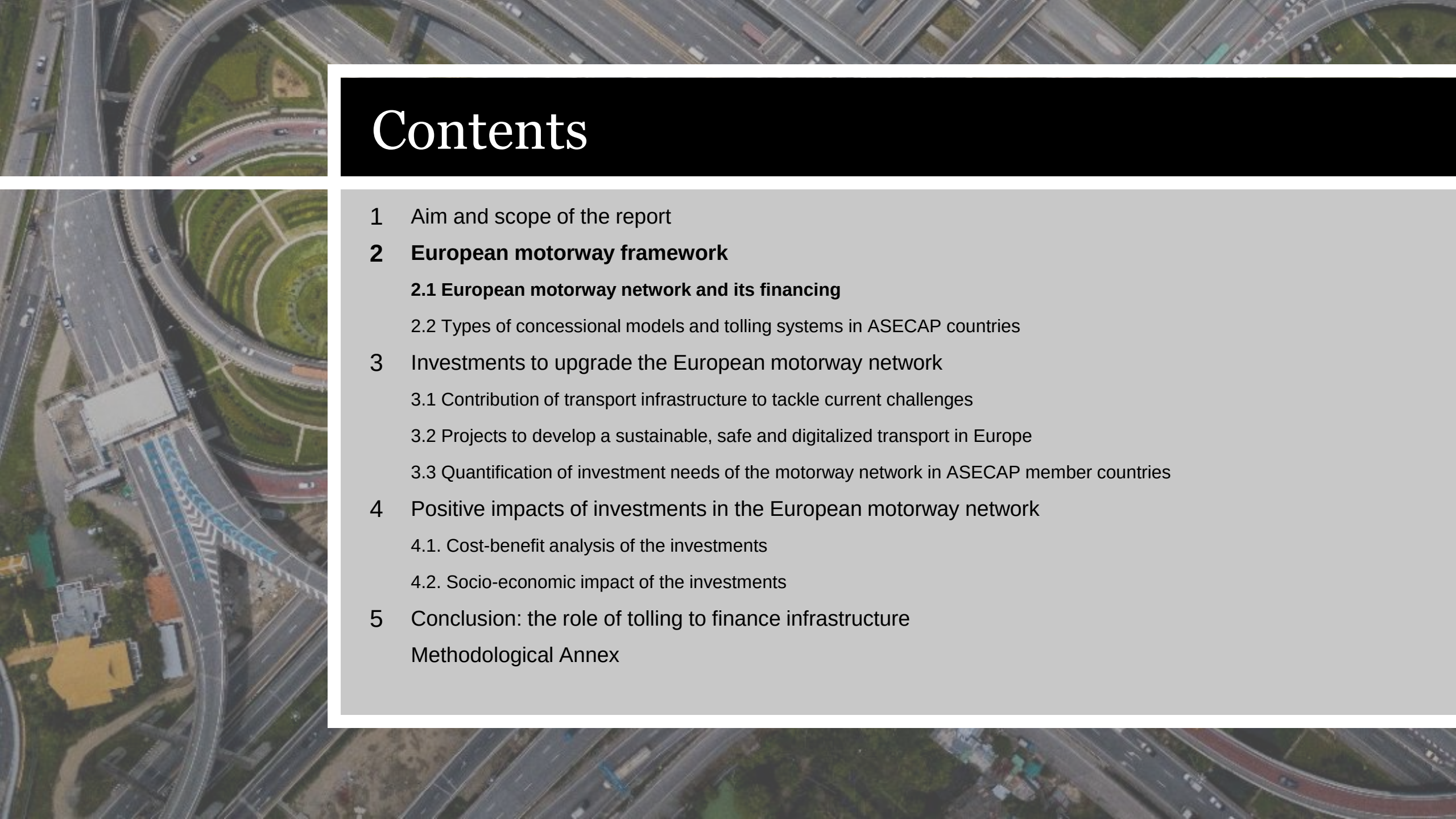
Geographical Scope

- The geographical scope of the study is **Europe**
- Special focus on **the 15 ASECAP full member countries** for which data is available: Austria, Croatia, Denmark, France, Greece, Hungary, Ireland, Italy, Morocco, Poland, Portugal, Serbia, Slovenia, Spain, The Netherlands, Turkey
- Morocco is also included as ASECAP associate country



Temporal Scope

- For **descriptive** purposes, **historical data** with the maximum available period has been used
- The **investment** data comes from a **survey** conducted by PwC in **2024**
- This data has been used to estimate **impacts** and primarily provides information on **investments** for **2025-2035**



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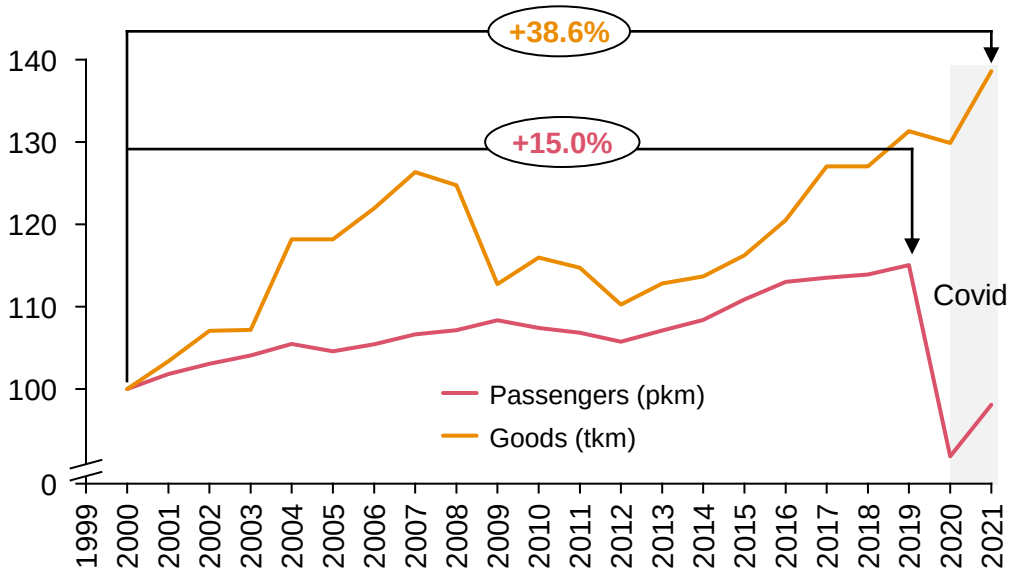
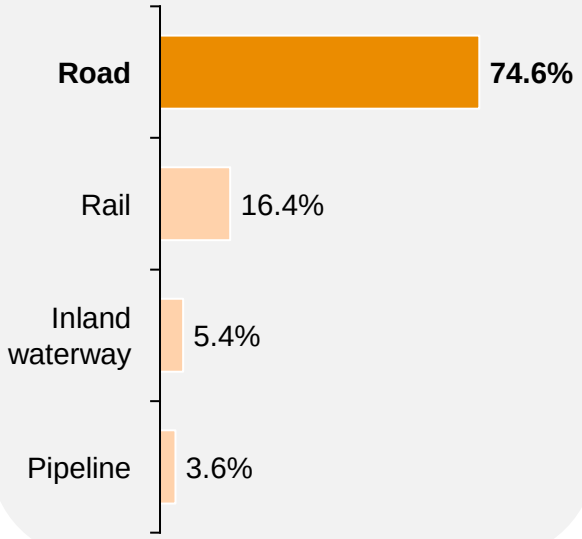
Road transport is the most used inland mode in the EU-27, with growth of 38.6% for freight and 15.0% for passenger transport over the past two decades

- In 2019, more than 4.8 trillion passenger-kilometers traveled in the 27 Member States of the EU (EU-27) by road, with an **increase of 15.0%** compared to the year 2000. **Road transport** played a dominant role, accounting for **92.9% of inland passenger transport[1] in 2021**. This underscores the vital **importance of road networks to support** the **mobility needs of EU citizens**
- Similarly, the demand for **road freight transport** has seen substantial growth. Between 2000 and 2021, the total demand for road freight transport increased by **38.6%**. In 2021, road transport accounted **for 74.4% of total inland freight transport** within the EU-27, highlighting its **central role in the logistics and supply chain** sector

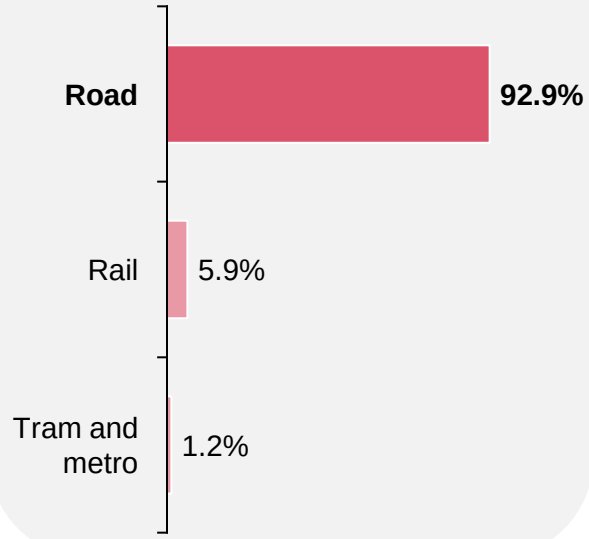
Growth of road transport for passengers and goods in the EU-27 (2000-2021)



Inland freight transport in EU by modal split (2021)



Inland passenger transport in EU by modal split (2021)



(1) In the case of passengers, it has been considered road passenger transport: Passenger cars, powered two-wheelers, buses & coaches
Source: PwC analysis with information from "EU Transport in Figures - Statistical pocket book 2023", European Commission (2023).

Its infrastructure drives economic development by reducing commuting times and costs, and enhancing labour mobility and trade

Main benefits of road transport

User benefits

- Major road interventions can yield benefits for businesses and freight travelers by **reducing journey times**, such as by **alleviating congestion**
- These reductions in journey times translate into a **decrease in the cost of conducting business** for both business and freight travelers. In most markets, this would likely result in **higher profits, lower prices, and increased output**

Agglomeration

- Enhancements to road infrastructure serve to forge **closer connections** among individuals, businesses, and locales, thereby fostering an environment ripe for **heightened productivity**
- This increased proximity facilitates **greater collaboration, resource pooling, risk mitigation**, and more **efficient alignment between labor and companies**

Business Investment & FDI

- Reduced transport costs can lead to increased productivity, motivating firms to **invest in areas benefiting from road improvement**
- Capital influx, whether through foreign direct investment (FDI) or domestic expansions, has the potential to **reshape the local economy** (changes in the structure of industries, job markets, and business landscapes)

Labour market effects

- The **improved accessibility** to a greater number of job opportunities can lead to the **creation of employment opportunities**
- Workers may be enticed to relocate to an area with **shorter commuting times** or to take advantage of the **benefits** associated with increased **agglomeration and investment**, such as higher wages and access to a wider range of goods

Trade

- Reduced travel times and enhanced reliability can expand trade opportunities, while **better access to airports, ports, and major transport hubs** may stimulate **international trade**
- Increased trade levels can foster **specialization**, and **heightened competition** among firms may drive **efficiency improvements** and lower prices for consumers

Induced housing investment

- Reduced travel expenses resulting from road improvements can **elevate the desirability of areas that have become more accessible** for both residents and businesses
- In cases where bottlenecks or congestion impede development, **road enhancements can "unlock" investment opportunities**, assuming other supportive factors are also present

Source: PwC analysis with information from “Transport in the European Union Current trends and issues”, European Commission (2024), “Exploring the economic benefits of strategic roads”, Frontier Economics (2017), “Getting Infrastructure Right The Ten Key Governance Challenges and Policy Options”, OECD (2016) and “The socio-economic benefits of roads in Europe”, European Union Road Federation (2007).

The European motorway network plays a key role in economic growth and integration, having expanded significantly throughout the 20th century

The European Motorway Network: Key Dates

1924 A 8

Italy completes the world's first motorway

1935 5

The Reichsautobahn programme is announced

1961 A 2

The A2 Autoroute in France is completed

1975

The European Agreement on Main International Traffic Arteries is signed

1984

Spain embarks on a major motorway building plan

2013

The EU announces nine new TEN-T initiatives

- **At the dawn of the 20th century, there were no limited-access highways** worldwide; however, today, these extensive networks span the globe, making them collectively one of the most significant construction endeavors in human history
- These infrastructures have fundamentally **transformed the movement of people and goods, reshaped economic governance, connected disparate regions, and influenced national development**
- The evolution of these networks **commenced in the 20th century** with the construction of the **world's first motorway**, the Autostrada dei Laghi, in **Italy in 1924**, linking Milan to the northern lake region
- Subsequently, Germany expanded its motorway system in the 1930s through the Reichsautobahn program
- In 1975, the **European Agreement on Main International Traffic Arteries** was signed, setting **minimum standards for international traffic routes** and facilitating cross-border travel
- To further bolster economic integration across Europe, the **Trans-European Transport Network (TEN-T) policy was introduced**, serving as a pivotal tool for planning and developing a coherent, efficient, multimodal, and high-quality transport infrastructure throughout the EU
- The first TEN-T action plan was adopted in 1990, and in **2013, the EU unveiled nine new TEN-T initiatives**. These initiatives, alongside other funding programs such as the European Regional Development Fund (ERDF), provide financial support to enhance the European motorway network

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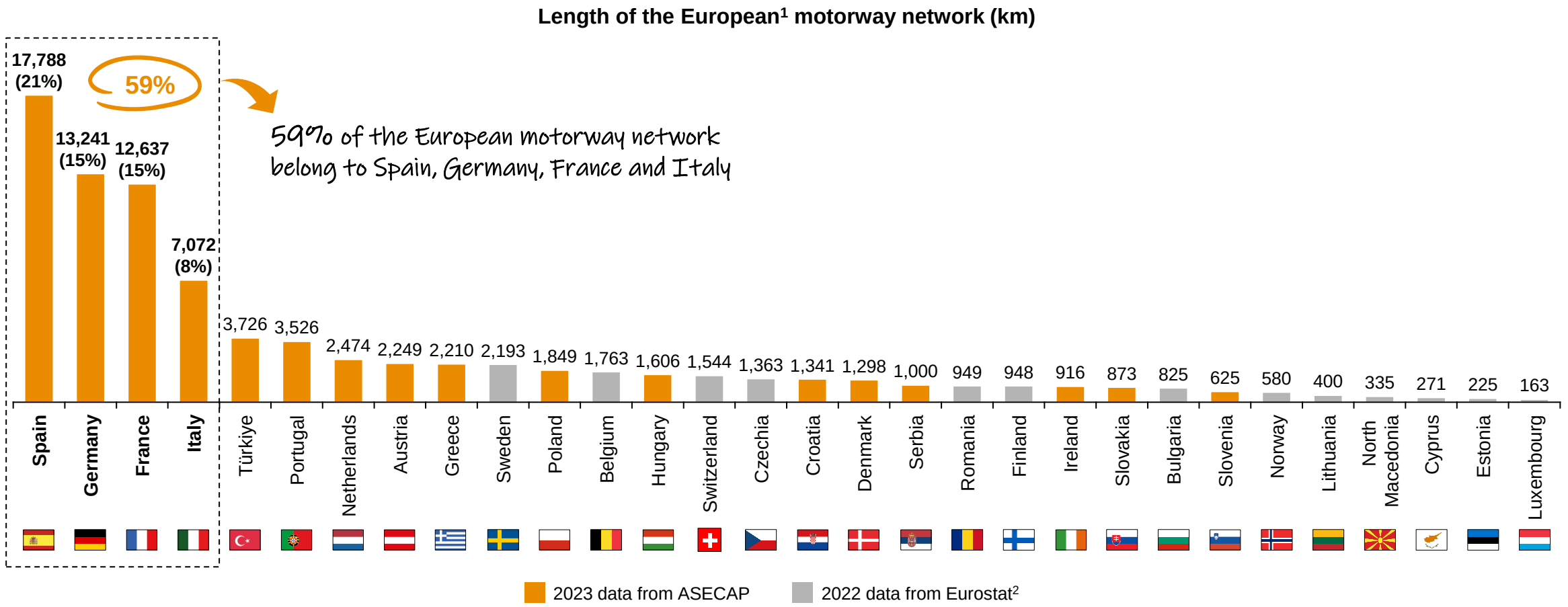
Source: PwC analysis with information from V&A and the EU

This network currently spans 85,990 km, with Spain, Germany, France, and Italy accounting for 59% of the total length



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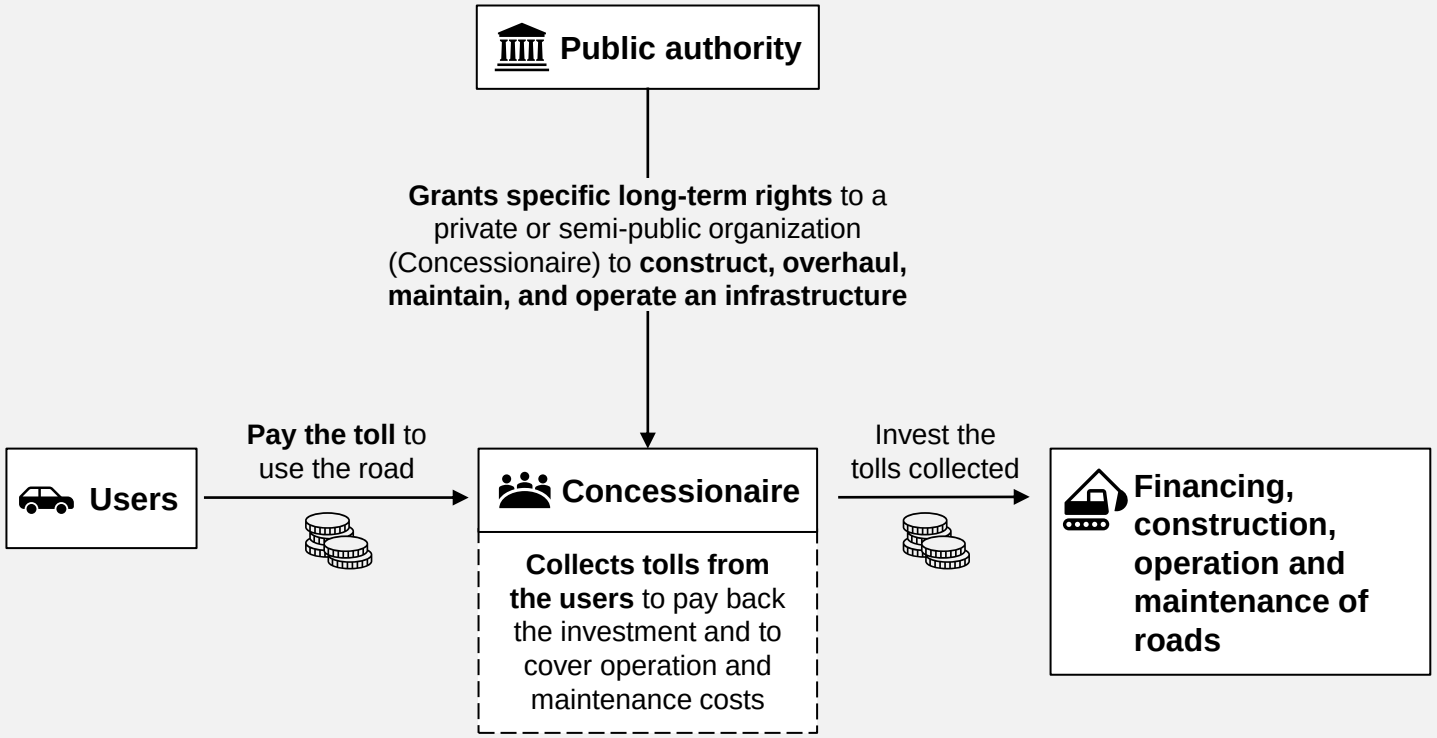
Source: PwC analysis with information from ASECAP and Eurostat. The differences between the databases are approximately 4%.

Constructing and maintaining motorway infrastructure incurs high costs, and tolls are an efficient and widely used method to fund it

General operation of toll roads



- **Constructing and maintaining the motorway network is expensive**, and governments are often unable or unwilling to commit public funds on it
- Consequently, **road tolls** were introduced mainly to help financing the **construction and maintenance of motorway networks**
- Hence, **European governments** have gradually **expanded** the use of **toll roads** to **fund infrastructure projects** and better **manage** t**he quality** and quantity of traffic on their roads
- In this context, a **toll refers to the fee or charge that drivers must pay to use a specific road or motorway**
- **Toll roads** can be defined as infrastructure projects that are financed, constructed, operated, and maintained with funds coming from the tolls paid by users
- These projects establish distinct roles: **the public authority owns the road network**, while a **company (concessionaire) manages and operates it**
- In **Europe**, various forms of this relationship exist, including **road toll concession schemes, direct public authority control through agencies and public-private partnerships**

Source: PwC analysis with information from “Evaluation and future of road toll concessions”, PwC (2014) and “Europe’s Evolving toll infrastructure: New Complexities and Costs for Fleets and Rentals”, Verra Mobility (2022)

The original concept of tolls was based on the "user pays" principle, which has evolved over the past decades to also incorporate the "polluter pays" principle

Institutional framework of tolls

Italy was the first European country to introduce the use of a **road toll on a 50km section of motorway** *Milano-Laghi*

1924

1999

European Commission's **Directive 1999/62** encourage Member States to use taxation and **infrastructure charging** effectively and fairly, adhering to the **'user pays**' and **'polluter pays'** principles, focusing on **heavy-goods vehicles**

The European commission amended the Directive, with a shift on focus away **from national tolling to a trans-European road network**

2006

2011

The European commission amended the Directive, with the differentiation of tolls according to the **environmental performance of the vehicle**

The European Commission amended the Directive to **extend the "user pays" principle to passenger cars**

2022

User Pays Principle

- The "User Pays Principle" centers on the idea that **users of a public facility** or consumers of a public good **should bear the costs associated with the infrastructure they utilize**
- By requiring users to pay for the services and facilities they use, the User Pays Principle **discourages overuse and misuse of public goods**, as individuals are more likely to use them responsibly when they are directly accountable for the costs
- This principle also helps to create a **fairer system** where the **financial burden does not fall disproportionately on taxpayers** who may not directly use the infrastructure

Polluter Pays Principle

- The "Polluter Pays Principle" asserts that **the polluter should be responsible for the costs associated with pollution prevention measures or compensating for the damage caused by pollution**
- This principle was **first adopted** in the early **1970s**, coinciding with the introduction of stringent environmental regulations in OECD countries
- It addresses the question of **who should bear the financial burden of environmental protection**, rather than determining the exact amount to be paid
- This principle aims to **internalize the environmental costs of economic activities**, ensuring that these costs are reflected in the prices of goods and services. By doing so, it **incentivizes polluters to reduce their environmental impact and invest in cleaner technologies**

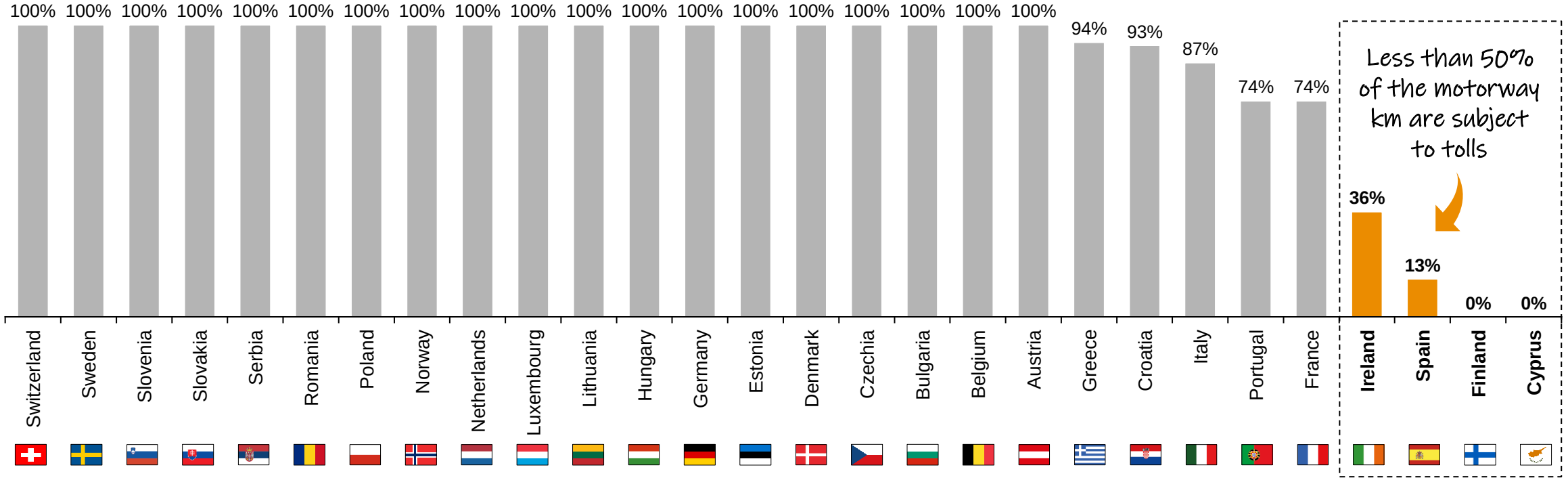
Source: PwC analysis with information from "Directive 1999/62/EC", European Parliament (1999), "Directive 2006/38/EC", European Parliament (2006), "Directive 2011/76/EU", European Parliament (2011), "Directive (EU) 2022/362", European Parliament (2022), and "Sustainability Report 2022", AISCAT (2023).

The current toll motorway network in Europe represents approximately 73.8% of the total network

73.8% of motorways subjects to tolls

Approximately **73.8% of the European motorway network is subject to tolls**, predominating across most European countries, with the notable **exceptions of Ireland (36%), Spain (13%), Finland (0%), and Cyprus (0%)**

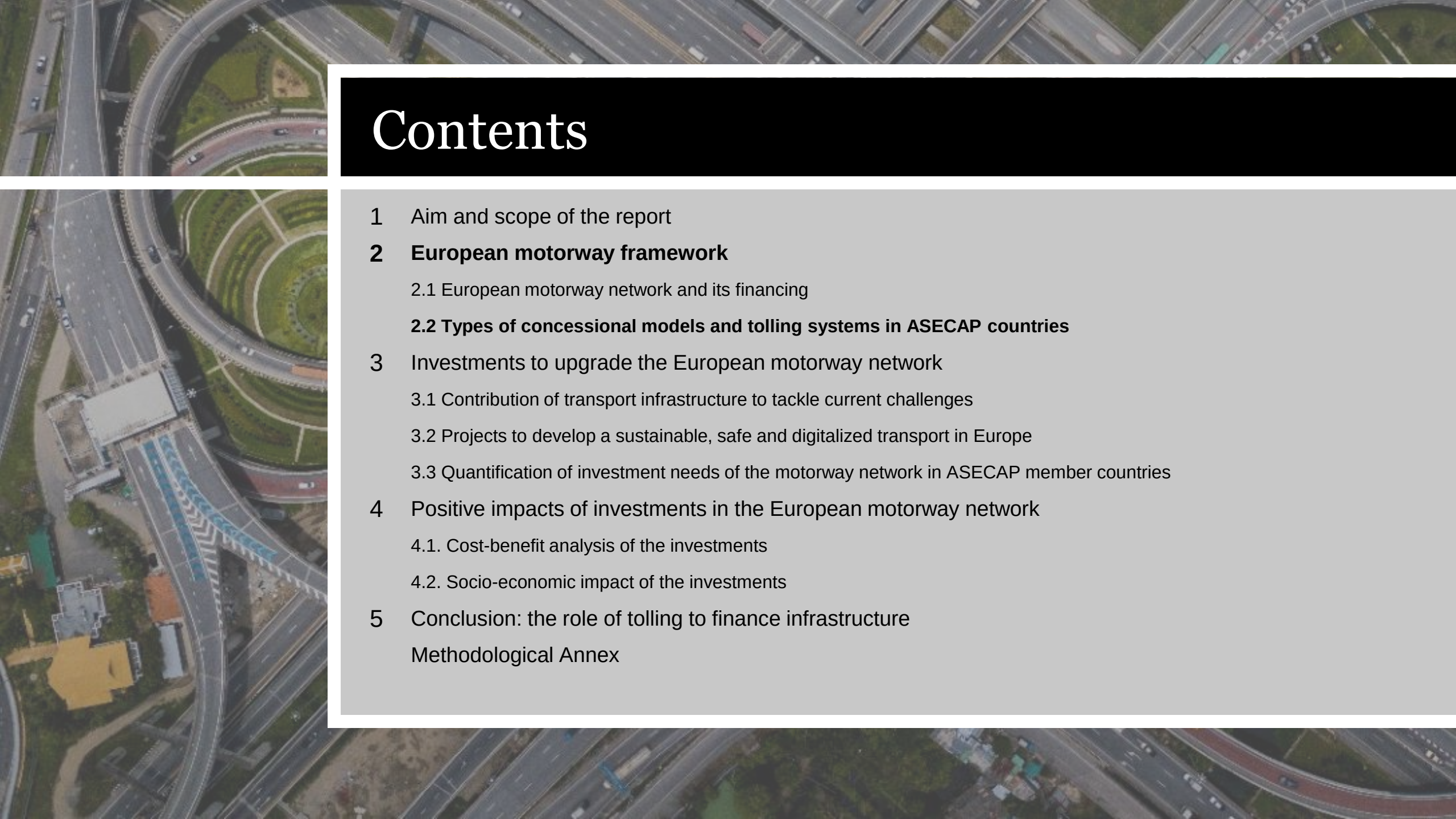
% of the kilometers of the European[1] motorway network subject to tolls[2] (km, 2023)



(1) The term 'European countries' refers to 27 EU countries, 3 EFTA countries (Iceland, Norway, and Switzerland), and 4 EU candidate countries (Montenegro, North Macedonia, Serbia, and Türkiye). There was no data available for Iceland, Latvia, Malta, Macedonia, Montenegro and Türkiye.

(2) It includes toll and vignette system, and it does not imply that all types of vehicles are subject to tolls

Source: PwC analysis with information from ASECAP.



Contents

ASECAP, the European Association of Operators of Toll Road Infrastructure, manages over 81,300 km of toll roads across Europe

ASECAP main figures

81,300 Km of network

124 Companies

+8 Billion € Investments

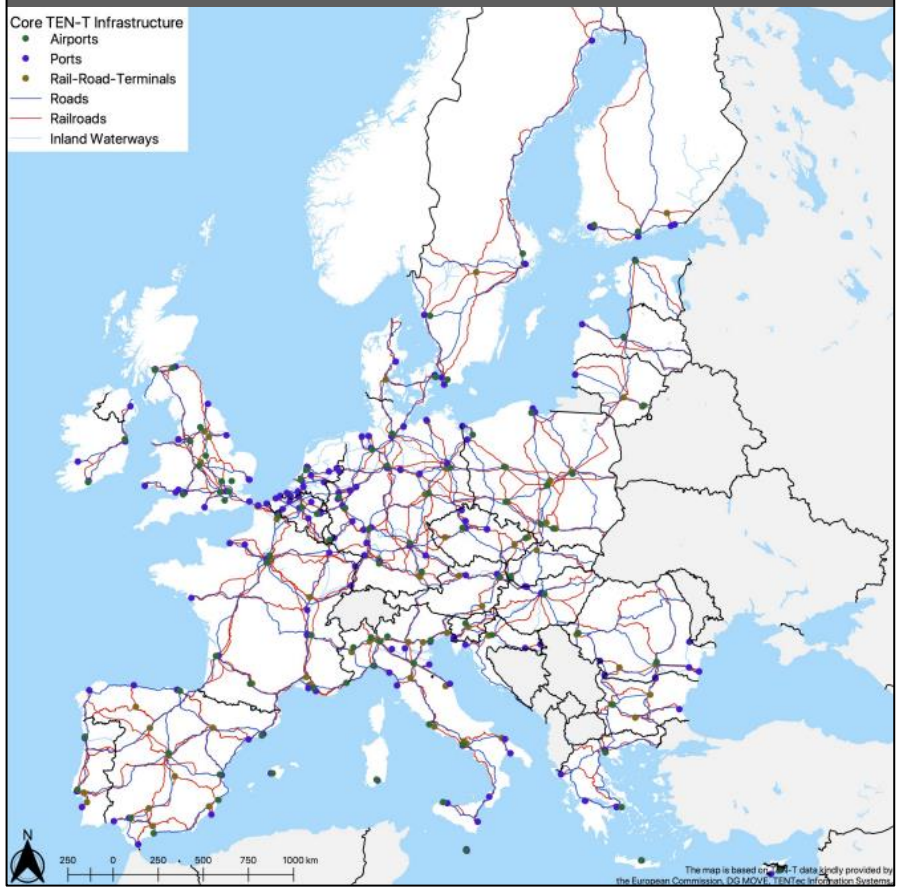
+5.9 Billion € VAT

+35 Billion € Toll revenues

46.200 Employees

- ASECAP members operate a network of **almost 80,000 km of roads**, primarily located within the **core TEN-T network**
- This network serves as a **vital infrastructure** backbone, ensuring **smooth transportation flows** and contributing to the **overall functioning of economies and societies**. By linking major ports, airports, and territories, it plays a **crucial role** in facilitating **trade, tourism, and regional development**
- The toll road network indeed supports the daily lives of us all. It gives access to the **goods and services** that citizens need. It **connects people** with their families and friends. It is also the lifeblood of the economy, performing a crucial function in supporting **jobs and growth**
- Additionally, **factories and companies tend to expand near a toll road** providing better connections and communication links, thereby creating new **jobs and revenues** to the surrounding communities and ultimately **fostering economic development**

TEN-T corridor infrastructure



Note: Data from 2023.
Source: PwC analysis with data from “Key Figures”, ASECAP (2023), “Sustainability Report”, ASECAP (2022), “Asecap Proposals reaching net zero carbon mobility tools for sustainable mobility solutions”, ASECAP (2020) and “EN-T Corridors – Stairway to Heaven or Highway to Hell?”, Goldmann and Wessel (2018)

Within the network, tolls are imposed on bridges, tunnels, and roads, and can be paid directly by users or indirectly through public funds as shadow tolls

- There are **several types funding forms**, each tailored to specific needs and environments. Diverse tolling systems can be found at **various locations to fund different infrastructures,** such as **bridges, tunnels, motorways, and urban areas**
- The choice of tolling system and its location are influenced by factors such as **traffic volume, geographical constraints, financial feasibility, and local regulatory frameworks**
- Tolls can be **structured** as:

Time-based

Vignette

- A vignette is a **time-based fee** for the use of road infrastructure, with charges **varying based on the duration of use**
- This fee is **typically paid upfront** and allows vehicles to access specific road networks within designated countries or regions

Distance-based

Barrier system (Open)

- A barrier system refers to a **physical toll plaza** where vehicles are required to pay tolls based on their category **when passing through**
- These toll plazas are commonly found at **entrances or exits of bridges, tunnels, or shorter-distance toll roads**

Ticket system (Closed)

- A ticket system refers to a **physical toll plaza** where vehicles are required to pay tolls based on **the entry and exit toll station combination** of the motorway
- Typically, a **ticket is issued at the entry** toll station point and the **toll is collected at the exit** toll station point

Multi-Lane Free Flow

- It is a type of **electronic toll collection system** that allows vehicles to pass through tolling points **without having to stop or slow down**
- It can support various tolling models, including distance-based tolling

Shadow toll

- A **shadow toll** is an infrastructure **financing model** in which **the toll is not directly paid by the users**
- The **government pays the toll** to the concessionaire, and the price is set based on the number of users or vehicles using the infrastructure

Road user pays

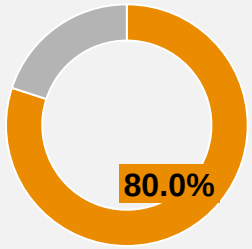
Taxpayer pays

Source: PwC analysis with information from "Directive 1999/62/EC", European Parliament (1999), "Directive 2006/38/EC", European Parliament (2006), "Directive 2011/76/EU", European Parliament (2011), "Directive (EU) 2022/362", European Parliament (2022), "Toll Systems in Europe: Overview of Different Tolling Systems and Their Impact on Road Freight Costs", International Forwarding Association (2023), "How many toll systems are there and how do they work in Europe?", OnTheRoadTrends (2022) and Ferrovial.

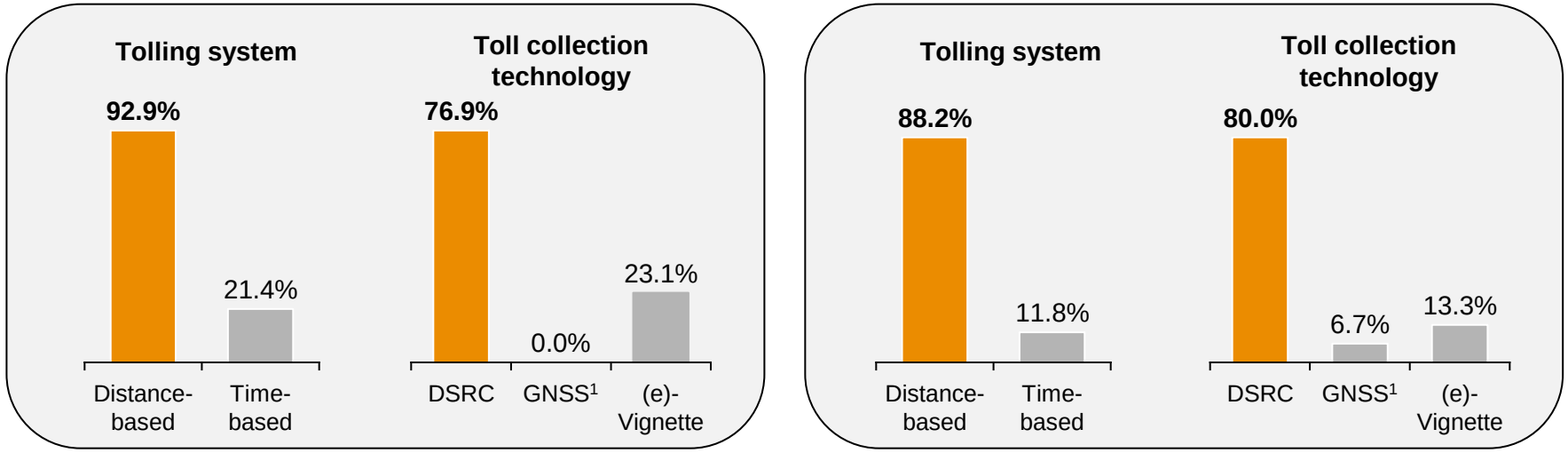
Specifically, most of the ASECAP member countries utilize barriers, distance-based tolling systems, and DSRC technology for toll collection

- A tolling system defines the **methods used for collecting toll fees** and specifies **which types of vehicles are subject to these tolls**. Across European countries, **all vehicles**, light and heavy are **required to pay tolls**, and **most systems** (80%) **rely on barriers** for payment enforcement
- Across and within European countries, tolling systems exhibit **varying characteristics** depending on the **vehicle type**. Toll systems typically distinguish between **light and heavy vehicles**, often applying different rates and collection methods
- Tolling systems can be based on either **distance or time** and they can employ different **technologies for toll collection**
- However, for both types of vehicles, most European toll systems are **distance-based**, and DSRC is the most widely used electronic toll collection system (ETC)

Use of barriers



In the ASECAP members' network, **all vehicle types**, both light and heavy, are **subject to tolls**. However, the definition of a heavy vehicle varies slightly across countries, with some using a 3.5-tonne threshold and others a 12-tonne threshold



(1) Global Navigation Satellite System (GNSS). There are 8 countries in Europe that use GNSS, although almost none of them are part of ASECAP and therefore subject to the survey.
Source: PwC analysis with information from "Evaluation and future of road toll concessions", PwC (2014) and from ASECAP.

Toll conditions are determined by concession agreements, which vary among ASECAP members in terms of their nature, obligations, and tariff-setting criteria

- To ensure the provision of **high-quality motorway infrastructure**, governments must decide who will be responsible for **designing, financing and building** the roads. Once they are constructed, the responsibility of **operating, maintaining** and upgrading it needs also to be allocated.
- **Governments** can choose -based on objective analyses such as the Value for Money- to **directly perform** all these actions or **outsource** some (or all) of them. If the preference is to **externalize**, the **role of concessionaire** companies comes into play
- In this context, the **concessional model** establishes the **terms of the concession agreement** between the concession authority and the concessionaire. This agreement includes crucial details such as the **duration of the contract, risk sharing, and the specific responsibilities and obligations of both parties**
- **In Europe, concession periods** range between **20 and 35 years**. However, there are **exceptions** such as **Austria and Serbia,** in which the concession period is **unlimited**
- Furthermore, **concessional models vary** significantly across countries in Europe. These variations reflect the **diverse approaches and regulatory frameworks** adopted by different European countries to manage and develop their motorway networks and they can be summarized in **three key areas**:

Nature of the concessionaries

Private systems: composed by one or more privately-owned concessionaries

Public systems: concessionaries are owned by the public authority (publicly-owned)

Mixed systems: concessionaries that are partially owned by the public authority, or coexistence of public and private concessionaires

Obligations

The **obligations** of the concessionaire refer to those **actions** that the **company is required to perform** during the concession period. These are **stated in the contract** and differ across models

The concessionaire company can be requested mainly to **design, finance, construct, maintain, operate and/or upgrade the infrastructure**

Tariff setting

The **financial aspects** include factors for **establishing tariffs** and determining who sets them

Tariffs can be based on **construction and maintenance costs**, vehicle dimensions, passenger count, vehicle type, and emissions

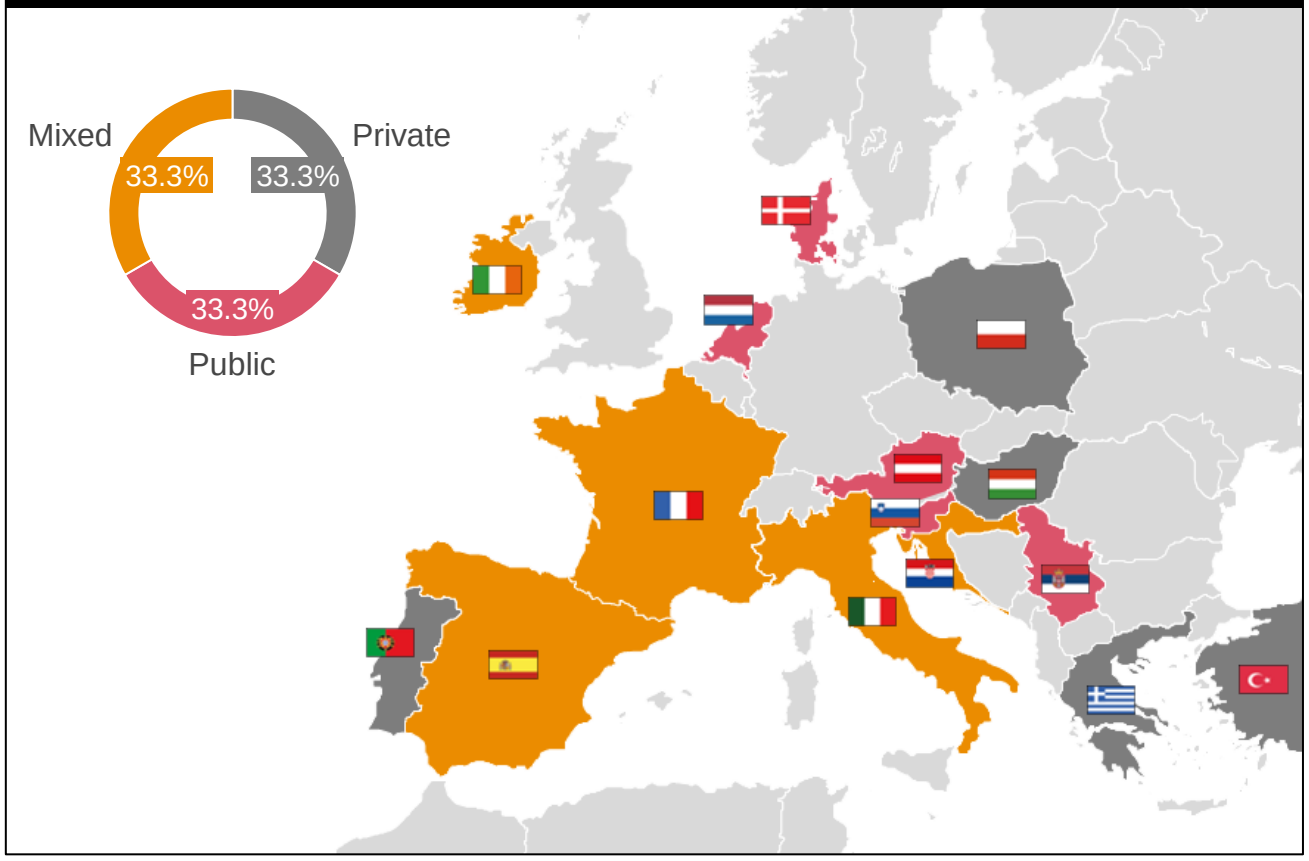
The **price** can be **set** by either the **concessionaire company** or the **government** and may be **fixed or adjusted** based on indicators like the price index

Source: PwC analysis with information from “Evaluation and future of road toll concessions”, PwC (2014).

The nature of concession models varies across countries, with private and mixed schemes predominating in the south and east, and public models in the north

- The nature of concessional models varies across Europe, although **each type** holds **similar weight across different countries**
- **Private** concessional models have a strong presence in some **southern and eastern European countries**. These models feature multiple private concessionaries that coexist and work in collaboration with the public sector through public-private partnerships
- Additionally, **mixed schemes** are also predominant in Southern Europe. This concessional model involves several concessionaire companies that may be **public, private, or have mixed ownership**
- In contrast, **public systems dominate in northern European** countries. Here, a single government-owned concessionaire company typically manages the entire toll motorway network
- The **choice of a particular system** is influenced by various factors, including government **financing capacity and risk tolerance**
- **Larger government revenues** decrease countries' preference for **private or mixed schemes.** Conversely, countries with **higher risk aversion** can be **more prone** to implement them, as these **shift the risk** to the concessionaire

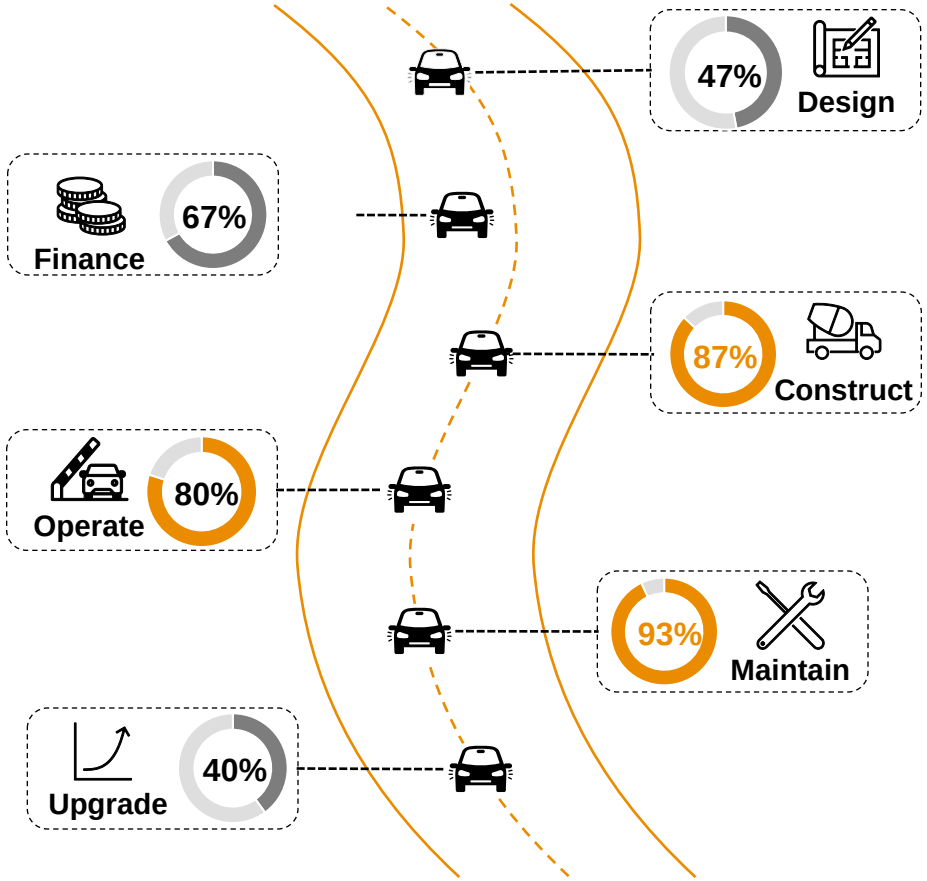
Nature of the concessional model by country



(1) Data includes the 15 ASECAP members. Private schemes include one or more private concessionaries. Public schemes include one or more government-owned concessionaire. Mixed schemes have either mixed-ownership concessionaries or concessionaries of both types (public and private). For more information see the methodological annex.
Source: PwC analysis with data from ASECAP, ASECAP associations, "Evaluation and future of road toll concessions" (PwC, 2014), "Determinants of public–private partnership policies" (Rosell and Carranza, 2020), "Concession period for PPPs: A win–win model for a fair risk sharing" (Carbonara et al., 2014).

The most common obligations of concessionaire companies include road maintenance (93%), construction (87%), and operation (80%)

Obligations of the concessional models in Europe (%) [1]

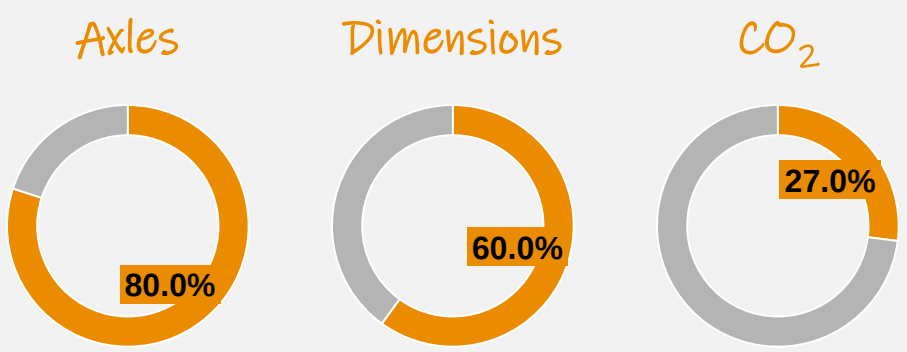


Concessions are primarily used for **maintenance (93%) and construction (87%)** of infrastructure. However, in 80% of the countries, the concessionaire is also operating the motorways. In some cases (67%), the company also finances the infrastructure; while **designing and upgrading are the least common obligations** among ASECAP countries

(1) Data includes the 15 ASECAP members. For more information see the methodological annex.
Source: PwC analysis based on data from ASECAP, ASECAP associations, “Evaluation and future of road toll concessions” (PwC, 2014), Directive 1999/62/EC and Directive (EU) 2022/362.

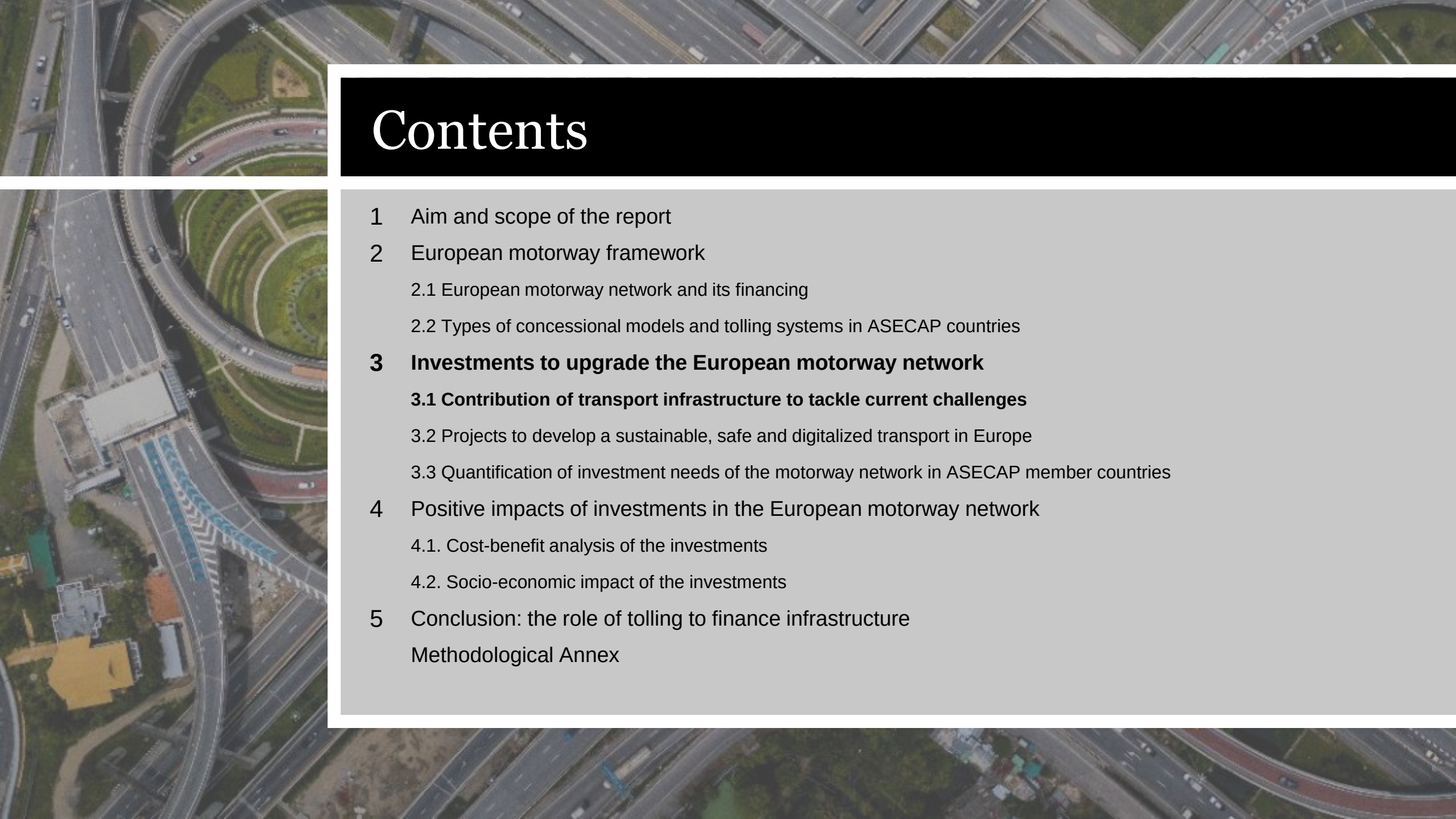
Regarding the tariff-setting mechanism, multiple factors are considered, including increasing charges for CO2 emissions

Main factors considered to set the toll tariff in Europe [1]



- **Tariffs** are set based on **capital and/or operating expenses**, aiming to collect sufficient funds to **recoup the initial investment** and cover **ongoing costs**
- Tariffs are **reviewed annually** in each country, according to their own criteria, and in many cases, the tariff is a **variable in the concession award process**
- In some countries, the **toll price** is set based on **additional factors**, such as the number of axles of the vehicle (80%) or its dimensions (60%)
- **CO2 emissions are becoming an increasingly important tariff component**. At present, only four countries (27%) included emissions in their tariffs
- However, Directive (EU) 2022/362, effective from 2024, mandates that tolls for **heavy-duty vehicles** must be **based on CO2 emissions**, with this differentiation **optional for light-duty** vehicles
- Hence, the share of countries including CO2 **emissions** in their tariffs is expected to **increase** in the short term

(1) Data includes the 15 ASECAP members. For more information see the methodological annex.
Source: PwC analysis based on data from ASECAP, ASECAP associations, “Evaluation and future of road toll concessions” (PwC, 2014), Directive 1999/62/EC and Directive (EU) 2022/362.



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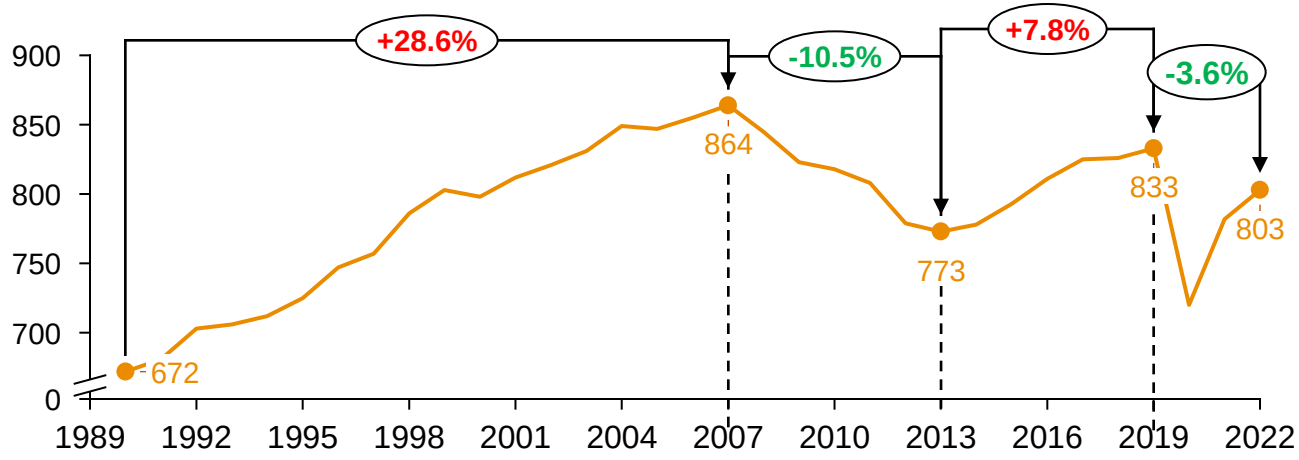
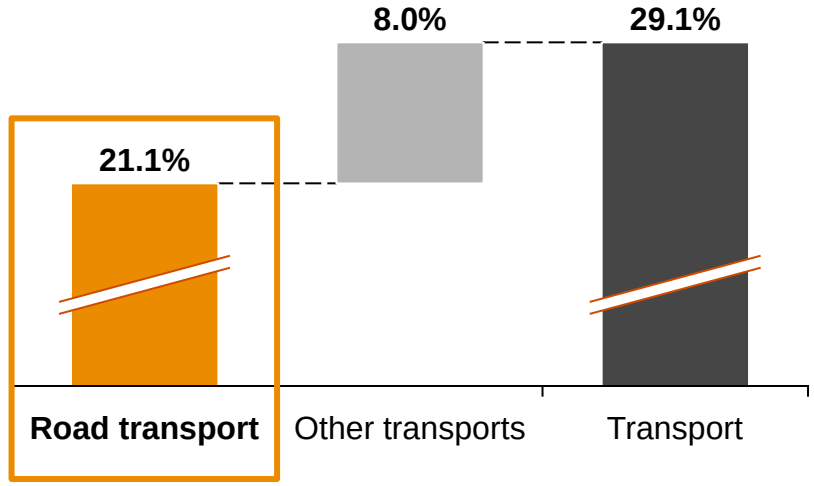
Since 1990, road transport emissions have been increasing, currently representing 73% of transport emissions and 21% of total emissions in Europe

Transport greenhouse gas emissions in Europe (1990-2022, million tonnes of CO_2 equivalent)



- **1990-2007:** the EU's domestic **GHG emissions from transport** steadily **increased,** reaching a peak with a 28.6% rise over this period. This growth was driven by **increased demand for passenger transport and inland freight volumes**
- **2007-2013:** there was a notable **decrease of 10.5%** in emissions, reflecting efforts to improve fuel efficiency and implement stricter emission regulations
- **2013-2019: GHG emissions from transport began to rise again**, reversing the previous trend
- **2019-2022:** the disruption caused by the **Covid-19 pandemic** led to a **temporary reduction** in emissions, only for them to rise again afterward

% of transport greenhouse gas emissions (2022[1])



Road transport accounts for approximately 21.1% of European GHG emissions, representing almost 73.2% of all transport emissions

(1) Including emissions from international bunkers.
Source: PwC analysis with information from the European Environment Agency.

To address this situation, international and European targets have been established to promote digitalization and decarbonization

In the last decade, **international and European institutions** have pursued an **agenda** aimed at advancing **digitalization and decarbonization**, with a clear and profound impact on toll road operators

United Nations

2030 Agenda for Sustainable Development

In 2015, the UN **2030 Agenda** set the **17 Sustainable Development Goals (SDG)** that should be the priority of governments and society. Some of these Goals are specially focused on **environmental and climate change** Aims

The SDGs that are of special concern to road infrastructure providers are:

European Green Deal

Presented in 2019, this political document aims to **make Europe the first climate-neutral continent by 2050**, proposing **3 Aims** to transform the EU into a modern, resource-efficient and competitive economy

The 3 European Green Deal Aims

1	No net emissions of greenhouse gases by 2050
2	Economic growth decoupled from resource use
3	No person and no place left behind

The **milestones** to achieve these aims have been **developed and outlined in three** key **documents**:

- **2020 EC Communication on Sustainable and Smart Mobility Strategy**
- **2021 European Climate Law**
- **2021 EC Communication 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality**

Sources: PwC analysis with information from "Sustainability Report", ASECAP (2022), United Nations 2030 Agenda for Sustainable Development (Department of Economic and Social Affairs) and European Green Deal (European Commission)

Specifically, the European Commission's Sustainable and Smart Mobility Strategy outlines the future of mobility and the actions required to achieve it

2020 EC Communication on Sustainable and Smart Mobility Strategy

Sustainable mobility	Smart mobility	Resilient mobility
		
90% reduction of greenhouse gas emissions in transport **by 2050**	To unleash **automated multimodal mobility** and the **use of data** and AI	To reinforce the **single market** by making **mobility fair and safe** for all and across all modes
• Installing **3 million public charging points** by 2030 • Doubling **high-speed rail traffic** and developing extra **cycling infrastructure** over the next 10 years • Pursuing a comprehensive set of measures to deliver **fair and efficient pricing** across all transport	• Installing **digital systems** to allow for passengers to buy tickets for **multimodal journeys** and freight to seamlessly **switch between transport modes** • Supporting the deployment of **drones and unmanned aircraft** and further actions to build a **European Common Mobility Data Space**	• Investing to complete the **Trans-European Transport Network** (TEN-T) and **modernise the fleets** in all modes • Making mobility **affordable and accessible** for all passengers and improving the **labour conditions** for transport workers • Bringing the **death toll close to zero** by 2050

To make these policy and legislative actions a reality, there are 2 main European mechanisms to help finance the investments needed

Next Generation EU funds
The EU's €800 billion temporary recovery instrument to support the economic recovery from the coronavirus pandemic and build a greener, more digital and more resilient future

European Taxonomy
A classification system that defines criteria for economic activities aligned with a net zero trajectory and that helps direct investments to the activities most needed for the transition

PwC Sources: PwC analysis with information from European Green Deal (European Commission) and Sustainable and Smart Mobility Strategy (European Commission).

The European Taxonomy has been established to support the financing of decarbonization investments…

- In 2020, the European Union published the **EU Taxonomy Regulation**, which is a cornerstone of the **EU's sustainable finance framework** and an important **market transparency tool**
- The EU Taxonomy is a **classification system** that defines **criteria for economic activities** aligned with a **net zero trajectory by 2050** and broader **environmental goals** beyond climate
- It enables financial and non-financial companies to **share a common definition of what constitutes environmentally sustainable activities**

The European Taxonomy…

is…	is not…
a list of economic activities and relevant criteria to define sustainable investments	a rating to differentiate good and bad companies
flexible and can be used for different investment strategies	a mandatory list of sectors to invest in
based on the latest scientific advances and industry experience	make any value judgment about the financial performance of an investment
dynamic, it will adapt to technological changes and new activities	inflexible nor static

PwC Sources: PwC analysis with information from European Commission.

...and identifies over 200 eligible activities that may potentially contribute to environmental goals

EU environmental goals

The EU Taxonomy identifies economic activities that may potentially contribute to one or more environmental objectives:

- Climate change mitigation
- Climate change adaptation
- The sustainable use and protection of water and marine resources
- The transition to a circular economy
- Pollution prevention and control
- The protection and restoration of biodiversity and ecosystems

Eligible activities

The EU Taxonomy sets performance thresholds for economic activities to be eligible:

- **94** activities are eligible for **climate change mitigation** classification
- **108** activities are eligible for **climate change adaptation** classification
- **6** activities are eligible for **water protection** classification
- **21** activities are eligible for **circular economy** classification
- **6** activities are eligible for **pollution prevention** classification
- **2** activities are eligible for **biodiversity and ecosystems** classification

Aligned activities: a 3-step approach

To be aligned with the EU Taxonomy, an economic activity must meet technical selection criteria related to:

Substantially contribute to at least one of the 6 environmental objectives, with a clear rationale:

1. Climate change mitigation
2. Climate change adaptation
3. Water protection
4. Circular economy
5. Pollution prevention
6. Biodiversity and ecosystems

Not cause significant harm to any of the other five environmental objectives

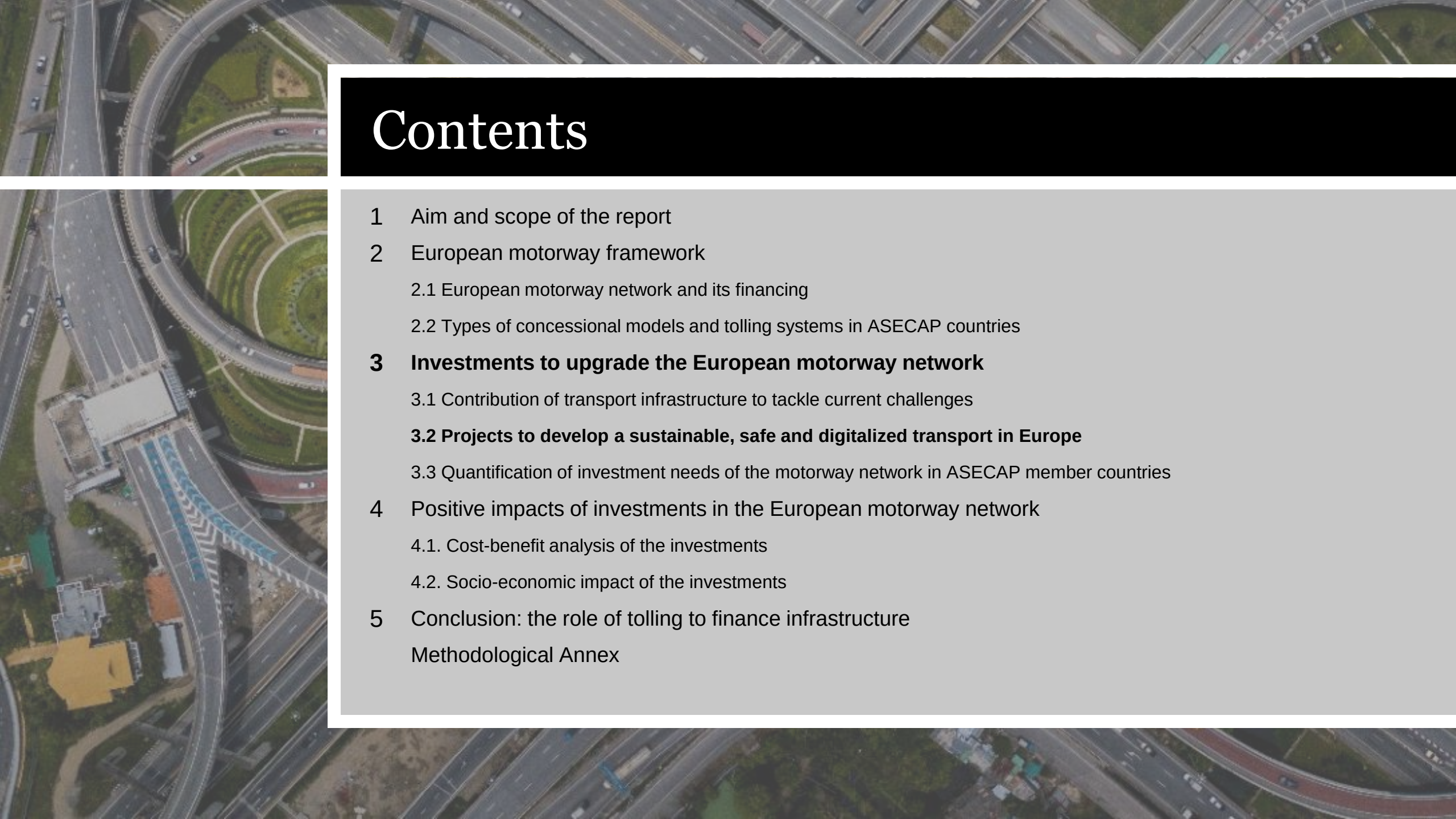
Comply with minimum social safeguards (OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights)

PwC Sources: PwC analysis with information from European Commission.

Five of these activities pertain to investments in the field of motorway infrastructure

Sector	Activity	Environmental goal	Description
Construction and real estate activities	**Maintenance of roads and motorways**	Circular economy	The economic activity of **maintaining streets, roads, motorways**, and related infrastructure involves actions to sustain and restore serviceability and level of service
	Installation, maintenance and repair of renewable energy technologies	Climate mitigation	Installation, maintenance and repair of **renewable energy technologies**. This activity covers the **installation**, maintenance and repair of **solar photovoltaic systems** or solar hot water panels among others
	Installation, maintenance and repair of energy efficiency equipment	Climate mitigation	Individual renovation measures consisting in installation, maintenance or repair of **energy efficiency equipment**
Transport	**Infrastructure enabling low-carbon road transport and public transport**	Climate mitigation	**Construction, modernization, maintenance and operation of infrastructure** that is required for zero tailpipe CO_2 operation of **zero-emissions road transport**, as well as infrastructure dedicated to transshipment, and infrastructure required for operating urban transport
	Infrastructure enabling road transport and public transport	Climate adaptation	This activity covers the **construction, modernization, maintenance, and operation of motorways**, roads, highways, bridges, tunnels, and airfield runways, along with related services like architecture, engineering, and material testing

PwC Sources: PwC analysis with information from European Commission.



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The transformation of the mobility sector requires investments in sustainable, safe, and digitized infrastructure to upgrade the European motorway network

- The **mobility sector** is undergoing a profound and **rapid transformation**, driven by several key factors. These include the **technological revolution** spurred by the **energy transition**, advancements in **assisted, autonomous, and connected vehicle** technologies, and the emergence of **innovative mobility services**
- As the sector evolves, there is a strong emphasis on creating **more efficient, sustainable, and safer roads**. This focus aims to generate both short-term and long-term benefits for customers and users
- **Sustainability and ESG** factors are now central to the road transport sector, which is addressing **environmental impact and future challenges**. **Security remains a priority**, with **digitalization** improving asset **management and real-time mobility**, enhancing safety and user experience
- To achieve these goals, **significant investments are needed to improve the infrastructure of European motorways** in the areas of sustainability, safety, and digitalization:

	Investment areas to upgrade the European motorway network		
	Sustainability	**Safety**	**Digitalization**
Goal	Reduce CO2 emissions derived from transport services	Enhance road safety and reduce accident rates on the motorway network	Improve efficiency and real-time management of the motorway network
Key areas	Lighting optimization	Decision Support Systems (DSS)	Communication network investments
	Photovoltaic panels	Prediction of road pavement deterioration	Intelligence Transport System (ITS)
	Alternative fuels and charging infrastructure		
	Carpooling and reserved lanes		
	Free-flow road charging infrastructure		

In the area of sustainability, investments are primarily focused on LED lighting technology and smart lighting, which can achieve energy savings of up to 75%

Lighting optimisation and photovoltaic panels

Benefits

- **Lower environmental impact**, as they reduce carbon footprint and CO_2 emissions, thus contributing to environmental sustainability
- Less maintenance and have lower electricity costs, implying an **energy saving of more than 50%,** and even up to **75%** when using **smart lighting**
- **More natural and higher-quality illumination**, leading to faster and more effective responses to road incidents, **ultimately enhancing overall road safety**

- Toll road operators are investing in the adoption of **LED lighting technology**, recognizing its numerous benefits
- To further enhance efficiency, toll road operators are implementing **smart lighting systems**. These systems **adjust the brightness** of LED luminaires in motorway sections based on the **level of traffic** and to the **quality of driving conditions**
- By utilizing traffic load data, **neural networks, and machine learning capabilities**, the system predicts **future traffic loads** and **weather conditions** to calculate the required **brightness level** while adhering to minimum **safety standards**
- To complement the energy-efficient LED lighting system, toll road operators are also investing in **renewable energy solutions**, such as **installing photovoltaic panels on roadway** fixtures to generate electricity for facilities and buildings along motorways
- By harnessing solar energy, toll road operators are creating **infrastructure that is largely self-sufficient in energy**, thereby promoting sustainability and minimizing environmental impact

PwC Sources: PwC analysis with information from "ASECAP Sustainability Report 2022", ASECAP (2023) and ASECAP information.

Providing accessible charging infrastructure for vehicles is expected to encourage drivers to transition away from gasoline and diesel vehicles

Alternative fuels and charging infrastructure

Benefits

- **Promotes the adoption of EVs** by providing accessible charging infrastructure, thereby encouraging a shift away from gasoline and diesel vehicles
- This results in a **lower environmental impact**, reducing carbon footprint and CO_2 emissions, and thus contributing to environmental sustainability

- As part of the 'Fit for 55' package, Regulation on the deployment of Alternative Fuels Infrastructure, approved in 2023, **oblige EU countries to install charging and fuelling points at regular intervals on major highways**: every 60 kilometres for electric charging and every 150 kilometres for hydrogen refuelling
- This will **necessitate significant investments**, both private and public, marking a **crucial step towards achieving CO2-neutral highways**
- While the deployment of **electric vehicle charging infrastructure for light vehicles is already underway**, road transport remains a significant contributor to carbon emissions, particularly from trucks. To address this, research is underway to **explore the use of hydrogen as a fuel for trucks.** With substantial volumes of hydrogen-powered trucks expected on the roads by the end of the decade, **it will be crucial to establish infrastructure for hydrogen refuelling at service areas**
- Additionally, **dynamic charging systems**, such as Electric Road Systems, are being considered to transmit energy to trucks while they are in motion. These systems, utilizing overhead **catenaries, rails, or induction,** offer various benefits, including reducing the size of onboard batteries, minimizing emissions linked to battery production, and eliminating downtime for recharging. **These initiatives represent important steps in decarbonizing road transport** and achieving sustainability goals associated with battery production, and eliminating downtime for recharging

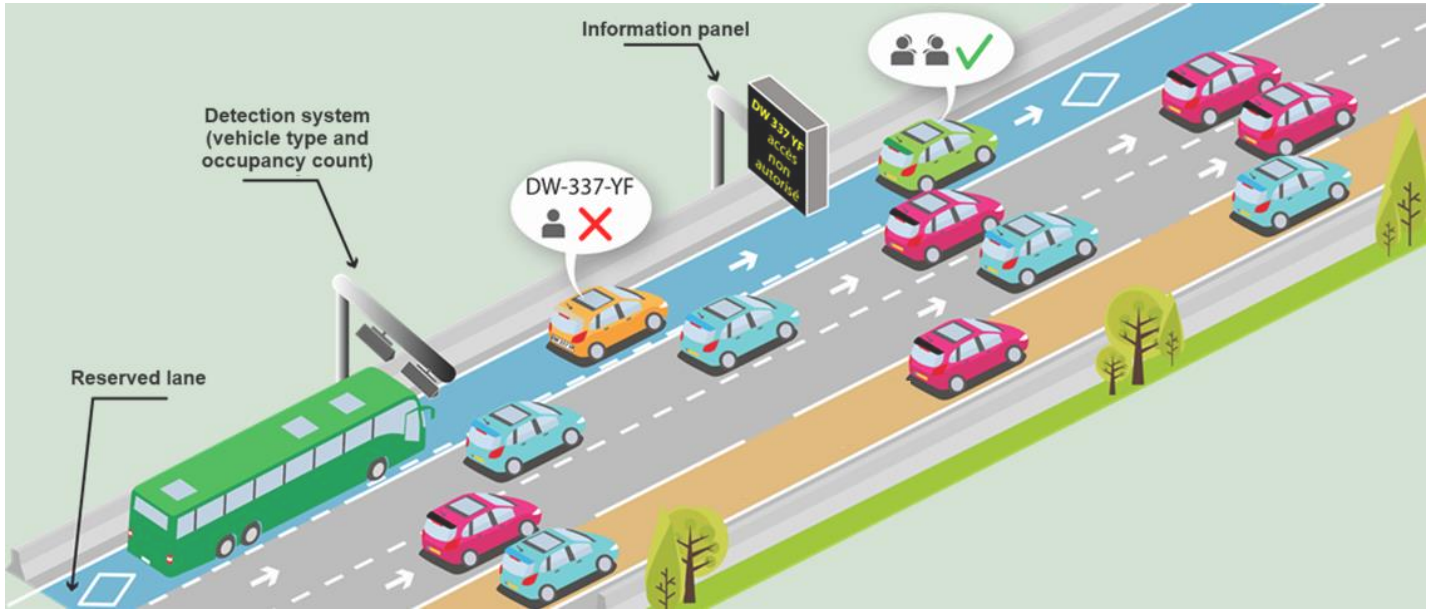
PwC Sources: PwC analysis with information from ASECAP associations and "ASECAP Sustainability Report 2022", ASECAP (2023).

Implementing carpool lanes, reserved lanes for public transport, and multimodal exchange hubs helps alleviate traffic congestion and improve air quality

Carpooling and reserved lanes

Benefits

- Carpooling helps **reduce traffic congestion** by decreasing the number of vehicles on the road. This, in turn, leads to **lower carbon emissions and improves air quality**
- Reserved lanes for public transport **enhance bus and transit efficiency** by avoiding traffic, resulting in faster and more reliable service. This encourages **greater use of public transport**, reducing private vehicle numbers, **alleviating congestion, and cutting emissions**



- Achieving emissions reduction goals in the transportation sector necessitates a **shift in behavior among road users**, aiming to **increase vehicle occupancy and reduce their numbers**
- Motorway operators are striving to **foster the development of carpooling and public transportation**, particularly for peri-urban commuter routes where they are most pertinent
- To make carpooling more appealing, infrastructure managers can influence travel times by implementing **carpool lanes** and facilitating user journeys through the establishment of a comprehensive network of **carpool parking facilities**
- Additionally, the implementation of express bus lines or efficient bus services can benefit from dedicated **lanes for public transport**, as well as the creation of **multimodal exchange hubs near motorway corridors and urban areas**
- These hubs **facilitate access via alternative transportation modes** (walking, cycling) and connections with other urban transport networks

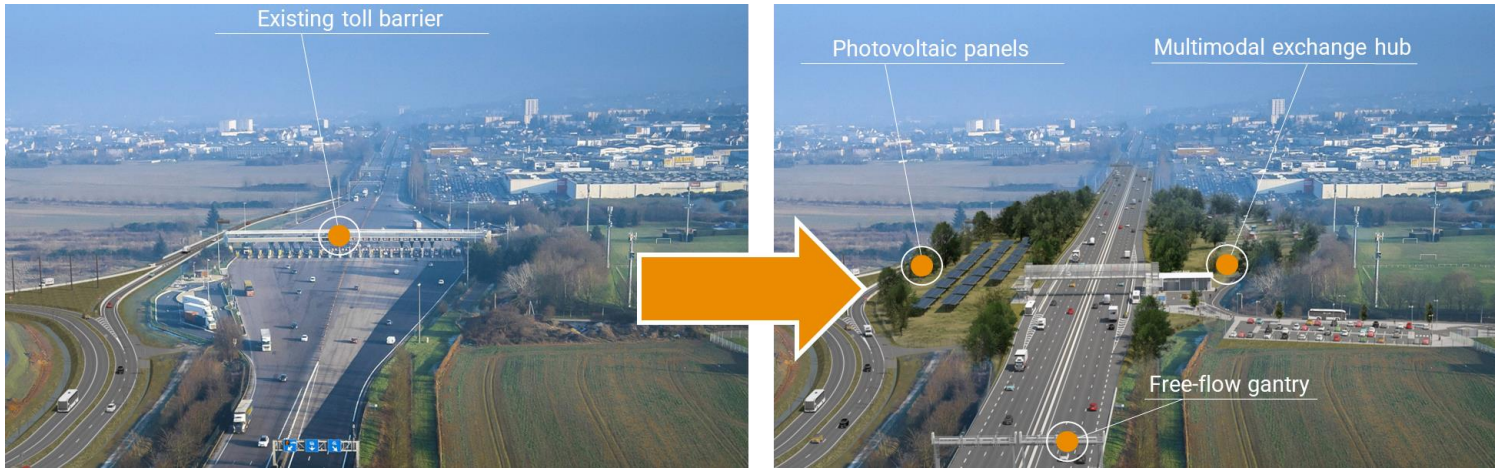
PwC Sources: PwC analysis with information from ASECAP associations.

Transitioning from traditional physical toll systems to free-flow tolling will help reduce pollution, noise, fuel consumption, and congestion

Free-flow road charging infrastructure

Benefits

- **Reduction of CO2 emissions** from stops/restarts
- **Reduction of noise pollution and improvement of air quality** for residents in affected areas by alleviating congestion and reducing overall traffic volumes
- **Decrease in electricity consumption** from lighting and toll plaza operations due to the elimination of traditional toll booths and their associated power needs
- **Redevelopment of currently impermeable surfaces** utilizing freed-up road space for multimodal service facilities, installing photovoltaic panels, and integrating vegetation and soil restoration. This includes reforestation, ecosystem and landscape restoration, which enhances environmental sustainability



- Toll road operators have understood the great **potential of artificial intelligence** (AI) to facilitate the **transition** from the old, traditional **physical toll system to a free-flow tolling system**, thereby preparing for a seamless transition for customers in the future
- The barrier-free tolling system, also known as "free-flow," is a **toll collection system** that brings substantial benefits to users and the environment, **reducing pollution, noise, fuel consumption, and traffic congestion**
- However, the **gradual conversion** of full lane barriers and existing toll plazas entails the demolition of buildings and canopies, the reintegration of freed roadway surfaces, and the installation of dedicated gantries and associated computer systems, all of which **will require investments**

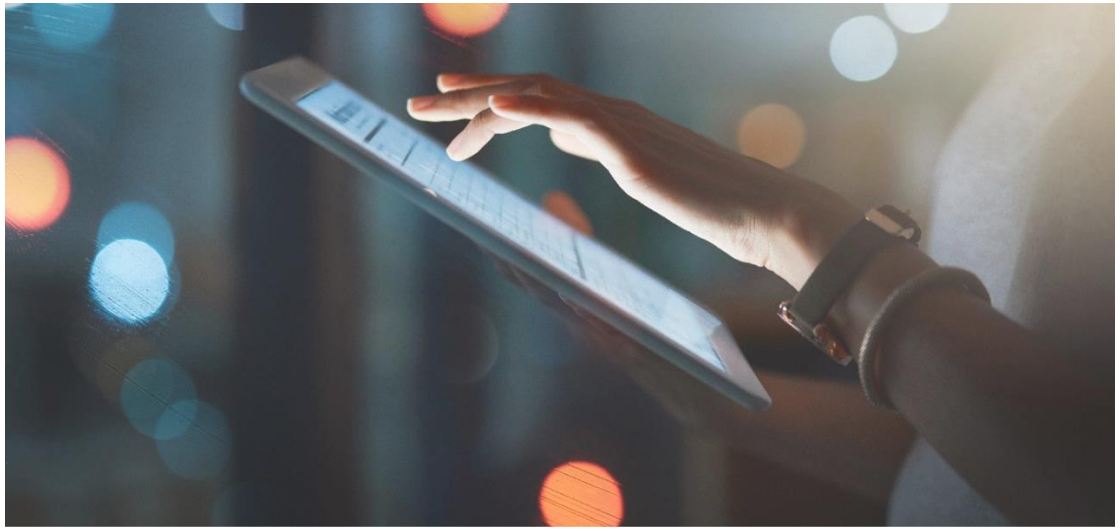
PwC Sources: PwC analysis with information from ASECAP associations and "ASECAP Sustainability Report 2022", ASECAP (2023).

In the field of road safety, decision support systems will enhance the anticipation and response to accidents and hazardous events, thereby improving road safety

Decision Support Systems (DSS)

Benefits

- Continuous observation and analysis of traffic patterns enable proactive management and quick response to incident, improving overall **road safety** and **reduced travel times**
- Efficient monitoring and predictive maintenance reduce the need for extensive repairs and **lower operational costs**
- Anticipate, prepare for, and **respond effectively to dangerous climate-related events** and trends



- **Decision Support Systems (DSS)** in the field of **road safety** are designed to assist policymakers in implementing evidence-based road safety policies by providing detailed information on road risk factors and possible countermeasures
- By continuously **monitoring and collecting infrastructure data**, such as accident statistics and road conditions, these systems **enhance adaptability and reduce vulnerabilities**, allowing for more effective planning and dynamic adjustments to intervention priorities and procedures
- These systems offer policymakers a comprehensive understanding of **which measures are most effective in improving road safety**, along with key strategies to **mitigate risks**
- **Road safety DSS are currently utilized by policymakers**, industry stakeholders, and research organizations. The European Union launched its own Road Safety DSS, SafetyCube, in 2018, which provides comprehensive accident data and identifies the most effective countermeasures
- Furthermore, **DSS have significant potential to enhance road safety** in the future by making infrastructure more resilient to the **effects of climate change**. This could be achieved through the development of a unified framework for necessary actions to bolster site resilience, ensuring these actions are integrated into policies and strategies. For instance, Kassandra is an innovative, integrated decision support system designed to facilitate better decision-making in the context of climate change

 Sources: PwC analysis with information from ASECAP associations, "ASECAP Sustainability Report 2022", ASECAP (2023) and "The European Road Safety Decision Support System", EC (2018)

Prediction of road pavement deterioration will assist in anticipating and responding to hazardous climate events and in reducing operational costs

Prediction of road pavement deterioration

Benefits

- Anticipate, prepare for, and **respond effectively to dangerous climate-related events** and trends
- Continuous observation and analysis of traffic patterns enable proactive management and quick response to incident, improving overall **road safety** and **reduced travel times**
- Efficient monitoring and predictive maintenance reduce the need for extensive repairs and **lower operational costs**

- Prediction of road pavement deterioration tools provide highly accurate **forecasts of long-term pavement deterioration**
- These use **advanced machine learning and big data techniques** that analyze extensive data on asphalt imperfections to enhance its models for predicting pavement wear and tear
- The systems integrate **data on road usage, construction details, and environmental factors, such as weather conditions**, to generate these forecasts
- The primary objective of this tool is to **improve road safety** throughout the pavement's lifecycle, as they enable for efficient monitoring and predictive maintenance
- It also aims to **optimize operations and maintenance** by delivering detailed and effective solutions for addressing specific areas of deterioration, thus enabling more efficient and targeted interventions

PwC Sources: PwC analysis based on information from ASECAP associations and "ASECAP Sustainability Report 2022", ASECAP (2023)

In the field of digitalization, investments in communication networks are essential to ensure efficient communication between vehicles and infrastructure…

Communication network investments

Benefits

- Facilitate the **adaptation** of mobility and roads to **autonomous vehicles** and the integration of the infrastructure and the vehicles
- Provide **digital services** to the vehicle and the driver, which can result in **improved mobility and safety**
- The adaptation of a connectivity network to the roads can **optimize traffic**, reduce **CO2**, and improve competitiveness, among other benefits

- Communication network investments will enable a broad range of **digital services** for the vehicle, the driver, the passengers and other relevant players
- The deployment of a fast communication network is essential for the communication between vehicles and the infrastructure, which is crucial for advancing **future technological solutions**, including adapting to the first **connected vehicles** and developing **future autonomous vehicles**
- Hence, communication network investments will pave the way to driving with high levels of automation
- Automated mobility can result in **improved road safety**, optimized road traffic, **reduced CO2** emissions, and **industrial competitiveness** of both the transport and mobility sector
- In Europe, 5G corridors are considered the key drivers for the Green and Digital transition
- However, as the communication sector evolves, new speeds irrupt, such as **6G**, that speeds up 100 times faster than 5G. It is thought to have a potential to **transform digital road infrastructure** in ways that were previously impossible
- Hence, this new speed, has de capacity to enable the development of **more advanced and responsive traffic** management systems, the improvement of vehicle communications and enhance the efficiency and effectiveness of our road networks

PwC Sources: PwC analysis with information from “5G Corridor Deployment”, EC (2024) and “The future impact of 6G communications technology on digital road infrastructure”, Intertraffic (2024)

...and the deployment of Day 1 and Day 1.5 intelligent transport systems services can lead to safer, faster and more sustainable mobility

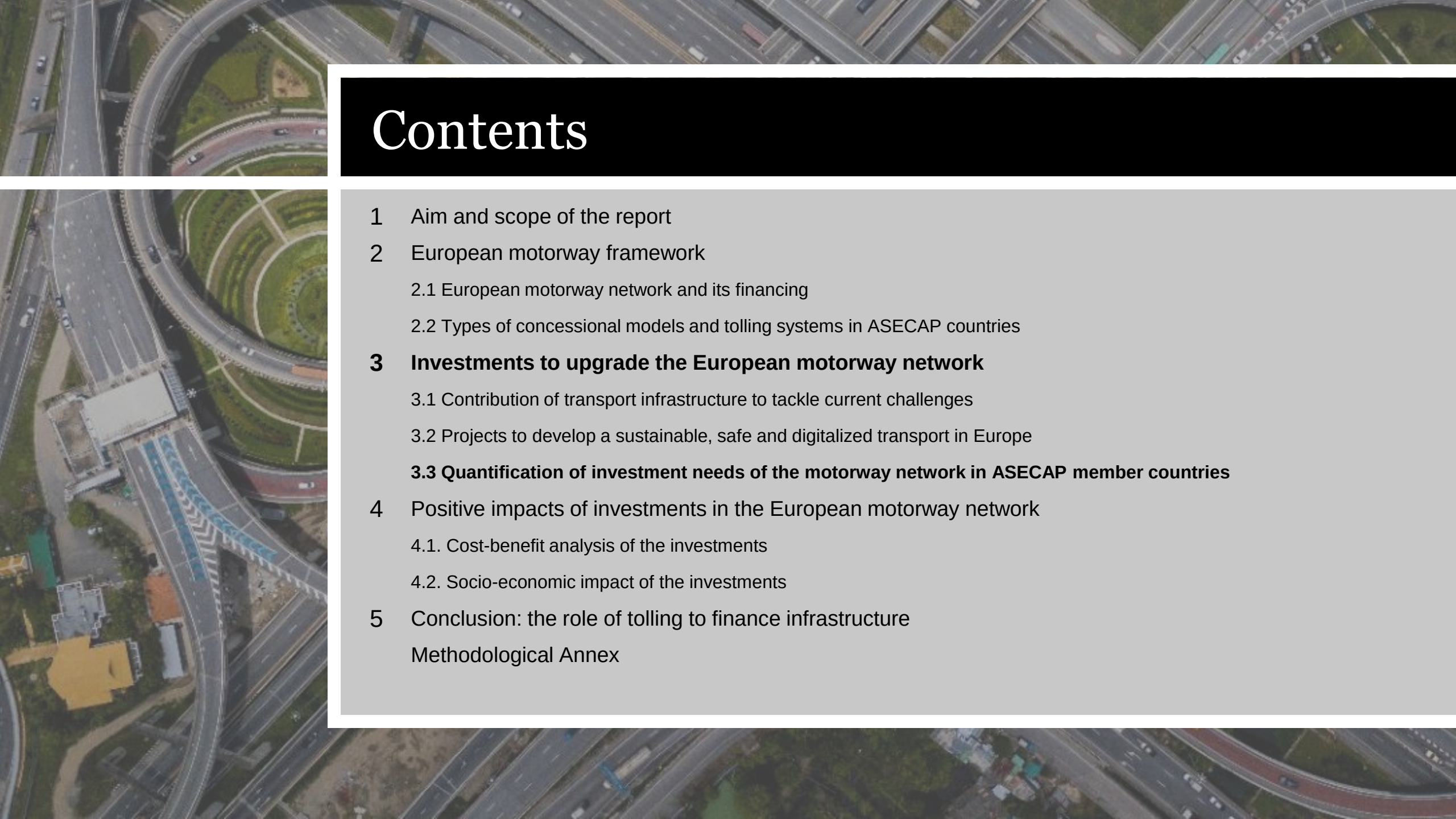
Intelligent Support Systems (ITS)

Benefits

- Real-time communication between vehicles and infrastructure helps to **prevent accidents** by providing warnings about hazards, traffic conditions, and potential collisions
- Enables more **efficient traffic flow** and **congestion management**, leading to smoother and more predictable travel.
- Improved traffic flow and efficient routing contribute to **reduced emissions and fuel consumption**, supporting environmental sustainability

- **Intelligent Transport Systems** (ITS) focus on digital technologies providing intelligence placet at the roadside or in vehicles
- **Cooperative Intelligent Support Systems** (C-ITS) focus on the communication between those systems (vehicle communicating with another one, with the infrastructure, or with other C-ITS systems)
- Vehicles and infrastructure equipped with C-ITS receive critical **route information**, such as details about **work zones, incidents, road hazards, and traffic conditions**
- This information is instantly accessible to any connected vehicle traveling on the equipped network, **enhancing safety** and enabling dynamic **traffic management**
- This coordination between vehicles and the infrastructure has several benefits for road safety and requires technologies already **available** in the **market**
- **Day 1 and Day 1.5** are two lists elaborated by the European Commission in collaboration with the C-ITS platform, that include those C-ITS services more beneficial and easier to implement
- These services include in-vehicle **speed limits**, emergency **electronic braking light**, road works warning, weather conditions, intersection safety and vulnerable road user protection
- The deployment of these investments can result in a **safer, faster** and more **sustainable mobility**

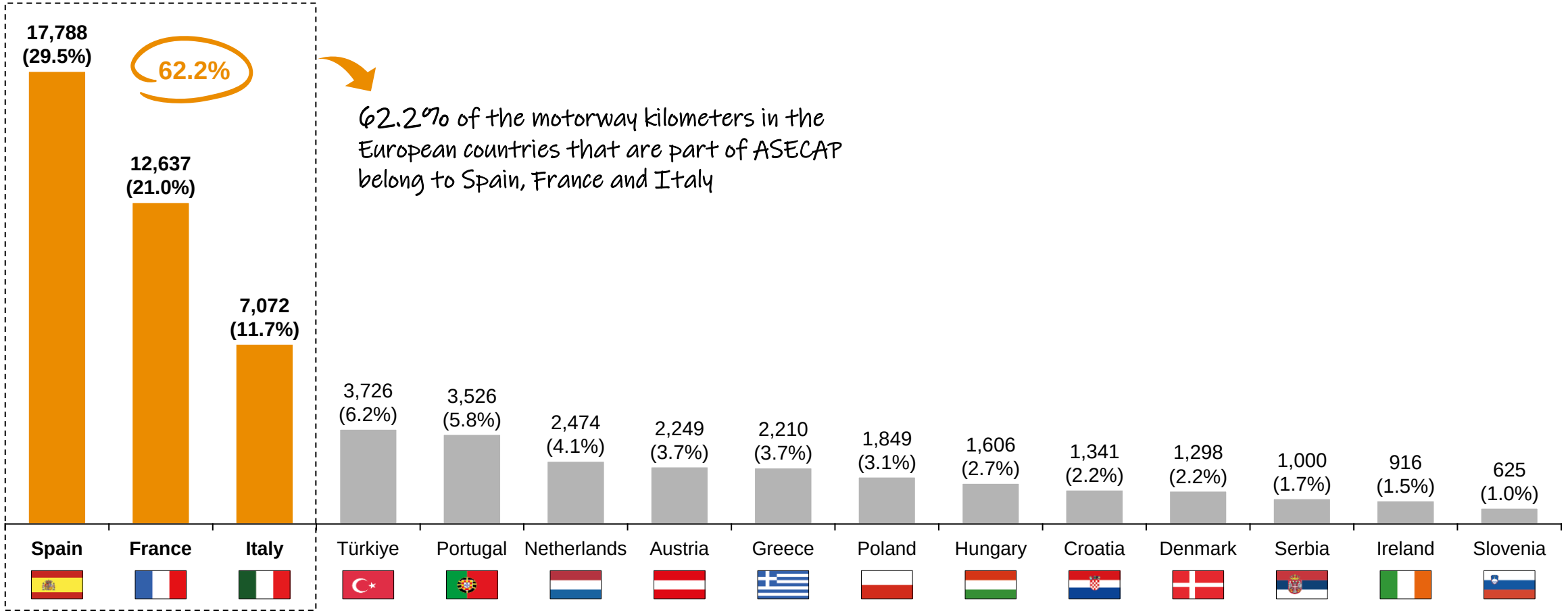
PwC Sources: PwC analysis with information from “Cooperative Intelligent Transport Systems (C-ITS)”, European Transport Safety Council (2017).



Contents

The motorway network of ASECAP full members spans 60,317 kilometers, with Spain, France, and Italy accounting for 62.2% of this total

Length of the ASECAP countries' motorway network (km, 2023)[1]



(1) The data account for the total of the country's motorway network, regardless of whether they are operated by ASECAP members or have tolls.
Source: PwC analysis with information from ASECAP.

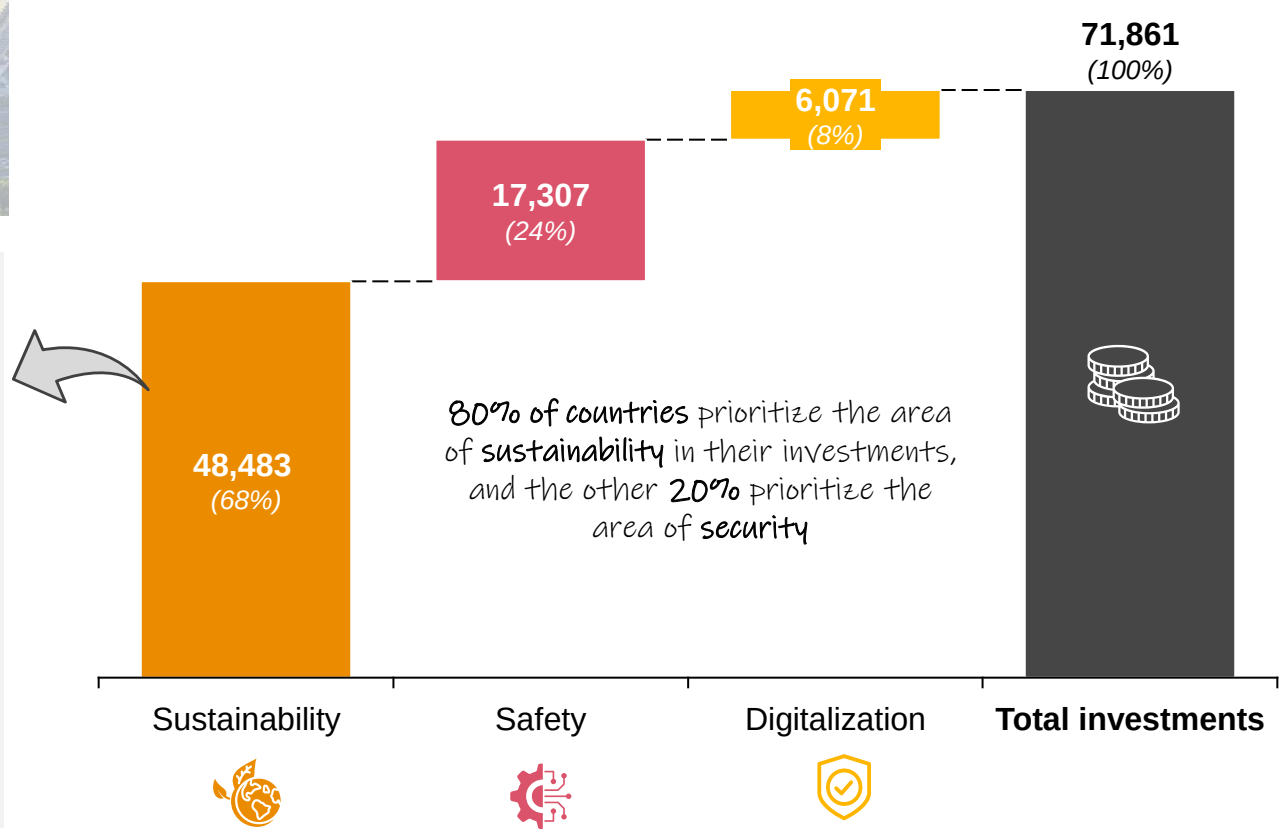
To upgrade the motorway infrastructure of this network, an investment of €71,861 million is needed in addition the current motorway obligations

71,861 M€

Investments (2025-2035[1])

In **ASECAP member countries** an **investment of over 71,861 M€** has been estimated to improve the network, **68%** allocated to **sustainability**, **24%** to **safety**, and **8%** to **digitalization**

Identified investment needs to improve the motorway network in ASECAP member countries, broken down by investment area (M€, 2025-2035)

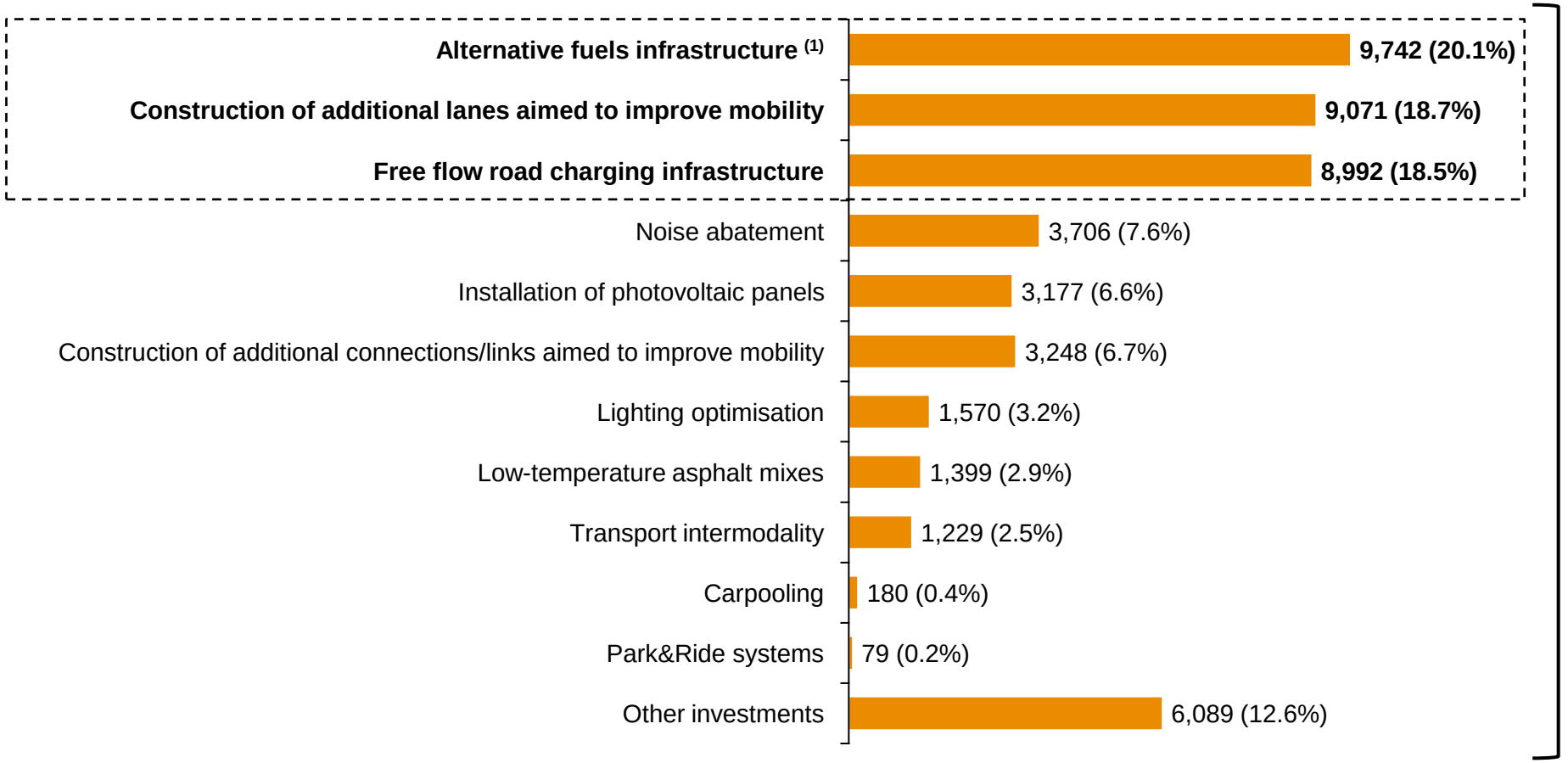


(1) According to the survey 27% of the responses indicate that they would carry out the investments in less than three years, 19% in three to five years, 43% in five to ten years, and 10% in more than ten years. The period "2025-2035" has been defined assuming that the investments will begin in 2025 and takes into account only 10 years, since 90% of the responses fall within that period.

Sources: PwC analysis with information from a survey conducted with ASECAP member associations.
For more information see the methodological annex.

The main investments in the sustainability area are focused on alternative fuels infrastructure, construction of additional lanes and free flow road charging

Breakdown of the identified investments in the sustainability area to improve the motorways of ASECAP member countries (M€, 2025-2035)



Sustainability

48,483 M€

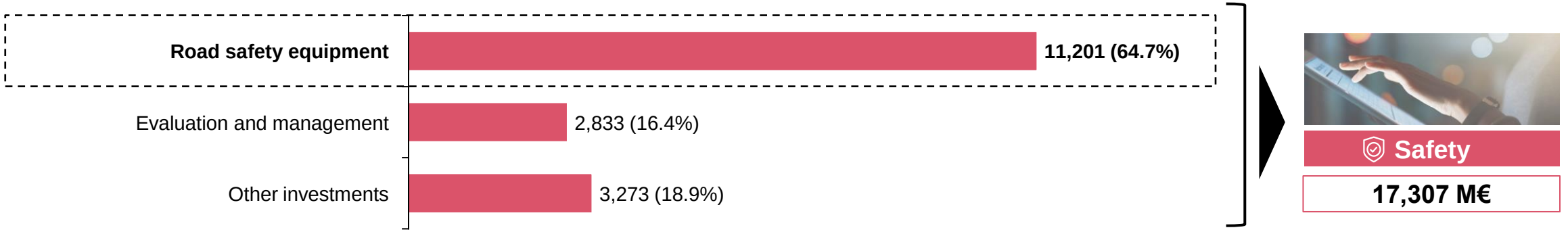
57.3% of the investments in the sustainability area are directed towards the installation of **alternative fuels infrastructure**, the construction of **additional lanes** and **free-flow** road charging infrastructure

(1) Alternative fuels infrastructure includes charging points for electric vehicles, hydrogen charging points and dynamic recharging systems

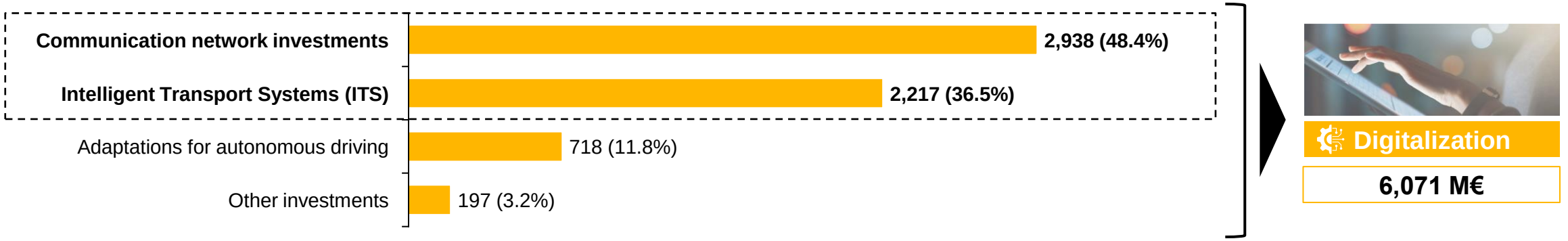
Sources: PwC analysis with information from a survey conducted with ASECAP member associations.
For more information see the methodological annex.

To upgrade the ASECAP network, an investment of 11,201 M€ is needed for road safety equipment and €5,155 million for communication networks and ITS

Breakdown of the identified investments in the safety area to improve the motorways of ASECAP member countries (M€, 2025-2035)



Breakdown of the necessary investments in the digitalization area to improve the motorways of ASECAP member countries



Sources: PwC analysis with information from a survey conducted with ASECAP member associations.
For more information see the methodological annex.

Nine of the necessary investments meet the substantial criteria of the EU Taxonomy, accounting for €27,176 million, which is 38% of the total investment

EU Taxonomy

Aligned activities: a 3-step approach

To be aligned with the EU Taxonomy, an economic activity must meet technical selection criteria related to:

Substantially contribute to at least one of the 6 environmental objectives, with a clear rationale:

1. Climate change mitigation
2. Climate change adaptation
3. Water protection
4. Circular economy
5. Pollution prevention
6. Biodiversity and ecosystems

Not cause significant harm to any of the other five environmental objectives

Comply with minimum social safeguards (OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights)

The **identified investments** have been analysed to understand whether they comply with the **substantial contribution criterion** of the **EU Taxonomy**

The result of the analysis shows that **nine investments (47%)** would make a substantial contribution to the goals of the **EU Green Deal**

Lighting optimisation

Alternative fuels infrastructure

Free flow tolling infrastructure

Park & Ride systems

Photovoltaic panels

Low temperature asphalt

Intelligence Transport System

27,176 M€

38% of the total investment amount

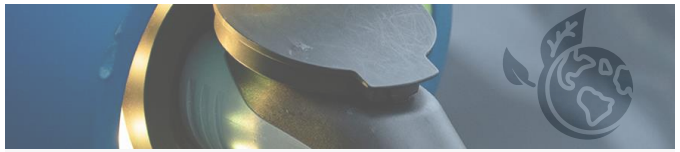
(1) Note that not complying in the EU Taxonomy does not imply that the investments are harmful for the environment but that they do not contribute enough to the EU Green Deal Goals

Sources: EU Taxonomy Navigator, EU Taxonomy Compass

Furthermore, some of the identified investments are also aligned with the objectives of the AFI regulation and the ITS directive

Alternative Fuels Infrastructure (AFI) Regulation

- This regulation aims to **ensure the basic infrastructure** for the **adoption of all types of alternative fuel vehicles**, ensure full interoperability of the infrastructure and provide thorough user information and **sufficient payment options at alternative fuels infrastructure**
- To accomplish this objective, it sets **mandatory national targets** for the deployment of **alternative fuels infrastructure** in the EU for all vehicles



The investments on **alternative fuels infrastructure** can contribute to achieving the **mandatory goals** set by the **AFI regulation**

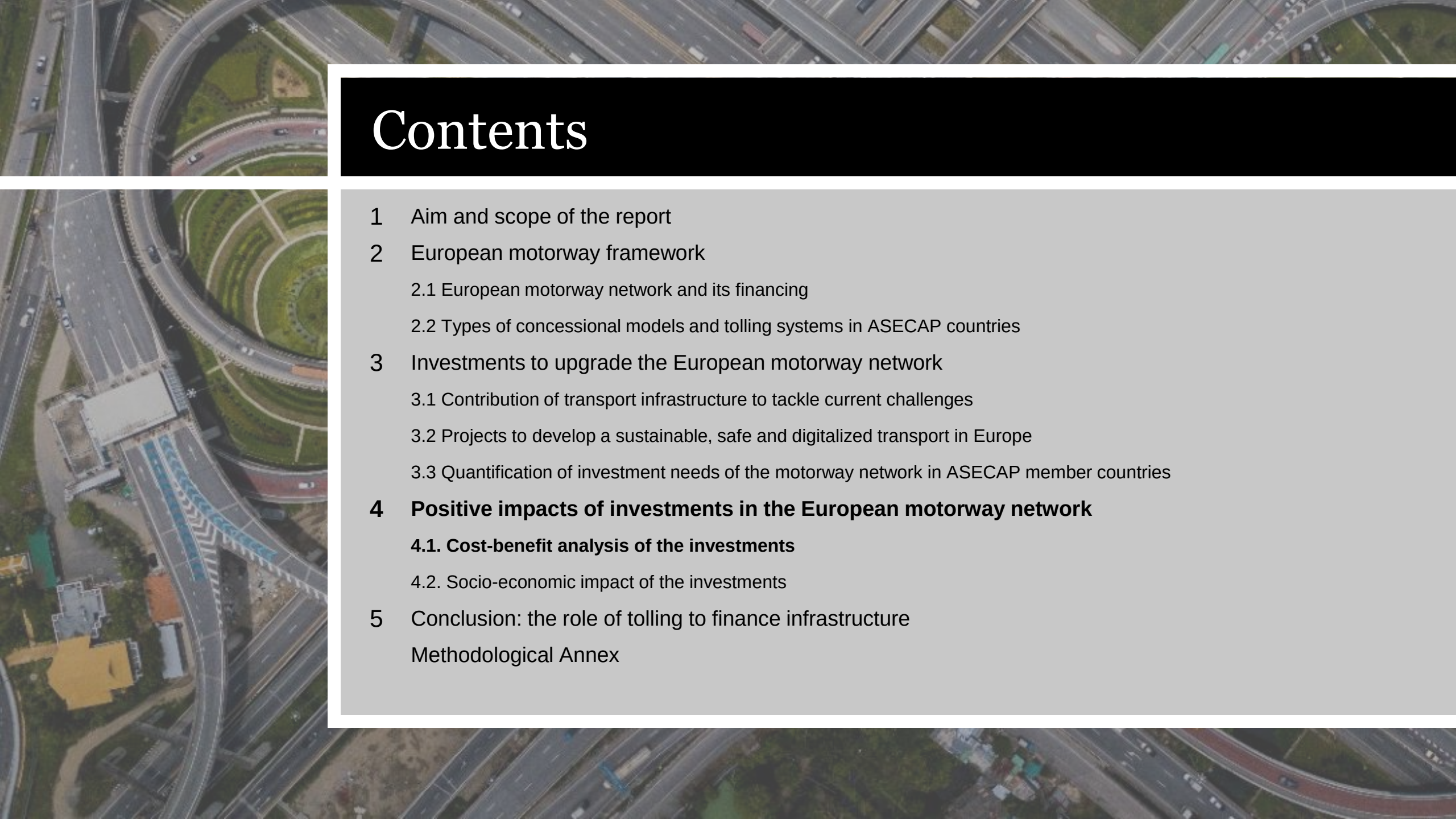
9,742 M€
13.5% of the total investment amount

Intelligent Transport Systems (ITS) Directive

- The main **objective** of the ITS directive is to **promote** the **development** of **innovative transportation technologies** to create ITS
- To achieve it, the directive introduces **common standards** and specification to **establish interoperable and efficient ITS**
- It was amended in 2023 with the aim to **adapt** to the emergence of **new road mobility options and automated mobility**

The investments in **Intelligent Transport Systems** can contribute to achieving the **goals** set by the **ITS directive**

2,217 M€
3.1% of the total investment amount



Contents

A Cost-Benefit Analysis (CBA) is a tool used to evaluate investment decisions by assessing their benefits and costs, and it is widely utilized in the transport sector

- A **Cost-Benefit Analysis (CBA)** is an analytical tool to be used to **appraise investment decisions and** assess its **cost and benefits** to understand their impact on welfare. It is a **relevant tool** to ensure the **efficient allocation of investments,** and to **justify certain expenditures** from the public and the private sector
- In **the transport sector** this tool is widely used and commonly **based on time savings, operating costs or avoided accidents**
- To perform a CBA, the **costs** of the considered investment are **subtracted** from its **economic and social benefits**. Both terms are discounted with an interest rate, to obtain the **Social Net Present Value (NPV)** of the investment
- The conclusion of the CBA depends on the **sign of the social NPV.** If **positive**, the **benefits outweigh the costs,** indicating that the investment should be made. Conversely, if the **NPV is negative**, the **costs exceed the benefits**, and therefore the investment should not be undertaken

BENEFITS of the **investment** [1]

- Air pollution reduction
- Accident reduction
- Noise pollution mitigation
- Travel time savings
- Congestion decrease
- Well-to-thank emissions reduction
- Ecosystem damage mitigation

Concepts considered in the CBA in this study

COSTS of the **investment** [1]

- Initial investment
- Operational costs
- Maintenance cost
- Cost of land
- Environmental cost

Social Net Present Value of the investment

CBA Conclusions

Social NPV > 0	The society is better-off **with the investment** and therefore it **should be implemented**
Social NPV < 0	The society is better-off **without the investment** and therefore it **should not be implemented**

(1) The lists of benefits and costs specified are not exhaustive. Both, benefits are costs, must be discounted using the interest rate to calculate the NPV
Source: PwC analisis from the "Guide to Cost-Benedit Analysis of Investment Projects", European Commission (2014), "Handbook on the external costs of transport", European Commission (2019) and "Cost-benefit analysis of transport projects: Theoretical framework and practical rules", De Rus et al. (2022)

Given the available information, this study will measure the benefits using a rating scale, while the costs considered will be the total initial investment amount

- The traditional **CBA approach relies on standardized methods** to measure market and non-market **benefits and costs of each investment**
- Due to a **lack of data** to quantify the magnitude of the benefits and the **broad scope of the project**, which includes multiple investments, an **alternative approach** consistent with the traditional **CBA methodology** will be used for the **benefits assessment.** This will be done using a rating system based on qualitative information about the contribution of each investment to the identified benefits
- To **identify the costs**, **information from the survey** of ASECAP members about the **investment needs** of the European motorway network will be used

BENEFITS

of the **investment area** to society

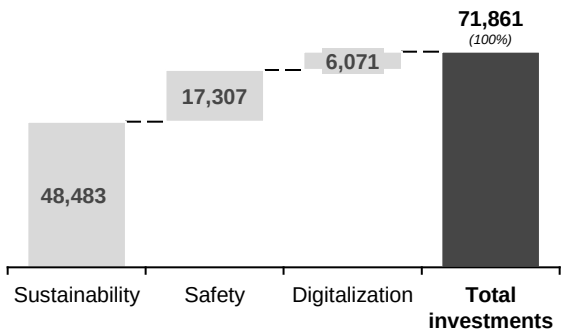
- For **each investment** identified in the previous section, its **associated benefits will be assessed**
- The **magnitude** of the benefit will be measured using a **ranking** scale ranging from **0 to 3:**

	CO2 reduction	Fatalities reduction
Alternative fuels	●●●	○○○
ITS	●○○	●●●

COSTS

of the **investment area** to society

- In order to improve the European motorway network, some **investments are needed**, and their **cost is the one considered in this CBA**:



CBA Results

(approaching to the NPV)

CBA Conclusions

- The **benefits** of each investment will be **summarized and ranked** according to the **number** of **contributing investments**
- The CBA provides a **qualitative comparison** between investments, but do not allow for any quantitative conclusions

	Sustainability	Safety
Benefits	●●●	○○○
Cost	48,483 M€	17,307 M€

Source: PwC analisis from the “Guide to Cost-Benedit Analysis of Investment Projects”, European Commission (2014)

The benefits considered are associated with the main negative external effects of transport; thus, it is assessed how investments can reduce these externalities

INVESTMENT BENEFITS

Air pollution reduction

- Air pollution refers to the **emission of harmful gases** and particulates. In the context of **transportation**, these emissions are primarily generated by vehicles and related infrastructure
- **Reducing air pollution** benefits the **environment**, lowers **healthcare** costs, reduces crop and **biodiversity** losses, and minimizes material damages

Accident reduction

- **Accident reduction** benefits refer to the decrease in external **costs associated with road fatalities**. These primarily include human costs, medical and administrative expenses, production losses, and material damages, among others
- Reducing road accidents can lead to a decrease in road fatalities and all the associated costs

Noise pollution mitigation

- Noise pollution from vehicles has **significant externalities**, primarily causing **physical and psychological health issues**
- Therefore, **reducing** noise pollution can help **prevent** these problems and lead to other substantial benefits, including **lowering healthcare costs**

Travel time savings

- Travel time represents an **opportunity cost** for individuals. Therefore, reducing the time spent traveling allows people to **allocate more time** to other, potentially more **pleasant or productive activities**
- Improved time management can enhance **physical and mental health**, thereby also reducing healthcare costs

Congestion decrease

- Congestion reduction refers to the **impediments that vehicles cause to each other** as traffic flow approaches the maximum capacity of the network
- The benefits of **reducing congestion** include **decreased travel time** and **reduced air pollution**, as congestion increases vehicle emissions

Source: PwC analisis from the “Handbook on the external costs of transport”, European Commission (2019), “Transportation Cost and Benefit Analysis II – Travel Time Costs”, Victoria Transport Policy Institute (2023) and “Air pollution and health risks due to vehicle traffir”, Zhang and Batterman (2014)

Investments in the sustainability area would primarily contribute to reducing GHG emissions, congestion and noise pollution, while also enhancing road safety

Benefits of the investments in the sustainability area

	Air pollution reduction	Accident reduction	Noise pollution mitigation	Travel time savings	Congestion decrease
Alternative fuels infrastructure	●●●	○○○	●●○	○○○	○○○
Additional lanes construction	●●○	●●○	●○○	●●●	●●●
Free-flow charging infrastructure	●●●	●●○	●●○	●●●	●●●
Noise abatement	○○○	○○○	●●●	○○○	○○○
Photovoltaic panels	●●●	○○○	○○○	○○○	○○○
Additional connections	●○○	●●●	●●○	●●●	●●●
Lighting optimisation	●●●	●●○	○○○	○○○	●○○
Low-temperature asphalt mixes	●●●	○○○	○○○	○○○	○○○
Transport intermodality	●●●	●●○	●○○	●●○	●●●
Carpooling	●●●	●○○	●○○	●●○	●●●
Park and ride systems	●●○	●○○	●○○	●●●	●●○
SUSTAINABILITY	●●○	●○○	●○○	●○○	●●○

Sources: PwC analysis with information from "ASECAP Sustainability Report 2022", ASECAP (2023) and ASECAP information.

Investments in the safety area could primarily contribute to accident reduction, while digitalization investments would have a transversal impact across areas

Benefits of the investments in the safety area

	Air pollution reduction	Accident reduction	Noise pollution mitigation	Travel time savings	Congestion decrease
Road safety equipment	○ ○ ○	● ● ●	○ ○ ○	○ ○ ○	● ○ ○
Evaluation and management	○ ○ ○	● ● ○	○ ○ ○	○ ○ ○	● ○ ○
SAFETY	○ ○ ○	● ● ●	○ ○ ○	○ ○ ○	● ○ ○

Benefits of the investments in the digitalization area

	Air pollution reduction	Accident reduction	Noise pollution mitigation	Travel time savings	Congestion decrease
Communication network	● ○ ○	● ● ●	○ ○ ○	● ● ○	● ● ○
ITS	● ● ○	● ● ●	● ○ ○	● ○ ○	● ● ●
Autonomous driving adaptation	● ○ ○	● ● ●	○ ○ ○	● ● ○	● ● ●
DIGITALIZATION	● ● ○	● ● ●	○ ○ ○	● ● ○	● ● ●

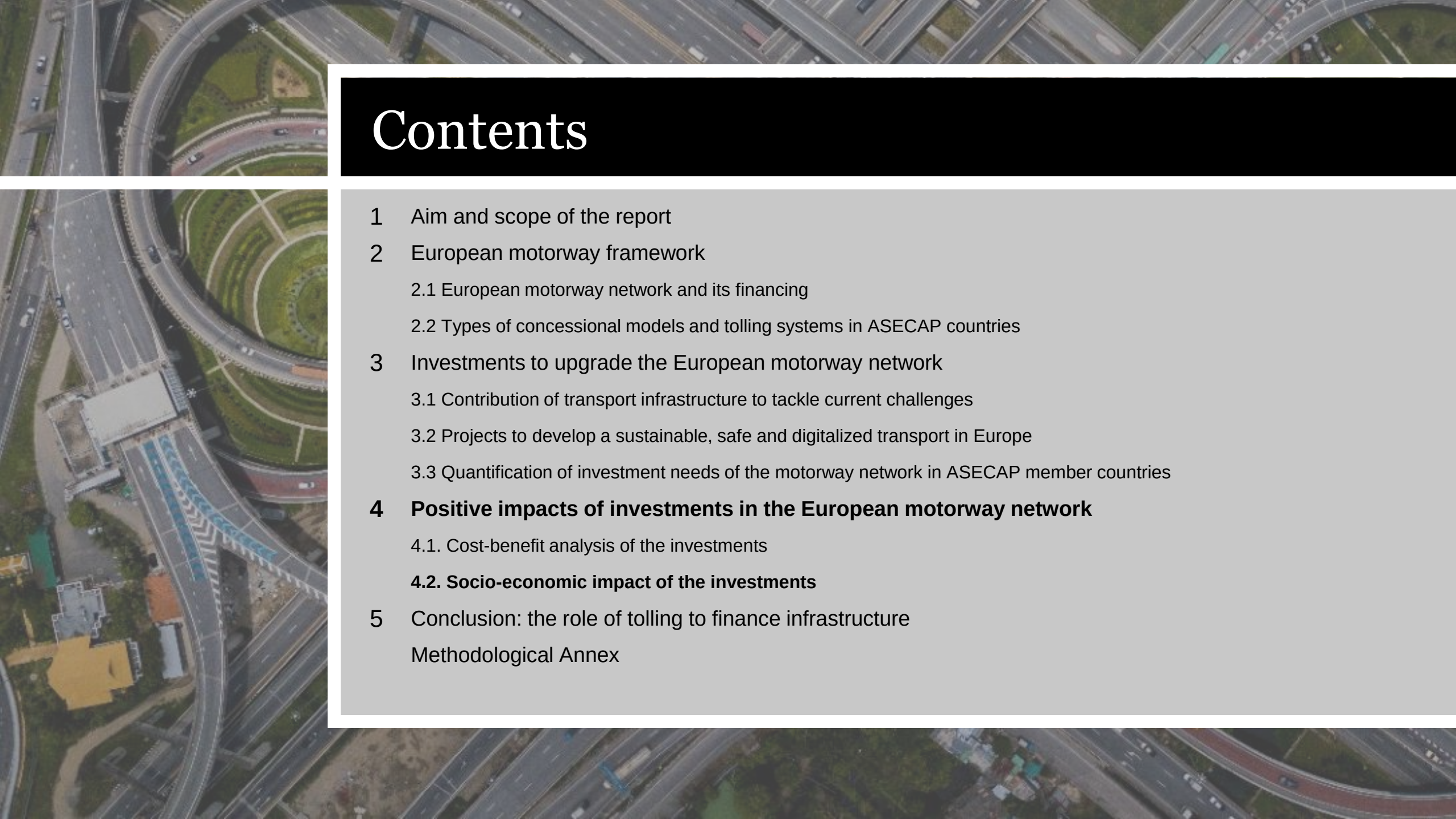
Sources: PwC analysis with information from "ASECAP Sustainability Report 2022", ASECAP (2023) and ASECAP information.

Overall, the CBA analysis allow us to identify the multiple benefits derived from the investments needed to upgrade the European motorway network

- Once the benefits in each area are analyzed, they are compared with the associated costs - the required upfront investment - to complete the cost-benefit analysis
- The results lead to the conclusion that **investments** in **sustainability and digitalization** offer the most **transversal benefits. The sustainability area** considers a wide variety of investments, which requires a **significant upfront investment.** In contrast, the investments in **digitalization**, achieve substantial benefits at a relatively **lower cost**
- On the other hand, the **safety** area, is more **targeted** and has a **localized** and **strong impact** on specific areas. Despite its narrower, the necessary investments also require a substantial upfront cost

		SUSTAINABILITY		SAFETY		DIGITALIZATION	
		Quantification	**Conclusion**	**Quantification**	**Conclusion**	**Quantification**	**Conclusion**
BENEFITS	**Air pollution reduction**	●●○	• Investments in the **sustainability** area primarily contribute to **reducing air pollution**, decreasing congestion, and lowering well-to-tank emissions • Regarding **costs**, this area requires higher initial investments compared to the other two. Consequently, it also **involves the highest upfront expenditure** • Overall, the CBA indicates that these investments **will significantly contribute** to **sustainable mobility**	○○○	• Investments in the safety sector primarily contribute to **accident reduction**, which in turn helps to **reduce congestion** to a lesser extent • The investment needs in this area also require a **high upfront expenditure** • In conclusion, the CBA shows that these **investments** could substantially **reduce road fatalities**, addressing one of the long-standing **priorities** of policy-makers and authorities	●●○	• Investments in digitalization have a substantial **impact on several areas**. They can potentially decrease road accidents and congestion, while also reducing air pollution, well-to-tank[1] emissions, and commuting times • Regarding costs, the survey conducted shows that the upfront **investment** in this area is relatively **low** compared to the **substantial benefits** it offers
	Accident reduction	●○○		●●●		●●●	
	Noise pollution mitigation	●○○		○○○		○○○	
	Travel time savings	●○○		○○○		●●○	
	Congestion decrease	●●○		●○○		●●●	
COSTS	**Initial investment**	**48,483 M€**		**17,307 M€**		**6,071 M€**	

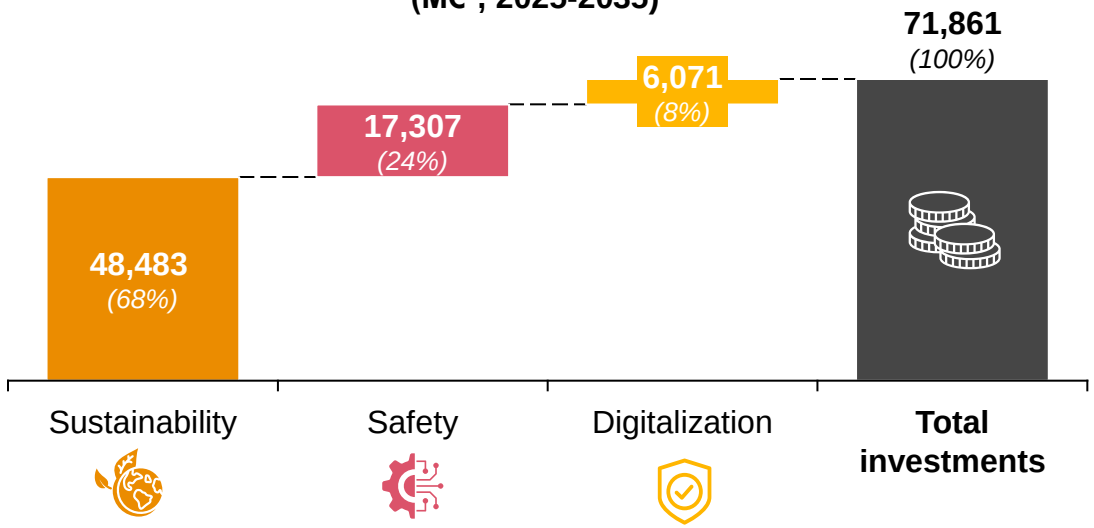
(1) “Well-to-tank”, a method used to calculate the energy consumed and GHG emitted from the moment of production of a transport fuel (petrol, diesel, electricity, natural gas) to the moment of fuel supply (at the recharging or refuelling station).



Contents

The investments to improve the European motorway network would have a socioeconomic impact on the EU in terms of GDP, employment, and tax revenue

Identified investment needs to improve the motorway network in ASECAP member countries, broken down by investment area (M€[1], 2025-2035)



Quantification of the socioeconomic impact of upgrading the European motorway network

Gross Domestic Product (GDP)	Economic contribution of upgrading the European motorway network **to EU-27 production** directly, indirectly, and induced in terms of GDP
Full Time Equivalent (FTE) Jobs	Contribution of upgrading the European motorway network **to EU-27 employment** directly, indirectly, and induced in terms of full-time equivalent (FTE) jobs
Tax returns	Contribution of civil upgrading of the European motorway network **to tax and social contribution revenue** through taxes borne and collected directly, indirectly, and induced within the EU-27

(1) 27% of the responses indicate that they would carry out the investments in less than three years, 19% in three to five years, 43% in five to ten years, and 10% in more than ten years. The period "2025-2035" has been defined assuming that the investments will begin in 2025 and takes into account only 10 years, since 90% of the responses fall within that period.

Sources: PwC analysis with information from a survey conducted with ASECAP member associations.
For more information see the methodological annex.

To estimate the socioeconomic impacts of the investments in the EU-27, we applied the Input-Output methodology using FIGARO tables from Eurostat

Types of impacts

A **Direct impact:** economic activity **generated directly by the investments** on sustainability, safety and digitalization made to improve the European motorway network

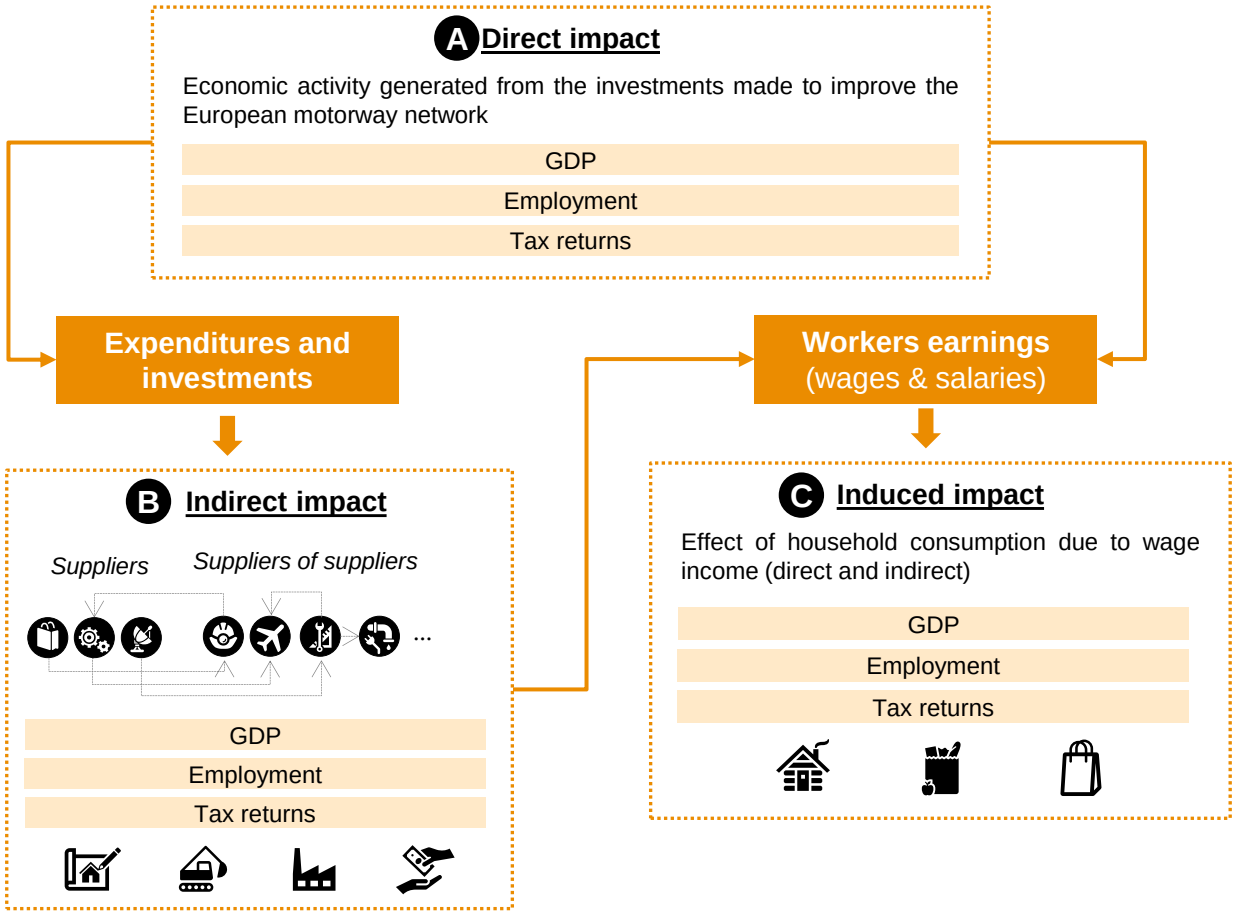
B **Indirect impact:** impact generated by **expenses and investments** made throughout the entire **value chain** (auxiliary activities, complementary services, supplies, etc.)

C **Induced impact:** impact generated by **household consumption** of goods and services derived from the **income earned directly and indirectly through labor**

Methodology

2022 EU inter-country input-output tables industry by industry (FIGARO) provided by **Eurostat** have been used to estimate the model. This is a **standard and internationally validated technique** that allows for the measurement of impacts generated from different perspectives

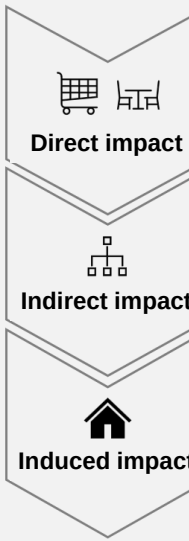
Outline of socioeconomic impacts analyzed:



The investments in the European motorway network would contribute 72,665 M€ to the EU's GDP, with 64% of this generated by indirect and induced effects

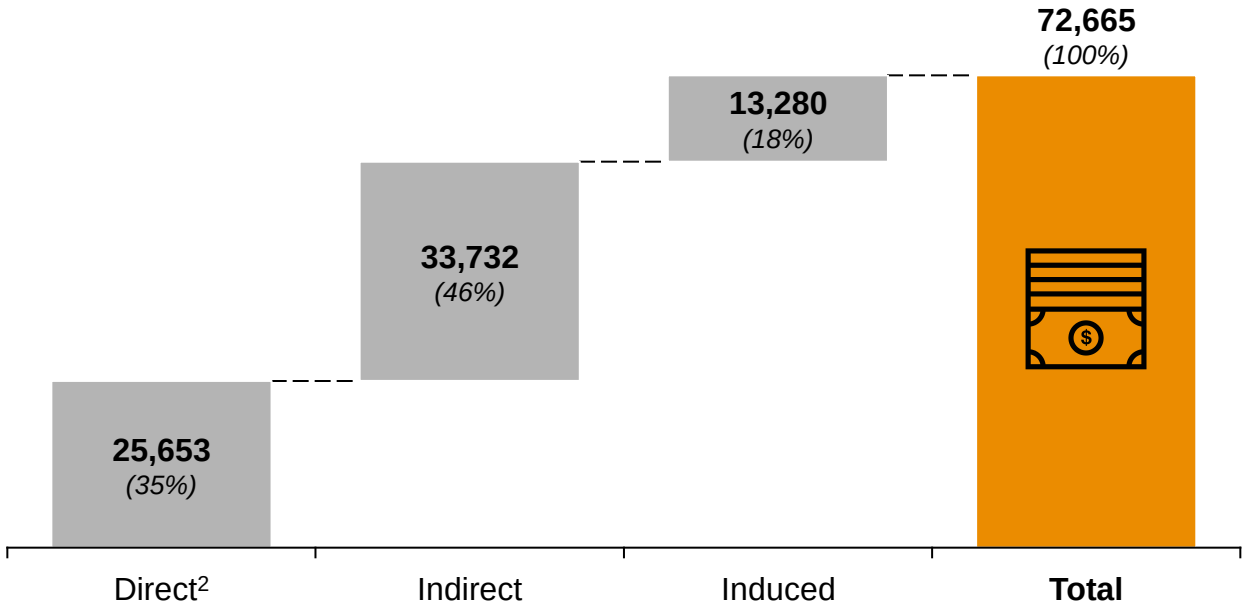
72,665 M€[1]

GDP (2025-2035)



35% of the total contribution to economic activity will be **generated directly** through the investments pursued, **46%** will be generated **indirectly** through expenditures and investments by their **suppliers**, and the remaining **18%** will be induced by **household consumption**

Contribution of future investments in the European motorway network to the GDP of the EU-27 (€M) broken down by type of impact



X2.8

For every **€ of direct GDP** linked to investments in the European motorway network, **€2.8 are generated in the overall European economy (EU-27)**

(1) Data in current euros for 2024.
(2) The investments required to improve the European motorway network of 71,861 million euros would generate a direct impact on GDP of 25,653 million euros in the EU-27, with the remainder being mainly intermediate consumption.
Sources: PwC estimates using Input-Output Methodology and Eurostat data.
For more information see the methodological annex.

The sectors that would benefit the most indirectly in GDP from the European motorway network investments are manufacturing, construction, and trade

23.3%

Of **indirect contribution** to GDP corresponds to **Manufacturing sector** *(7,866 M€)*

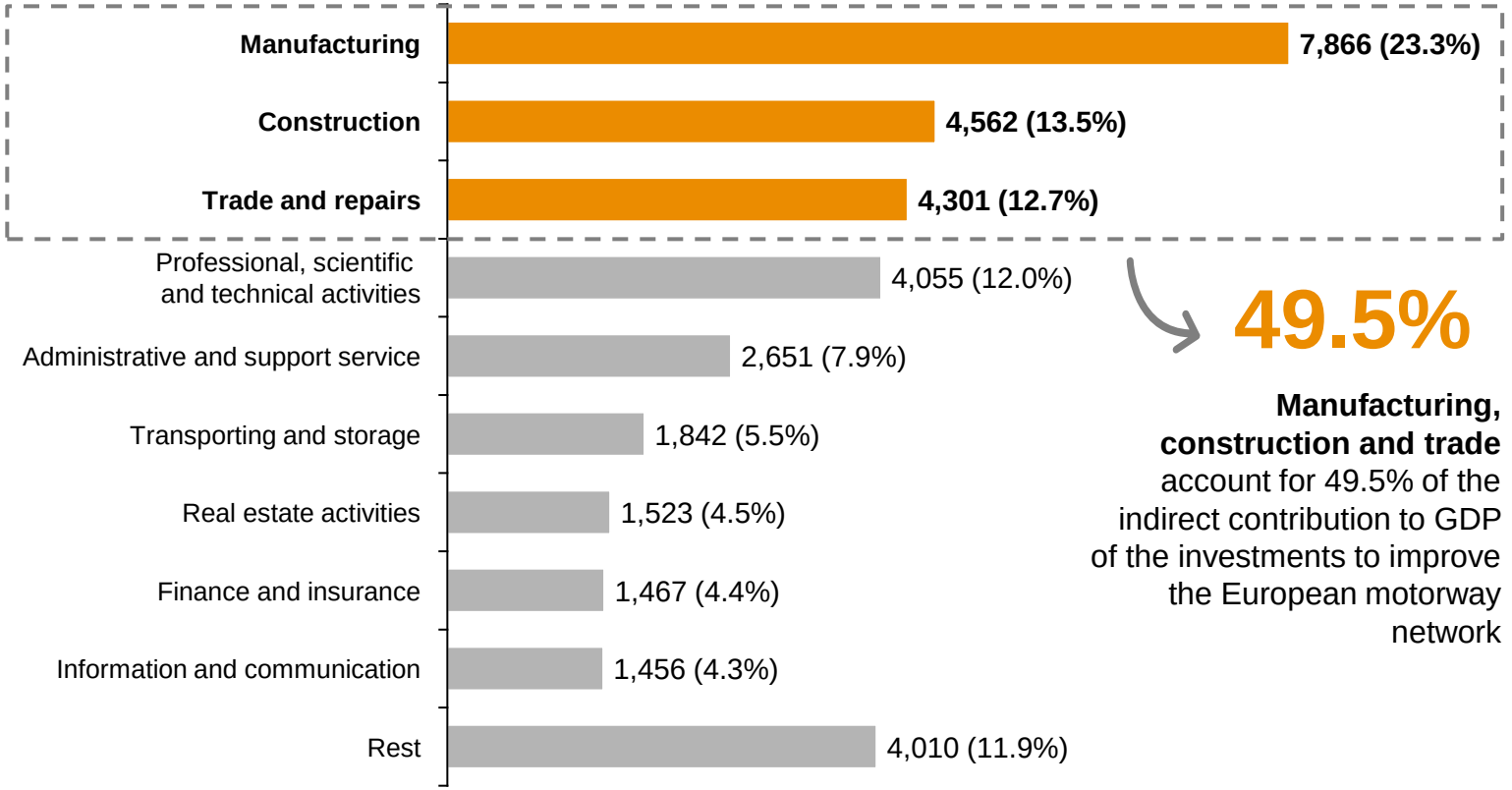
13.5%

Of **indirect contribution** to GDP corresponds to **Construction sector** *(4,562 M€)*

12.7%

Of **indirect contribution** to GDP corresponds to **Trade & Repair sector** *(4,301 M€)*

Indirect contribution of future investments in the European motorway network to the GDP of the EU-27 (€M[1]) by sector



49.5%

Manufacturing, construction and trade account for 49.5% of the indirect contribution to GDP of the investments to improve the European motorway network

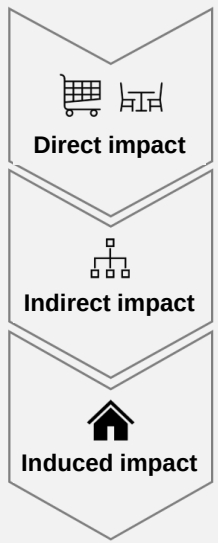
(1) Data in current euros for 2024.
Sources: PwC estimates using Input-Output Methodology and Eurostat data.
For more information see the methodological annex.

The investments in the European motorway network will contribute 96,006 full time equivalent (FTE/year) jobs to the EU's labour market

96,006

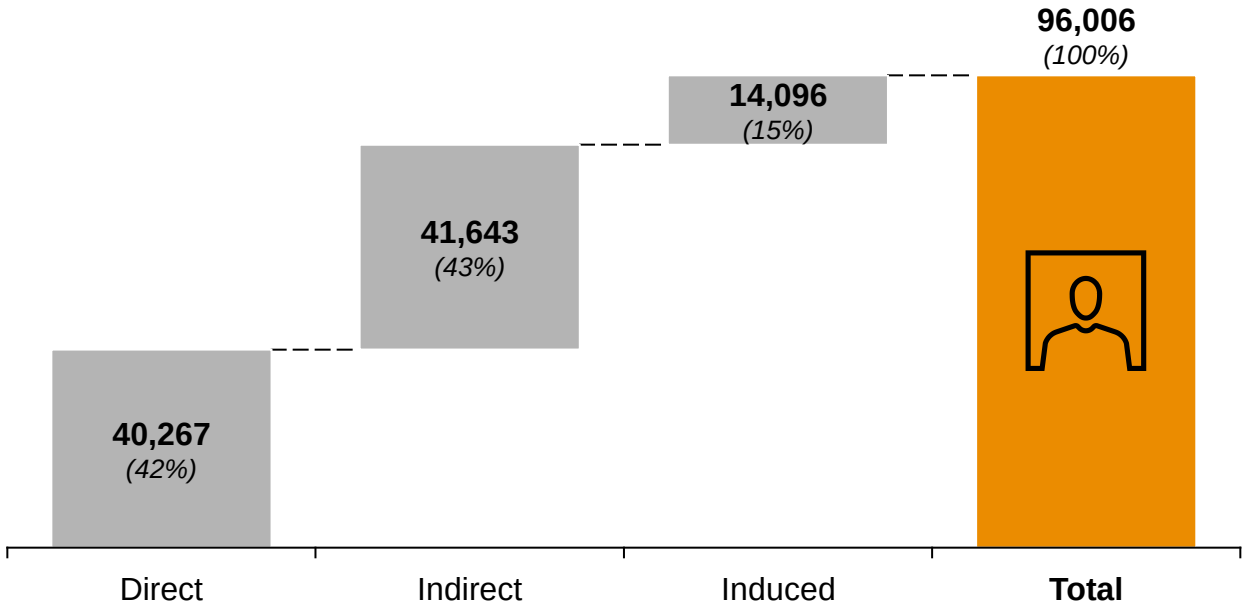
Jobs (FTE/year)[1]

(2025-2035)



42% of the total contribution to economic activity will be **generated directly** through the investments pursued, **43%** will be generated **indirectly** through expenditures and investments by their **suppliers**, and the remaining **15%** will be induced by **household consumption**

Contribution of investments in the European motorway network to the employment of the EU-27 (FTE/year jobs) broken down by type of impact



X2.4

For every **€ of direct jobs** linked to investments in the European motorway network, **2.4 jobs are generated in the overall European economy (EU-27)**

(1) They have been calculated taking into account a period of 10 years, since 90% of the responses indicate the investments would be carried out in less than 10 years.
Sources: PwC estimates using Input-Output Methodology and Eurostat data.
For more information see the methodological annex.

The sectors that would benefit the most indirectly in employment from the European motorway network investments would be manufacturing, construction and trade

23.4%

Of **indirect contribution** to employment corresponds to **Manufacturing sector** *(112,136 FTE jobs)*

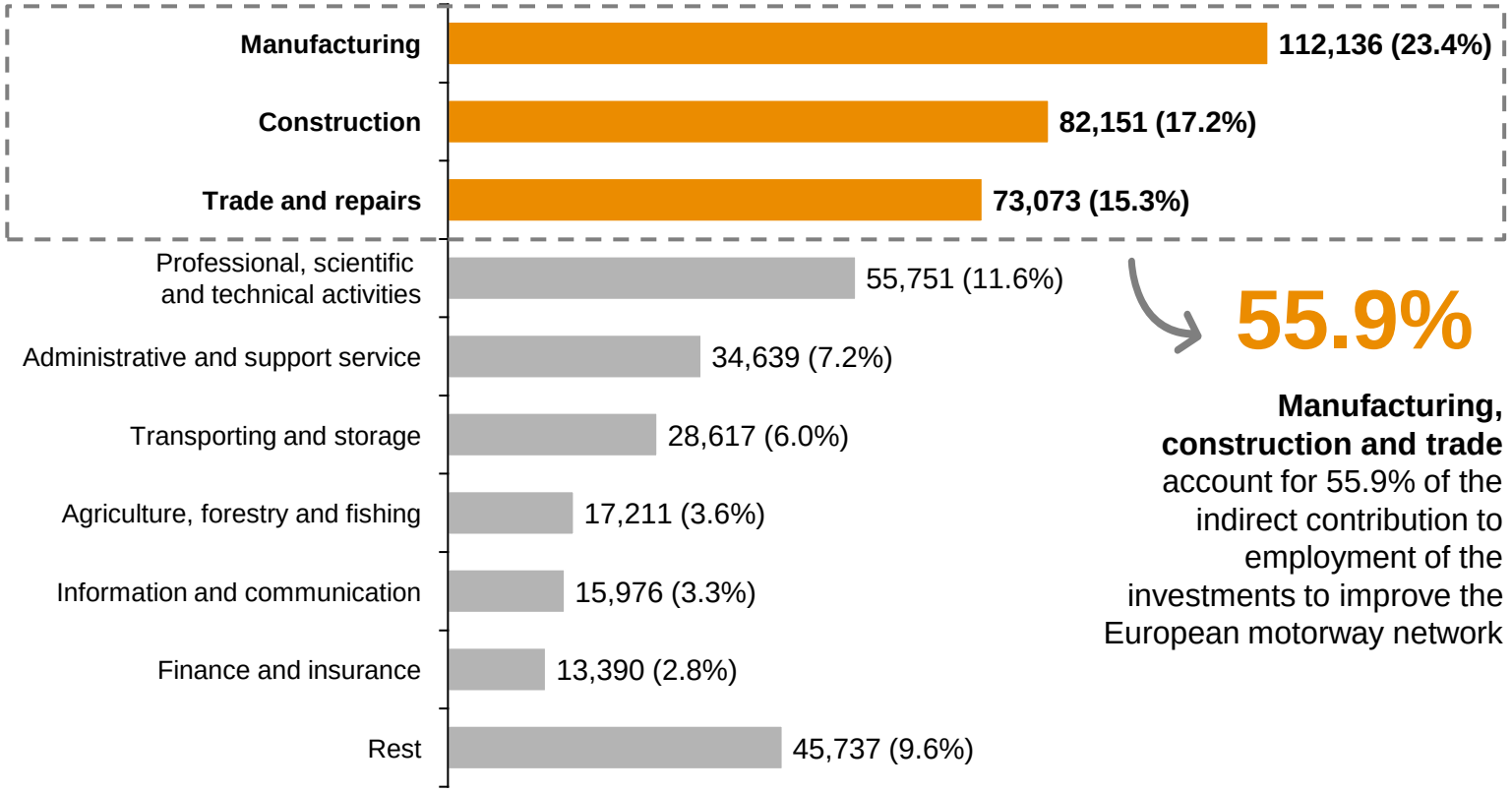
17.2%

Of **indirect contribution** to employment corresponds to **Construction sector** *(82,151 FTE jobs)*

15.3%

Of **indirect contribution** to GDP corresponds to **Trade & Repair sector** *(73,073 FTE jobs)*

Indirect contribution of future investments in the European motorway network to the GDP of the EU-27 (FTE/year jobs[1]) by sector



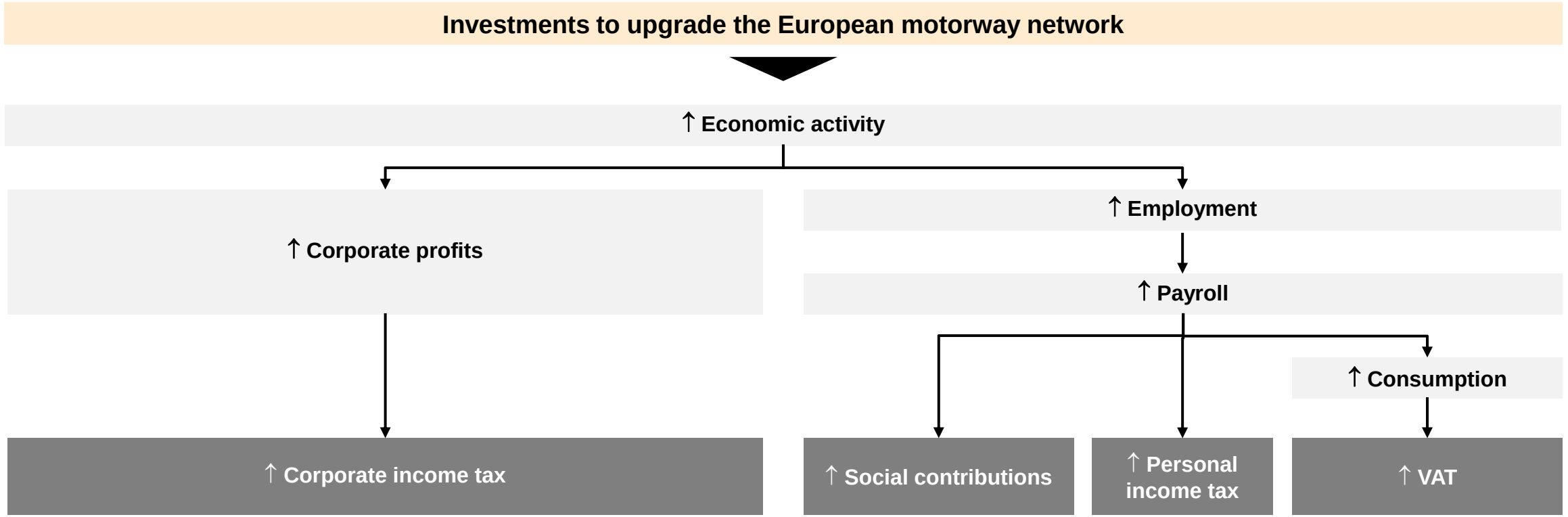
55.9%

Manufacturing, construction and trade account for 55.9% of the indirect contribution to employment of the investments to improve the European motorway network

(1) They have been calculated taking into account a period of 10 years, since 90% of the responses indicate the investments would be carried out in less than 10 years.
Sources: PwC estimates using Input-Output Methodology and Eurostat data.
For more information see the methodological annex.

In addition to contributing to GDP and employment, investments in the European motorway network will contribute to the tax revenue of the EU-27

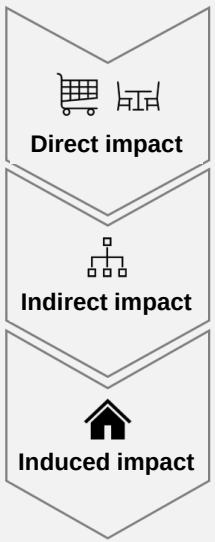
The contribution of investments in the European motorway network to tax revenue in EU-27 comes from both the **taxes borne** (corporate income tax, etc.) and **collected** (personal income tax of workers, social security contributions of employees, etc.) **directly by the sector**, as well as from the **related economic activity** (indirect and induced impacts)



The total fiscal contribution to the EU's economy from investments in the European motorway network will exceed 21,000 M€

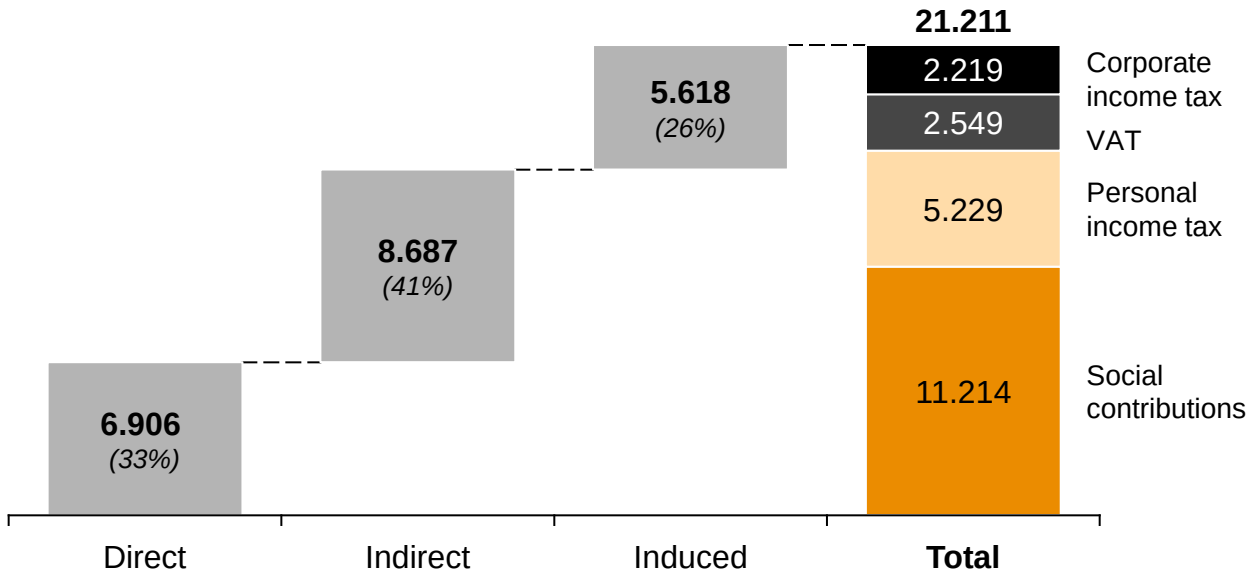
21,211 M€[1]

Tax revenue (2025-2035)



33% of the tax revenue will be **generated directly** through the investments pursued, **41%** will be generated **indirectly** through expenditures and investments by their **suppliers**, and the remaining **26%** will be induced by **household consumption**

Contribution of investments in the European motorway network to the tax revenues of the EU-27 (M€) broken down by type of impact



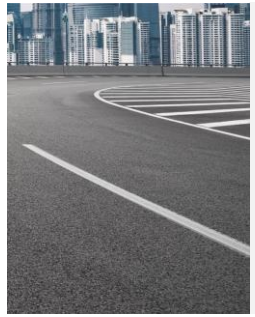
X3.1 For every **€ of direct tax revenue** linked to investments in the European motorway network, **€2.4 are generated in the overall European economy (EU-27)**

(1) Data in current euros for 2024.
Sources: PwC estimates using Input-Output Methodology and Eurostat data.

The total impact of the investments to upgrade the European motorway network will result in a contribution to the EU-27 economy equivalent to…

Socio-economic impact of the investments to upgrade the European motorway network

The total contribution of 72.655M€ to the GDP is equivalent to…



…93.2% of the subsidies allocated in the EU for road construction between 2007 and 2020
(78,000 M€)

…14.4% of the public investment on Gross Fixed Capital Formation in the EU in 2022
(505,432 M€)

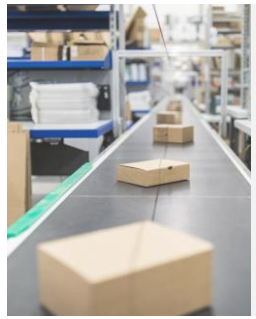
The total contribution of 96.006 jobs is equivalent to…

…0.9% of the employment of the transportation sector in Europe in 2023
(10,691 thousand employees)

…0.7% of the employment of the construction sector in Europe in 2023
(13,645 thousand employees)

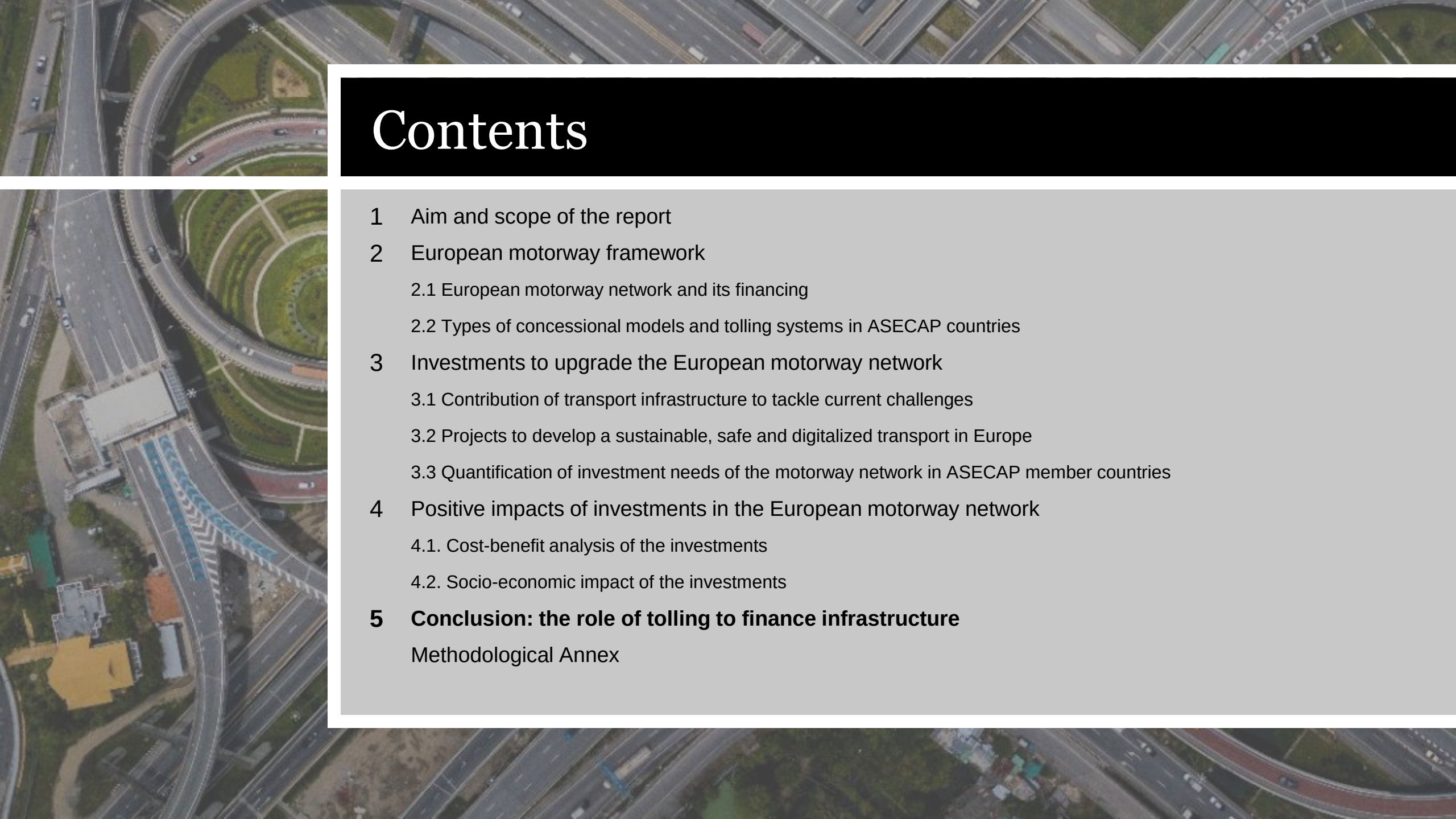
The total contribution of 21.211M€ on tax revenues is equivalent to…

…24.8% of the total taxes on imports[1] in the EU in 2022
(85,690 M€)



…4.4% of the total taxes on products[2] in the EU in 2022
(484,413 M€)

Sources: PwC estimates using Input-Output Methodology and Eurostat data.
(1) Excludes VAT
(2) Excludes VAT and import duties



Contents

The proposed investments would significantly enhance economy and social welfare, but sufficient funds need to be raised to implement them

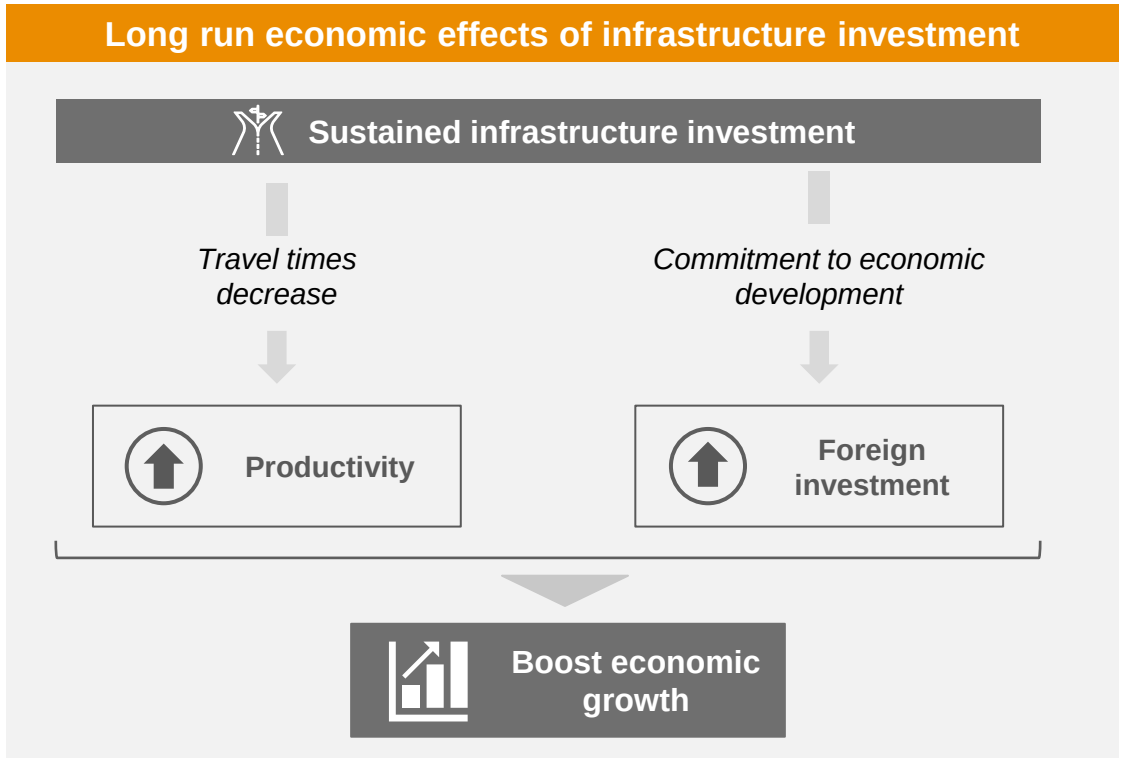
		SUSTAINABILITY	SAFETY	DIGITALIZATION
		Quantification	Quantification	Quantification
BENEFITS	Air pollution reduction	●●○	○○○	●●○
	Accident reduction	●○○	●●●	●●●
	Noise pollution mitigation	●○○	○○○	○○○
	Travel time savings	●○○	○○○	●●○
	Congestion decrease	●●○	●○○	●●●
COSTS	Initial investment	48,483 M€	17,307 M€	6,071 M€

72,665 M€
GDP

96,006 jobs
(FTE/year)

21,211 M€
Tax revenue

Infrastructure investment yields substantial long-term benefits, as it is positively correlated with enhanced productivity and economic growth

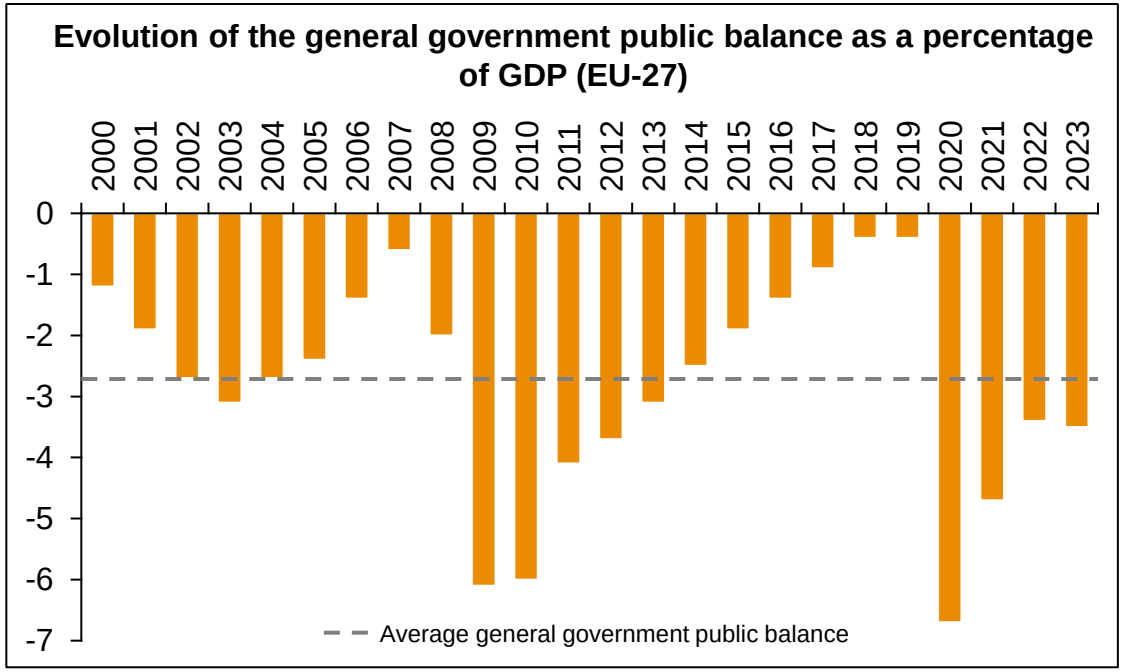


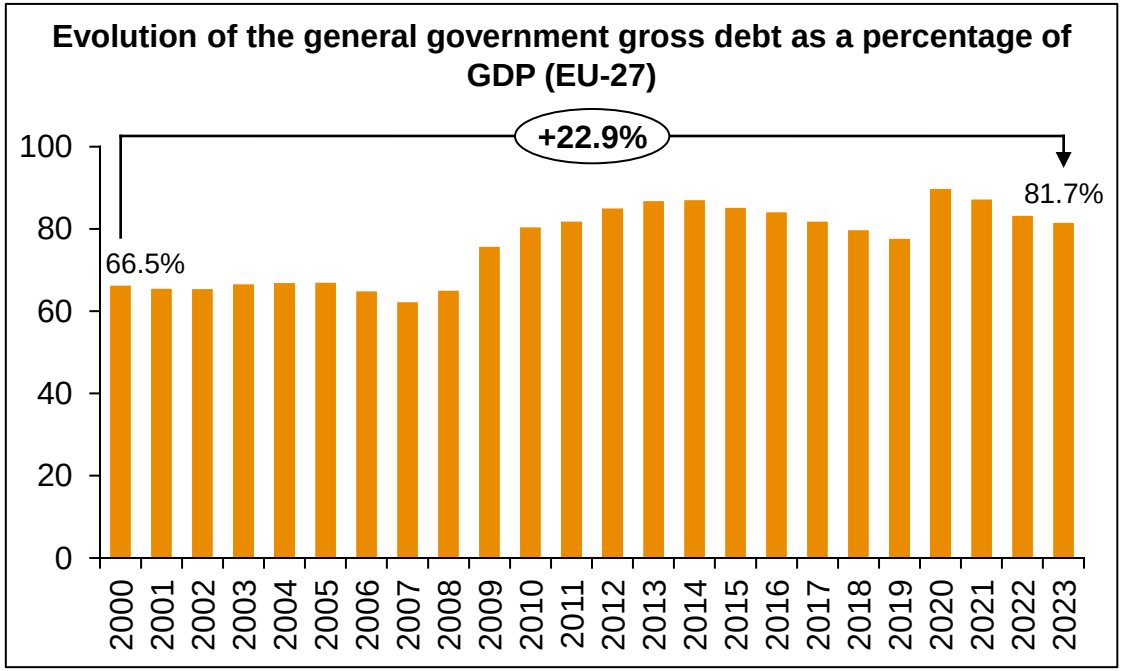
- **Public infrastructure** plays a major role in the European economy, and it is a **cornerstone of economic progress**
- A **long-term commitment** from governments and authorities to invest in public infrastructure is vital to enhance **sustainable business growth** and **economic development**
- **Infrastructure investments** not only yield positive effects in the short and medium term but also ensure **high returns** in the **long term**
- **High-quality and efficient infrastructure** can reduce travel times, thereby **boosting productivity**
- Furthermore, consistent and **sustained funding** in infrastructure signals that the country is committed to **economic development**
- Therefore, a long-term commitment to public infrastructure investment could potentially **attract international businesses and external capital investment**
- Al these mechanisms, will potentially **impact positively economic growth**
- In fact, this association has been shown in recent economic studies, which provide evidence of a **correlation between a robust road infrastructure network and GDP growth**
- Regions with well-developed road infrastructures typically experience **faster growth** compared to areas lacking such infrastructure

Sources: PwC analysis with information from “The role of transport infrastructure in economic growth: Empirical evidence in the UK”, Zhang & Cheng (2023), “Road infrastructure development and economic growth”, Ng et al. (2019), “The crucial role of long-term commitment to infrastructure investment: The HS2 case study”, CBI (2024)

Investment in public infrastructure typically relies on government expenditure, but this has been challenged by persistent public deficits

- A **sustainable, smart, and competitive European economy** should be supported by a **solid transport sector** with a **resilient infrastructure**
- Traditionally, **infrastructure investment** has been dominated by the **public sector**. However, over the **last 20 years**, the **EU-27 has consistently run budget deficits**, with deficits surpassing the average in the past four years. This has resulted in a **debt accumulation** that is **22.9% higher than that recorded in 2000**
- Given these fiscal pressures, **public budgets** are expected to remain under **significant strain**, making it increasingly **challenging** to meet the **financial demands of the sustainable and smart transition**, particularly within the transport sector

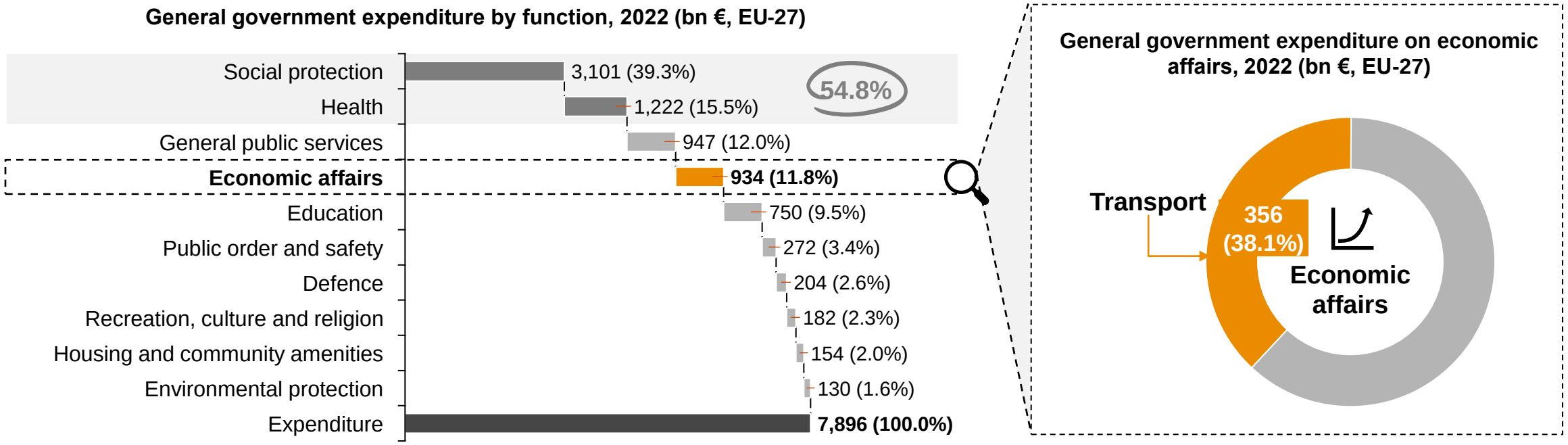




Sources: PwC analysis with information from Eurostat, “Connecting Europe. A transport funding and financing that is adapted to the challenges ahead”, TEN-T Coordinators’ Position Paper (2024) and “Building Resilience New Strategies for Strengthening Infrastructure Resilience and Maintenance”, OECD (2021).

Additionally, government priorities have redirected expenditure towards social protection and healthcare, leaving only 4.5% of the budget for transport

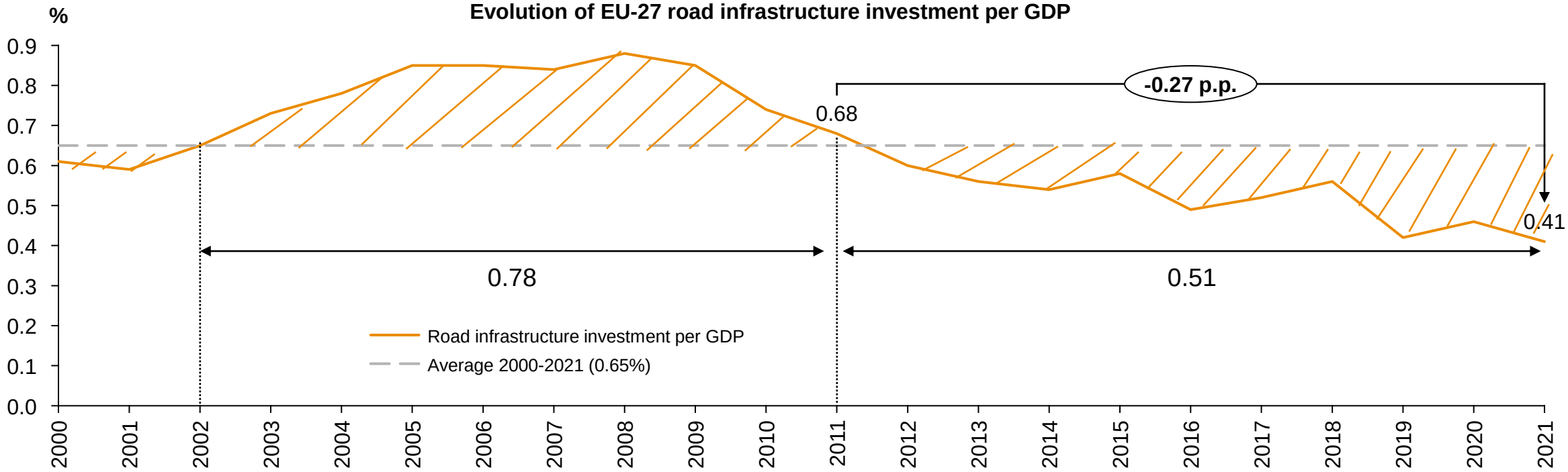
- **Fiscal consolidation** has exacerbated the impact on infrastructure investment by **prioritizing current expenditures**, such as **social transfers, over capital projects**. While some decline in public investment is attributable to economic changes, many countries are still grappling with **deteriorating infrastructure quality**, highlighting the urgent need for targeted investment
- In 2022, EU-27 general government **expenditure totaled €7,896 billion**, with **54.8% allocated to social protection and health**, indicating a strong focus on these areas. In contrast, **transport funding was significantly constrained, receiving only 4.5%** of the total budget. This disparity underscores the **challenge of maintaining and upgrading transport infrastructure** amidst competing fiscal priorities



Sources: PwC analysis with information from Eurostat and “Transport in the European Union Current trends and issues”, European Commission (2024).

Due to these budgetary constraints, investment in road infrastructure per GDP has decreased by 0.27 p.p., hindering the modernization of the transport sector

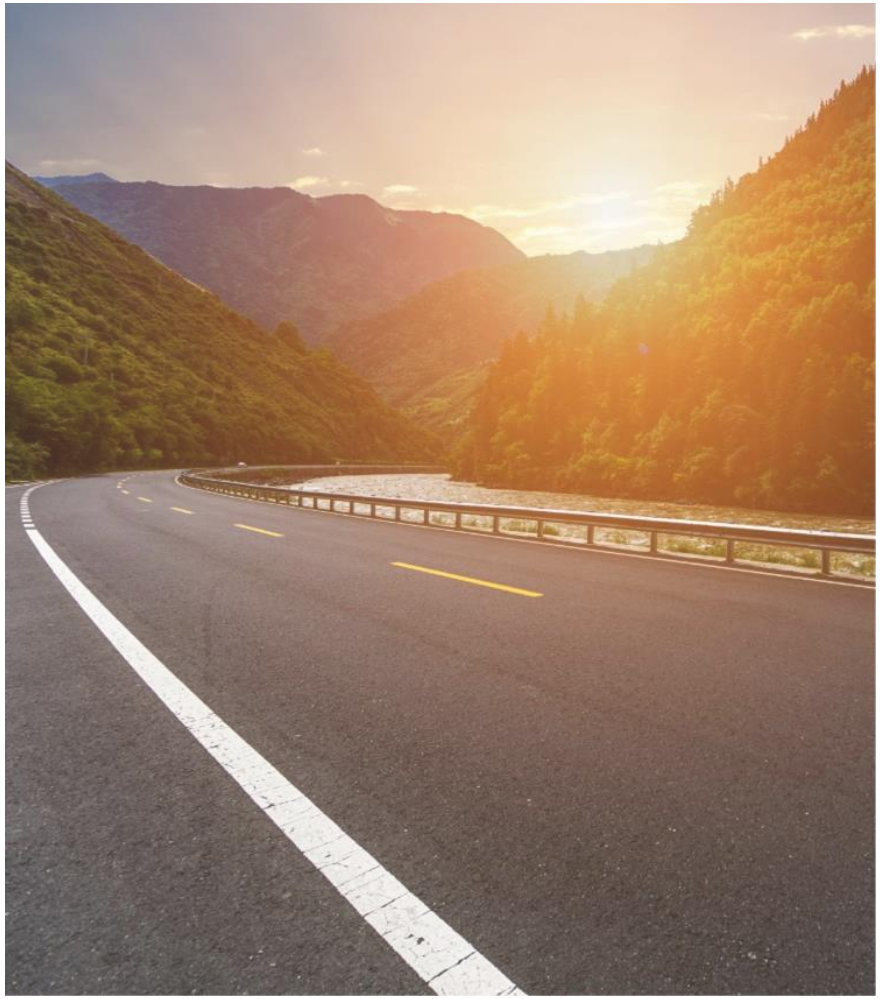
- Between **2000 and 2021**, **investment in road infrastructure** across the EU-27 countries averaged **0.645% of GDP**. However, this period is characterized by two distinct phases: **2002-2011 and 2012-2021**
- The first phase saw a notable **increase in investment**, **peaking at 0.88% of GDP in 2008**. However, after this peak, investment began to **decline** and**, from 2011 onwards, remained below the average, reaching a low of 0.41% of GDP by 2021**
- Given the **existing budgetary constraints**, the EU has long struggled with **inadequate investment in transport infrastructure**, which **hinders the modernization** of the transport system



Sources: PwC analysis with information from OECD, from “Transport in the European Union Current trends and issues”, European Commission (2024), “Connecting Europe. A transport funding and financing that is adapted to the challenges ahead”, TEN-T Coordinators’ Position Paper (2024), “Road infrastructure in Europe: road length and its impact on road performance”, European Commission (2022) and “Building Resilience New Strategies for Strengthening Infrastructure Resilience and Maintenance”, OECD (2021).

To address this issue, it is essential to explore alternative and diversified funding sources like tolls to provide stable funds to finance the infrastructure

- The **lack of reliable and stable funding for infrastructure** due to short-term planning, shifting political priorities, and constrained public budgets poses significant **barriers to maintaining and developing resilient infrastructure**. Consequently, funding for **infrastructure improvement remains both insufficient and poorly targeted**
- Given these budgetary constraints and the increasing challenges facing the transport sector, the EU and its Member States must seek **financing solutions to support their transport priorities**
- Among these, the **user-pays principle** stands out as a promising approach. This principle not only helps finance new investments but also aligns with the internalization of **the polluter-pays principle**, making it a **key tool for achieving the ecological transition in road transport** in accordance with **the EU Green Deal objectives**
- Implementing **tolls** based on the **user-pays principle** can substantially contribute to the Green Deal's aims. Tolls provide a **mechanism for funding enhanced and safer infrastructure**, and adapting to cleaner vehicles, which is vital for meeting both current and future demands. This approach can ensure that **public funds remain protected**, allowing Member States to allocate budgets to other essential public services
- The European Commission advocates for **earmarking road user charges to benefit the transport sector and promote sustainable mobility**. Such charges should fund projects that improve pricing efficiency, reduce pollution, enhance CO2 and energy performance, develop alternative infrastructure, optimize logistics, and boost road safety
- **Integrating tolls into the financing strategy will not only increase transport efficiency but also encourage the use of clean vehicles and intelligent transport behavior**. As countries advance towards cleaner and smarter transport systems, tolls will be a crucial financial tool, generating revenue for public budgets while promoting zero-emission vehicles and smart transport solutions
- By building on existing policies, **tolls offer a pathway to making road transport both cleaner and more efficient, aligning with broader sustainability and efficiency goals**



Sources: PwC analysis with information from “ASECAP Proposals reaching net zero carbon mobility tools for sustainable mobility solutions”, ADECAP (2023), “The Economic Impacts of Road Tolls”, Transport & Environment (2017) and “Building Resilience New Strategies for Strengthening Infrastructure Resilience and Maintenance”, OECD (2021).

Toll road concessions provide economic, social, and budgetary benefits, enhancing infrastructure networks with well-equipped facilities…

Main benefits of toll road concessions

Public budget

- Concessionaries undertaking road investments increase **savings in public budgets**, that can be allocated to **other social priorities**
- **Users**, who benefit from the use of the roads and generate externalities, **pay** for them, while **taxpayers do not bear the cost** of these roads

Distribution of risk

- **Risks** involved in building and operating the concession are **transferred** substantially over to the **concessionaire,** who becomes **responsible for full compliance** with all the **construction** and **operation standards** previously required by public authorities and **absorb some profit loss** due to changing circumstances

Road availability and demand

- Concessionaires can build **roads ahead of public funding**, allowing citizens to benefit sooner
- Furthermore, once the infrastructure is available, tolls help **regulate demand**, for example, by varying prices during peak and off-peak hours

Maintenance and safety

- Tolls guarantee **proper maintenance** of the road, especially given the dramatic decrease of public budgets dedicated to maintenance
- **Reducing the dependance on public budgets**, and at the same time keeping strict control from the awarding authorities, has a positive impact on **road safety**

Efficient management

- Concessionaires, as managing companies, are **incentivized to adhere to schedules and budgets** since their **revenues are tied to road efficiency and quality**
- They also possess a comprehensive view of the **infrastructure's life-cycle** and greater **flexibility to adapt** to economic changes

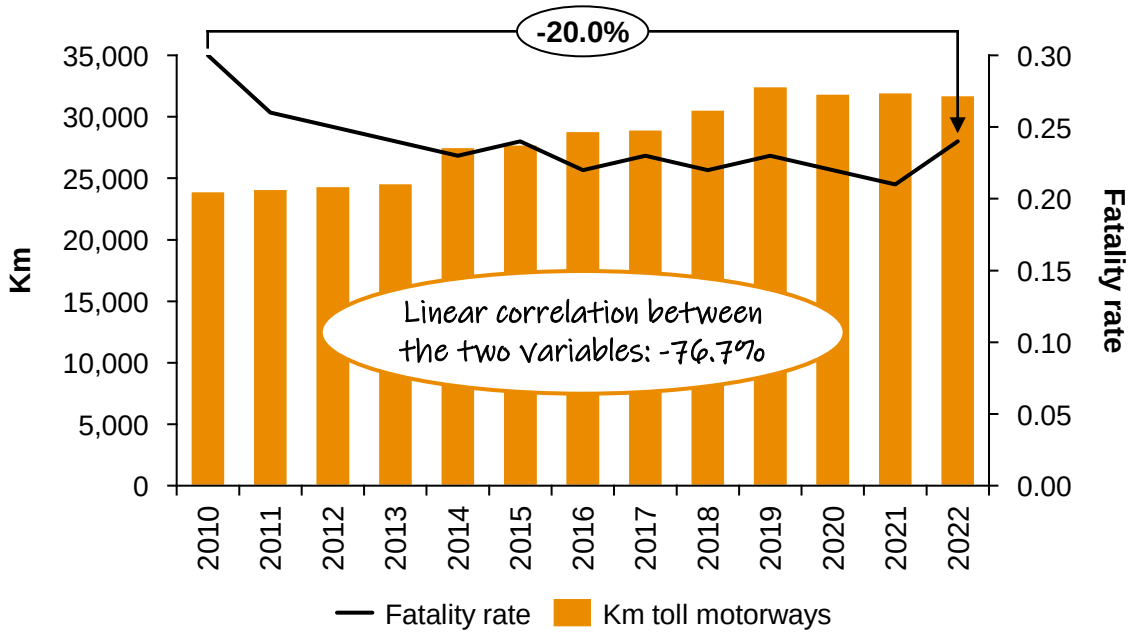
Sustainability benefits

- Tolls help **internalize the environmental cost** of CO2 emissions, incentivizing transport users to make **more sustainable choices**
- Furthermore, they also **enhance vehicle renewal** and **substitution** towards low-emission vehicles

Source: PwC analysis with information from “Manifesto on toll road concessions”, ASECAP (2020) and EU Sustainable and Smart Mobility Strategy, EC (2020).

…and support road safety through proper maintenance and regular updates

Evolution of the kilometers of motorways in ASECAP countries subject to tolls and the fatality rate (2010-2022)[1]



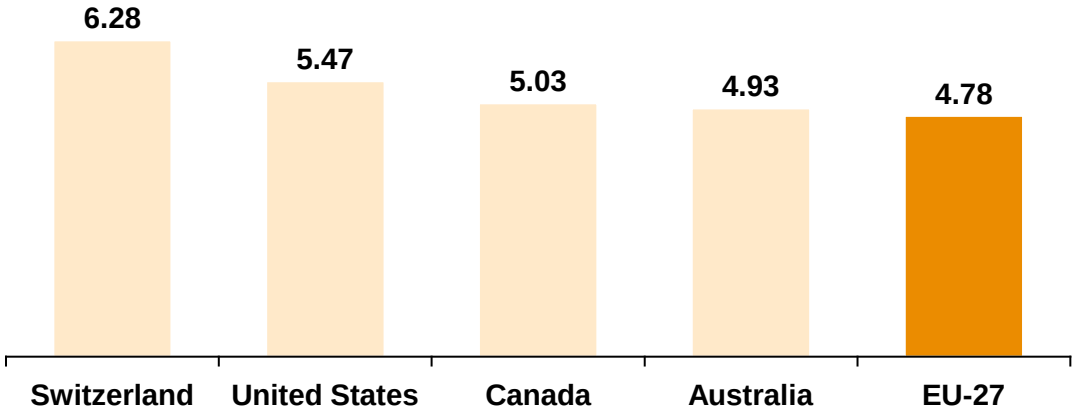
- **Road safety** is the result of the efficient and close interaction between the **infrastructure, the vehicle and the driver**
- The social contract of motorway companies is to **safeguard the safety of road users** and their road workers and operating people first and also to **target congestion-free traffic** on their network
- **Motorway infrastructures** are constructed with the **highest quality and technological standards**, making them **safer than other road infrastructure**
- **Continuous maintenance and operation are conducted year-round** by patrollers and operators, who manage traffic control centers to make informed road management decisions
- ASECAP's aim is to **defend and develop the system of motorways and road infrastructure in Europe applying tolls as a means to ensure the financing of their construction, maintenance and operation**
- **Toll motorways** have shown consistent **improvement in traffic safety** over the years, thanks to close traffic monitoring, active information campaigns, regular maintenance, and efficient accident response. Consequently, **between 2010 and 2022, the fatality rate on toll motorways decreased by 20%**
- However, as a number of **tolled road concession contracts in the EU** approach their **expiration in the next decade**, concerns arise regarding road financing. **Without toll revenues, the quality and safety of these roads may decline**

(1) Data provided by ASECAP includes 10 countries from 2010 to 2013 (Italy, Hungary, Portugal, Spain, France, Austria, Poland, Slovenia, Croatia, and Denmark), 11 countries from 2014 to 2015 (the previous 10 plus Greece), 14 countries from 2016 to 2017 (the previous 11 plus Ireland, the Netherlands, and Serbia), and 15 countries from 2018 to 2022. The fatality rate has been calculated per 100 million kilometers traveled.

(2) Source: PwC analysis with data from the European Commission and information from "ASECAP Proposals reaching net zero carbon mobility tools for sustainable mobility solutions", ASECAP (2023) and ASECAP Road Safety Leaflets.

Furthermore, success stories observed in comparable countries to the European Union highlight the importance of user fees and efficient concessional models

Road Quality Index, RQI (2019)[1]



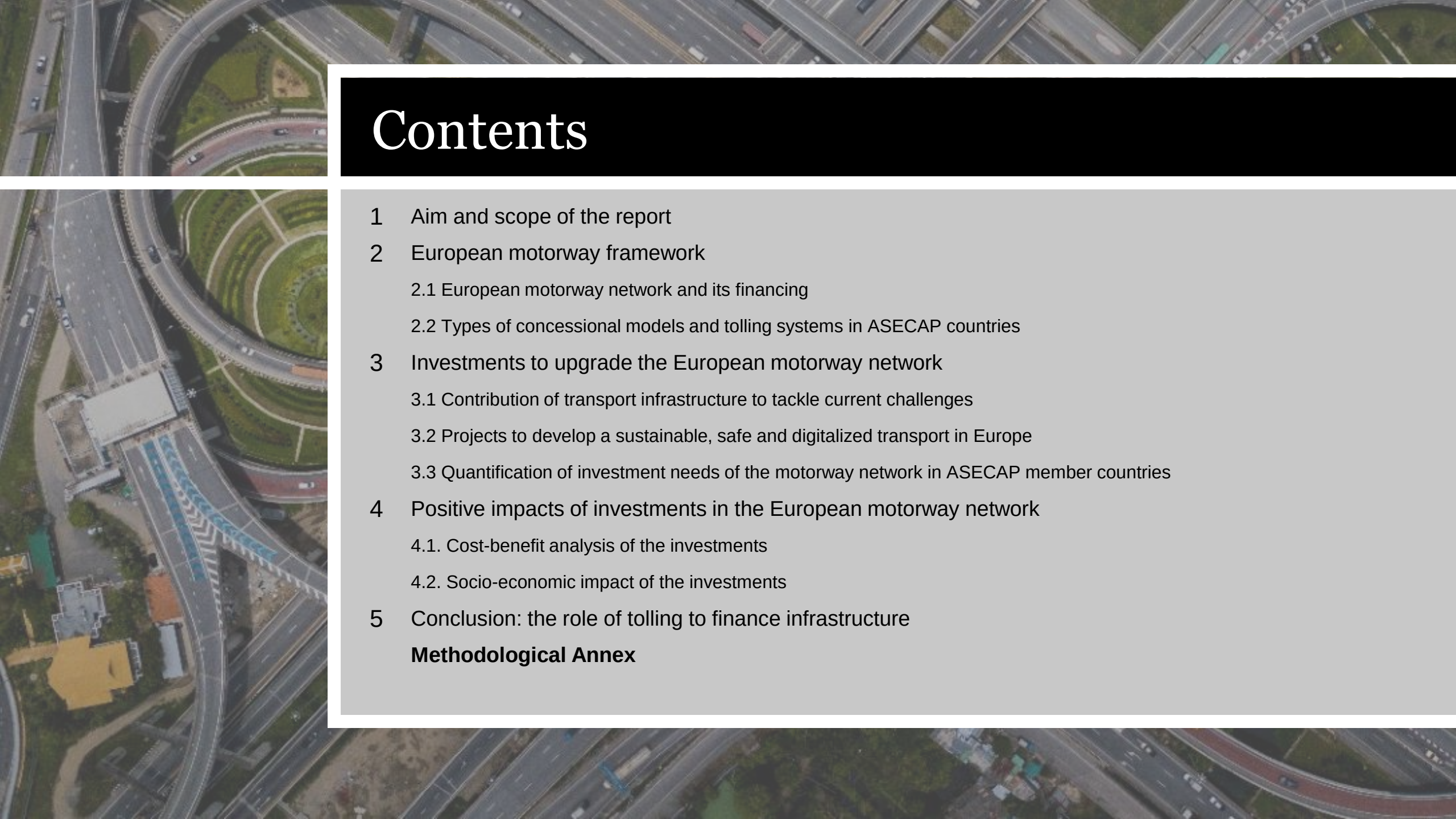
The **Road Quality Index (RQI)**, published by the World Economic Forum in 2019, **grades the roads** of each country based on a comprehensive **survey**

The survey involved business **leaders from 144 countries**, gathering their **opinions on roadways** around the world

The Index **ranges from 1 to 7**, with **7** indicating the **highest quality**

- The World Economic Review constructed in 2019 a **worldwide ranking of road quality** based on the **Road Quality Index**
- Within this ranking, the **EU-27 is placed in the 27th position**, although there is some heterogeneity between EU members
- The data shows that some **comparable countries** to the EU such as Switzerland, the United States, Canada and Australia have significantly **higher road quality**
- This difference can be attributed to many factors, such as government investment capacity, traffic levels, or climate conditions
- However, it should be noted that **Switzerland**, that has an overall score of 6.28 out of 7, has **100% of its motorway network under user fees**
- Consequently, these **user payments enhance investment** capacity for roads, resulting in an **exemplary road infrastructure** that serves as a global model
- Another success story can be found in the **United States**, were public-private collaboration is as popular as it is in the EU, and not all motorways are tolled
- However, the **concessional models in the US** are **more modern and flexible** compared to those in the EU, providing concessionaire companies with significantly **greater freedom** in **price setting** and **obligations**
- This **flexibility fosters innovation**, which overall has a positive impact on **road modernization, efficiency** and **adaptability** to new contexts
- Hence, even if road quality can be influenced by many factors, **models with user payments and flexible concessions have**, overall, **better roads**

(1) This info is from WEC and the most similar countries have been selected
Sources: PwC analysis with data from the World Economic Review and other public sources
PwC



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B. Impact methodology

ASECAP countries: Austria (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Austria	1 state owned company	2,249.0	2,249.0	100.0%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
ASFINAG	1 stated owned company	2,249.0	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Public	• Finance • Design • Construct • Maintain • Operate • Upgrade	• Vehicle category (LV/HV) • Number of axles • Emissions / CO2 classes

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Time	Vignette / E-vignette	No
Light vehicles	Distance[1]	Cash / Cards / ANPR	Yes / No
Heavy vehicles > 3.5 t. TPMLM[2]	Distance	DSRC	No

(1) Special toll section in alpine regions.
(2) Technically Permissible Maximum Laden Mass.
Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Croatia (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Croatia	2 private 1 public	1,341.1	1,252.1	93.4%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
HUKA	2 private 1 public	1,252.1	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Mixed	• Design • Finance • Construct • Maintain • Operate	• Number of axles • Weight • Dimension

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles	Distance	DSRC	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Denmark (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Denmark	1 state owned company	1,298.0	34.0	2.6%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
Sund≋Bælt	1 state owned company	34.0	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Public	• Design • Construct • Maintain • Operate • Upgrade	• Dimensions • CO2 emissions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC/ANPR	Yes
Heavy vehicles < 12 t.	Distance	DSRC/ANPR	Yes
Heavy vehicles > 12 t.	Time	E-vignette	No

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: France (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
France	18 private 3 public	12,637.1	9,328.1	73.8%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
ASFA	21	9,328.1	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Mixed, mainly private	• Design • Finance • Construct • Maintain • Operate	• Number of axles • Emissions • Dimensions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles	Distance	DSRC	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Greece (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Greece	8	2,210.0	2,080.9	94.2%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
HELLASTRON	8	2,080.9	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Private	• Maintain • Upgrade	• Vehicle category (LV/HV) • Dimensions • Number of axles

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles	Distance	DSRC	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Hungary (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Hungary	5	1,606.0	1,358.0	84.6%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
AKA M5 MOTORWAY	1	1,358.0	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Private	• Finance • Construct • Maintain • Operate	

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Time	E-Vignette	No
Heavy vehicles > 3.5 t.	Distance		No

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Ireland (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Ireland	8 private 1 public	916.0	325.9	35.6%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
ITIA	8	325.9	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Mixed, mainly private	• Design • Finance • Construct • Operate	• Vehicle type • Dimensions • Number of axles

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles	Distance	DSRC	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Italy (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Italy	26	7,072.3	6,133	86.7%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
Aiscat	16	4,597.1	75.0%

Concessional model

Nature	Obligations	Tariff setting
• Mixed	• Finance • Construct • Maintain • Upgrade	• Number of axles • Dimensions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Only in entrance/exit from motorway network (interconnected system)
Heavy vehicles	Distance	DSRC	

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Netherlands (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Netherlands		2,474.0	24.0	1.0%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
WESTERSCHELDE TUNNEL	1	24.0	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Public	• Maintain • Operate	• Dimensions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance		Yes
Heavy vehicles < 12 t.	Distance		Yes
Heavy vehicles > 12 t.	Time	E-vignette	No

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Poland (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Poland	4	1,849.0	729.0	39.4%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
POLSKIE AUTOSTRADY KONCESYJNE	4	468.0	64.2%

Concessional model

Nature	Obligations	Tariff setting
• Private	• Finance • Construct • Maintain • Operate • Upgrade	• Number of axles

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles < 3.5 t.	Distance	DSRC	Yes
Heavy vehicles > 3.5 t.	Distance	GNSS	No

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Portugal (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Portugal	25	3,526.3	2,594.5	73.6%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
apcap	20	2,506.2	96.6%

Concessional model

Nature	Obligations	Tariff setting
• Private	• Design • Construct • Maintain • Operate • Upgrade	• Number of axles • Dimensions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	No
Heavy vehicles	Distance	DSRC	No

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Serbia (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Serbia	1	999.5	882.5	88.3%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
PUBLIC ENTERPRISE ROADS OF SERBIA	1	882.5	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Public enterprise	• Construct • Maintain • Operate	• Number of axles

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles	Distance	DSRC	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Slovenia (2023)

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Slovenia	1	624.9	624.9	100.0%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
DARS	1	624.9	100.0%

Concessional model

Nature	Obligations	Tariff setting
• Public	• Finance • Construct • Maintain	• Number of axles • Emissions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Time	E-Vignette	No
Heavy vehicles > 3.5 t.	Distance	DSRC	No

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Spain

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Spain	• 15 private • 4 public agencies	17,788.0	2,349.0	13.2%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
seopan	15	1,334.9	56.8%

Concessional model

Nature	Obligations	Tariff setting
• Mixed, mainly private	• Finance • Construct • Maintain • Operate	• Number of axles • Dual tyre

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	DSRC	Yes
Heavy vehicles	Distance	DSRC	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

ASECAP countries: Turkey

Information at country level

Country	Nº concessionaire companies	Km motorways	Km toll motorways	% toll motorways
Turkey	8	3,726.0	3,266.0	87.7%

Information at ASECAP association level

ASECAP Association	Nº concessionaire companies	Km toll motorways	% country toll motorways
ICA	1	156.1	4.8%

Concessional model

Nature	Obligations	Tariff setting
• Private	• Design • Finance • Construct • Maintain • Operate • Handover	• Number of axles • Dimensions

Toll system

Type of vehicle	Toll system	Toll collection technology	Barriers
Light vehicles	Distance	ETC Hybrid	Yes
Heavy vehicles	Distance	ETC Hybrid	Yes

Source: PwC analysis based on data from ASECAP, ASECAP associations and “Evaluation and future of road toll concessions” (PwC, 2014).

Methodological Annex

A. Country profile

B. Impact methodology

Estimation of the investments to upgrade the European motorway network

To estimate the investments needed to upgrade the European motorway network in terms of sustainability, safety, and digitalization, **PwC conducted a survey among ASECAP** member associations and their concessionary companies.

Out of the 15 full member countries of ASECAP (sample countries), **responses were received from 10 countries**, reporting investments for 37,500 km of the network, representing approximately **62% of the motorway kilometers of the sample countries.**

The **data was treated** by identifying outliers of the variables “investment KPI in million euros per kilometer” for each of the three major investment categories (sustainability, safety, and digitalization) and **replacing the outlier data** with the maximum value (excluding outliers) for each country reporting outliers. Once the data was processed, the reported investments amounted to 46,270 million euros.

To **extrapolate these investments** to the rest of the network (the remaining 38% of kilometers for which we did not receive any data), the **variables “investment KPIs in million euros per kilometer”** for each of the three investment categories were used.

Two distinct approaches were taken depending on whether the extrapolations were to be applied to a country with survey data or without it.

For the extrapolations for missing data concerning the 10 countries with available data (e.g. in a country with four concessionary companies, and one of them not answering the survey), the specific **KPI for each country was applied**.

For the extrapolations concerning the remaining 5 countries, the following exercise was conducted:

- To create **groups with similar economic characteristics**, the 15 countries were classified into three main groups based on their GDP per capita, using Eurostat data:
    - High: above 30,000 euros per capita
    - Medium: between 15,000 and 30,000 euros per capita
    - Low: below 15,000 euros per capita
- The average investment KPI in million euros per kilometer was calculated for each of these country categories, and the appropriate amount was applied to each country that did not report data, according to its GDP per capita group.
- The economics impacts on GDP and employment have been calculated by considering the investments that would need to be made in the motorway **network of the 15 ASECAP member countries (60,317 km), estimated at 71,861 million euros.**

Output, GDP and GVA

The **economic contribution of the investments to upgrade the European motorway network** has been estimated using **Gross Value Added (GVA)** as **Gross Domestic Product (GDP)** is essentially the sum of the Gross Value Added (GVA) at basic prices across all sectors of the economy plus net taxes on products (VAT, excise taxes, etc., net of subsidies on products).

The Gross Value Added (GVA) at basic prices is calculated as the **difference between production value (output)** and the amount spent on the purchase of goods and services **- intermediate consumption -** (supplies, external services, and other current operating expenses), without deducting amortization or depreciation. It can be broken down into the following three elements:

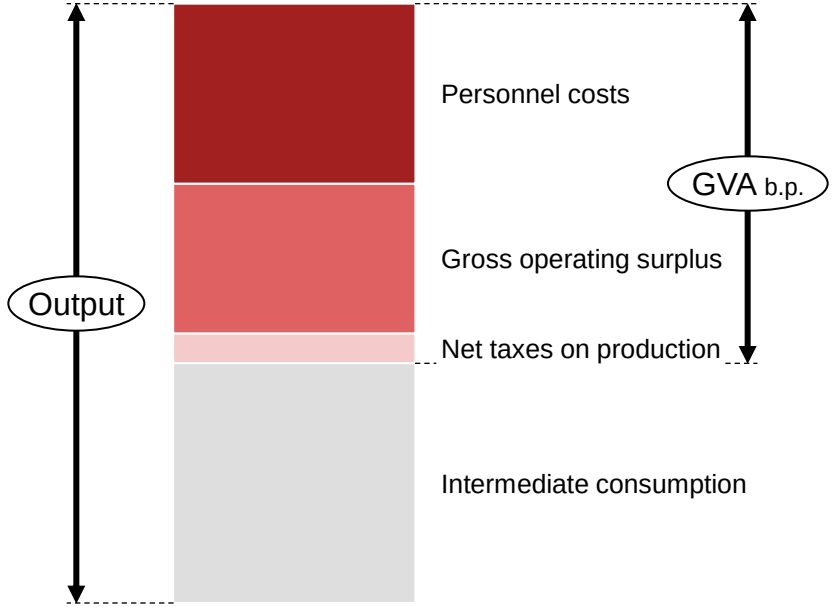
$$\text{GVA}_{bp.} = PC + GOS + NTP$$

Personnel costs (PC): Compensation for labor. It corresponds to all payments made to the company's own personnel for the remuneration of work (monetary or in kind), including social contributions and severance pay. It can be broken down into wages and salaries (gross) and social security contributions.

Gross Operating Surplus (GOS): Compensation for capital. It corresponds to the surplus generated by operating activities after remunerating labor and paying production taxes. It represents the available balance that allows for rewarding providers of equity and debt funds, paying profit taxes, and financing investments.

Net taxes on production (NTP): These are taxes that impose a burden on production, the use of labor, property, or the use of land, buildings, and other assets, regardless of the quantity or value of the products sold, minus subsidies for operation.

The figure below illustrates the decomposition of output (production value) between GVA at basic prices and intermediate consumption.



Input-Output model

Economic impacts are calculated on the basis of the **input-output (I-O) model** based on **data from Eurostat**.

Input-output models are a standard and widely used **technique for quantifying the economic impact of economic sectors, business activities and infrastructure investments**. They are based on **Leontief's production model**, which states that the production requirements of an economy are equivalent to the intermediate demand for goods and services by the production sectors, plus final demand, as expressed in the following equation:

$$\boldsymbol{X = AX + y}$$

where ***X*** is the column vector that represents the production needs of each sector in the economy (using a 21 sector breakdown from FIGARO and 27 countries we have 567 individual sectors), ***y*** is a column vector that represents the final demand of each sector, and ***A*** is the so-called matrix of technical coefficients (in this case - 567 rows x 567 columns), which by row indicates the percentage of production destined for each one of the other sectors in the economy for each specific sector, and by column indicates the weight that demand by each one of the other sectors in the economy has over its total production of goods and services for each sector. The above formula can also be represented in the following way:

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ \dots \\ X_{567} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1567} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2567} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3567} \\ & & \dots & & \\ a_{5671} & a_{5672} & a_{5673} & \dots & a_{567567} \end{bmatrix} \times \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ \dots \\ X_{567} \end{bmatrix} + \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \dots \\ y_{567} \end{bmatrix}$$

where, for instance, X_1 are the production needs of sector 1, y_1 is the final demand of that sector, and a_{11}, a_{12}, a_{13}, …, a_{1567} are the production percentages of sector 1 which are destined, respectively, for sectors 1, 2, 3, …,567 , while a_{11}, a_{21}, a_{31}, …, a_{567} are the weights on sector 1 production of goods and services demanded, respectively, from 1, 2, 3, …, 567.

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Thank you